

# PRODUCT SELECTION GUIDES

# TECHNICAL INFORMATION

## WHERE TO FIND THEM IN THE 1999 EDITION OF EEM

Batteries, Product Selection Guide	<b>D•1313</b>	Microwave Components, Product Selection Guide	<b>A•1671</b>
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide	<b>C•1003</b>	Motors, Drives, & Rotating Components, Product Selection Guide	<b>B•1169</b>
Capacitors, Product Selection Guide	<b>A•1003</b>	Oscilloscopes, Product Selection Guide	<b>D•1309</b>
Coils, Chokes, Inductors, Product Selection Guide	<b>A•1153</b>	Panel Hardware, Product Selection Guide	<b>C•1446</b>
Connectors & Sockets, Product Selection Guide	<b>C•1127</b>	Panel Meters, Analog & Digital, Product Selection Guide	<b>D•1273</b>
Cores, Magnets & Ferrites	<b>A•1349</b>	Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	<b>A•2010</b>
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	<b>A•1365</b>	Power Supplies, AC, Product Selection Guide	<b>D•2147</b>
Data Acquisition/Handling Systems & Accessories	<b>D•1139</b>	Power Supplies, DC, Product Selection Guide	<b>D•1379</b>
DC-DC Converters	<b>D•1879</b>	Protective Components (Fuses, Circuit Breakers, etc.) Product Selection Guide	<b>B•1231</b>
Delay Lines, Product Selection Guide	<b>A•1545</b>	Relays, Product Selection Guide	<b>B•1285</b>
Discrete Semiconductors, Product Selection Guide	<b>A•2049</b>	Resistors, Product Selection Guide	<b>A•1857</b>
Displays, Readouts, & CRTs, Product Selection Guide	<b>B•1006</b>	Solenoids, Product Selection Guide	<b>B•1450</b>
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	<b>C•1470</b>	Switches, Product Selection Guide	<b>B•1467</b>
Fiber Optics, Product Selection Guide	<b>B•1163</b>	Terminal Blocks	<b>C•1383</b>
Filters, Power, Product Selection Guide	<b>A•1577</b>	Test Accessories	<b>D•1270</b>
Filters, Signal, Product Selection Guide	<b>A•1615</b>	Thermal Components, Product Selection Guide	<b>B•1667</b>
Instruments, Test & Measuring, Product Selection Guide	<b>D•1178</b>	Transducers & Encoders, Product Selection Guide	<b>B•1736</b>
Keyboards, Keypads & Membrane Switches, Product Selection Guide	<b>B•1613</b>	Transformers, Product Selection Guide	<b>A•2079</b>
Lamps, Lights, & Indicators, Product Selection Guide	<b>B•1089</b>	Wire & Cable, Product Selection Guide	<b>C•1581</b>
LAN Products	<b>B•1002</b>		

**COMPONENTS - ELECTRONIC**

Manufacturer	Starting EEM Page No.	Transformers	Filter Modules	DC/DC Converters	Chokes	Power Supplies
Datatronics, Inc.	B•1004		√			

**DATA COMMUNICATION PRODUCTS**

Manufacturer	Starting EEM Page No.	Systems	Modems
Dataforth Corporation	B•1003	Rack-mounted, short-haul modem system	Industrial short-haul modems
Patton Electronics Co.	B•1005	Ethernet, Token ring	Baseband modems, line drivers, sync. modem eliminators, CSU/DSU, transceivers, print servers


**DATAFORTH®**

A Burr-Brown Company

Dataforth Corporation, established in 1984, is a worldwide leader in the design and manufacture of signal conditioning and data communications products for industrial and institutional markets.

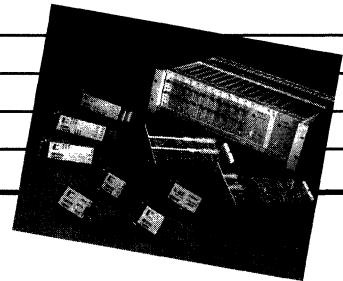
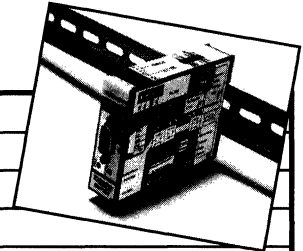
## Data Communications Products

Dataforth's rugged modems and modem systems "harden" and protect industrial data communications systems. Limited distance modems use wired pairs or fiber optic links, standard RS-232 or -485 protocols. Our new DCP485 gives customers a DIN-rail mounted, isolated, RS-232/RS-485 limited distance modem. The RML100 rack-mounted modem system allows efficient organization of a large number of data channels - up to 28 per rack - at a single site using a single power supply. Our new PC5000 FlexPort™ system adds flexible industrial serial data port capabilities to the PC/XT/AT ISA bus.

### LDM Series Industrial Limited Distance Modems

- Data Rates DC to 115.2K bps
- Distances to 12 Miles
- Multidrop Capabilities
- Industrial Isolation and Surge Protection
- Din-Rail Mounted Modems

<b>DCP485</b>	DIN-Rail Mounted Isolated RS-232/485 Converter	<b>NEW</b>
<b>LDM30</b>	Low Cost, General Purpose Limited Distance Modem	
<b>LDM35</b>	Signal-Powered Limited Distance Modem	
<b>LDM70</b>	Fully Isolated Limited Distance Modem	
<b>LDM422</b>	Isolated Limited Distance Modem, RS-232/RS-422 Converter	
<b>LDM485</b>	Isolated Limited Distance Modem, RS-232/RS-485 Converter	
<b>LDM2485A/B</b>	Signal-Powered Hi-Speed RS-232/RS-485 Converter	
<b>LDM80</b>	Signal-Powered Fiber Optic Modem	
<b>LDM85</b>	Fiber Optic Modem	
<b>LDM Accessories</b>	Wall-Mounted Power Supplies, Power Transformers, Optic Cables	



### RML100 Rack-Mounted Modem System

- Up to 28 Channels with Single Power Supply
- 500V Optical Isolation
- Null Modem and Loopback Switches
- Data Rates DC to 57.6K Baud
- Distances to 12 Miles
- Integrates with LDMs for Distributed Systems

<b>RML100/101</b>	14-slot Card Cage/Backpanel with 110/220VAC, ±12VDC Power Supply
<b>RML035</b>	Isolated RS-232 Current Loop Card, 2 Channels, 19.2K Baud @ .5mi
<b>RML070</b>	Fully Isolated RS-232 Current Loop Card, 2 Channels, 57.6K Baud @ .5mi
<b>RML485</b>	Isolated RS-485/422 Card, 2 Channels, 57.6K Baud @ .5mi
<b>RML104/105</b>	110/220VAC, ±12VDC Power Supplies

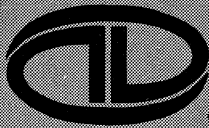
### PC5000 FlexPort™ PC/XT/AT Bus Plug-In Serial I/O Board System

- Up to 115.2K bps
- +5V Power
- 8 Interrupt Lines

<b>PC5000-2, -4</b>	Main Plug-In Boards Provide 2 or 4 Serial Ports
<b>PC5000-S1, -S2</b>	RS-232C or RS-485 Plug-In Daughter Boards With TXD, RXD, RTS, CTS, DTR, DSR, RLSD.

**CUSTOMER INFORMATION AND ASSISTANCE 800-760-1580**

E-mail: [techinfo@dataforth.com](mailto:techinfo@dataforth.com) • Web Center: [www.dataforth.com](http://www.dataforth.com)



# DATATRONICS





Tel: 909-928-7700 • Fax: 909-928-7701 • E-Mail: Sales@datatronics.com

## LAN FILTER MODULES

✓ High Performance ✓ SPC Quality ✓ Fast Delivery ✓ Low Cost ✓ Tech Support

✓ ISO 9001 Approved ✓ IEEE802 Compliant

Broad Selection With Economical Custom Designs

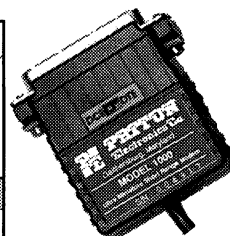
Technology	Datatronics Part No.	Description	IC Cross References
<b>10 Base-T/ 100 Base-TX</b>  	NT74836	4-channel transformer & choke	NWK918, PCA873, PCA912 PCA938, INTELS82555, S82558; ICS ICS1890, ICS1891; LEVEL ONE LXT970; LUCENT; LUC3X04, LUC3X14, LUC3X24; MICRO LINEAR ML6671; NSC DP83223, DP83840; TDK 78Q2120, 78Q2121, 78Q2250 TI TNETE2101
	NT74844	4-channel transformer & choke	
	NT74843	4-channel transformer & choke	
	NT74845	4-channel transformer & choke	
	NT74886	8-channel transformer & choke	
	NT74887	8-channel transformer & choke	
<b>100Base-TX/ TP-PMD</b>  	NT804-013	transmit/receive filter, transformer & choke	Micro Linear ML6671; NSC DP83223           NSC DP83223; Micro Linear ML6672, ML6673, ML6674; Most 100Base-TX Transceiver Chips
	NT804-021	2-channel filter, transformer & choke	
	NT804-031	2-channel filter, transformer & choke	
	NT805-011	transformer & choke	
	NT805-021	transformer & choke	
	NT805-041	2-channel transformer & choke	
	NT805-051	2-channel transformer & choke	
	NT805-053	transformer & choke	
	NT805-061	2-channel transformer & choke	
	NT805-071	2-channel transformer & choke	
NT805-081	2-channel transformer & choke		
<b>100VG-AnyLAN</b>  	NT803-011	4-channel filter, resistor, transformer & choke	AT&T ATT2X01, ATT2X02; Most 100VG-AnyLAN Transceiver Chips
	NT803-021	4-channel filter, resistor, transformer & choke	
	NT803-031	4-channel filter, transformer & choke	
	NT803-043	2-channel filter, resistor, transformer & choke	
<b>10Base-T/ 100Base-TX</b>	NT805-041	2-channel transformer & choke	NSC DP83223, DP83840; Most 10Base-T/100Base-TX Transceiver Chips
	NT805-051	2-channel transformer & choke	
<b>100Base-T4</b>  	NT806-011	4-channel filter, resistor, transformer & choke	BroadCom BCM500; Intel PHY 100; Most 100Base-T4 Transceiver Chips

Datatronics • 28151 Highway 74 • Romoland, CA • 92585

# LINE DRIVERS & CONVERTERS

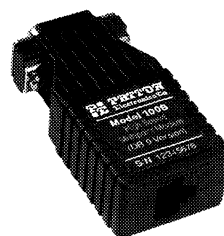
From the Trend-Setter in "micro" Datacom Products...

Self Powered Modems		Protocol	Top Speed (Kbps)	Max Distance (19AWG)	DCE/DTE Switch	DTE Connector	Carrier Sense	Full Carrier Control	Operation	Transformer Isolation	Surge Protection	Max Drops	Multipoint Rack Card
1000/1000R	Async	19.2	17 miles (27 km)	Yes	DB-25 RJ-45	—	—	4-Wire	—	Optional	—	Yes	—
1002	Async	19.2	5.6 miles (8 km)	Yes	DB25	—	—	2-Wire or Coax	—	Optional	—	—	—
1004	Async	115.2	9 miles (14 km)	Yes	DB25	—	Yes	2-Wire 4-Wire	—	Optional	50	Yes	—
1010/1010R	Async	19.2	9 miles (14 km)	Yes	DB-25 RJ-45	—	—	4-Wire	Yes	Optional	—	Yes	—
1012A/1012AR	Async	38.4	6 miles (9.5 km)	Yes	DB-25 RJ-45	Yes	Yes	4-Wire	Yes	Optional	15	Yes	—
1040	Async/ Sync	38.4	12 miles (19 km)	—	DB25	—	Yes	2-Wire 4-Wire	Yes	Optional	10	Yes	—
1045	Async/ Sync	64.0	10 miles (16 km)	—	DB25	—	Yes	4-Wire	Yes	Standard	10	Yes	—



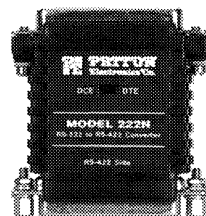
DB-25 Async Line Driver

Powered Modems	Max Distance (Miles)		Top Speed (Kbps)		Standalone	Rack Mount	Electrical Interface	Protocol	Operation	Line Isolation	Multipoint Capability	DTE Connectors	Line Connection
	12	38.4	Yes	Yes									
1050	12	38.4	Yes	Yes	RS-232	Async	4-WFD	Optical	No	DB-25(F)	—	RJ-11 & Terminal	
1060	14	115.2	Yes	Yes	RS-232	Async	4-WFD	Optical	Yes	DB-25(F)	—	RJ-11 & Terminal	
1070	10	19.2	Yes	Yes	RS-232	Sync	4-WFD	Optical	Yes	DB-25(F)	—	RJ-11 & Terminal	
1080A	17	57.6	Yes	Yes	RS-232	Async/ Sync	4-WFD 2WHD	Transformer	Yes	DB-25(F)	—	RJ-11 & Terminal	
1090	11	160.0	Yes	No	All	Sync	4-WFD	Transformer	Yes	All	—	RJ-45	
1092	10	128.0	Yes	Yes	All	Async/ Sync	2-WFD	Transformer	Yes	All	—	RJ-45	



DB-9 Async Line Driver

Interface Converters	Interface A		Interface B		Max Data Rate		Control Signals		Surge Protection		Interface Powered		AC Powered		Rack Mount Card		Physical Connectors	
	RS-232	RS-422	S	19.2 kbps	Optional	Yes	•	Yes	•	Yes	DB-25 (RS-232); DB-9 (EIA-574); RJ-11/45, TB (RS-422)							
222N	RS-232	RS-422	S	19.2 kbps	Optional	Yes	•	Yes	•	Yes	DB-25 (RS-232); DB-9 (EIA-574); RJ-11/45, TB (RS-422)							
222N9	EIA-574	RS-422	S	19.2 kbps	Optional	Yes	•	Yes	•	Yes	DB-25 (RS-232); DB-9 (EIA-574); RJ-11/45, TB (RS-422)							
2017A	RS-232	20mA (Actv/Passv)	S	115.2 kbps	•	Yes (+ Optical)	•	Yes	•	Yes	DB-25 (RS-232); RJ-11/45, TB (20mA current loop)							
2085/2089	RS-232 EIA-574	RS-485	S	115.2 kbps	Yes	Yes	Yes	•	•	•	DB-25 (RS-232); DB-9 (EIA-574); DB-25, RJ-11/45, TB (RS-485)							
2010	RS-232 Async	RS-232 Sync	S/A	19.2 kbps	Yes	•	Yes	•	•	•	Dual DB-25							
2020	RS-232	V.35	A	384 kbps	Yes	•	Yes	•	Yes	•	DB-25 (RS-232); M/34 (V.35)							
2040	V.35	HSSI	A	10 Mbps	Yes	•	•	Yes	•	•	M/34 (V.35); HD-50 (HSSI)							
2030	RS-232/423 Serial	IEEE-1284 Parallel	S	115.2 kbps	Yes	Yes	Yes	Yes	•	•	DB-25 (RS-232/423); Centronics® (IEEE-1284 Parallel)							
2035/2039	RS-232 Serial	Parallel	S	115.2 kbps	Yes	•	Yes	•	•	•	DB-25 (RS-232); DB-9 (EIA-574); Centronics®; DB-25 (Parallel)							



RS-232 to RS-422 Interface Converter



Serial-To-Parallel Interface Converter



7622 Rickenbacker Dr., Gaithersburg, MD 20879  
 Phone: (301) 975-1000 • Fax: (301) 869-9293  
 E-mail: sales@patton.com • WWW: http://www.patton.com

## DISPLAYS

Manufacturer	Starting EEM Page No.	Single Character	Multi-Character	Multi-line	Height			Segmented	Dot Matrix	Graphics	Electro-magnetic	In-can-descent	LED	Light Type					Panels: Back/Edge Lighted	
					1/2" or less	>1/2" <1 in.	1 in. or more							Plasma Gas Dis-charge	Vac-uum Fluo-rescent	Electro-lumi-nescent	Custom Design	CRT		
All Shore Industries, Inc.	B•1008	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓			✓	✓		✓
American Bright Optoelectronics Corp.	B•1011	✓	✓	✓	✓	✓	✓	✓	✓				✓					✓		✓
AND	B•1012		✓	✓		✓		✓	✓	✓				✓				✓		✓
Apollo Display Technologies, Inc.	B•1014		✓	✓	✓	✓	✓		✓	✓			✓		✓			✓		✓
Asia Wintek	B•1016		✓	✓		✓			✓	✓			✓							✓
AZ Displays	B•1017							✓	✓			✓	✓							
Babcock, Inc.	B•1019		✓	✓	✓	✓	✓	✓	✓	✓					✓	✓			✓	
Clinton Electronics Corp.	B•1020																	✓	✓	
Crystaloid	B•1022	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓					✓		✓
Cyber Touch	B•1023																		Touch Screen	
Data Image Corp. of North America	B•1025		✓	✓	✓	✓	✓		✓	✓			✓	✓				✓		✓
Data Ray Corp.	B•1026																		✓	
DCI Inc.	B•1029	✓	✓	✓	✓	✓	✓	✓					✓	✓						✓
Dynamic Displays Inc.	B•1030												✓					✓	✓	
Earth Computer Technologies	B•1033									✓			✓	✓			✓	✓		✓
Endicott Research Group	B•1034												✓	✓	✓			✓		✓
Excel Technology International Corp.	B•1036	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓		
Fox Meter	B•1037		✓	✓	✓	✓	✓	✓	✓			✓						✓		
Futaba Corp.	B•1038	✓	✓	✓	✓	✓	✓	✓	✓	✓					✓					
Hantronix, Inc.	B•1040	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓				✓		✓
Hitachi America, Limited	B•1042		✓	✓	✓		✓	✓	✓				✓							✓
Homalite	B•1046											✓	✓	✓	✓	✓	✓	✓	✓	✓
IEE (Industrial Electronics Engineer, Inc.)	B•1047	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓			✓		
Infodex, Inc.	B•1048																	✓	✓	
LXD, Inc.	B•1050	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓					✓		✓
Ocular, Inc.	B•1052	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓				✓	✓	✓
Okaya Electric America, Inc.	B•1054		✓	✓	✓	✓		✓	✓				✓							✓
Omni Vision, Inc.	B•1058		✓	✓					✓										✓	
Optrex America, Inc.	B•1060		✓	✓	✓			✓	✓				✓					✓		✓
Polytronix, Inc.	B•1062		✓	✓	✓	✓	✓	✓	✓				✓	✓				✓		
Seiko Instruments	B•1065		✓	✓	✓		✓	✓	✓				✓					✓		✓
Shelly Associates, Inc.	B•1066	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓				✓	✓	✓
Il Stanley Company, Inc.	B•1068	✓	✓	✓	✓		✓	✓	✓				✓	✓						✓
Staver Company, Inc.	B•1071	✓					✓	✓	✓		✓									
Sun Led Co.	B•1077	✓	✓		✓	✓	✓	✓	✓				✓					✓		✓
Texas Displays/FPD Technologies	B•1078		✓	✓	✓	✓	✓	✓	✓				✓	✓		✓	✓			
TNG Industry (USA) Inc.	B•1079		✓	✓	✓	✓	✓	✓	✓				✓							
Update Electronics Corp.	B•1081	✓	✓	✓	✓	✓	✓		✓				✓					✓		✓
Vishay Dale Electronics	B•1082		✓	✓		✓	✓	✓	✓					✓				✓		
VL Electronics, Inc.	B•1083	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓				✓	✓	✓
WTS	B•1085		✓	✓	✓	✓	✓	✓	✓				✓	✓				✓	✓	✓
Xcel Digitran	B•1086												✓						✓	
Z-Axis, Inc.	B•1087																		✓	

## BACK LIGHT PANELS FOR DISPLAYS

Manufacturer	Starting EEM Page No.	Type			Colors Available	Brightness (Cd/M <sup>2</sup> )	Thickness (mm)	Length (mm)	Current (mA)	Voltage (Vrms)	Life (hours)	Applications
		Electro-luminescent	Fluor- escent	LED								
All Shore Industries, Inc.	B•1008	√	√	√	Gray, Yellow, Blue, White, Black, Red, Green	Varies	Varies	Varies	Varies	Varies	Varies	Instruments, Medical, Telecommunications, Consumer Products, Auto, Industrial Displays
American Bright Optoelectronics Corp.	B•1011			√	√	Varies	Varies	Varies	Varies	Varies	Varies	Varies
Apollo Display Technologies, Inc.	B•1014	√	√	√	Blue/Green, Yellow/Green, White, Green, Red,	Varies	Varies	Varies	Varies	Varies	Varies	Varies
Crystaloid	B•1022	√	√	√	Red, Green, Amber, White, Yellow, Blue	Varies	3 mm Max.	Varies	Varies	Varies	Up to 100,000	All
DCI Inc.	B•1029			√	Red, Yellow Green							
Endicott Research Group	B•1034	√	√		N/A							ERG builds the the inverters for the backlights... (Power Supplies)
Hantronix	B•1040	√	√	√	Yellow, B/W Green, Blue, Red, Orange, Amber		5					
Hitachi America, Limited	B•1042		√	√	Black, White, Gray							
Ocular, Inc.	B•1052	√	√	√	White, Green, Red, Yellow, Amber		Varies	Varies	Varies	Varies	50-100K	LCD Backlight
Optrex America, Inc.	B•1060	√	√		Blue/Green, White, Yellow							Office equipment, Instrumentation, Telecomm, Medical
Seiko Instruments	B•1065	√	√	√								
Shelly Associates, Inc.	B•1066	√	√	√	Green, White, Yellow							
Il Stanley Company	B•1068			√	Yellow							
Sun Led Co.	B•1077			√	√		√	√				
VL Electronics	B•1083	√		√	Blue, White, Amber, Red, Yellow		2		20 and up	3	100K	For LCD
WTS	B•1085	√	√	√	Amber, Grey, Yellow/Green, Blue, Black, White	20-50/ 70-200	1.5		100	EL= 100VAC, LED= 2.1-24VDC	100K	All graphic or character LCD Apps.



# ALL SHORE LCD Displays

**FIRST in Price! FIRST in Quality! FIRST in Service!**

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Standard LCD Glass Panels

*Complete Customer Satisfaction*

## 1 DIGIT --- 2 & 3 DIGIT ---



ASI-1024A



ASI-009



ASI-010



ASI-1113



ASI-1077

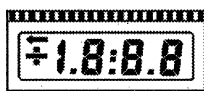
## 3 1/2 & 4 DIGIT ---



ASI-2773



ASI-002



ASI-008



ASI-001



ASI-016



ASI-017



ASI-006



ASI-024



ASI-004



ASI-1028

## 4 1/2 DIGIT --- 6 DIGIT ---



ASI-007



ASI-003



ASI-005

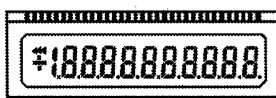


ASI-970H

## 8 DIGIT --- 10 1/2 DIGIT --- ALPHA/NUMERIC ---



ASI-928



ASI-022



ASI-991C

- STANDARD & CUSTOM LCD PANELS
- 100% QUALITY CONTROL
- WIDE OPERATING TEMPERATURE RANGES

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# ALL SHORE LCD Modules



Standard and Custom Modules in TN, STN an FSTN technologies are available. Listed below are some of our standard modules. Further information, including complete product specifications, can be viewed on our website @ [www.allshore.com](http://www.allshore.com). We offer many of the following features in both character and graphic modules:

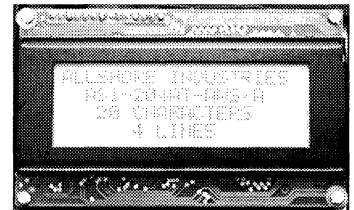
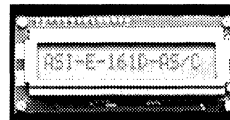
## ASI Standard Character Modules

Display Format	Part Number*	Module Dimensions	Display Area	Character Size	Dot Size	Duty	Controller	BACKLIGHT		
								w/o	EL	LED
8 x 2	ASI-(X)-82	58 x 32	44.2 x 16	3.55 x 5.94	.56 x .66	1/8	HD44780, KS0066, SED1278	•	•	•
16 x 1	ASI-(X)-161B	122 x 33	99 x 13	4.84 x 9.66	.92 x 1.10	1/16	HD44780, KS0066, SED1278	•	•	•
16 x 1	ASI-(X)-161D	80 x 36	64.5 x 13.8	3.07 x 5.73	.55 x .75	1/16	KS0066, HD44780	•	•	•
16 x 2	ASI-(X)-162A	122 x 44	99.5 x 24	4.84 x 8.06	.92 x 1.10	1/16	KS0066, HD44780	•	•	•
16 x 2	ASI-(X)-162B	80 x 36	64.5 x 13.8	2.95 x 3.80	.55 x .50	1/16	KS0066, HD44780	•	•	•
16 x 2	ASI-(X)-162D	85 x 36	63.5 x 15.8	2.96 x 4.86	.56 x .66	1/16	KS0066, HD44780	•	•	•
16 x 2	ASI-(X)-162E	85 x 30	64.5 x 13.8	2.95 x 3.80	.55 x .50	1/16	HD44780, KS0066, SED1278	•	•	•
16 x 2	ASI-(X)-162F	84 x 44	63.5 x 15.8	2.95 x 4.86	.55 x .50	1/16	HD44780, KS0066, SED1278	•	•	•
16 x 4	ASI-(X)-164	87 x 60	61.8 x 25.2	2.95 x 4.15	.55 x .55	1/16	KS0066, SED1278	•	•	•
20 x 2	ASI-(X)-202	116 x 37	83 x 18.6	3.20 x 4.85	.60 x .65	1/16	KS0066, HD44780	•	•	•
20 x 4	ASI-(X)-204A	98 x 60	76 x 25.2	2.95 x 4.15	.55 x .55	1/16	HD44780, KS0066, SED1278	•	•	•
20 x 4	ASI-(X)-204B	77 x 47	60 x 22	2.30 x 4.03	.42 x .46	1/16	KS0066, SED1278	•	•	•
20 x 4	ASI-(X)-204C	146 x 62.5	123 x 42.5	4.84 x 9.22	.53 x .92	1/16	HD44780	—	—	•
24 x 2	ASI-(X)-242	118 x 36	94.5 x 15.8	3.20 x 4.85	.60 x .65	1/16	HD44780, KS0066, SED1278	•	•	•
40 x 2	ASI-(X)-402	182 x 33.5	154 x 15.3	3.20 x 4.85	.60 x .65	1/16	HD44780, KS0066, SED1278	•	•	•
40 x 4	ASI-(X)-404	190 x 54	149 x 31	2.78 x 4.27	.50 x .55	1/16	HD44780, KS0066, SED1278	•	•	•

- Temperature range -20 to + 70°C in single +5V & dual supply
- Standard & Custom designs
- Built-in Controller
- Wide Viewing Angle
- High Contrast

Character units are available with:

- TN, STN Gray, Yellow & Blue
- Reflective, LED & EL Backlight



## ASI Standard Graphic Modules

Display Format	Part Number*	Module Dimensions	Display Area	Dot Size	Duty	Controller	BACKLIGHT			
							w/o	EL	LED	CCFT
122 x 32	ASI-(X)-1223A	69.2 x 31.75	57.2 x 17.2	.38 x .38	1/32	SED1520	•	•	•	—
122 x 32	ASI-(X)-1223B	84 x 44	60.5 x 18.5	.40 x .45	1/32	SED1520	•	•	•	—
128 x 64	ASI-(X)-1286C	77.8 x 69.8	70.7 x 38.8	.48 x .48	1/64	HD61202	•	•	•	—
128 x 64	ASI-(X)-1286A	93 x 70	70.7 x 38.8	.48 x .48	1/64	HD61202	•	•	•	—
128 x 128	ASI-(X)-12812	72.4 x 69.9	49 x 49	.32 x .32	1/128	LC7981	•	•	•	•
128 x 128	ASI-(X)-12812B	84.4 x 100	62 x 62	.40 x .40	1/128	T6963C, HD61202	•	•	•	•
240 x 64	ASI-(X)-2406A	180 x 65	133 x 40	.49 x .49	1/64, 1/240	T6963C, HD44780	•	•	•	•
240 x 128	ASI-(X)-24012B	144 x 104	114 x 64	.42 x .42	1/128	HD61830, LC7981	•	—	•	•
240 x 128	ASI-(X)-24012A	170 x 101.2	132 x 76	.47 x .47	1/128	T6963C	•	—	•	•
320 x 240	ASI-(X)-32024C	134.5 x 117	103 x 79	.27 x .27	1/240	MSM6255**	—	—	•	—
320 x 240	ASI-(X)-32024A	160 x 109	120 x 90	.33 x .33	1/240	MSM6255**	•	•	—	•
320 x 240	ASI-(X)-32024B	174 x 112	122 x 92	.33 x .33	1/320	MSM6255, HD64646, SED1330**	—	—	—	•

Graphic units are available with:

- STN Gray, Yellow & Blue
- FSTN Black/White
- Reflective, LED, EL & CCFL Backlight

Above modules are standard. We have a variety of non-standard modules in addition to the above. Please visit our website @ [www.allshore.com](http://www.allshore.com) for details & specifications.

\* Refer to Part Numbering System \*\* Recommended Controller or Equivalent. NOT Built-in!

- NOTES:
1. Normal Operating Temps: 0 to 50°C; Normal Storage Temps: -20°C to +70°C Ranges.
  2. Modules are available in GRAY, YELLOW, BLUE, Normally WHITE and normally BLACK.
  3. Module dimensions will vary in width depending on type of backlight used.
  4. Built-in Controller is as specified or the equivalent.

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# MINIGLOSSARY ENCAPSULATION

## MATERIALS/HANDLING

**Catalyst:** A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

**Conformal coating:** Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

**Curing agent:** See catalyst.

**Hardener:** See catalyst.

**Hermetic:** A permanent gas-tight seal.

**RTV:** Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

**Thermoplastic:** Plastic materials which can be made to flow *repeatedly* with the application of heat.

**Thermosetting:** Plastics which once cured cannot be made to flow again.

**Thixotropy:** The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

**Viscosity:** Measured in units of *poise* or *centipoise*. The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

## PROCESSING

**Casting:** Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

**Dip coating:** Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

**Embedding:** Wherein an encapsulant substantially fills all voids in and about an assembly.

**Impregnation:** A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

**Molding:** Similar to casting except this process usually implies multicavity molds and costly machines.

**Potting:** Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

## DIELECTRIC

**Arc resistance:** An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

**Breakdown voltage:** The voltage at which an encapsulant fails electrically.

**Capacitance:** The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

**Corona:** A luminous discharge of electricity due to air ionization when a cer-

tain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

**Dielectric:** Insulator (Nonconductor.)

**Dielectric constant:** The property of a material that determines its ability to store electrostatic energy.

**Dielectric strength:** The ratio of dielectric breakdown to the thickness of insulating material.

**Dissipation factor:** The ratio of a dielectric material's energy losses.

**Flashover:** Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

**Insulation resistance: (IR)** An insulating material's total DC leakage.

**Surface resistivity:** The resistance of the surface of an insulating material to the flow of direct current.

**Voltage endurance:** Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

**Volume resistivity:** The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.



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## SINGLE DIGIT DISPLAY

Diagram	Digit Size (inch)	Part No.	Emitting Color	nm	I <sub>v</sub> (μcd) at 10mA
	0.30	BS-A302RD	green	568	3000
	0.30	BS-A303RD	yellow	585	2000
	0.30	BS-A304RD	H.E. red	635	2500
	0.30	BS-A306RD	sup. red	660	5000
	0.36	BS-A322RD	green	568	2000
	0.36	BS-A323RD	yellow	585	1500
	0.36	BS-A324RD	H.E. red	635	2000
	0.36	BS-A326RD	sup. red	660	3500
	0.56	BS-A512RD	green	568	2800
	0.56	BS-A513RD	yellow	585	2000
	0.56	BS-A514RD	H.E. red	635	2500
	0.56	BS-A516RD	sup. red	660	5000
	1.00	BS-AA12RD	green	568	5000
	1.00	BS-AA13RD	yellow	585	4000
	1.00	BS-AA14RD	H.E. red	635	5000
	1.00	BS-AA16RD	sup. red	660	10000
	2.30	BS-AD12RD	green	568	12000
	2.30	BS-AD13RD	yellow	585	10000
	2.30	BS-AD14RD	H.E. red	635	10000
	2.30	BS-AD16RD	sup. red	660	18000
	3.00	BS-AF02RD	green	568	14000
	3.00	BS-AF03RD	yellow	585	12000
	3.00	BS-AF04RD	H.E. red	635	13000
	3.00	BS-AF06RD	sup. red	660	22000
	4.00	BS-AE02RD	green	568	13000
	4.00	BS-AE03RD	yellow	585	10000
	4.00	BS-AE04RD	H.E. red	635	12000
	4.00	BS-AE06RD	sup. red	660	20000
	5.00	BS-AG02RD	green	568	25000
	5.00	BS-AG03RD	yellow	585	20000
	5.00	BS-AG04RD	H.E. red	635	22000
	5.00	BS-AG06RD	sup. red	660	30000

## ALPHA-NUMERIC DISPLAY

Diagram	Digit Size (inch)	Part No.	Emitting Color	nm	I <sub>v</sub> (μcd) at 10mA
	0.50	BS-A562RD	green	568	3500
	0.50	BS-A563RD	yellow	585	3000
	0.50	BS-A564RD	H.E. red	635	3000
	0.50	BS-A566RD	sup. red	660	6000
	1.00	BS-AA22ND	green	568	5000
	1.00	BS-AA23ND	yellow	585	4000
	1.00	BS-AA24ND	H.E. red	635	5000
	1.00	BS-AA26ND	sup. red	660	10000
	2.30	BS-AD22RD	green	568	14000
	2.30	BS-AD23RD	yellow	585	11000
	2.30	BS-AD24RD	H.E. red	635	12000
	2.30	BS-AD26RD	sup. red	660	18000
	0.54	BD-E522RD	green	568	2500
	0.54	BD-E523RD	yellow	585	2000
	0.54	BD-E524RD	H.E. red	635	2500
	0.54	BD-E526RD	sup. red	660	6000

## SINGLE/MULTI-COLOR 5X7/8X8 DOT MATRIX

Diagram	Digit Size (inch)	Part No.	Emitting Color	nm	I <sub>v</sub> (μcd) at 10mA
	2.00	BM-20257MD	green	568	12000
	2.00	BM-20457MD	H.E. red	635	10000
	2.00	BM-20657MD	sup. red	660	15000
	4.00	BM-40257MD	green	568	16000
	4.00	BM-40457MD	H.E. red	635	15000
	4.00	BM-40657MD	sup. red	660	20000
	1.20	BM-10EG57MD	HER/green	635/568	8000/9000
	2.00	BM-20EG57MD	HER/green	635/568	10000/12000
	4.00	BM-40EG57MD	HER/green	635/568	15000/16000
	4.00	BM-41EG57MD	HER/green	635/568	13000/15000
	1.20	BM-10EG88MD	HER/green	635/568	10000/11000
	2.30	BM-20EG88MD	HER/green	635/568	12000/13000

## DOUBLE DIGIT DISPLAY

Diagram	Digit Size (inch)	Part No.	Emitting Color	nm	I <sub>v</sub> (μcd) at 10mA
	0.56	BD-A512RD	green	568	2800
	0.56	BD-A513RD	yellow	585	2000
	0.56	BD-A514RD	H.E. red	635	2500
	0.56	BD-A516RD	sup. red	660	5000

## THREE DIGIT DISPLAY

Diagram	Digit Size (inch)	Part No.	Emitting Color	nm	I <sub>v</sub> (μcd) at 10mA
	0.40	BT-M402RD	green	568	2500
	0.40	BT-M403RD	yellow	585	2000
	0.40	BT-M404RD	H.E. red	635	2500
	0.40	BT-M406RD	sup. red	660	5500
	0.56	BT-M512RD	green	568	2800
	0.56	BT-M513RD	yellow	585	2000
	0.56	BT-M514RD	H.E. red	635	2500
	0.56	BT-M516RD	sup. red	660	5000

## FOUR DIGIT DISPLAY

Diagram	Digit Size (inch)	Part No.	Emitting Color	nm	I <sub>v</sub> (μcd) at 10mA
	0.36	BQ-M322RD	green	568	2000
	0.36	BQ-M323RD	yellow	585	1500
	0.36	BQ-M324RD	H.E. red	635	2000
	0.36	BQ-M326RD	sup. red	660	3500
	0.56	BQ-M512RD	green	568	2800
	0.56	BQ-M513RD	yellow	585	2000
	0.56	BQ-M514RD	H.E. red	635	2500
	0.56	BQ-M516RD	sup. red	660	5000

## LED LIGHT BARS & BAR GRAPH ARRAYS

Diagram	Digit Size (mm)	Part No.	Emitting Color	nm	I <sub>v</sub> (μcd) at 10mA
	10.0x20.16	BA-8G6UW	green	568	12000
	10.0x20.16	BA-8Y6UW	yellow	585	10000
	10.0x20.16	BA-8E6UW	H.E. red	635	12000
	10.0x20.16	BA-8S6UW	sup. red	660	30000
	10 Bars	BA-10G1UD	green	568	5000
	10 Bars	BA-10Y1UD	yellow	585	4500
	10 Bars	BA-10E1UD	H.E. red	635	5000
	10 Bars	BA-10S1UD	sup. red	660	8000
	12 Bars	BA-12G3UD	green	568	4500
	12 Bars	BA-12Y3UD	yellow	585	3500
	12 Bars	BA-12E3UD	H.E. red	635	4000
	12 Bars	BA-12S3UD	sup. red	660	10000

## LED LAMP CLUSTER

Diagram	Diameter (inch)	Part No.	Emitting Color	nm	I <sub>v</sub> (mcd) at 20mA
	1.024	BLO-26GS01	green	568/660	2500/3500
			sup. red		
	2.047	BLO-52GS01	green	568/660	4500/6000

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\*\*\*Listed displays are common anode configurations. Custom type, common cathode & other sizes displays are available.

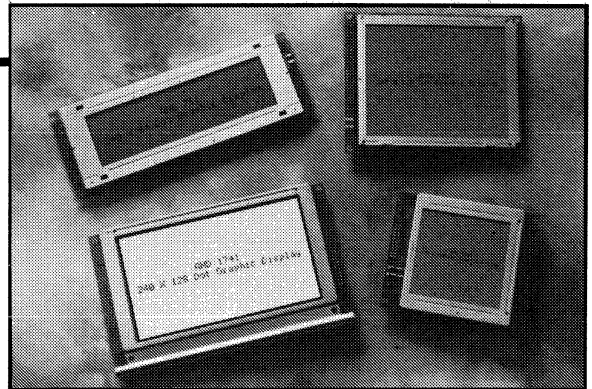
Also see AMERICAN BRIGHT in LAMPS Section.



# LCD Products

## MONOCHROME LCD DISPLAYS

- Intelligent graphic displays with controller
- Intelligent character displays with controller
- Segmented panel displays
- Industry standard sizes in stock
- Engineering technical support



## LCD - INTELLIGENT GRAPHIC DISPLAYS (STN, FSTN, BST)

Part Number	Pixel Count WxH	Pixel Size (mm) WxH	Viewing Area (mm) WxH	Overall Dimension (mm) WxHxD	Driving Voltage (V)	Built-in Controller	Backlight		Contrast Ratio
							-30	-EL	
AND1021ST-EO	120 x 64	0.56 x 0.60	62.5 x 43.5	85 x 70 x 20	+5/-8.5	T6963C	-	EL	4:1
AND1021ST	120 x 64	0.56 x 0.60	62.5 x 43.5	85 x 70 x 20	+5/-8.5	T6963C	-	-	4:1
AND1261WGST	128 x 64	0.43 x 0.43	60 x 33	75 x 53 x 6.8	+5/-8.0	Built-in Data RAM	-	-	6:1
AND1261WGST-LED	128 x 64	0.43 x 0.43	60 x 33	75 x 53 x 8.9	+5/-8.0	Built-in Data RAM	LED		6:1
AND1391ST-EO	128 x 128	0.43 x 0.43	62 x 62	84.4 x 100 x 14	+5/-14.5	T6963C	-	EL	4:1
AND1391ST	128 x 128	0.43 x 0.43	62 x 62	84.4 x 100 x 14	+5/-14.5	T6963C	-	-	4:1
AND1013ST-EO	160 x 128	0.60 x 0.60	101 x 82	129 x 104.5 x 14	+5/-8.5	T6963C	-	EL	4:1
AND1013ST-30	160 x 128	0.60 x 0.60	101 x 82	129 x 104.5 x 14	+5/-8.5	T6963C	-30	-	4:1
AND711AST-EO	240 x 64	0.53 x 0.53	132 x 39	180 x 65 x 12	+5/-8.5	T6963C	-	EL	4:1
AND711AST-30	240 x 64	0.53 x 0.53	132 x 39	180 x 65 x 12	+5/-8.5	T6963C	-30	-	4:1
AND1781BST	240 x 64	0.53 x 0.53	127.2 x 33.9	180 x 70 x 14	+5/-7.2	T6963C	CCFL		6:1
AND1781MST	240 x 64	0.53 x 0.53	127.2 x 33.9	180 x 70 x 14	+5/-8.0	T6963C	CCFL		12:1
AND1741MST	240 x 128	0.50 x 0.50	126 x 70	170 x 106 x 14	+5/-14.5	T6963C	CCFL		12:1
AND1741BST	240 x 128	0.50 x 0.50	126 x 70	170 x 106 x 14	+5/-13.5	T6963C	CCFL		6:1
AND1742MST	240 x 128	0.51 x 0.51	134 x 76	180 x 110 x 15.1	+5	SED1330	CCFL		6:1
AND3222MST	320 x 240	0.36 x 0.43	128 x 110	166 x 134 x 15.1	+5/-18.0	SED1330	CCFL		6:1
AND3223MST	320 x 240	0.36 x 0.36	128 x 110	167 x 109 x 11	+5/-19.5	None	CCFL		6:1

- "30" means that the LCD has a transreflective reflector. Part would be ordered with a "-30" suffix. (i.e. AND1013ST-30)
- "EO" means that an electroluminescent panel is installed in the LCD. Order with the "EO" suffix. (i.e. AND1013ST-EO)
- CCFL means that a cold cathode fluorescent lamp is installed in the module
- "MST" means Film Super Twist Nematic (FSTN); "BST" means Blue Mode Super Twist Nematic LCD.

## LCD STN - INTELLIGENT CHARACTER DISPLAYS

(For extended temperature and electroluminescent backlight options please contact factory)

Part Number	Lines x Characters	Characters Size (mm) WxH	Viewing Area (mm) WxH	Outline Dimensions (mm) WxHxD	Driving Voltage (V)	Controller	Backlight
AND671GST	1 x 16	3.07 x 6.56	64.5 x 13.8	80 x 36 x 11.3	5	HD44780	-
AND671GST-LED	1 x 16	3.07 x 6.56	64.5 x 13.8	80 x 36 x 16	5	HD44780	LED
AND471GST	2 x 16	4.84 x 9.66	99 x 24	122 x 44 x 11.3	5	HD44780	-
AND471GST-LED	2 x 16	4.84 x 9.66	99 x 24	122 x 44 x 15.3	5	HD44780	LED
AND481GST	2 x 16	2.78 x 4.89	62 x 16	85 x 30 x 10.1	5	HD44780	-
AND481GST-LED	2 x 16	2.78 x 4.89	62 x 16	85 x 30 x 15.8	5	HD44780	LED
AND491GST	2 x 16	2.95 x 4.75	64.5 x 13.8	80 x 36 x 11.3	5	HD44780	-
AND491GST-LED	2 x 16	2.95 x 4.75	64.5 x 13.8	80 x 36 x 15.8	5	HD44780	LED
AND501GST	2 x 20	3.2 x 5.55	83 x 18.6	116 x 37 x 11.3	5	HD44780	-
AND501GST-LED	2 x 20	3.2 x 5.55	83 x 18.6	116 x 37 x 15.8	5	HD44780	LED
AND771GST	2 x 24	3.2 x 5.55	94.5 x 17.8	118 x 36 x 11.3	5	HD44780	-
AND771GST-LED	2 x 24	3.2 x 5.55	94.5 x 17.8	118 x 36 x 15.8	5	HD44780	LED
AND591GST	2 x 40	3.2 x 5.55	154.4 x 15.8	182 x 33.5 x 11.3	5	HD44780	-
AND591GST-LED	2 x 40	3.2 x 5.55	154.4 x 15.8	182 x 33.5 x 16.3	5	HD44780	LED
AND731GST	4 x 16	2.95 x 4.15	61.8 x 25.2	87 x 60 x 11.6	5	HD44780	-
AND731GST-LED	4 x 16	2.95 x 4.15	61.8 x 25.2	87 x 60 x 15.8	5	HD44780	LED
AND721GST	4 x 20	2.95 x 4.15	76 x 25.2	98 x 60 x 11.6	5	HD44780	-
AND721GST-LED	4 x 20	2.95 x 4.15	76 x 25.2	98 x 60 x 15.8	5	HD44780	LED
AND791GST	4 x 40	2.78 x 4.89	147 x 29.5	190 x 54 x 10.1	5	HD44780	-
AND791GST-LED	4 x 40	2.78 x 4.89	147 x 29.5	190 x 54 x 16.3	5	HD44780	LED

## LCD SEGMENTED PANEL DISPLAYS (ALSO AVAILABLE)

See our Web Site for complete specifications or call for our full line catalog.

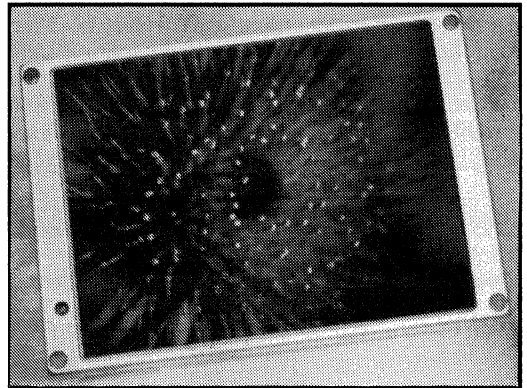
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# LCD Products



## COLOR TFT DISPLAYS

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- Control circuitry, inverters, and cabling available
- Engineering technical support



## COLOR TFT MONITORS (includes CCFL backlight, inverter and control circuitry)

Part Number	Screen Diagonal (inches)	Pixel Count WxH	Brightness cd/m <sup>2</sup>	Pixel Pitch (mm) WxH	Active Area (mm) WxH	Overall Dimension (mm) WxHxD	Driving Voltage	Input Signal
AND-TFT-18DM	1.8	160 x 234	230	0.076 x 0.114	36.5 x 27.4	51 x 39 x 13	12.0*	TFT Analog RGB
AND-TFT-25DM	2.5	160 x 234	300	0.106 x 0.161	50.9 x 27.7	68 x 55 x 13	12.0*	TFT Analog RGB
AND-TFT-5MQ	5	320 x 234	210	0.32 x 0.32	102.7 x 74.9	127 x 93 x 20	12	NTSC Composite
AND-TFT-5SQ	5	320 x 234	300	0.32 x 0.42	101.6 x 74.7	120 x 90 x 20	9.5	NTSC comp. & analog RGB interface
AND-TFT-4D	4	160 x 220	200	0.504 x 0.275	80.6 x 60.5	120 x 90 x 20	9.5	NTSC comp. & analog RGB interface
AND-TFT-5D	5	240 x 234	200	0.32 x 0.42	101.6 x 74.7	120 x 90 x 20	9.5	NTSC comp. & analog RGB interface
AND-TFT-5MQ	5	320 x 234	210	0.32 x 0.32	102.7 x 74.9	127 x 93 x 20	12	NTSC Composite
AND-TFT-5SQ	5	320 x 234	300	0.32 x 0.42	101.6 x 74.7	120 x 90 x 20	9.5	NTSC comp. & analog RGB interface
AND-TFT-6DQ	6	320 x 234	250	0.39 x 0.38	121.0 x 90.8	159 x 116 x 34	9.5	NTSC comp. & analog RGB interface
AND-TFT-6SQ	6	320 x 234	250	0.39 x 0.38	121.0 x 90.8	144 x 109.4 x 20	9.5	NTSC comp. & analog RGB interface
AND-TFT-64MQ	6.4	320 x 234	300	0.416 x 0.416	130.6 x 97.3	156 x 129 x 20	12	NTSC Composite

\* With external DC-DC converter / inverter

## COLOR TFT MODULES (includes CCFL backlight)

Part Number	Screen Diagonal (inches)	Pixel Count WxH	Brightness cd/m <sup>2</sup>	Pixel Pitch (mm) WxH	Active Area (mm) WxH	Overall Dimension (mm) WxHxD	Driving Voltage	Input Signal
AND08C015KA	7.8	640 x 480	100	0.25 x 0.35	160.0 x 120.0	225 x 158 x 10	5.0	Digital 3-bit interface
AND09C016K	9.5	640 x 480	95	0.30 x 0.30	192.0 x 144.0	267 x 180 x 12	5.0	Digital 3-bit interface
AND10C209A-HB	10.4	640 x 480	250	0.33 x 0.33	211.2 x 158.4	265 x 189 x 12	5.0	Digital 6-bit interface
AND10C209A-UHB	10.4	640 x 480	1000	0.33 x 0.33	211.2 x 158.4	265 x 189 x 25	5.0	Digital 6-bit interface
AND10C039	10.4	800 x 600	80	0.264 x 0.264	211.2 x 158.4	265 x 180 x 8.5	5.0	Digital 6-bit interface
AND10C273-HB	10.4	800 x 600	250	0.264 x 0.264	211.2 x 158.4	265 x 189 x 12	5.0	Digital 6-bit interface
AND12C268	12.1	800 x 600	70	0.3075 x 0.3075	246.0 x 184.5	275 x 195 x 8	3.3	Digital 6-bit interface
AND12C275A-HB	12.1	800 x 600	250	0.3075 x 0.3075	246.0 x 184.5	290 x 220 x 15	5.0	Digital 6-bit interface

## COLOR STN MODULES (includes CCFL backlight)

Part Number	Screen Diagonal (inches)	Pixel Count WxH	Brightness cd/m <sup>2</sup>	Pixel Pitch (mm) WxH	Active Area (mm) WxH	Overall Dimension (mm) WxHxD	Driving Voltage	Input Signal
ANDCS057Q-010	5.7	320 x 240	105	0.36 x 0.36	115.2 x 86.4	159 x 111 x 10	+5/+28.1	8-bit parallel
ANDCS104V-010	10.4	640 x 480	70	0.33 x 0.33	211.2 x 158.4	264 x 183 x 9	+5/+26.5	8-bit parallel <sup>(2)</sup>
ANDCS121S-010	12.1	800 x 600	150	0.306 x 0.306	245.0 x 183.8	275 x 202.5 x 8	+5 <sup>(1)</sup>	8-bit parallel <sup>(2)</sup>
ANDCS150X-010	15.0	1024 x 768	150	0.297 x 0.297	304.1 x 228.1	367 x 300 x 18	+5 <sup>(1)</sup>	8-bit parallel <sup>(2)</sup>

NOTE 1: Requires separate 0.8 - 2.8 volts for contrast adjustment; NOTE 2: Dual scan.

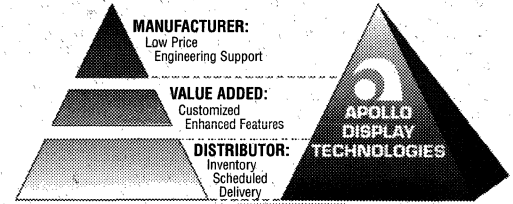
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# OPTREX LCD... OPTREX LCD... OPTREX LCD... OPTREX LCD

Apollo Display Technologies is a unique manufacturer/distributor specializing in LCD technology. Since the beginning of the LCD module industry, Apollo has served the OEM market as a technical, stocking distributor and value added manufacturer of LCD products and services. Our standard product line of OPTREX LCD modules are sold at aggressive factory-direct prices. Our value added and semi-custom manufacturing services broaden the variety and performance characteristics to best suit customers' needs. It is our unique combination of low-cost standard products, large inventory, technical assistance and value added services that has made Apollo the first choice of so many display engineers.

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CHAR x ROW	CHAR HT	BACKLIGHT	PART #	CHAR x ROW	CHAR HT	BACKLIGHT	PART #
8x2	4.75	REFLECTIVE	DMC50448N	20x4	4.75	REFLECTIVE	DMC20434N-B
16x1	9.66	Y/G LED	DMC16128NY-LY	20x4	4.75	WHITE EL	DMC20481N-SEW
16x1	5.95	Y/G LED	DMC16105NY-LY	20x4	4.75	Y/G LED	DMC20481NY-LY-B
16x1	9.66	REFLECTIVE	DMC16129N-B	24x2	5.55	REFLECTIVE	DMC24227N-B
16x1	14.54	Y/G LED	DMC16188NY-LY	24x2	5.55	WHITE EL	DMC24227N-SEW-B-11
16x2	5.55	REFLECTIVE	DMC16207N-B	24x2	5.55	Y/G LED	DMC2074NY-LY-B
16x2	4.85	Chip-On-Glass	DMC50747NF	24x2	5.55	REFLECTIVE	DMC40218N-B
16x2	4.35	Y/G LED	DMC50292NY-LY-B	40x2	5.55	WHITE EL	DMC40218N-SEW-B
16x2	5.55	Y/G LED	DMC16202NY-LY-1(B)	40x2	5.55	Y/G LED	DMC40267NY-SLY-B
16x2	5.55	WHITE EL	DMC16207N-SEW-B	40x2	5.55	Y/G LED (mini)	DMC40205NY-LY-B
16x2	9.66	REFLECTIVE	DMC16230N	40x4	4.89	REFLECTIVE	DMC40457N-B
16x2	9.66	Y/G LED	DMC16230NY-LY-B	40x4	4.89	WHITE EL	DMC40457N-SEW-B
16x4	4.75	REFLECTIVE	DMC16433N-B	40x4	4.89	Y/G LED	DMC40457NY-LY-B
16x4	4.75	WHITE EL	DMC16433N-SEW-B				
20x1	9.66	Y/G LED	DMC20171NY-LY				
20x2	5.55	REFLECTIVE	DMC50218N-B				
20x2	5.55	WHITE EL	DMC20261AN-SEW-B				
20x2	5.55	Y/G LED	DMC20261ANY-LY-B				
20x2	9.22	Y/G LED	DMC20203NY-LY-B				

## GRAPHIC LCD WITH CONTROLLER ON-BOARD

**Most popular Optrex LCD's with controller IC and RAM on LCD's driver board:**

Resolution	Type #	Dot Pitch	Controller IC	Popular Versions (Type # -)	Comments
119 x 73	DMF50834	0.36 x 0.36	UPD16435	-NFJ-SEB	EL w/inverter (wide temp)
128 x 32	DMF50426	0.43 x 0.43	HD61202	-NYJ-LY	LED (wide temp)
128 x 64	DMF50427	0.43 x 0.43	HD61202	-NYJ-LY, NFJ-EB	LED (wide temp)
128 x 112	DMF5002	0.54 x 0.53	T6963C	-N, NY-EB	Reflective, EL
128 x 128	DMF50549	0.43 x 0.43	T6963C	-NU	Reflective
160 x 128	DMF5001	0.58 x 0.58	T6963C	-NF, -NYL-EB, -NY-LY	Reflective, EL, LED
160 x 128	DMF5003	0.58 x 0.58	T6963C	-NB-FW, -NF-FW	CCT, CCT B&W
240 x 64	DMF5005	0.53 x 0.53	T6963C	-N, -NF, -NF-SEW, -NY-LY	Reflective, Reflective B&W, EL B&W, LED
240 x 64	DMF5010	0.53 x 0.53	T6963C	-NB-FW, -NF-FW (back-lit)	CCT, CCT B&W
240 x 64	DMF50316	0.53 x 0.53	T6963C	-NF-FW-1 (edge-lit)	CCT B&W
240 x 128	DMF50773	0.50 x 0.50	T6963C	-NF-SLY, -NF-FW	LED, B&W, CCT B&W

## GRAPHIC LCD WITH EXTERNAL CONTROLLER

**Most popular Optrex LCD's with external controller IC or controller board required:**

Resolution	Type #	Dot Pitch	Controller Board	Popular Versions (Type # -)	Comments
128 x 64	DMF50202	0.44 x 0.60	PC55, CDS6255	-NY-LY	LED
128 x 64	DMF50051	0.44 x 0.60	PC55, CDS6255	-N-SEW	EL
160 x 64	DMF50374	0.60 x 0.60	CDS1330, PC104-1330	-NYU-LY-1	LED
256 x 128	DMF682A	0.47 x 0.47	CDS1330, PC104-1330	-NF, -NF-EW	Reflective, B&W EL
256 x 128	DMF6104	0.47 x 0.47	CDS1330, PC104-1330	-NFL-SFW, -NF-FW	CCT, CCT B&W
256(x3) x 64	DMF50887	0.117(X3) X 0.35	Consult Sales	-NCJU-FW-1	CCT, 1-DIN Color
320 x 240	DMF50081	0.30 x 0.30	CDS1330, PC8106N, VGA-104N, PC/104-1330	-NB-FW, -NF-FW, NY-SEW	CCT, CCT B&W, EL
320 x 240	DMF50417	0.30 x 0.30	CDS1330, PC8106N, VGA-104N, PC/104-1330	-NY-SLY	LED
320 x 240	DMF50174	0.36 x 0.30	CDS1330, PC8106N, VGA-104N, PC/104-1330	-NB-FW, -NF-FW	CCT, CCT B&W
320 x 240	DMF50174	0.36 x 0.36	CDS1335, PC8106N, VGA104N, PC/104-1330	-NFL-SFW-11	CCT, sunlight read
320 x 240	DMF50840	0.36 x 0.36	CDS1335, PC8106N, VGA104N, PC/104-1330	-NF-SFW	CCT, sunlight read
320 x 240	DMF50840	0.36 x 0.36	CDS1330, PC8106N, VGA104N, PC/104-1330	-NF-FW	CCT, <i>touch option</i>
320 x 240	DMF50840	0.36 X 0.36	CDS1335, PC8106N, VGA104N, PC/104-1330	-NFL-SLY	LED, sunlight read
320(x3) x 240	DMF50944	0.09(x3) x 0.33	PC8106N, VGA-104N	-NCU-FW-11	CCT 5.7" Color
640 x 200	DMF50036	0.35 x 0.49	CDS1330, PC8106N, VGA-104N, PC104-1330	-NBU-FW, NFU-FW	CCT, CCT B&W
640 x 480	DMF50766	0.079 x 0.237	PC8106N, VGA-104P	-NC-FW	CCT 7.5" Color
640 x 480	DMF50961	0.23 x 0.23	PC8106N, VGA-104N	-NF-FW	CCT 7.2" B&W
640 x 480	DMF50260	0.30 x 0.30	PC8106N, VGA-104N	-NF-FW-15	CCT 9.4" B&W

For 10.4" ~ 15.0" color screens & kits with controller, inverter and cable(s), please contact the Apollo Sales Office for the latest models and specifications.

**OPTREX LCD...OPTREX LCD...OPTREX LCD...OPTREX LCD****Apollo LCD Controller Boards****PC\104 Bus**

- **VGA-104:** low cost, dedicated PC/104 bus controller card driving both monochrome and color passive LCD's from 320 x 240 to 640 x 480 screens.
- **PC\104-1330:** low cost, general purpose PC\104 bus controller for sub-VGA resolution monochrome LCDs; features on-board character generator with a full graphic overlay capability; based around SMOS SED1330(5) controller IC; supports single scan screen resolutions of 160x64, 240x128, 256x128, 320x240 and 640x200.
- **PC\104-5000:** low cost, general purpose PC\104 bus interface board for graphic LCDs ("5000-Series") which have a Toshiba T6963C controller IC on the LCD itself; interface is 8-bit parallel data; the T6963C includes character generator ROM and 8k screen RAM with graphics bit-mapped; supports screen resolutions of 128x112, 128x128, 128x160, 160x128, and 240x64.

**PCI Bus**

- **PCI-1000:** 32-bit PCI-bus controller for passive & active color LCD screens from VGA to XGA and EWS resolutions.

**ISA Bus**

- **PC8106:** low cost, dedicated controller for color and monochrome passive LCD's replacing the standard ISA VGA video card; supports screen resolutions from 320x200 up to 640x480.
- **CDS-545:** 16-bit ISA bus controller for passive color and active color TFT LCD displays of VGA (640x480), SVGA (800x600), XGA (1024x 786) and EWS (1280x1024) resolutions.

**General Purpose CPU/MPU**

- **CDS1350 Series:** runs small, mid-size and large graphic passive LCD's with direct, low cost, microprocessor control. Can run monochrome screens to 16-grey levels and color screens to 256 simultaneous colors. Character & graphic software available to simplify development.
- **CDSxyG:** parallel I/O controller board/IC for displays with on-board T6963C controller IC. Smart "windows" with high level commands to simplify graphics programming. Available in board or IC format.
- **CDS1330/VEE/32K:** general purpose controller for CPU/MPU with 8-bit parallel data interface; supports Intel and Motorola formats; includes Vee LCD contrast circuit and 32K screen RAM (optional 64K); features on-board character generator with a full graphic overlay capability; based around the SMOS SED1330(5) controller IC; supports single-scan screen resolutions of 160x64, 240x128, 256x128, 320x240 and 640x200. [Note: this controller is often more popular than the CDS6255 noted below due to the CDS1330's multiple character fonts and graphic capabilities; however, since it can only support single scan LCDs, the CDS6255 is offered as an alternative].

**RS232 Serial**

- **CDSxxxC:** general purpose serial to parallel converter for serial RS232 interface to character LCDs which have the HD44780 (or compatible) controller on the LCD itself. Direct LCD mounting is available for many modules.
- **CDSxyG:** many graphic software features with this serial RS-232 controller for small & mid-size graphic LCD's. Keyboard I/O and direct mounting to display available.

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## ASIA WINTEK: *Standard Character Type LCMs*

Display Format (char. x line)	Model No.	Module Size (W x H x T) mm	Effective Viewing Area (W x H) mm	Character Size (W x H) mm	Dot Size (W x H) mm	Driving Method (Duty)	Apx. Weight (g)	Process & Color					Backlight			
								TN	HTN	STN Gray	STN Yellow	STN Blue	None	LED	EL	
<b>16x1</b>	WM-C1601M	80.0 x 36.0 x 9.5/14.5	64.5 x 15.0	3.07 x 6.56	0.55 x 0.75	1/16	26	○	○	○	○	○	○	○	○	○
	WM-C1601P	80.0 x 36.0 x 9.5/14.5	64.5 x 15.0	3.07 x 6.56	0.55 x 0.75	1/16	26	○	○	○	○	○	○	○	○	○
	WM-C1601Q	122.0 x 33.0 x 10.0/14.5	99.0 x 13.0	4.84 x 9.66	0.92 x 1.10	1/16	55	○	○	○	○	○	○	○	○	○
	WD-C1601T	80.0 x 36.0 x 9.5/14.5	64.5 x 15.0	3.07 x 6.56	0.55 x 0.75	1/16	26	○	○	○	○	○	○	○	○	○
<b>16x2</b>	WM-C1602K	84.0 x 44.0 x 9.5/14.5	63.0 x 18.0	2.95 x 5.55	0.55 x 0.65	1/16	30	○	○	○	○	○	○	○	○	○
	WM-C1602M	80.0 x 36.0 x 9.5/14.5	64.5 x 15.0	2.95 x 5.55	0.55 x 0.65	1/16	34	○	○	○	○	○	○	○	○	○
	WD-C1602N	93.0 x 50.0 x 10.0	72.0 x 227.0	3.49 x 7.22	0.65 x 0.85	1/16	30	○	○	○	○	○	○	○	○	○
	WM-C1602N	85.0 x 29.5 x 9.5/13.0	62.5 x 16.5	2.78 x 4.89	0.50 x 0.55	1/16	30	○	○	○	○	○	○	○	○	○
	WM-C1602Q	122.0 x 44.0 x 10.0/14.5	99.0 x 24.0	4.84 x 9.66	0.92 x 1.10	1/16	46	○	○	○	○	○	○	○	○	○
	WD-C1602Q	122.0 x 44.0 x 10.0/14.5	99.0 x 24.0	4.84 x 9.66	0.92 x 1.10	1/16	46	○	○	○	○	○	○	○	○	○
	WD-C1602R	85.0 x 36.0 x 9.5/14.5	64.5 x 15.0	2.95 x 4.35	0.55 x 0.50	1/16	40	○	○	○	○	○	○	○	○	○
<b>16x4</b>	WM-C1604M	87.0 x 60.0 x 9.5/14.5	61.8 x 25.2	2.95 x 4.75	0.55 x 0.55	1/16	50	○	○	○	○	○	○	○	○	○
<b>20x2</b>	WM-C2002M	116.0 x 37.0 x 9.5/14.5	84.0 x 18.6	3.20 x 5.55	0.60 x 0.65	1/16	40	○	○	○	○	○	○	○	○	○
	WM-C2002P	180.0 x 40.0 x 9.5/14.5	149.0 x 23.0	6.00 x 9.66	1.12 x 1.12	1/16	80	○	○	○	○	○	○	○	○	○
<b>20x4</b>	WM-C2004M	98.0 x 60.0 x 9.5/14.5	76.0 x 25.2	2.95 x 4.75	0.55 x 0.55	1/16	60	○	○	○	○	○	○	○	○	○
<b>24x2</b>	WM-C2402M	118.0 x 36.0 x 9.5/14.5	94.5 x 18.0	3.20 x 5.55	0.60 x 0.65	1/16	50	○	○	○	○	○	○	○	○	○
	WM-C2402P	113.1 x 36.0 x 9.5	94.5 x 18.0	3.20 x 5.55	0.60 x 0.65	1/16	50	○	○	○	○	○	○	○	x	x
<b>40x2</b>	WM-C4002M	182.0 x 32.0 x 9.5/14.5	154.5 x 16.5	3.20 x 5.55	0.60 x 0.65	1/16	75	○	○	○	○	○	○	○	○	○
<b>40x4</b>	WM-C4004A	190.0 x 54.0 x 10.5/14.5	147.0 x 29.5	2.78 x 4.89	0.50 x 0.55	1/16	125	○	○	○	○	○	○	○	○	○

## ASIA WINTEK: *Standard Graphic Type LCMs*

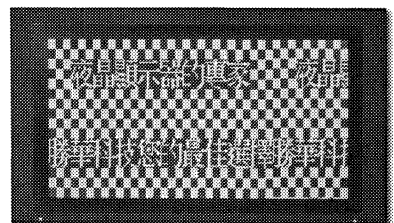
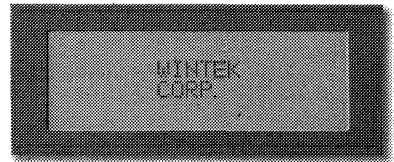
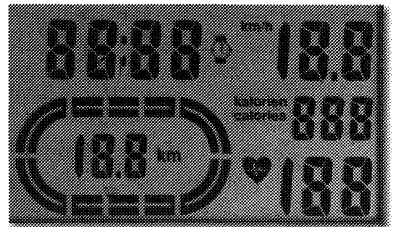
Number of DOTS	Model No.	Module Size (W x H x T) mm	Effective Viewing Area (W x H) mm	Dot Size (W x H) mm	Dot Pitch (W x H) mm	Driving Method (Duty)	Apx. Weight (g)	Process & Color					Backlight				Built-In Controller	Notes	
								HTN	STN Gray	STN Yellow	STN Blue	NONE	LED	EL	CCTL				
<b>122x32</b>	WM-G1203Q	84.0 x 44.0 x 10.0/13.0	60.5 x 18.5	0.4 x 0.45	0.44 x 0.49	1/32	30	○	○	○	○	○	○	○	○	○	○	SED1520	Vop=4.6v
<b>128x64</b>	WM-G1206A	93.0 x 70.0 x 8.5/13.5	71.7 x 39.0	0.48 x 0.48	0.52 x 0.52	1/64	65	○	○	○	○	○	○	○	○	○	○	HD61202	Single Power Supply Available
<b>240x64</b>	WM-G2406A	180.0 x 65.0 x 10.0/20.1	134.0 x 40.0	0.49 x 0.49	0.53 x 0.53	1/64	120	○	○	○	○	○	○	○	○	○	○	T6963C	
<b>240x64</b>	WM-G2406B	180.0 x 65.0 x 10.0/20.1	134.0 x 40.0	0.49 x 0.49	0.53 x 0.53	1/64	120	○	○	○	○	○	○	○	○	○	○	HD61830	
<b>240x128</b>	WM-G2412A	170.0 x 101.0 x 14.0	132.0 x 76.0	0.47 x 0.47	0.50 x 0.50	1/128	180	○	○	○	○	○	○	○	○	○	○	T6963C	
<b>320x240</b>	WM-G3224A	167.0 x 109.0 x 10.0	122.0 x 92.0	0.33 x 0.33	0.36 x 0.36	1/240	240	○	○	○	○	○	○	○	○	○	○		



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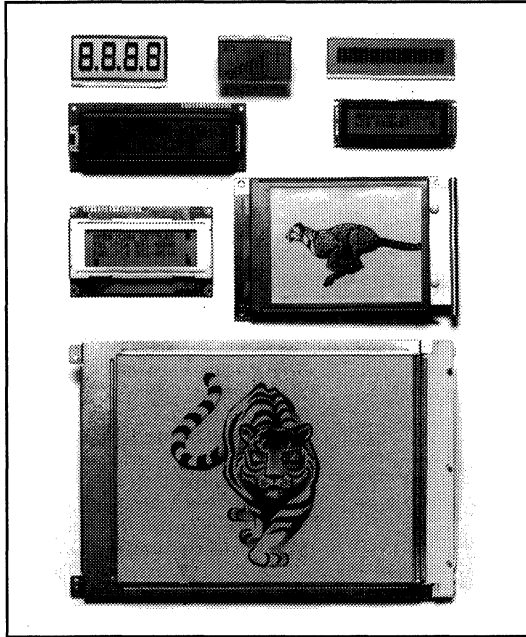
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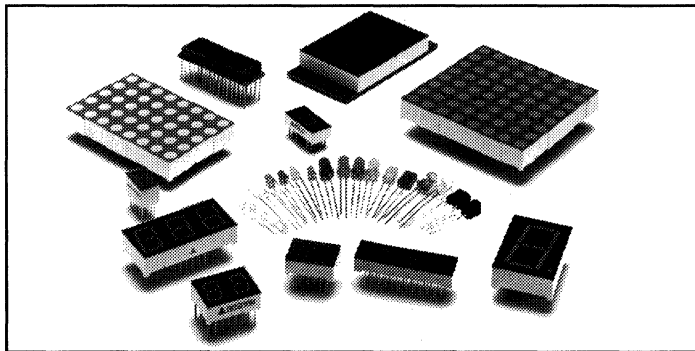
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# LED

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# COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

## A

**A/D** acrylonitrile butadiene-styrene  
**A/D** analog to digital  
**ADC** analog to digital converter  
**ADP** automatic data processing  
**AFC** audio frequency control  
**AFT** automatic filter test  
**ALGOL** algorithmic language  
**AM** a logical operator  
**AQL** acceptable quality level  
**ASCII** American national standard code for information interchange  
**ASIC** application specific IC  
**ATE** automatic test equipment  
**ATG** automatic test generation  
**AWG** American wire gauge

## B

**BALUN** balanced to unbalanced  
**BASIC** beginners' all-purpose symbolic instruction  
**BCD** binary-coded decimal  
**BNC** baby "N" connector  
**BUS** basic utility syste

## C

**CAD** computer-aided design  
**CAE** computer-aided engineering  
**CAM** computer-aided manufacture  
**CAMAC** computer-automated measurement and control  
**CAPP** computer-aided process planning  
**CAT** computer-aided test  
**CATV** cable television or community antenna television  
**CCC** (leaded) ceramic chip carriers  
**CCD** computer-controlled display  
**CERMET** ceramic metal element  
**CIE** computer-integrated engineering  
**CIM** computer-integrated manufacturing  
**CLCC** ceramic leadless chip carriers  
**CMOS** complementary metal-oxide semiconductor  
**Comm.** communications  
**CPS** characters per second  
**CPU** central processing unit

## D

**D/A** digital to analog  
**DAC** digital to analog converter  
**DBMS** data base management system  
**DC** direct current  
**DFT** design for testability  
**DIAC** bidirectional trigger diode  
**DIL** dual in-line  
**DIN** Deutsche Industrie Normenausschuss  
**DIP** dual in-line package  
**DPM** digital panel meter  
**DRAM** dynamic RAM  
**DTL** diode transistor logic

## E

**EDA** electronic design automation  
**EDP** electronic data processing  
**EBCDIC** extended binary coded decimal interchange code  
**EEPROM** electrically erasable PROM

## EIA Electronic Industries

Association  
**EMC** electromagnetic compatibility  
**EMI** electromagnetic interference  
**EMP** electromagnetic pulse  
**EPROM** erasable programmable ROM  
**ESR** equivalent series resistance

## F

**FEP** fluorinated ethylene propylene Copolymer, 200° Teflon  
**FET** field-effect transistor  
**FM** frequency modulation  
**FORTRAN** formula translator

## G

**GaAsFET** gallium arsenide FET  
**CMIP** commn management information protocol  
**GPIB** general purpose interface bus  
**GPS** global positioning system

## H

**HF** high frequency (3 to 30 MHz)  
**HIPOT** test, measurement, and diagnostic equipment  
**HLL** high level language  
**HV** high voltage  
**Hz** Hertz

## I

**IAB** Internet Activities Board  
**IC** integrated circuit  
**IDC** insulation displacement contact  
**IF** intermediate frequency  
**IO** input/output (devices)  
**IR** insulation resistance (or) infrared  
**ISDN** integrated services digital network  
**ISO** International Standards Organization

## J

**JEDEC** Joint Electronic Device Engineering Council  
**JFET** junction FET  
**JMOS** junction MOS

## K

**kHz** kilohertz ( $10^3$  hertz)  
**KSR** keyboard send/receive

## L

**LAN** local area network  
**LC (filters)** inductance/capacitance  
**LCC** leaded chip carrier  
**LCD** liquid crystal display  
**LED** light-emitting diode  
**LF** low frequency (30 to 300 kHz)  
**LIF** low insertion force  
**LNA** low noise amplifier  
**LNB** low noise band  
**LSI** large scale integration  
**LVDT** linear velocity displacement transformer

## M

**MASER** microwave amplification by stimulated emission of radiation  
**MATV** master antenna television

## µF microfarad

**MHz** megahertz  
**MIC** microwave IC  
**MIPS** million instructions per second  
**MIB** microcomputer interface board  
**MOS** metal oxide semiconductor  
**MOSFET** metal oxide semiconductor FET  
**MOSIGT** metal oxide semiconductor insulated-gate transistor  
**MOV** metal oxide varistor  
**MPU** microprocessor unit  
**MSI** medium scale integration

## N

**NBS** National Bureau of Standards  
**NEMP** nuclear electromagnetic pulse  
**NIM** national instrumentation module  
**NOR** not OR  
**NTC** negative temperature coefficient

## O

**OCR** optical character reader  
**OEM** original equipment manufacturer  
**OR** a logical operator  
**OSI** open systems interconnection

## P

**PAL** programmable array logic  
**PC** printed circuit  
**PCB** printed circuit board  
**PCM** pulse code modulation  
**PCS** plastic clad silica  
**pF** picofarad  
**PGA** pin grid array  
**PIN** positive-intrinsic-negative (transistor)  
**PLA** programmable logic array  
**PLCC** plastic leaded chip carrier  
**PLL** phased lock loop  
**PPI** plan position indicator  
**PROM** programmable ROM  
**PTC** positive temperature coefficient  
**PUT** programmable unijunction transistor

## Q

**QAM** quadrature amplitude modulation  
**Q (meter)** quality-factor meter

## R

**RAM** random access memory  
**RC** resistance-capacitance  
**RFI** radio frequency interference  
**RMS** root mean square  
**ROM** read only memory  
**RF** radio frequency  
**RFC** radio-frequency choke  
**RFI** radio-frequency interference  
**RTD** resistance-temperature detector  
**RTL** resistor transistor logic  
**RTV** room temperature vulcanizing  
**RW** read/write

## S

**SAS** silicon asymmetrical switch  
**SBC** single board (micro) computer

**SBS** silicon bilateral switch  
**SCR** silicon-controlled rectifier  
**SCS** silicon-controlled switch  
**SDA** source & detector assemblies  
**SGMP** simple gateway monitoring protocol  
**SIDAC** bidirectional voltage-triggered switch  
**SIMM** single in-line memory module  
**SIP** single in-line package  
**SMD** surface mount device  
**SMT** surface mount technology  
**SNMP** simple network management protocol  
**SO** small outline  
**SOIC** small outline IC  
**SOT** small outline transistor  
**SSI** small scale integration  
**SSR** solid-state relay  
**STL** Schottky transistor logic  
**SUS** silicon unilateral switch

## T

**TC** temperature coefficient  
**TCE** thermal coefficient of expansion  
**TXCO** temperature compensated crystal oscillator  
**TFE** tetrafluoride ethylene propylene Copolymer, 250° Teflon  
**TRIAC** bidirectional AC switch  
**TTL** transistor-transistor logic  
**TTY** teletypewriter

## U

**UHF** ultra high frequency (300 MHz to 3 GHz)  
**UJT** silicon unijunction transistor  
**UL** Underwriters Laboratory  
**UPS** uninterruptible power supply

## V

**VAC** volts (of) alternating current  
**VAN** value-added network  
**VAR** volt-ampere reactive  
**VCR** video cassette recorder  
**VDC** volts (of) direct current  
**VHF** very high frequency (30 kHz to 300 MHz)  
**VHSIC** very high speed integrated circuit  
**VLF** very low frequency (3 to 30 kHz)  
**VLSI** very large scale integration  
**VME** virtual machine environment  
**VRM** voice recognition module  
**VTVM** vacuum tube volt meter  
**VU** volume unit  
**SWR** voltage standing wave ratio

## W

**WPS** word processing software

## Y

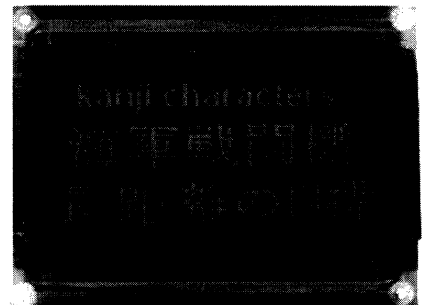
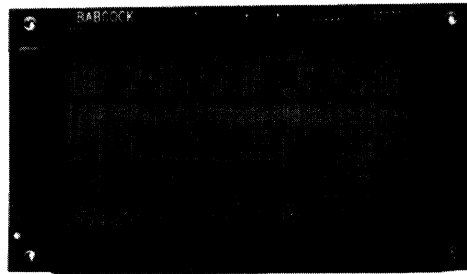
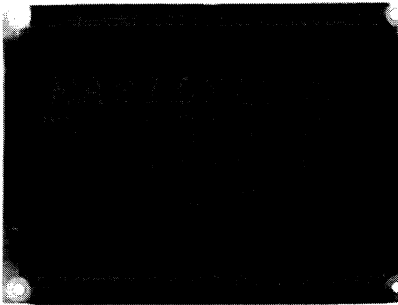
**YIG** yttrium iron garnet

## Z

**ZIF** zero insertion force

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## PLASMA GRAPHIC DISPLAYS

Graphic and character format dc-plasma flat panel displays **MADE IN THE USA.** Custom or standard designs. Standard vacuum fluorescent modules.

Columns/ Rows	Pixel Size	Pixel Pitch	Glass Size	Glass P/N	Module P/N with Drivers	Module P/N with Controller
128 x 32	.050	.100	13.93 x 4.14	GP-032X128-01	GD-032D128-02	GD-032C128-01
128 x 64	.020	.040	6.75 x 3.67	GP-064X128-01	GD-064D128-01	GD-064C128-01
128 x 64	.050	.100	13.92 x 7.34	GP-064X128-02	GD-064D128-02	GD-064C128-02
128 x 64	.012	.025	4.33 x 2.75	GP-064X128-03	GD-064D128-03	GD-064C128-03
192 x 64	.050	.080	16.45 x 6.22	GP-064X192-01	GD-064D192-01C	GD-064C192-01C
256 x 64	.040	.060	13.75 x 5.14	GP-064X256-01	GD-064D256-01C	GD-064C256-01C
192 x 96	.012	.030	6.57 x 3.66	GP-096X192-01	GD-096D192-01	GD-096C192-01
192 x 96	.012	.026	5.40 x 3.77	GP-096X192-02	GD-096D192-02	GD-096C192-02
280 x 120	.015	.035	9.50 x 5.45	GP-120X280-01	GD-120D280-01	GD-120C280-01C

\*Model P/N's ending with a "C" denote a model with integrated dc-dc converter.

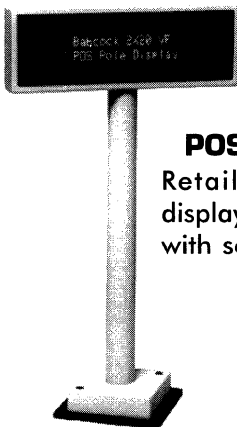
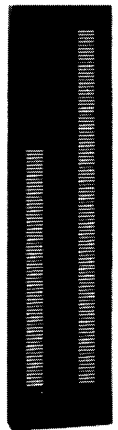
## PLASMA CHARACTER FORMAT DISPLAYS

Lines/Char	# of Char.	Character Ht.	Glass Size	Glass P/N	Module P/N
4 x 16	64	9.9mm (.39")	6.10 x 2.90	SP-481-002	DM-0416
4 x 20	80	5.0mm (.20")	4.75 x 2.30	SP-481-007	DM-0420
6 x 40	240	6.5mm (.26")	9.85 x 3.38	SP-481-010	DM-0640
8 x 32	256	6.6mm (.26")	9.90 x 4.75	SP-481-008	DM-0832
12 x 40	480	6.6mm (.26")	9.58 x 6.68	SP-481-006	DM-1240

\*7 and 14-Segment format display panels are available in various sizes.

## PLASMA DUAL BAR GRAPH

Babcock can provide replacement bar graph displays for hard to find discontinued models.



### POS DISPLAY

Retail customer display replacement with serial interface

## VF CHARACTER FORMAT DISPLAYS

Lines/Char	# of Char.	Character Ht.	Format	Module P/N
1 x 20	20	9.0mm (.35")	5 x 7	VF/VL-0120
1 x 40	40	4.6mm (.18")	5 x 7	VF/VL-0140
2 x 20	40	5.0mm (.20")	5 x 7	VF/VL-0220
2 x 20	40	9.5mm (.37")	5 x 7	VL-0220-05
2 x 40	80	5.0mm (.20")	5 x 7	VF/VL-0240
6 x 40	240	5.0mm (.20")	5 x 7	VF-0640

\*14-Segment format modules available as one line by 16, 20 or 32 characters.

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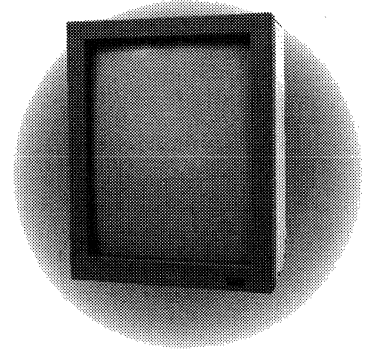
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### MODEL 1654 – 21 INCH FS 2048x2560 PIXELS

- *Active video area:* 11.8x15.75 with P45 phosphor
- *Brightness:* 90ftL with 90% AR panel
- *Contrast Ratio:* 256:1 at 1.5fc ambient

### MODEL 2000 – 21 INCH FS 2048x2560 PIXELS

- *Active video area:* 11.8x15.75 with P45 phosphor
- *Brightness:* 150ftL with 90% AR panel
- *Contrast Ratio:* 500:1 at 1.5fc ambient

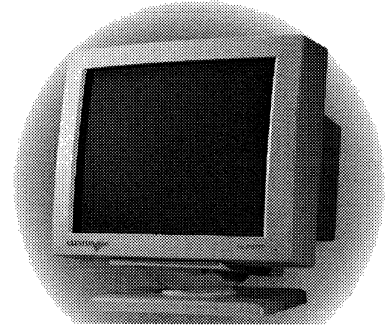


### MODEL DS2000 SERIES – 20 INCH FP 1600 x1280 PIXELS

- *Digital multi-sync:* VGA to 1280 lines @ 105 kHz
- *Active video area:* 14.25x10.7 with P104 phosphor
- *Brightness:* up to 100ftL peak with 90% AR panel at 1024 lines

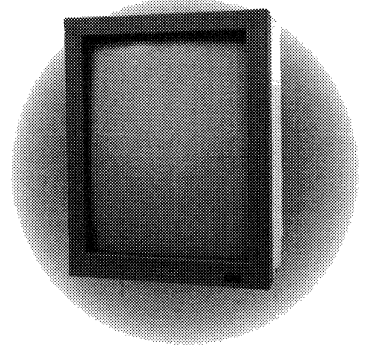
### MODEL DS2100HB – 21 INCH FS 1600 x1280 PIXELS

- *Digital multi-sync:* VGA to 1280 lines @ 105 kHz
- *Active video area:* 15.25x11.4 with P104 phosphor
- *Brightness:* up to 75ftL peak with 90% AR panel at 1024 lines.



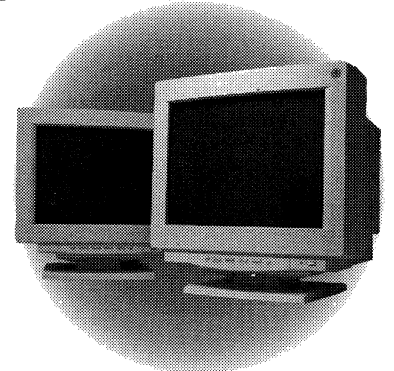
### MODEL D2100 P/L – 21 INCH FS 2048x2560 PIXELS

- *Digital controlled:* Portrait or Landscape
- *Active video area:* 11.8x15.75 with P45 phosphor
- *Brightness:* 100ftL with 61% AR panel  
or 150ftL with 90% AR panel
- *Contrast Ratio:* 700:1 at 1.5fc ambient with 61% panel  
or 500:1 at 1.5fc ambient with 90% panel



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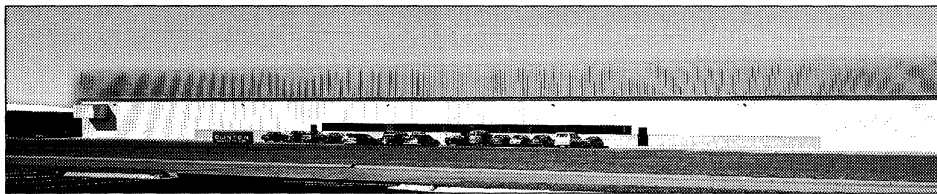
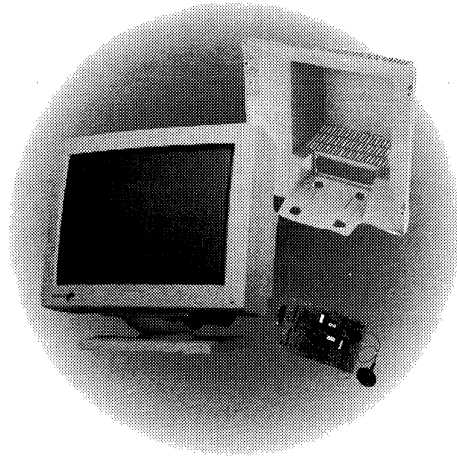
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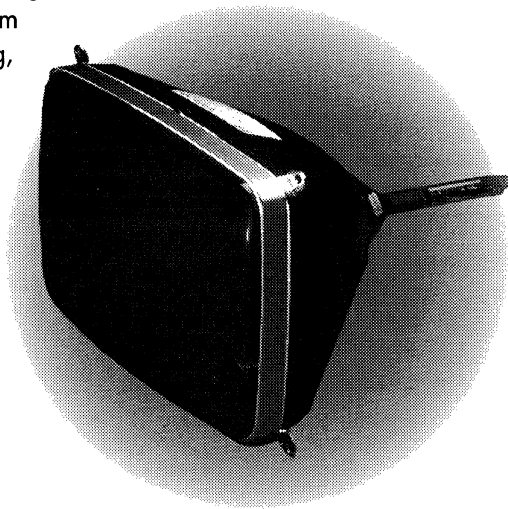
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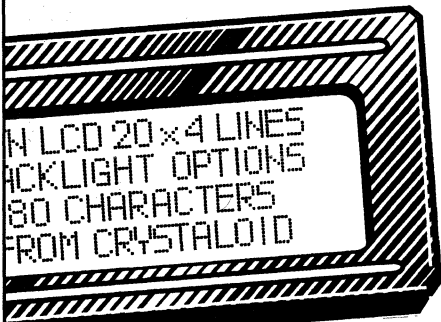
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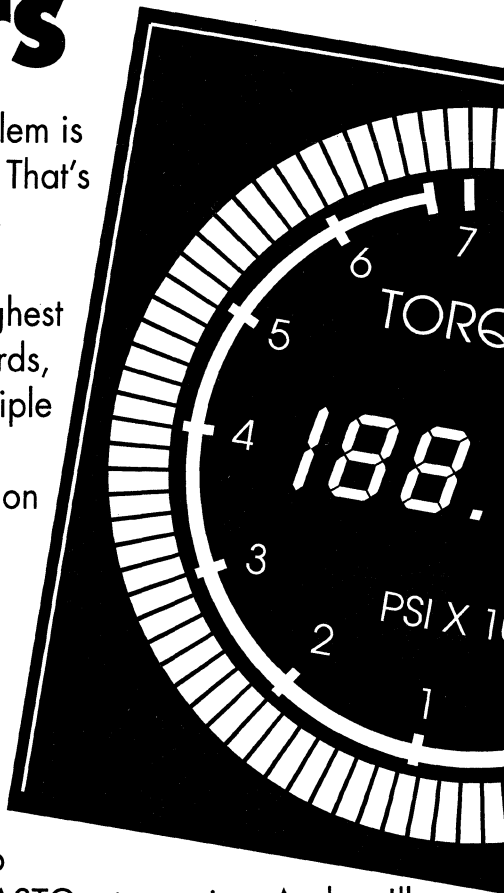
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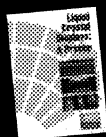
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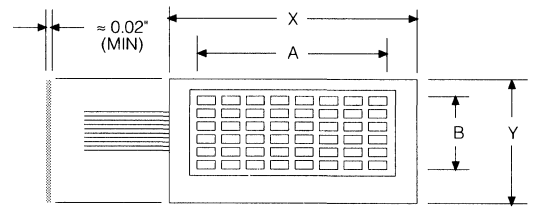
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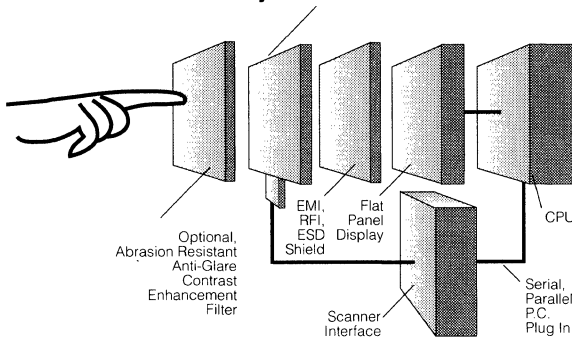


A • B = ACTIVE AREA  
X • Y = OVERALL AREA

### Standard Touch Screens

Active Area		Resolution		Part No.
A	B	Row X	Column	
2.1	2.1	4	4	1880
3.0	3.0	4	4	1146
3.6	2.9	4	4	2560
3.7	2.9	6	9	2510
3.8	2.8	8	8	3130
4.0	3.0	12	16	2000
4.2	2.3	8	8	2630
4.6	3.4	5	6	2660
4.8	2.6	8	8	2790
5.0	2.7	8	8	2600
5.3	3.9	8	8	3003
6.0	4.2	8	8	1951
6.5	4.5	6	8	1052
6.7	5.1	8	8	3780
7.6	4.7	11	18	1185
7.7	3.8	16	32	1081
7.7	3.8	5	8	2170
7.7	4.8	8	8	1232
7.8	5.9	16	16	2270
8.3	6.2	32	32	3770
9.5	7.0	24	40	1036
10.1	7.5	8	10	2970
12.9	9.5	25	40	3970

CyberTouch Touch Screen



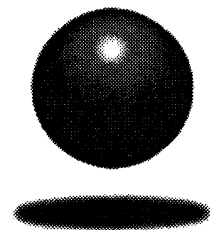
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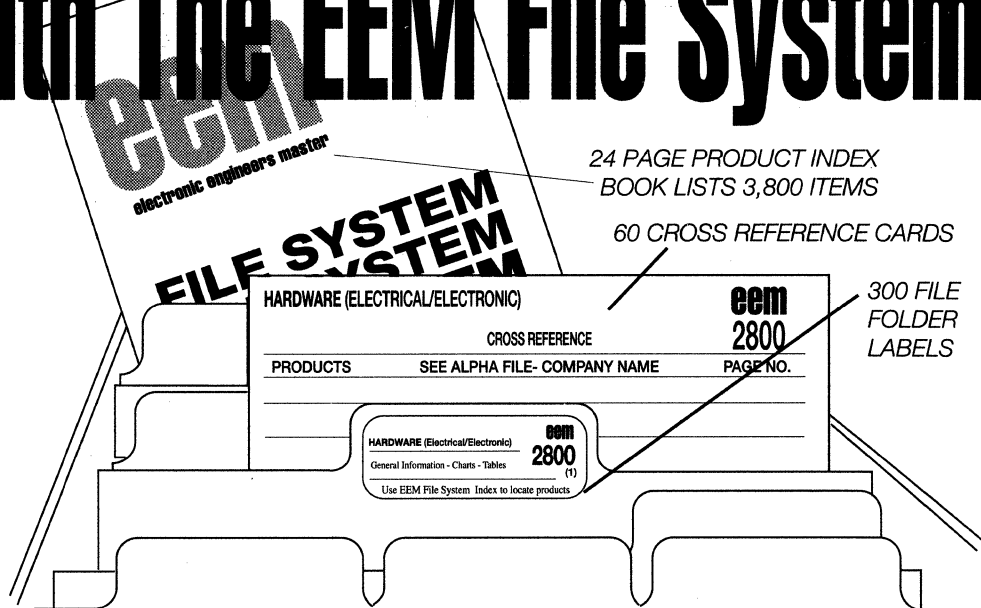
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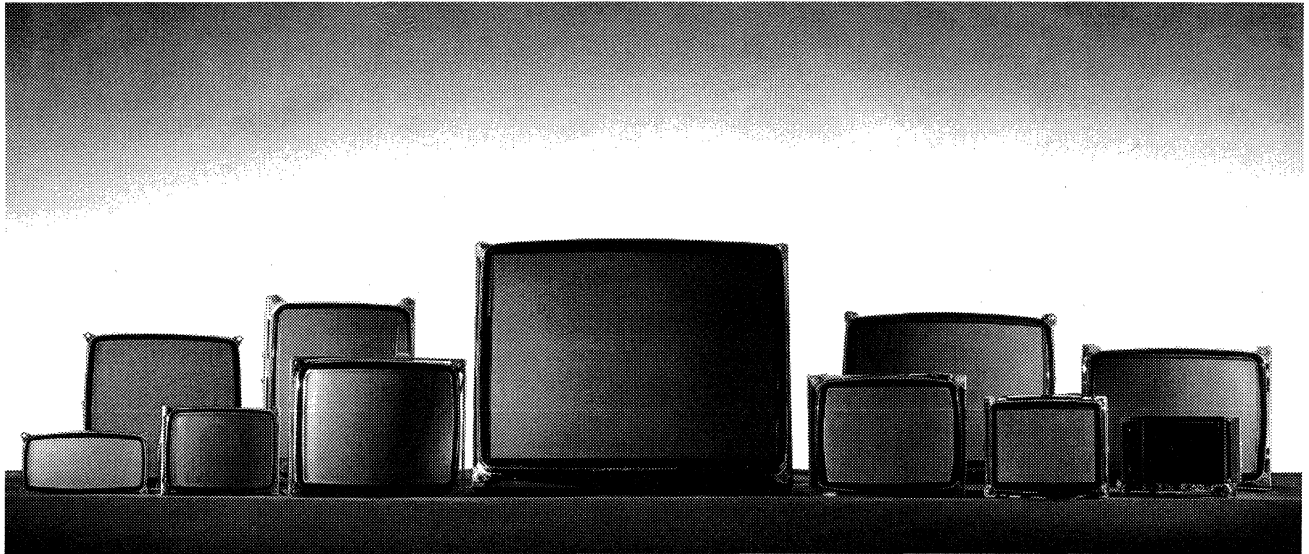
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## GRAPHIC LCD MODULES

Display Format	Part No.	Variation	Dot Size (W x H mm)	Dot Pitch (W x H mm)	Viewing Area (W x H mm)	Outline Dimension (W x H x Tmm)	Built-in Controller	Driving Multiplex	
122 x 32	GM 12321	Reflective	0.40 x 0.45	0.44 x 0.49	64.0 x 17.9	84.0 x 44.0 x 10.0	Bit Map SED 1520	1/32 duty 1/6 bias	
		EL B/L				84.0 x 44.0 x 10.0			
		LED B/L				84.0 x 44.0 x 15.0			
	GM 12322	Reflective	0.36 x 0.41	0.40 x 0.45	56.8 x 19.0	65.4 x 29.0 x 5.5	Bit Map SED1520	1/32 duty 1/6 bias	
		LED B/L				65.4 x 29.0 x 5.5			
	GM 12323	Reflective	0.36 x 0.41	0.40 x 0.45	56.8 x 19.0	65.4 x 29.0 x 5.5	Bit Map SED1520	1/32 duty 1/6 bias	
LED B/L		65.4 x 29.0 x 5.5							
128 x 64	GM 12641	Reflective	0.48 x 0.48	0.52 x 0.52	72.5 x 41.6	93.0 x 70.0 x 10.0	Bit Map KS0107/ KS0108	1/64 duty 1/9 bias	
		EL B/L				93.0 x 70.0 x 10.0			
		LED B/L				93.0 x 70.0 x 15.0			
	GM 12642	Reflective	0.40 x 0.56	0.44 x 0.60	62.0 x 44.0	78.0 x 70.0 x 10.0	Bit Map KS0107/KS0108	1/64 duty 1/9 bias	
		LED B/L				78.0 x 70.0 x 13.0			
	GM 12643	Reflective	0.40 x 0.56	0.44 x 0.60	62.0 x 44.0	78.0 x 70.0 x 10.0	T6963C	1/64 duty 1/9 bias	
		LEDB/L				78.0 x 70.0 x 13.0			
	GM 12644	Reflective	0.40 x 0.40	0.43 x 0.43	60.0 x 32.5	75.0 x 52.7 x 6.8	Bit Map KS0107/ KS0108	1/64 duty 1/9 bias	
		LED B/L				75.0 x 52.7 x 9.0			
	240 x 64	GM 24641	Reflective	0.49 x 0.49	0.53 x 0.53	135.0 x 40.0	180.0 x 65.0 x 10.0	LC7981	1/64 duty 1/9 bias
			EL B/L				180.0 x 65.0 x 10.0		
			LED B/L				180.0 x 65.0 x 16.0		
CCFL B/L			180.0 x 65.0 x 20.0						
GM 24642		Reflective	0.49 x 0.49	0.53 x 0.53	135.0 x 40.0	180.0 x 65.0 x 10.0	T6963C	1/64 duty 1/9 bias	
		LED B/L				180.0 x 65.0 x 16.0			
CCFL B/L	180.0 x 65.0 x 20.0								
240 x 128	GM 24121	CCFL B/L	0.47 x 0.47	0.50 x 0.50	128.0 x 74.0	170.0 x 103.2 x 12.0	T6963C	1/128 duty 1/12 bias	
320 x 240	GM 32241	CCFL B/L	0.33 x 0.33	0.36 x 0.36	127.0 x 97.0	167.1 x 109.0 x 10.0	—	1/240 duty 1/14 bias	

## CHARACTER LCD MODULES

Character x Lines	Part No.	Version	Character Format (W x H)	Character Size (W x H mm)	Outline Dimensions (W x H x T mm)	Built-in Controller	Driving Multiplex
8 ch x 2 lines	CM 0820	5 x 8 dots	Reflective	2.945 x 5.545	58.0 x 32.0 x 10.0	KS0066 or Equivalent	1/16 duty
			LED B/L		58.0 x 32.0 x 14.5		
16 ch x 1 line	CM 1610	5 x 8 dots	Reflective	3.07 x 6.56	80.0 x 36.0 x 10.0	KS0066 or Equivalent	1/16 duty
			LED B/L		80.0 x 36.0 x 14.5		
16 ch x 2 lines	CM 1611	5 x 7 dots + cursor	Reflective	4.84 x 8.06	122.0 x 33.0 x 10.5	KS0066 or Equivalent	1/16 duty
			LED B/L		122.0 x 33.0 x 15.5		
	CM 1621	5 x 7 dots + cursor	Reflective	4.84 x 8.06	122.0 x 44.0 x 10.5	KS0066 or Equivalent	1/16 duty
			LED B/L		122.0 x 44.0 x 14.0		
	CM 1622	5 x 8 dots	Reflective	2.95 x 5.55	85.0 x 29.5 x 10.0	KS0066 or Equivalent	1/16 duty
			LED B/L		85.0 x 29.5 x 14.5		
	CM 1623	5 x 8 dots	Reflective	2.95 x 5.55	85.0 x 36.0 x 10.0	KS0066 or Equivalent	1/16 duty
			LED B/L		85.0 x 36.0 x 14.5		
	CM 1624	5 x 8 dots	Reflective	2.95 x 5.55	84.0 x 44.0 x 10.0	KS0066 or Equivalent	1/16 duty
			LED B/L		84.0 x 44.0 x 14.5		
	CM 1625	5 x 8 dots	Reflective	2.95 x 5.55	80.0 x 36.0 x 10.0	KS0066 or Equivalent	1/16 duty
			LED B/L		80.0 x 36.0 x 14.5		
CM 1626	5 x 8 dots	Reflective	2.95 x 5.55	85.0 x 32.6 x 10.0	KS0066 or Equivalent	1/16 duty	
		LED B/L		85.0 x 32.6 x 14.5			
CM 1627	5 x 8 dots	Reflective	4.07 x 7.76	100.0 x 38.8 x 10.0	KS0066 or Equivalent	1/16 duty	
		LED B/L		100.0 x 38.8 x 14.5			
16 ch x 4 lines	CM 1640	5 x 8 dots	Reflective	2.95 x 4.75	87.0 x 60.0 x 10.0	KS0066 or Equivalent	1/16 duty
20 ch x 2 lines	CM 2020	5 x 8 dots	Reflective	3.20 x 5.55	116.0 x 37.0 x 10.0	KS0066 or Equivalent	1/16 duty
			LED B/L		116.0 x 37.0 x 15.0		
	CM 2021	5 x 8 dots	Reflective	6.00 x 9.66	180.0 x 40.0 x 10.0	KS0066 or Equivalent	1/16 duty
			LED B/L		180.0 x 40.0 x 14.5		
	CM 2022	5 x 8 dots	Reflective	5.90 x 12.70	182.0 x 60.0 x 10.0	KS0066 or Equivalent	1/16 duty
			LED B/L		182.0 x 60.0 x 14.5		
20 ch x 4 lines	CM 2040	5 x 8 dots	Reflective	2.95 x 4.75	98.0 x 60.0 x 10.0	KS0066 or Equivalent	1/16 duty
			LED B/L		98.0 x 60.0 x 14.5		
CM 2041	5 x 8 dots	Reflective	4.84 x 9.22	146.0 x 62.5 x 10.0	KS0066 or Equivalent	1/16 duty	
		LED B/L		146.0 x 62.5 x 14.5			
24 ch x 2 lines	CM 2420	5 x 8 dots	Reflective	3.20 x 5.55	118.0 x 26.0 x 10.0	KS0066 or Equivalent	1/16 duty
			LED B/L		118.0 x 26.0 x 14.5		
24 ch x 4 lines	CM 2440	5 x 8 dots	Reflective	2.7 x 5.55	93.0 x 60.0 x 10.0	KS0078	1/32 duty
			LED B/L		93.0 x 60.0 x 14.5		
40 ch x 2 lines	CM 4020	5 x 8 dots	Reflective	3.20 x 5.55	182.0 x 33.5 x 10.0	KS0066 or Equivalent	1/16 duty
			LED B/L		182.0 x 33.5 x 14.0		
40 ch x 4 lines	CM 4040	5 x 8 dots	Reflective	2.78 x 4.89	190.0 x 54.0 x 10.0	KS0066 or Equivalent	1/16 duty
			LED B/L		190.0 x 54.0 x 14.0		



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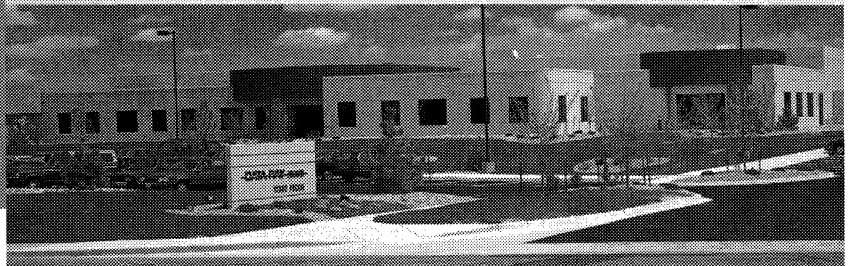
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**Responsive Customer Support**

Data Ray's qualified and dedicated staff of over 100 people in engineering, operations, sales and administration will enable us to successfully meet the increasing requirements of our customers for years to come.



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**DR53 Series****High Performance Color Monitors**

- Ideal for Medical and Industrial Imaging
- Automatic White Balance
- 14", 15" and 17" Displays
- Excellent Geometry and High Voltage Regulation
- Switches Automatically between NTSC and PAL
- Excellent VCR Playback
- High Reliability

**CRT**

Type: Shadow Mask  
Size: 14", 15" and 17"  
Electron Gun: In-Line  
Dot Pitch: 28mm

**VIDEO INPUT**

Type: Analog RGB  
Level: Composite: 1.0V p-p  
Signal Polarity: Positive  
Termination Impedance: 75 Ohms

**SYNC**

Type: Composite, Separate, or Sync on Green  
Level: 0.3 to 5.0V p-p @ 75 Ohms; or TTL  
Signal Polarity: Negative (Composite)  
Negative or Positive (Separate)

**ELECTRICAL PERFORMANCE**

Resolution: Up to 1024 x 768 (Non-Interlaced)  
Scanning Frequency:  
Horizontal: 15.75-48 kHz (fixed)  
Vertical: 50-72 Hz

High Voltage Regulation: Better than 1%

**POWER REQUIREMENTS**

Voltage: 110/220 VAC (Manual Switch Available)  
Frequency: 47-63 Hz  
Power Consumption: 75 watts Nominal

**VIDEO**

Bandwidth: Up to 70 MHz

**ENVIRONMENT**

Operating: 0°C to 50°C  
Storage: -20°C to 65°C  
Humidity: 10-95% Non-condensing  
Altitude: 10,000 ft. Operating

**AGENCY APPROVAL**

Designed to comply with UL, CSA, TUV, PTB, FCC, DHHS, MPR II, TC02

**MECHANICAL**

Available in chassis (standard or custom)

**DR10/DR15 Series****Monochrome Data Display**

- Ideal for Instrumentation and Data Display Applications
- Cost-effective
- High Reliability
- Compact Design

**CRT**

Size: 7" to 14"  
Faceplate: Polished (standard)  
Non-glare / Contrast treatments available

Phosphors: All EIA Phosphors  
Neck Size: 20mm

**DISPLAY**

Resolution: Up to 640 x 480  
Linearity: 10% Standard  
(Tighter tolerances available)

Geometry: 1% of Display Size  
Dynamic Focus: Horizontal  
High Voltage Regulation: 5% Standard

**VIDEO INPUT**

Bandwidth: Up to 30 MHz  
Input Signal: TTL, Composite or Analog  
Polarity: Positive

**HORIZONTAL SYNC**

Frequency: 15.75-31.5 kHz (fixed)  
Input: TTL or Sync on video  
Polarity: Positive or Negative

**VERTICAL SYNC**

Frequency: 50-60 Hz (fixed)  
Input: TTL or Sync on video  
Polarity: Positive or Negative

**POWER REQUIREMENTS**

Input Voltage: 12 VDC nominal  
115/230 VAC Available  
(Automatic Switch)

Power Consumption: 20 watts typical

**ENVIRONMENT**

Operating: 0°C to 50°C  
Storage: -20°C to 65°C  
Humidity: 10-90% Non-condensing  
Altitude: 10,000 ft. Operating

**AGENCY APPROVAL**

Designed to comply with UL, CSA, TUV, PTB, FCC, DHHS

**MECHANICAL**

Available in kit or chassis (standard or custom)  
Some enclosures available

**DR65/DR75 Series****High Performance Monochrome Monitors**

- Engineered for high performance, the DR65/DR75 Series is especially suited to meet the demanding requirements of the medical and industrial imaging industries
- Dual Axis Dynamic Focus
- Backporch Clamping
- Capable of Excellent Linearity

**CRT**

Size: 5" to 21"  
Faceplate: Polished (standard)  
Non-glare / Contrast treatments available

Phosphors: All EIA Phosphors  
Neck Size: 20mm/29mm

**DISPLAY**

Resolution: Up to 1280 x 1024  
Linearity: 10% Standard  
(Tighter tolerances available)

Geometry: 1% of Display Size  
Configuration: Portrait or Landscape  
Dynamic Focus: Horizontal and Vertical  
High Voltage Regulation: 3% Standard

**VIDEO INPUT**

Input Signal: TTL, Composite or Analog  
Polarity: Positive = White

**HORIZONTAL SYNC**

Frequency: 15-64 kHz (fixed)  
Input: TTL or Sync on video  
Polarity: Positive or Negative

**VERTICAL SYNC**

Frequency: 30-120 Hz (fixed)  
Input: TTL or Sync on video  
Polarity: Positive or Negative

**POWER REQUIREMENTS**

Input Voltage: 12-24 VDC nominal or  
110/220 VAC (Automatic Switching)  
Power Consumption: 15 watts typical  
(DR65 Series w/9" CRT)  
36 watts typical  
(DR75 Series w/15" CRT)

**ENVIRONMENT**

Operating: 0°C to 50°C  
Storage: -20°C to 65°C  
Humidity: 10-90% Non-condensing  
Altitude: 10,000 ft. Operating

**AGENCY APPROVAL**

Designed to comply with UL, CSA, TUV, PTB, FCC, DHHS

**MECHANICAL**

Available in kit or chassis (standard or custom)  
Some enclosures available

**DR80/DR90/DR110****High Resolution Monochrome Monitors****Model DR80**

- 25" Ultra High Resolution Portrait Monochrome Monitor  
1536 x 2048 • 2048 x 2560
- Ideal for Large Screen, High Resolution Imaging
  - 25", 90°, 36mm CRT
  - Supports up to 2048 x 2560 Resolution
  - 110 Foot-Lamberts @ 47% Transmission
  - High Contrast, High Brightness
  - Image Size: 14.5" x 18.5"  
Displays a full-size film with room to spare
  - Dynamic Focus/Astigmatism Correction System  
Provides superior focus over entire screen
  - Magnetic Focus System  
Allows smallest spot size resulting in extremely sharp images
  - Agency Certified for US and Europe
  - Compatible with Wide Variety of Controllers

**Model DR90**

- 21" Medium Resolution Monochrome Monitor  
1024 x 1280 • 1200 x 1600
- Ideal for Medium Resolution PACS/  
Teleradiology Applications
  - 21", FS, 110° CRT
  - Supports up to 1200 x 1600 Resolution @ 76 Hz
  - 65 Foot-Lamberts @ 34% Transmission
  - High Contrast, High Brightness
  - Dynamic Focus/Astigmatism Correction System  
Provides excellent focus over entire screen
  - Image Size: 11.6" x 15.4"
  - Agency Certified for US and Europe
  - Compatible with Wide Variety of Controllers

**Model DR110**

- 21" Ultra High Resolution Portrait Monochrome Monitor  
1536 x 2048 • 1728 x 2304 • 2048 x 2560
- Ideal for High and Ultra High Resolution PACS  
and Primary Diagnostic Applications
  - 21", Flat Square, 90°
  - Supports up to 2048 x 2560 Resolution, 71 Hz
  - 120 Foot-Lamberts @ 30% Transmission
  - High Contrast, High Brightness
  - Dynamic Focus/Astigmatism Correction System  
Provides excellent focus over entire screen
  - Image Size: 11.4" x 15.2"
  - Agency Certified for US and Europe
  - Compatible with Wide Variety of Controllers

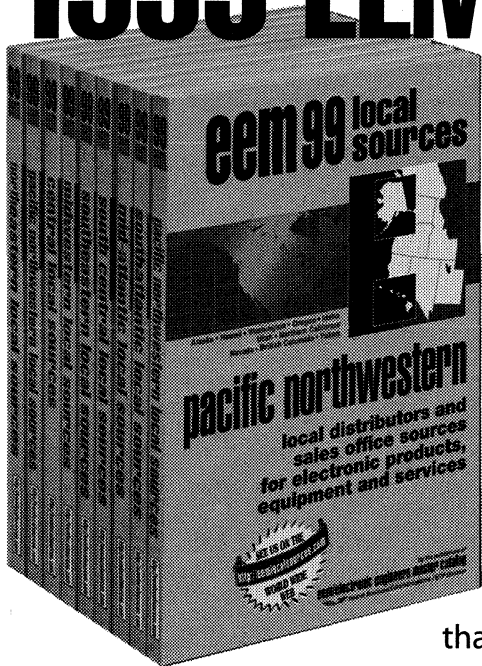
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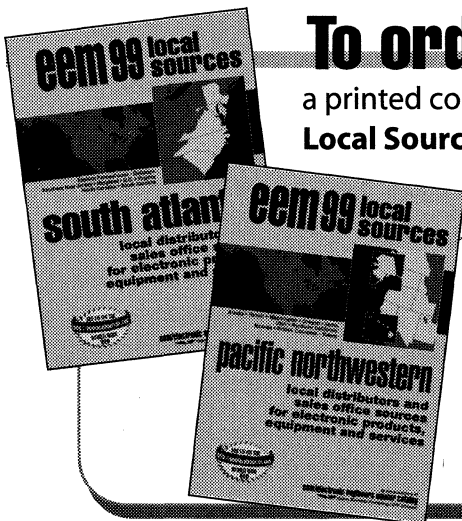
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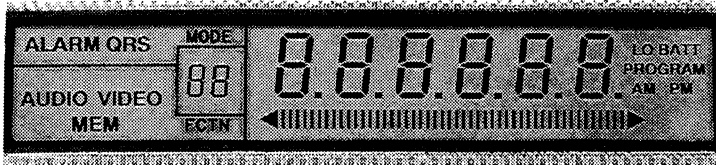
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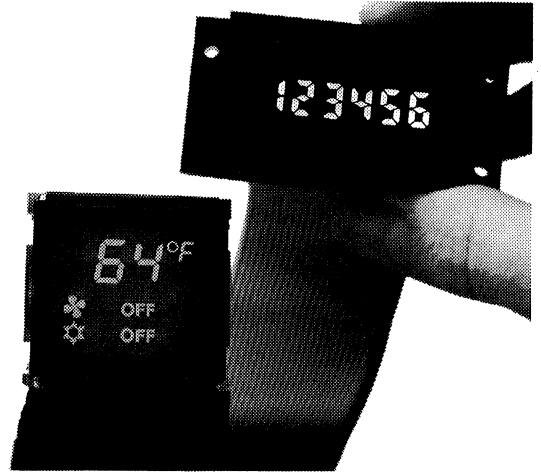
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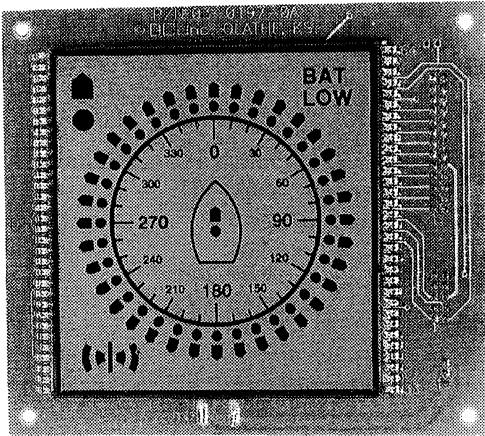
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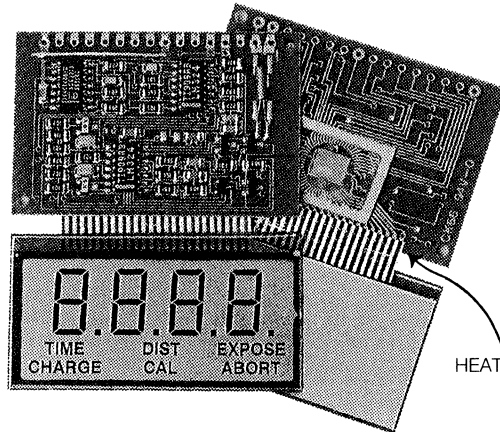
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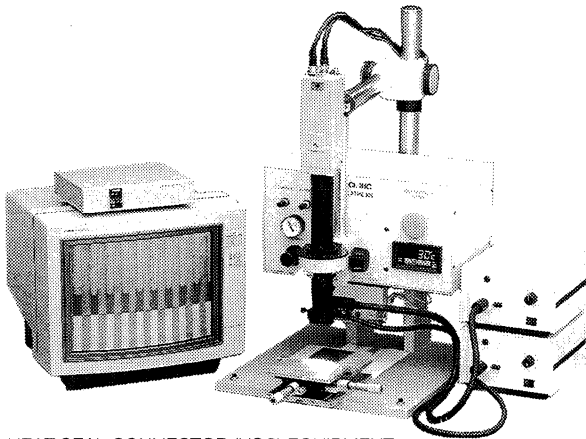
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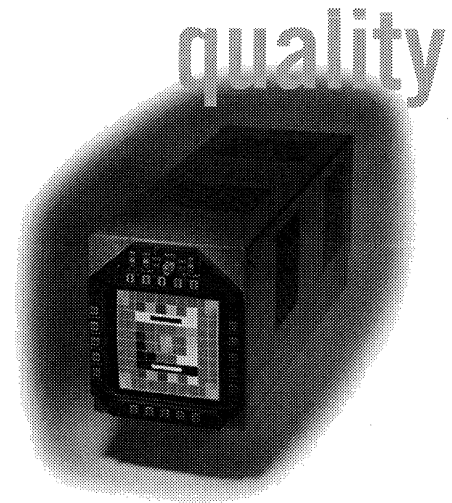
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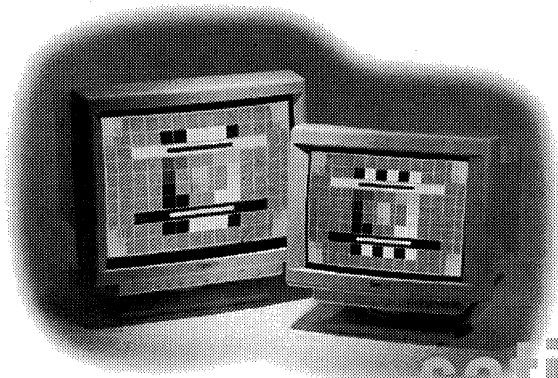
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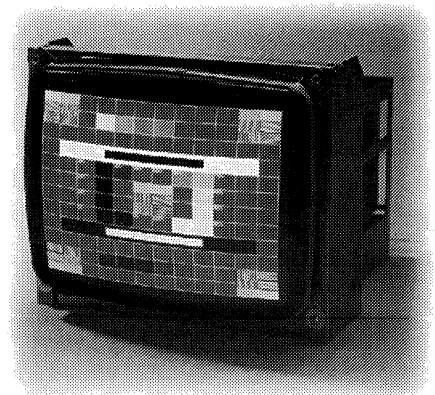


- CRT sizes of 15" to 21" in both landscape and portrait configurations available
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- 525 line to 5 megapixel resolutions available
- Multisync operation is standard

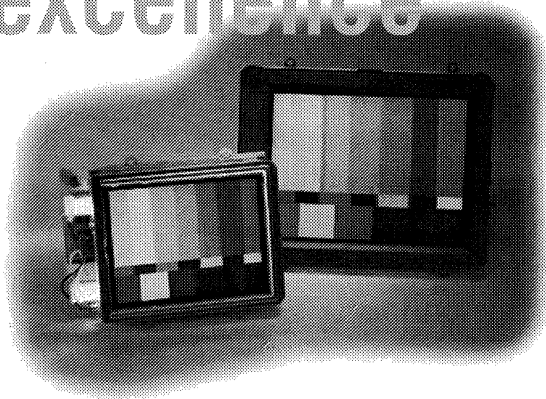
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## QES 2000 Series

- Standard CRT sizes of 14"-17"
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- Multisync operation
- RGB, NTSC or CGA inputs as available options



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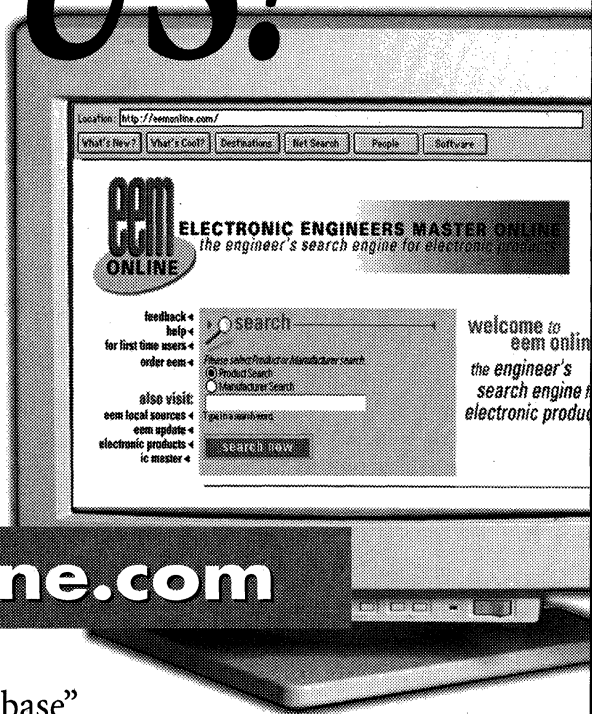
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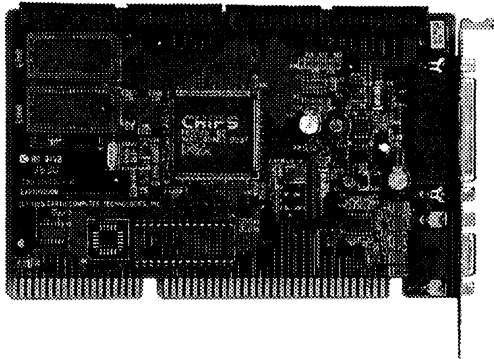


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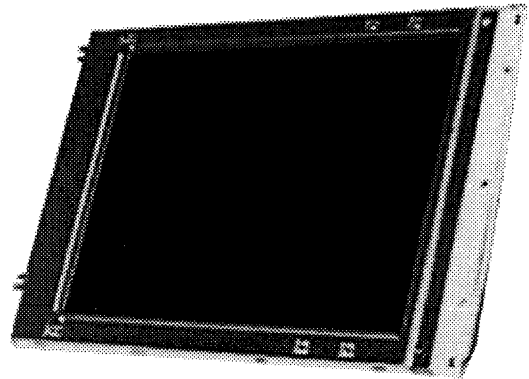
VGA, TFT & STN LCD - LCD CONTROLLERS - TOUCH SCREENS

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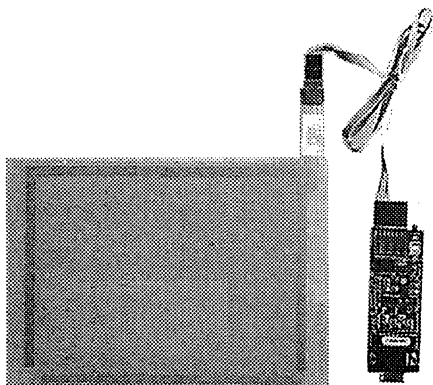
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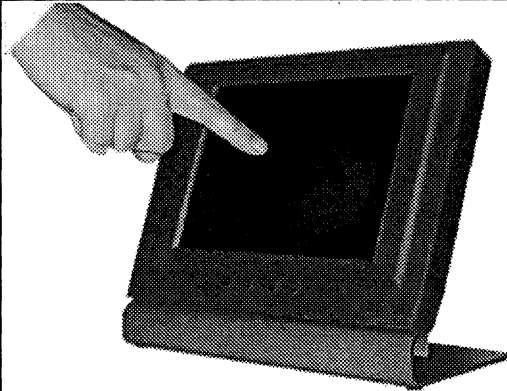
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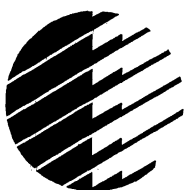
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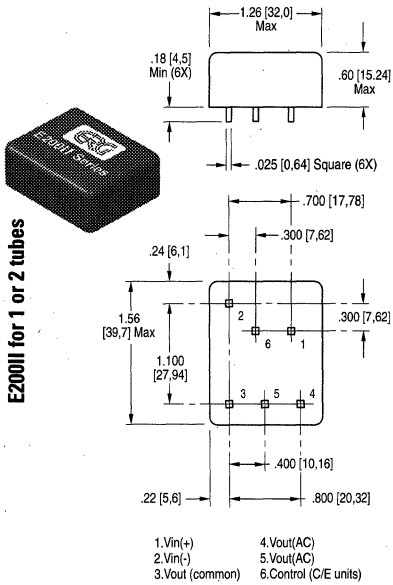


# The Power Behind Today's CCFT-Backlit LCDs!

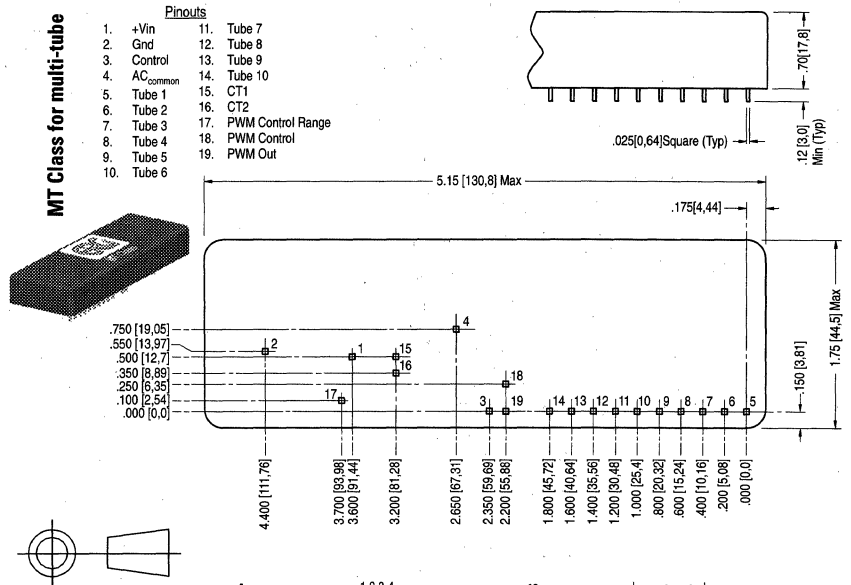
If you're specifying power supplies for cold cathode fluorescent tube backlit LCDs, use the DC-AC inverters recommended by LCD manufacturers for reliability, economy and performance!

Product	Construction	Maximum No. Tubes	Maximum Output	Size in. (mm)	Features
E200II Series	Encapsulated, 94VO Rating	2-2	10 W	1.26 (32,0) x 1.56 (39,7) x .60 (15,24) H	PCB Mountable; Dimming Available
8m Class	Open Frame	1	8 W	.79 (32,0) x 3.58 (91,0) x .32 (8,0) H	Low Profile; On-Board Display Connector; Dimmable
E1388 Type	Encapsulated, 94VO Rating	6	18 W	2.03 (51,6) x 2.10 (53,3) x .70 (17,8) H	PCB Mountable; Only .7" High; Dimming Available
MT Class	Encapsulated 94VO Rating	10	28 W	1.72 (43,7) x 5.15 (130,8) x .70 (17,8) H	PCB Mountable; On-Board Dimming Circuitry
K Series	Open Frame	2	8 W	.79 (20,1) x 4.20 (106,7) x .32 (8,0) H	Low-Profile; 2 Display-Compatible Output Connectors; Dimming Control Pin

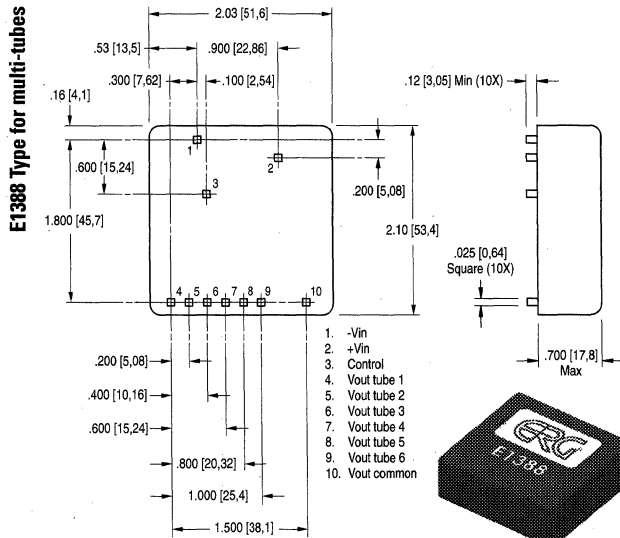
E200II for 1 or 2 tubes



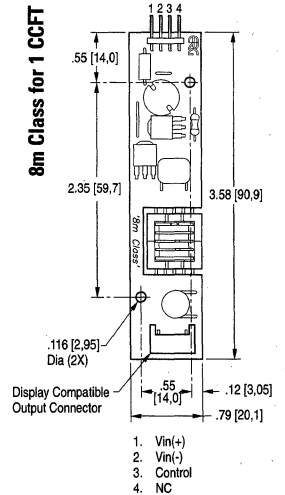
MT Class for multi-tube



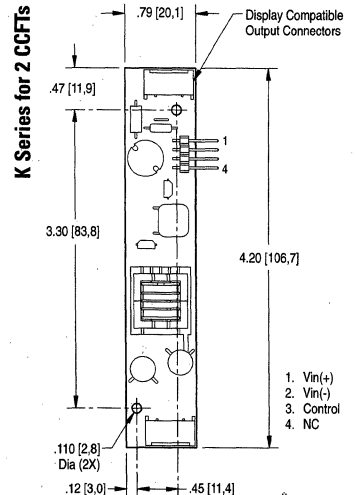
E1388 Type for multi-tubes



8m Class for 1 CCFT



K Series for 2 CCFTs



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- Hitachi
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# Smart Force™ EL Inverters, Converters for VF Displays, and DC-DC Converters

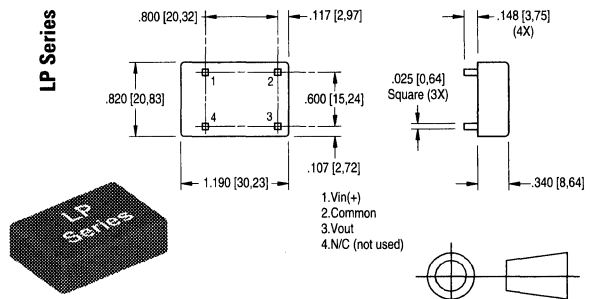
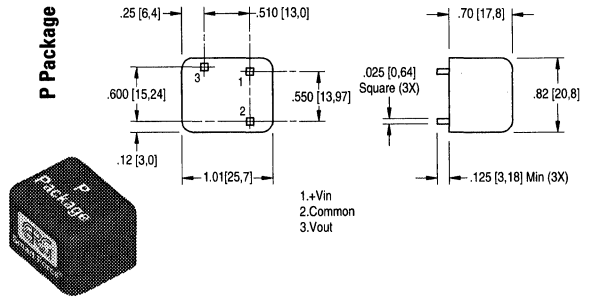


## Smart Force™ DC-AC Inverters for EL Lamps

ERG's Smart Force is the way to ensure longer useful lamp life for electroluminescent displays. These self-adjusting power inverters automatically adjust operating voltage and frequency as the lamp ages and changes.

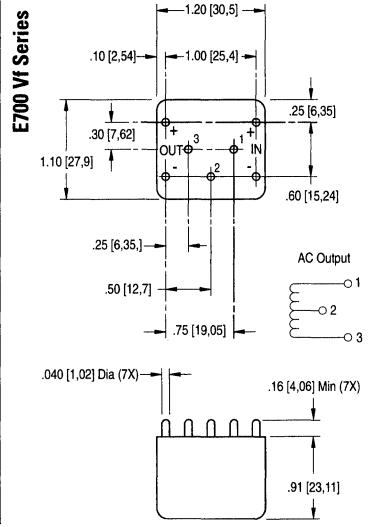
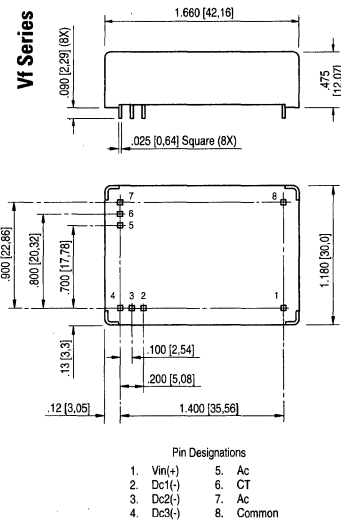
Parameter	Symbol	Units	Code D	Code 1	Code 2	Code 3
Input Power per unit load	Pin	watts	*0.200	*0.300	*0.400	*0.500
Minimum Input Voltage	Vin(min)	%	-40	-40	-40	-40
Maximum Input Voltage	Vin(max)	%	25	25	25	25
Minimum Operating Temperature	T(min)	°C	-25	-25	-25	-25
Maximum Operating Temperature	T(max)	°C	85	85	85	85
Nominal Output Voltage	Vout	V rms	60	80	100	120
Nominal Operating Frequency	Fout	Hertz	400	400	400	400
Maximum Number of Unit Loads	Lmax	-	17	10	7	5
Output Voltage Tolerance	-	%	±10	±10	±10	±10
Operating Frequency Tolerance	-	%	±10	±10	±10	±10
Output Current per Unit Load	Iout	marms	3.1	4.1	5.1	6.2

\* Input power may increase by 10% on low input voltage and/or single unit load inverters. A unit load is equivalent to 4 sq." of electroluminescent material.



## DC-DC/AC Converters for Vacuum Fluorescent Backlighting

- For VF Displays from <1W to 12W
- Stable Output Voltages over Wide Input Voltage Range
- Multiple Outputs, including:
  - DC Voltage for the Anode
  - AC Output for the Filament
- Different Combinations of Anode and Filament Voltages Available
- Custom-Designed Prototypes Available
- Power 2, 3, even 6 displays from 1 converter - save PCB space



## DC-DC Converters

ERG DC-DC Converter series can be used for a wide range of display power applications, including gas discharge displays and remote power sources.

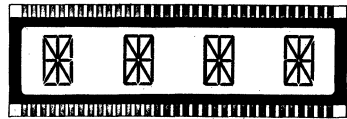


Endicott Research Group, Inc.  
The Power Behind the Display

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Model	Input	Output	Efficiency	Idling Power	Size (Inches)	Approx. Weight (grams)
E700U	5 Vdc to 48 Vdc	10 Vdc to 500 Vdc	75% @ 5 Vin 85% @ 24 Vin	1 Watt	1.10 x 1.20 x .91 High	30
E500U (3 Watts max)	5 Vdc to 28 Vdc	10 Vdc to 500 Vdc	75% @ 5 Vin 85% @ 24 Vin	1 Watt	1.00 x 1.38 x .70 High	20
E1600 (6 Watts max)	5 Vdc to 28 Vdc	10 Vdc to 500 Vdc	75% @ 5 Vin 85% @ 24 Vin	1.25 Watts	1.30 x 1.88 x .82 High	44
E900 (12 Watts max)	5 Vdc to 28 Vdc	10 Vdc to 250 Vdc	75% @ 5 Vin 85% @ 24 Vin	1.75 Watts	2.00 x 2.50 x .98 High	122
E1200 (25 Watts max)	12 Vdc to 28 Vdc	100 Vdc to 250 Vdc	82% @ 12 Vin 88% @ 24 Vin	2.5 Watts	2.00 x 2.50 x 1.19 High	185

# EXCEL Technology International Corp. EXCELIX<sup>®</sup> LCD



Excelix L.C.D. Model #	Digit Height (inches)	Display Format	Connector	Glass Size (inches)
3150	0.181	3 1/2 digits, duplex	S.I.L. Elastomer	0.808 x 0.520
3252	0.200	3 1/2 digits, duplex	S.I.L. Elastomer	0.808 x 0.520
3253	0.200	3 1/2 digits, direct, ←	D.I.L. Pins	1.600 x 0.700
6200	0.200	6 digits, duplex	D.I.L. Pins	1.500 x 0.600
8200	0.236	8 digits, M/E, triplex	S.I.L. Elastomer	2.090 x 0.690
3251	0.240	3 digits, direct	Dip Pin	0.680 x 0.550
3250	0.255	3 1/2 digits, direct	D.I.L. Elastomer	0.808 x 0.590
4303	0.280	4 digits, direct	Elastomer	1.130 x 0.500
8200E	0.284	8 digits, triplex	S.I.L. Elastomer	1.575 x 0.567
3351	0.300	3 1/2 digits, direct	Dip Pin	1.450 x 0.640
3455S	0.300	3 1/2 digits, lobat, direct	Dip Pin	2.000 x 0.900
8300	0.300	8 digits, triplex	D.I.L. Pins	2.750 x 1.100
2300T	0.350	2 digits, direct	Dip Pin	1.000 x 0.950
2303	0.350	2 digits, direct	Dip Pin	0.800 x 0.700
3300	0.350	3 digits, direct	D.I.L. Pins	1.300 x 0.950
4320	0.350	4 digits, direct	D.I.L. Pins	2.000 x 0.900
1400	0.400	1 digit, direct	D.I.L. Pins	
3401	0.400	3 1/2 digits, direct	S.I.L. Pins	2.500 x 1.100
3450	0.400	3 1/2 digits, duplex	S.I.L. Elastomer	1.960 x 0.950
4451	0.400	4 1/2 digits, ←, direct	D.I.L. Pins	2.005 x 1.200
4451S	0.400	4 1/2 digits, ←, direct	Dip Pin	2.000 x 0.900
4455	0.400	4 1/2 digits, Lobat, direct	D.I.L. Pins	2.000 x 1.200
5400	0.400	5 digits, direct	D.I.L. Pins	2.000 x 1.200
5400S	0.400	5 digits, direct	Dip Pin	2.000 x 0.900
3451	0.433	3 1/2 digits, direct	D.I.L. Pins	1.960 x 0.950
3501	0.500	3 1/2 digits, direct	S.I.L. Pins	2.000 x 1.200

Excelix L.C.D. Model #	Digit Height (inches)	Display Format	Connector	Glass Size (inches)
3551	0.500	3 1/2 digits, ←, direct	D.I.L. Pins	2.000 x 1.200
3555	0.500	3 1/2 digits, Lobat, direct	D.I.L. Pins	2.000 x 1.200
3557	0.500	3 1/2 digits, AM, PM, bell	D.I.L. Pins	2.000 x 1.200
4500	0.500	4 digits, direct	D.I.L. Pins	2.000 x 1.200
4500 (M3)	0.500	4 digits, triplex	D.I.L. Pins	2.000 x 1.200
6500	0.500	6 digits, direct	D.I.L. Pins	2.750 x 1.200
8500	0.500	8 digits, direct	D.I.L. Pins	3.695 x 1.200
3751	0.700	3 1/2 digits, ←, direct	D.I.L. Pins	2.750 x 1.500
4700	0.700	4 digits, direct	D.I.L. Pins	2.750 x 1.500
5400	0.400	5 digits, direct	D.I.L.	2.000 x 1.200
5700	0.700	5 digits, direct	D.I.L. Pins	3.200 x 1.500
5701	0.700	5 digits, 1 D.P., direct	D.I.L. Pins	3.200 x 1.500
6700	0.700	6 digits, direct	D.I.L. Pins	3.695 x 1.500
4851A	0.750	4 1/2 digits, ←, direct	D.I.L. Pins	3.000 x 1.550
4540	0.500	4 characters, direct	D.I.L.	3.500 x 1.150
8540	0.500	8 characters, triplex	D.I.L.	3.700 x 1.200
12540	0.500	12 characters, triplex	D.I.L.	5.750 x 1.200
16540	0.500	16 characters, triplex	D.I.L.	7.250 x 1.200
11040	1.000	1 character, direct	S.I.L. Elastomer	1.000 x 1.750
31030	1.000	3 digits, direct	D.I.L. Pins	3.695 x 1.800
31051	1.000	3 1/2 digits, ←, direct	D.I.L. Pins	3.695 x 1.800
41000	1.000	4 digits, direct	D.I.L. Pins	3.695 x 1.800
41051	1.000	4 1/2 digits, ←, direct	D.I.L. Pins	4.000 x 1.800
12000	2.000	1 digit, direct	Dip Pin	1.660 x 2.730
14000	4.000	1 digit, direct	Dip Pin	3.200 x 4.830

## PIONEERS IN LCD TECHNOLOGY

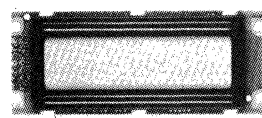
**Twisted Nematic  
Supertwist**

- Numeric
- Alphanumeric
- Bar Graphs
- Light Valves

**Guest-host  
Backlighting**

- Dot Matrix
- Graphic
- LCD Modules

## EXCELIX<sup>®</sup> LCD MODULES

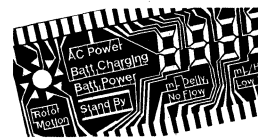


**Features**

- Slim, light-weight design.
- High-contrast, wide viewing angle.
- Built-in control IC for easy interfacing.
- Low power consumption.

## CUSTOM DISPLAYS FROM EXCEL

*Make your display unique by using unusual messages, symbols and artwork.*



With the expertise of Excel's Design and Layout department, it's easy to have a display custom-made to meet your particular requirements. Whether you need us to duplicate a display from an existing design, or help you bring your own ideas to life, we can help you move from start to finish smoothly and cost-effectively.

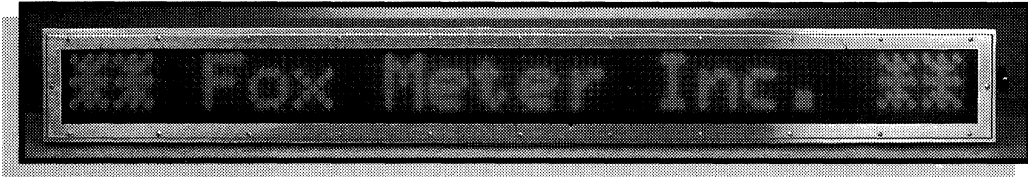
## EXCELIX<sup>®</sup> LCD MODULE MECHANICAL SPECIFICATIONS

Excelix <sup>®</sup> No.	Character Format Line x Character	Character Font	Module Size (W x H x T, mm)	Viewing Area (W x H, mm)	Character Size (W x H, mm)	Dot Size (W x H, mm)	Backlight Type	
							EL	LED
LCM1610	1 x 16	5 x 7 dots + cursor	80 x 36 x 10	64.5 x 13.8	3.07 x 5.73	0.55 x 0.75	avail	avail
LCM1610 B	1 x 16	5 x 7 dots + cursor	122 x 33 x 10	99. x 13.	4.84 x 8.06	1.10 x 0.92	avail	avail
LCM1620-30	2 x 16	5 x 7 dots + cursor	85 x 30 x 10	62.2 x 17.2	2.78 x 4.27	0.50 x 0.55	avail	avail
LCM1620-44	2 x 16	5 x 7 dots + cursor	84 x 44x 10	62.2 x 17.8	2.96 x 4.86	0.56 x 0.66	avail	avail
LCM1640	4 x 16	5 x 7 dots + cursor	87 x 60 x 10	61.5 x 25.2	2.95 x 4.15	0.55 x 0.55	avail	not avail
LCM2020	2 x 20	5 x 7 dots + cursor	115 x 36 x 10	83.0 x 18.8	3.20 x 4.85	0.60 x 0.65	avail	avail
LCM2420	2 x 24	5 x 7 dots + cursor	118 x 36 x 10	94.5 x 18.0	3.20 x 4.85	0.60 x 0.65	avail	avail
LCM4020	2 x 40	5 x 7 dots + cursor	182 x 35.5 x 10	154. x 16.	3.20 x 4.85	0.60 x 0.65	avail	not avail



**NEW !!!**

**Text Displays**



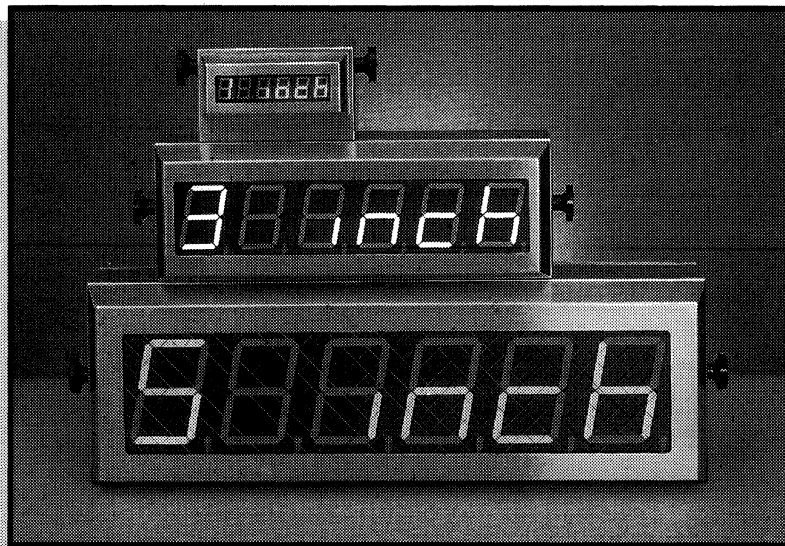
**FK150 series - 4" tall 20 character serial ASCII text display - ultra bright - outdoor enclosure**  
**Scrolling message up to 16,000 characters long - commands for scrolling speed and pause**  
**6 by 8 dot pattern displays the full ASCII character set - consult factory for variations**

**Large Displays**

**FA Series 1" Tall  
 6 Digit Tri-Color  
 LED Panel  
 Display**

**FB & FG Series  
 3" Tall 4 & 6  
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 LED Displays**

**FH & FJ Series  
 5" Tall 4 & 6  
 Digit Tri-Color  
 LED Displays**



- ♦ All models accept a wide range of input signals: RS232, RS422/485, process signals, DC volts/amps, AC volts/amps, resistance, thermocouple, RTD, strain gauge, counts, rate, frequency and time
- ♦ All models are NEMA 4 X standard
- ♦ All models have stainless steel bezels with glass windows
- ♦ Stand alone stainless steel enclosures are available
- ♦ User programmable color changes based on the display

Series	No. of Digits	Character Height	Tri-Color Digits	120 VAC Power	240 VAC Power	5-12 VDC Power	10-30 VDC Power	Relay Outputs	Serial Output	Analog Output	Base Price
FA	6	1"	YES	YES	YES	NO	NO	2	YES	YES	\$ 505
FB	4	3"	YES	YES	YES	NO	NO	2	YES	YES	\$ 575
FG	6	3"	YES	YES	YES	NO	NO	2	YES	YES	\$ 725
FH	4	5"	YES	YES	YES	NO	NO	2	YES	YES	\$ 875
FJ	6	5"	YES	YES	YES	NO	NO	2	YES	YES	\$ 1175

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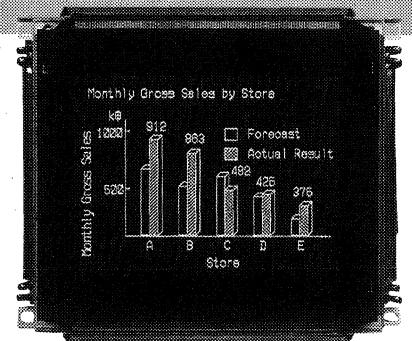
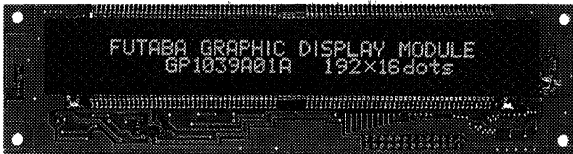


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# FUTABA CORPORATION OF AMERICA

## Graphic display module series



## Graphic display module series specifications

Part Number	No. of dots (W x H)	Display Area (W x H) [mm]	Dot pitch (W x H) [mm]	Outer Dimensions (W x H x T) [mm]	Interface	Power Supply	Power Consumption Typ. [W]	Exclusive Power Supply
GP1069A01A	128x16	81.0x11.8	0.635x0.75	130.0x29.5x27.0	8bit Parallel/Serial	5V	2.3	-
GP1010B03A	176x16	140.7x12.7	0.80x0.80	186.0x60.0x42.0	CPU Bus Access	5.50,135V/5.9Vac	4.7	9P00A002-02
GP1039A02A	192x16	124.6x10.2	0.65x0.65	180.0x40.0x26.1	8bit Parallel	5V	4.0	-
GP1028A01A	80x32	49.9x19.9	0.625x0.625	90.0x58.0x18.4	CPU Bus Access	5.55,110V/2.6Vac	1.7	-
GP1059A01B	240x36	149.8x28.6	0.625x0.8	205.2x62.0x25.6	8bit Parallel	5V, 70V	4.6	-
GP1067A01A	160x40	132.6x33.0	0.83x0.83	190.0x70.0x30.0	RS-232C	12V	6.0	-
GP1068A01A	255x60	76.5x17.9	0.3x0.3	130.5x34.6x17.0	8bit Parallel	5, 115V/3.1Vac	4.4	-
GP1005F03A	128x64	80.0x39.8	0.625x0.625	155.0x77.0x38.0	CPU Bus Access	5V, 12V	6.2	-
GP1009C10A	240x64	107.9x28.7	0.45x0.45	160.0x70.0x36.0	CPU Bus Access	5V, 12V	6.5	-
GP1045A01A	256x64	163.6x39.4	0.64x0.62	215.0x85.0x42.0	8bit Parallel	5V	8.0	-
GP1045A02A	256x64	163.6x39.4	0.64x0.62	215.0x85.0x42.0	CPU Bus Access	5V	8.0	-
GP1045A07A	256x64	163.6x39.4	0.64x0.62	215.0x85.0x42.0	CPU Bus Access	5V	8.0	-
GP1045A06C	256x64	163.6x39.4	0.64x0.62	230.0x88.5x30.1	RS-232C	24V	7.2	-
GP1063A01A	256x64	255.7x63.7	1.0x1.0	320.0x120.0x41.5	8bit Parallel	5V, 12V	22.1	-
GP1031B01A	256x128	115.2x57.6	0.45x0.45	180.0x105.0x45.0	CPU Bus Access	5V, 12V	12.5	-
GP1002D03A	320x240	120.0x90.0	0.375x0.375	180.0x160.0x41.0	CPU Bus Access	5V, 90V	11.5	-
GP1002D07A	320x240	120.0x90.0	0.375x0.375	180.0x160.0x41.0	CPU Bus Access	5V, 130V	14.8	9P00A005-03
GP1010B02A	400x240	120.0x90.0	0.30x0.375	180.0x160.0x41.0	CPU Bus Access	5V, 90V	11.5	-
GP1040B05C (2 colors)	200x240 (pixel)	120.0x90.0	0.30x0.375	180.0x160.0x41.0	CPU Bus Access	5V, 110V	13.1	9P00A005-02

## Message display module series specifications

Part Number	Character height [mm]	No. of characters	No. of dots (W x H)	Display Area (W x H) [mm]	Outer Dimensions (W x H x T) [mm]	Interface	Power Supply	Power Consumption Typ. [W]
GP1041A01A	26.1	16	256x16	309.5x26.1	385.0x59.5x32.0	8bit Parallel	5V	10.0
GP1041A05D	26.1	16x4rows	256x16/row	309.5x26.1/row	370.0x207.0x40.0	8bit Parallel	5V, 24V	46.1
GP1026A01A	30.9	11	176x16	263.7x30.9	330.0x54.8x39.0	CPU Bus Access	5V,12V	13.6
GP1042A01A	35.7	11	176x16	316.5x35.7	385.0x59.5x40.0	8bit Parallel	5V	15.0
GP1047A01A	35.7	16	256x16	460.5x35.7	525.0x59.5x40.0	8bit Parallel	5V	22.5
GP1048A01A	35.7	20	320x16	559.7x35.7	625.0x59.5x40.0	8bit Parallel	5V	27.5
GP1072A01A	51.6	16	256x16	639.6x51.6	720.0x85.0x41.9	8bit Parallel	5V, 24V	36.8
GP1049B01A	51.7	14	224x16	559.7x51.7	625.0x79.5x43.0	8bit Parallel	5V, 24V	29.3
GP1022A04A	35.7	11	264x24	316.5x35.7	367.0x77.0x42.1	CPU Bus Access	5V, 12V	11.8
GP1022A05B	35.7	11	264x24	316.5x35.7	367.0x77.0x54.0	RS-232C	5V, 12V	13.5
GP1022A05C	35.7	11	264x24	316.5x35.7	367.0x77.0x54.0	RS-485	5V, 12V	13.5
GP1057A01A	35.7	16	384x24	460.5x35.7	525.0x63.3x40.0	8bit Parallel	5V	22.5
GP1058A01A	51.3	14	336x24	557.5x51.3	625.0x80.0x43.0	8bit Parallel	5V, 24V	29.3
GP2009A01A (2 colors)	19.5	12	192x16 (pixel)	237.8x19.5	310.0x48.0x36.6	8bit Parallel	5V	7.5
GP2008A01A (2 colors)	34.4	16	256x16 (pixel)	460.4x34.4	525.0x59.5x40.0	8bit Parallel	5V	25.0
GP2007A01A (2 colors)	39.6	12	192x16 (pixel)	498.8x39.6	575.0x68.5x42.0	8bit Parallel	5V, 24V	31.7
GP2006A01A (2 colors)	63.6	8	128x16 (pixel)	537.2x63.6	630.0x102.0x62.0	8bit Parallel	5V, 24V	72.5



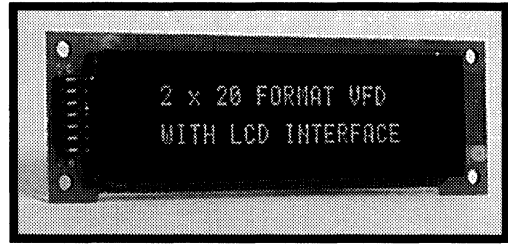
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Futaba Corporation of America



# FUTABA CORPORATION OF AMERICA

## Character display module series



## Character display module series specifications

Part Number	Digits x Rows	Character Format	Character Size [mm]	External Dimensions (W x H x T) [mm]	User's Efinable Font	Interface	Power Supply	Power Consumption Typ. (W)
M16MD05AA	1x16	5x7+Dp, com	5.2x8.8	180.0x345.0x28.5	-	8bit Parallel/serial	5V	2.0
M16MD07AA	1x16	5x7+Dp, com, descriptor	7.2x11.3	225.0x38.0x33.0	-	8bit Parallel/serial	5V	2.0
NA16SD03AB	1x16	5x7	3.5x5.0	170.0x65.0x22.3	16	Serial	5V	1.0W
M16MY02AA	1x16	Alphanumeric	6.4x11.1	180.0x31.0x23.1	-	Serial	5V	1.75W
US16MY02AA	1x16	14 Segment	6.4x11.1	177.3x32.0x23.0	-	Serial	5V	
US16SY11AB	1x16	14 Segment	3.0x5.0	125.0x33.5x17.58	-	Serial	5V	0.75
US162SD03CB	2x16	5x7	2.3x4.51	109.86x43.1x24.6	8	Serial	5V	2.25
M20MD07AB	1x20	5x7	9.0x6.3	230.0x35.0x23.0	8	8bit Parallel/Serial	5V	2.5
M20SD03GR/GS	1x20	5x7	3.5x5.0	150.0x31.0x27.0	-	8bit Parallel/Serial	5V	0.75
M202LD06BA/BB	2x20	5x7+Dp,com, descriptor	7.2x11.3	273.0x76.2x31.5	-	8bit Parallel/Serial	5V	5.0
M202MD12HB	2x20	5x7+descriptor	5.5x10.5	190.0x64.0x25.0	-	8bit Parallel/serial	5V	5.0
M202SD01LA	2x20	5x7	2.25x4.16	000.0x35.0x26.3	4	8bit Parallel/Serial	5V	1.6
M202SD08GR	2x20	5x7+cursor	3.5x5.0	155.0x43.0x20.6	-	8bit Parallel/Serial	5V	1.8
M202SD08HA/HJ	2x20	5x7+cursor	3.5x5.0	155.0x39.0x20.5	-	8bit Parallel/Serial	5V	1.8
NA202SD01BA1	2x20	5x7	2.25x4.16	116.0x37.0x14.8	4	8bit Parallel/serial	5V	1.8
NA202SD08CB	2x20	5x7	3.5x5.0	170.0x65.0x22.3	-	8bit Parallel	5V	2.0
M204LD01AA	4x20	5x7	7.3x11.3	290.0x100.0x40.0	-	8bit Parallel	5V	11.0
M204SD01AA/AB	4x20	5x7	3.2x5.0	135.0x70.0x31.0	3(AA)/4(AB)	8bit Parallel/Serial	5V	3.8
NA204SD01AC	4x20	5x7	3.2x5.0	150.0x64.0x29.1	2	8bit Parallel	5V	3.25
M40SD04GR	1x40	5x7+cursor	3.5x5.0	240.0x35.0x20.1	-	8bit Parallel/Serial	5V	1.5
M402SD07GR/GS	2x40	5x7+cursor	3.5x5.0	240.0x43.0x20.6	-	8bit Parallel/Serial	5V	3.8
M404SD01BA/BB	4x40	5x7	3.0x5.0	230.0x60.0x32.0	3	8bit Parallel/Serial	5V	7.0



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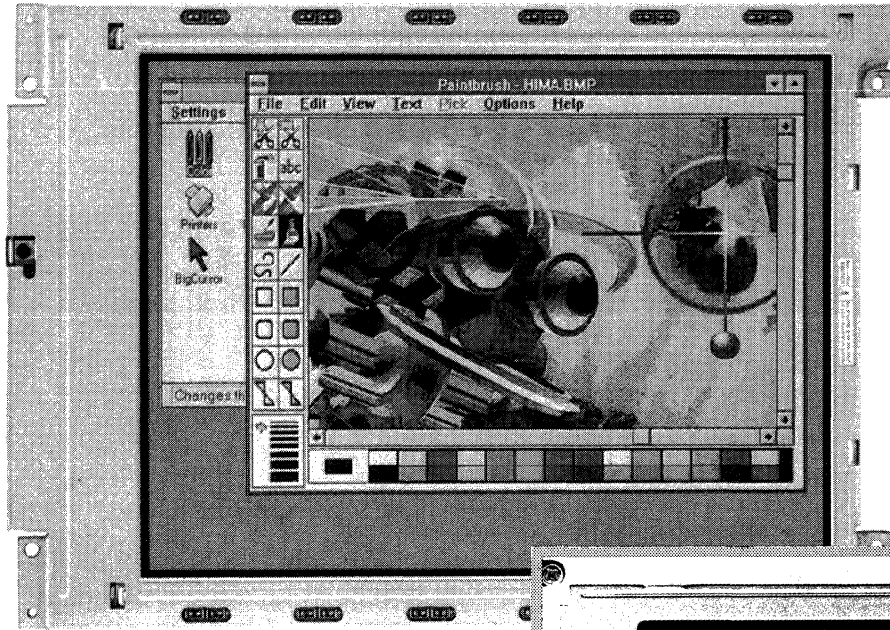
Futaba Corporation of America

Futaba Corporation is the world leader of Vacuum Fluorescent Flat Panel Displays for automotive, consumer products and industrial applications. Futaba constantly strives for continuous improvement and to provide maximum value to our customers.

# HANTRONIX DOT MATRIX LCD MODULES

## LIQUID CRYSTAL DISPLAYS · STANDARD & CUSTOM DESIGNS

# CRYSTAL CLEAR and VISIBLY SUPERIOR



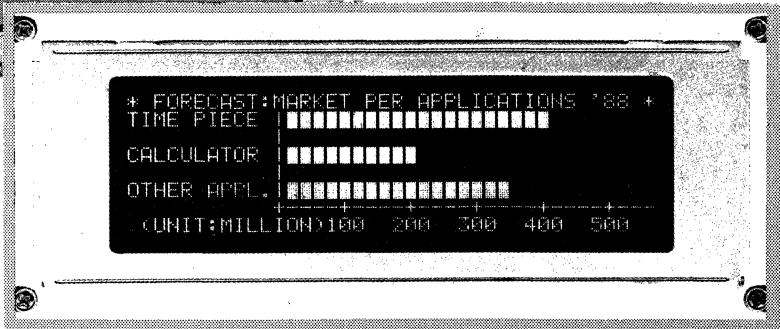
### APPLICATIONS

- Portable computer terminals
- Telecommunications
- High class electronic calculators
- Display devices
- Automobile display panels
- Word processors
- Chemical analyzers
- Measuring equipment
- Medical instruments

For fast turnaround on all your LCD requirements, check with Hantronix, Inc. first. We specialize in delivering complete custom LCD modules for low-volume customers.

For even faster turnaround, check out our standard line of dot-matrix LCDs. Modules consume very little power, yet display crystal-clear characters and graphic images with sharp contrast over a wide viewing angle. All modules are designed to make interfacing exceptionally easy.

High-quality Hantronix, Inc. LCDs are competitively priced, with discounts on larger-volume orders. They're warranted for one year, and backed by Hantronix, Inc.'s high reliability standards and prompt service. For full details, contact Hantronix, Inc. today.



### FEATURES

- By the combination of dots it can be displayed many kinds of characters and symbols.
- Using REM-TN liquid crystal developed newly, it has wide viewing angle.
- Due to low drive voltage and low current consumption, it can be operated with battery.
- Charectere generator included.
- Many kinds of types are available according to user's requirements.

### OPTIONS

#### TN(Twisted Nematic) or STN (Super Tweisted Nematic) Type

- STN type offers high contrast and wider viewing angle
- Viewing angle(TN:±20°, STN:±40°)

#### Standard Temperature Type

- Operating temperature range: 0°C~+50°C
- Storage temperature range: -20°C~+70°C

#### Extended Temperature Type

- Operating temperature range:-20°C~+70°C
- Storage temperature range: -40°C~+80°C

#### E/L Backlight Type

- Electro Luminescence for backlight
- Standard emitted color is "blue-green"
- Inverter is required

#### LED Backlight Type

- Brighter and even backlighting
- Long lifetime of LED

#### CCFL Bcklight Type

- Paper white backlight for graphic LCD
- Less power consumption than LED

#### Single Voltage Type

- 5V for logic circuit and LCD driving

#### Dual Voltage Type

- 5V for logic Circuit
- -1V to -5V for LCD driving
- Graphic modules to 32V for LCD driving

**HANTRONIX** 10080 BUBB ROAD, CUPERTINO, CA 95014-4132 Tel: (408) 252-1100 • Fax: (408) 252-1123  
 Email: info@hantronix.com Web site: www.hantronix.com



**HANTRONIX****DOT MATRIX LCD MODULES****STANDARD PRODUCTS (Character Modules)****CHARACTER TYPE (NO BACK LIGHT OR EL)**

MODEL	EXTERNAL DIMENSIONS (WxHxDmm)	CHARACTER x LINE	CHARACTER SIZE (WxHmm)
HDM0811H-1	54.0x37.0x10.0	8x1	2.90x7.60
HDM08216H-1	54.0x37.0x10.5	8x2	2.95x5.15
HDM08216H-2	58.0x32.0x10.0	8x2	2.95x5.56
HDM12216H	55.7x32.0x9.8	12x2	3.20x6.20
HDM16116H-2	80.0x36.0x13.0	16x1	3.20x6.35
HDM16116H-7	122.0x33.0x10.0	16x1	4.84x9.66
HDM16116H-L	151.0x40.0x10.0	16x1	6.0x14.54
HDM16216H-2	85.0x36.0x10.0	16x2	3.15x5.75
HDM16216H-4	122.0x44.0x10.0	16x2	4.84x9.66
HDM16216H-5	80.0x36.0x10.0	16x2	2.95x4.35
HDM16216H-6	80.0x36.0x9.7	16x2	2.96x5.56
HDM16216H-B	84.0x44.0x10.0	16x2	2.95x5.55
HDM16216H-C	71.5x36.0x14.5	16x2	2.78x4.89
HDM16216H-D	85.0x30.0x10.0	16x2	2.95x4.35
HDM16216H-I	72.0x30.0x10.0	16x2	2.51x5.16
HDM16216H-S	53.0x20.0x8.5	16x2	1.85x3.15
HDM16416H	87.0x60.0x10.0	16x4	2.95x4.75
HDM20216H-3	116.0x37.0x10.0	20x2	3.20x5.55
HDM20216H-L	146.0x43.0x10.0	20x2	4.84x9.22
HDM20416H	98.0x60.0x10.0	20x4	2.95x4.75
HDM20416H-M	146.0x62.5x10.0	20x4	4.85x9.23
HDM24216H-2	118.0x36.0x10.0	24x2	3.20x5.55
HDM24416H-1	130.0x62.0x10.0	24x4	2.80x6.30
HDM40216H-4	182.0x33.5x10.0	40x2	3.20x5.55
HDM40416H	215.0x60.0x10.0	40x4	3.20x6.25

\* These modules are available with a touch screen.

# These modules are color.

**CHARACTER TYPE (LED BACK LIGHT)**

MODEL	EXTERNAL DIMENSIONS (WxHxDmm)	CHARACTER x LINE	CHARACTER SIZE (WxHmm)
HDM08216L	58.0x37.0x10.0	8x2	2.96x5.56
HDM12216L	55.7x32.0x12.8	12x2	3.20x6.20
HDM16116L	80.0x36.0x14.5	16x1	3.20x6.35
HDM16116L-7	122.0x33.0x15.0	16x1	4.84x9.86
HDM16116L-H	85.0x28.0x14.0	16x1	3.07x6.56
HDM16116L-L	151.0x40.0x15.0	16x1	6.0x14.54
HDM16216L-2	80.0x45.0x12.5	16x2	3.20x6.55
HDM16216L-5	80.0x35.0x14.5	16x2	2.95x4.35
HDM16216L-6	80.0x36.0x14.5	16x2	2.96x5.56
HDM16216L-7	122.0x44.0x14.5	16x2	4.84x9.60
HDM16216L-8	130.0x38.1x13.0	16x2	4.84x9.66
HDM16216L-B	84.0x44.0x14.5	16x2	2.95x5.55
HDM16216L-C	71.5x36.0x14.5	16x2	2.78x4.89
HDM16216L-D	85.0x30.0x14.0	16x2	2.95x4.35
HDM16216L-S	53.0x20.0x8.5	16x2	1.85x3.15
HDM16216L-T	69.0x29.2x6.5	16x2	2.95x5.55
HDM16416L	87.0x60.0x12.5	16x4	2.95x4.75
HDM20216L	116.0x37.0x13.0	20x2	3.20x5.55
HDM20216L-L	146.0x43.0x14.2	20x2	4.84x9.22
HDM20416L	98.0x60.0x12.5	20x4	2.95x4.75
HDM20416L-B	118.0x43.0x14.0	20x4	2.95x4.75
HDM20416L-M	146.0x62.5x13.6	20x4	6.0x9.22
HDM24216L-2	118.0x36.0x14.0	24x2	3.20x5.55
HDM24416L-1	125.0x39.0x14.0	24x4	3.20x5.55
HDM40216L	182.0x33.5x13.0	40x2	3.20x5.55
HDM40416L-4	190.0x54.0x14.5	40x4	2.80x4.91

**STANDARD PRODUCTS (Graphics Modules)****GRAPHIC TYPE (GENERAL PURPOSE)**

MODEL	EXTERNAL DIMENSIONS (WxHxDmm)	NUMBER OF DOTS (WxH)	BUILT-IN CONTROLLER	BACKLIGHT
HDM32GS12-1	80.0x36.0x14.0	122x32	YES	EL, LED
HDM32GS12Y-3	65.8x27.1x8.4	122x32	YES	EL
HDM32GS12L-4	122.0x44.0x14.5	128x32	YES	LED
HDM48GS12	84.0x48.0x11.1	128x48	YES	EL, LED
HDM64GS12	93.0x70.0x8.5	128x64	YES	EL, LED
HDM64GS12-1	78.0x70.0x13	128x64	YES	EL, LED
HDM64GS20	210.6x89.9x2.8	640x200	NONE	NONE
HDM64GS24-2	180.0x65.0x9.6	240x64	YES	EL, LED
HDM64GS24-4	180.0x65.0x13.8	240x64	YES	EL, LED, CCFL
HDM128GS12Y	85.0x100.0x14.0	128x128	YES	EL
HDM128GS12-1	72.4x69.9x9.5	128x128	YES	EL, LED
HDM128GD16	129.0x104.5x15.9	160x128	YES	EL, LED
HDM128GS24	144.0x104.0x12.5	240x128	YES	EL, LED
HDM128GS24Y-1	170.0x102.0x14.0	240x128	YES	CCFL
HDM150GS32	116.5x42.0x15.5	150x32	YES	EL, LED
HDM240GS16	76.0x80.5x9.0	240x160	NONE	EL
HDM240I92	122.0x92.0x6.0	240x192	NONE	NONE
HDM240200	88.0x85.0x9.5	240x200	NONE	EL
HDM3224	143.0x96.8x13.0	320x240	NONE	CCFL
HDM3224-1	143.0x96.8x13.0	320x240	NONE	CCFL
HDM3224TS-1*	143.0x96.8x13.0	320x240	NONE	CCFL
HDM3224-5	134.5x117.0x14.0	320x240	NONE	LED
HDM3224-6	143.0x96.8x15.0	320x240	NONE	EL, LED, CCFL

Web site: [www.hantronix.com](http://www.hantronix.com)E-mail: [sales@hantronix.com](mailto:sales@hantronix.com)**GRAPHIC TYPE (DSTN NOTEBOOK)**

MODEL	EXTERNAL DIMENSIONS (WxHxDmm)	NUMBER OF DOTS (WxH, DOTS)
HDM6448-1	260.0x174.0x8.0	640x480
HDM6448-S*	205.0x141.0x7.0	640x480
HDM640CN03C-S	264.0x183.0x8.0	640x(R,G,B)x480
HDM800CN01C-S	264.0x183.0x8.0	800x(R,G,B)x600
HDM800CN02C-S	264.5x193.5x8.3	800x(R,G,B)x600
HDM800CN04C-S	276.5x199.0x8.0	800x(R,G,B)x600

**GRAPHIC TYPE (ANALOG NTSC/PAL)**

MODEL	EXTERNAL DIMENSIONS (WxHxDmm)	NUMBER OF DOTS (WxH, DOTS)
HDK480234T	63.8x54.8x12.7	480-x234
HDK600234T	127.2x92.7x12.8	600x234
HDK960234T	127.2x92.7x12.8	960x234
HDK960234T-6	153.6x119.8x14.3	960x234

**Chip-On-Glass CHARACTER AND GRAPHICS**

MODEL	EXTERNAL DIMENSIONS (WxHxDmm)	NUMBER OF CHARACTERS OR NUMBER OR DOTS	VIEWING AREA (WxHmm)
HDG1601P/F	70.0x25.0x2.1	16x1	65.6x13.8
HDG1602P/F	70.0x25.0x2.1	16x2	65.6x13.8
HDG2002P/F	81.0x28.3x2.1	20x2	77.0x16.5
HDG12832F	56.0x26.39x2.1	128x32	52.0x13.8
HDG12864F	77.5x51.3x2.8	128x64	70.7x38.8

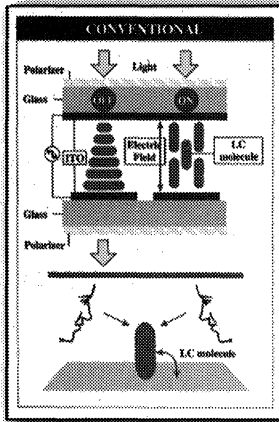
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**Liquid Crystal Displays**

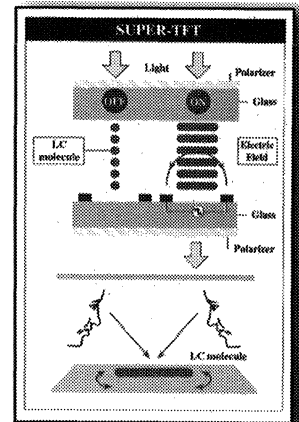
**“Super TFT” Technology with Patented In-Plane Switching (IPS) Capability**



	Conventional TFT-LCD	Super TFT-LCD
Upper side view 30 degrees		
Front view 0 degrees		
Right side view 50 degrees		

Image source: Hitachi Photo CCD Sample in di. Ltd.

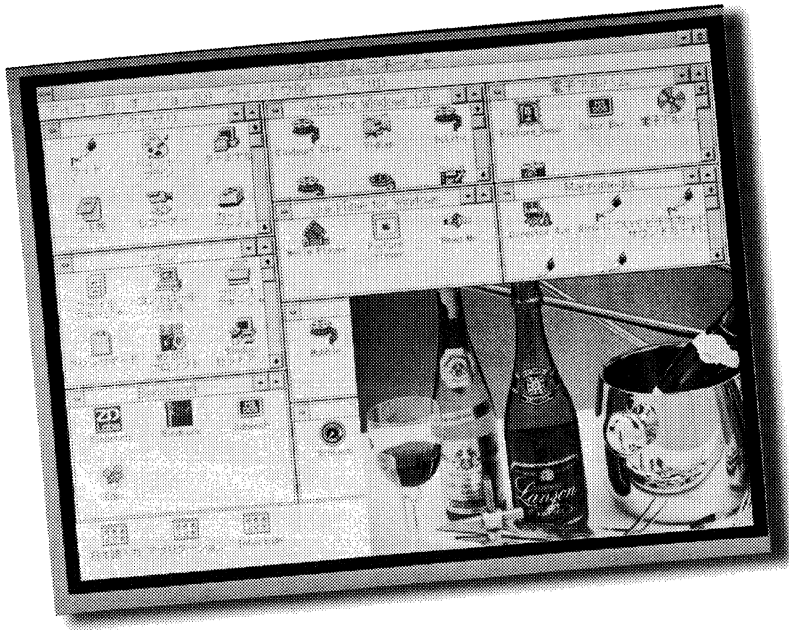
Comparison of Displayed Images Between a Conventional (TN) TFT-LCD and a Super TFT-LCD.



Product Availability	14.1"	15.0"	18.0"
Part Number	TX36D11VC0CAA	TX38D11VC1CAA	TX46D11VC1CAA
Pixel Number	1024 x 768	1024 x 768	1280 x 1024
Pixel Pitch (mm)	0.279 x 0.279	0.297 x 0.297	0.279 x 0.279
Resolution	XGA	XGA	SXGA
Contrast Ratio	200	200	200
Brightness (cd/m <sup>2</sup> )	200	200	200
Color	262,144 colors	262,144 colors	262,144 colors
Viewing > 10	V: 160°, H:160°	V: 160°, H:160°	V: 160°, H:160°
Angle > 0.04 CIE	V: 160°, H:160°	V: 160°, H:160°	V: 160°, H:160°
# of CCFL	4/Side	4/Side	8/Direct
Interface	LVDS (2 ch.)	LVDS (1 ch.)	LVDS (2 ch.)
Power Supply	5V	5V	3.3V, 12 V
Connector	20p, JAE	20p, JAE	20p x 2, JAE
Weight (g)	1,400	1,500	2,800
External Dimension(mm)	330 x 252 x 15.5	350 x 265 x 15.5	415 x 330 x 45
Remarks	w/o Inverter	w/o Inverter	w/o Inverter
MP Availability	5/98	10/98	10/98

**HITACHI**

HITACHI ELECTRONIC DEVICES, INC. Flat Panel Display, 3850 Holcomb Bridge Rd., Suite 300, Norcross, GA 30092  
Phone (770) 409-3000 Fax (770) 409-3028

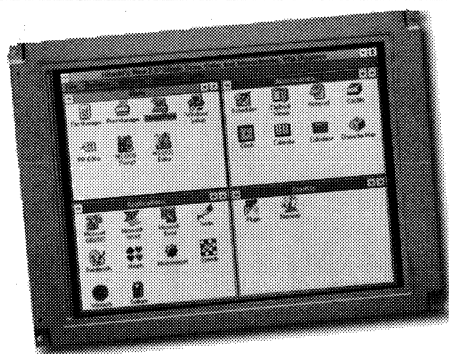
**HITACHI®****Liquid Crystal Displays****Thin, Light, Bright Color TFT Displays...**

- 12-15" Sizes
- High Contrast
- Wide Viewing Angles
- Long Life Backlighting
- High Brightness Levels

Product Availability	12.1"	12.1"	13.3"	14.1"
Part Number	TX31D27VC1CAB	TX31D33VC1CAF	TX34D62VC1CAC	TX36D61VC1CAB
Pixel Number	800 x 600	800 x 600	1024 x 768	1024 x 768
Pixel Pitch (mm)	0.3075 x 0.3075	0.3075 x 0.3075	0.264 x 0.264	0.279 x 0.279
Resolution	SVGA	SVGA	XGA	XGA
Brightness (cd/m <sup>2</sup> )	70/150	70/150	70/150	70/150
# of CCFL	1 per side	1 per side	1 per side	1 per side
CCFL Lifetime	25,000 Hrs	25,000 Hrs	25,000 Hrs	25,000 Hrs
Contrast	150:1 (TYP)	150:1 (TYP)	150:1 (TYP)	150:1 (TYP)
Color	262,144 colors	262,144 colors	262,144 colors	262,144 colors
Interface	18 Bit Digital	LVDS (1 ch.)	LVDS (1 ch.)	LVDS (1 ch.)
Power Supply	3.3 V	3.3 V	3.3 V	3.3 V
Weight (g)	420	420	510	590
External Dimension (mm)	275.5 x 199 x 8.0	275.5 x 199 x 7.0	296.5 x 214.5 x 7.0	304.0 x 227.0 x 6.0

**HITACHI**

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 Phone (770) 409-3000 Fax (770) 409-3028

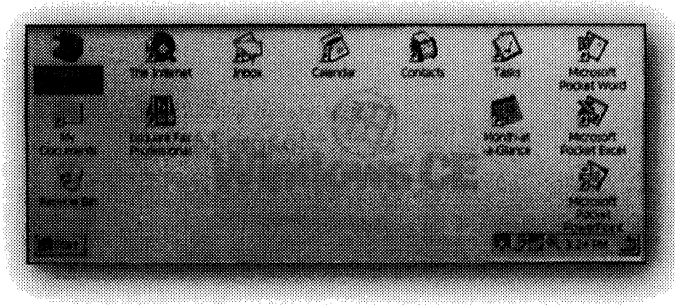
**HITACHI®**VGA Liquid  
Crystal Display**Liquid Crystal Displays****Color Passive  
Matrix Displays...**

<b>Product Availability: VGA Resolutions</b>			
	<b>SP19V001</b>	<b>SX19V001</b>	<b>SX21V001</b>
Display Area	7.5"	7.5"	8.2"
Display Mode	STN B & W	Color STN	Color STN
Pixel Resolution	640 x 480	(640 x RGB) x 480	(640 x RGB) x 480
Pixel Pitch (mm)	0.237 x 0.237	(0.079 x 3) x 0.237	(0.087 x 3) x 0.261
Pixel Size (mm)	.217 x .217	(.056 x 3) x .214	(.064 x 3) x .238
Duty Ratio	1/480	1/480	1/480
Contrast Ratio	18:1	20:1	50:1
Response Time	270 milliseconds	550 milliseconds	350 milliseconds
Polarization Mode	Transmissive	Transmissive	Transmissive
Viewing Direction	6:00 Bottom View	6:00 Bottom View	6:00 Bottom View
Backlight	Single CCFL	Single CCFL	Single CCFL
Brightness	70 (cd/m <sup>2</sup> )	70 (cd/m <sup>2</sup> )	70 (cd/m <sup>2</sup> )
Data Interface	8 Bit Parallel	8 Bit Parallel	8 Bit Parallel x 2
Driver IC Package	Flat Micro T.C.P.	Flat Micro T.C.P.	Flat Micro T.C.P.
Module Size (mm)	197.0 x 145.0 x 8.5	197.0 x 145.0 x 8.5	205.0 x 142.5 x 6.0

<b>1/2 VGA</b>			<b>1/4 VGA</b>		
	<b>SR16H005-R</b>	<b>SX16H002</b>	<b>LMG7520RPFC</b>	<b>SP140001</b>	<b>SP14Q002</b>
Display Area	6.5"	6.5"	4.72"	5.67"	5.67"
Display Mode	Film STN B & W	Color STN	Film STN B & W	STN Blue Mode	Film STN B & W
Pixel Resolution	640 x 240	(640 x RGB) x 240	320 x 240	320 x 240	320 x 240
Pixel Pitch (mm)	0.24 x 0.24	(0.08 x 3) x 0.24	0.30 x 0.30	0.36 x 0.36	0.36 x 0.36
Pixel Size (mm)	0.23 x 0.23	(0.06 x 3) x 0.22	0.285 x 0.285	0.345 x 0.345	0.345 x 0.345
Duty Ratio	1/240	1/240	1/240	1/240	1/240
Contrast Ratio	10:1	25:1	20:1	12:1	12:1
Polarization Mode	Reflective	Transmissive	Transmissive	Transmissive	Transmissive
Viewing Direction	6:00 Bottom View	6:00 Bottom View	6:00 Bottom View	6:00 Bottom View	6:00 Bottom View
Backlight	No Backlight	Single CCFL	Single CCFL	Single CCFL	Single CCFL
Brightness	Not Applicable	70 (cd/m <sup>2</sup> )	100 cd/m <sup>2</sup>	80 cd/m <sup>2</sup>	80 cd/m <sup>2</sup>
Data Interface	4 Bit Parallel	8 Bit Parallel	4 Bit Parallel	4 Bit Parallel	4 Bit Parallel
Module Size (mm)	176.9 x 75.2 x 7.8	171.6 x 74.2 x 8.5	129.6 x 92.6 x 7.5	167 x 109 x 8.5	167 x 109 x 8.5

**HITACHI**

HITACHI ELECTRONIC DEVICES, INC. Flat Panel Display, 3850 Holcomb Bridge Rd., Suite 300, Norcross, GA 30092  
 Phone (770) 409-3000 Fax (770) 409-3028

**HITACHI®****Liquid Crystal Displays****Graphic Displays...**

<b>Other Graphic Displays</b>				
	<b>LMG7400 Series</b>	<b>LMG7401 Series</b>	<b>LMG7402 Series</b>	<b>LMG6400 Series</b>
Display Area	5.4"	5.4"	5.4"	5.4"
Display Mode	Film STN B & W	Blue and White	Film STN B & W	STN or Film STN
Pixel Resolution	240 x 128	240 x 128	240 x 128	240 x 128
Pixel Pitch (mm)	0.5 x 0.5	0.5 x 0.5	0.5 x 0.5	0.5 x 0.5
Pixel Size (mm)	0.47 x 0.47	0.47 x 0.47	0.47 x 0.47	0.47 x 0.47
Duty Ratio	1/128	1/128	1/128	1/128
Polarization Mode	Transmissive	Transmissive	Transflective	Reflective and Transflective
Viewing Direction	6:00 Bottom View	6:00 Bottom View	6:00 Bottom View	6:00 Bottom View
Backlight	Single CCFL	Single CCFL	Single CCFL	None or EL
Brightness	90 (cd/IC <sup>2</sup> )	90 (cd/IC <sup>2</sup> )	90 (cd/IC <sup>2</sup> )	N/A or 10 (cd/IC <sup>2</sup> )
Data Interface	8 Bit Parallel	8 Bit Parallel	8 Bit Parallel	8 Bit Parallel
Module Size (mm)	159.4 x 101 x 11	159.4 x 101 x 11	159.4 x 101 x 11	159.4 x 101 x 9.5
<b>Models Available</b>				
	<b>LMG7400PLFC</b>	<b>LMG7401 PLBC</b>	<b>LMG7402PLBC</b>	<b>LMG6400PLGR</b>
	Hitachi controller	Hitachi controller	Hitachi controller	Reflective STN
	#HD61830	#HD61830	#HD61830	
	<b>LMG7420PLFC-X</b>	<b>LMG7421 PLBC</b>	<b>LMG7412PLFF</b>	<b>LMG6401PLGE</b>
	Toshiba controller	Toshiba controller	No Controller	Transflective STN
	#T6963C	#T6963C	#T6963C	with EL backlight
			<b>LMG7422PLFF</b>	<b>LMG6402PLFR</b>
			Toshiba controller	Reflective Film
			#T6963C	STN

**Hitachi contact for more information.****Hitachi Electronic Devices (USA), Inc. Flat Panel Display Sales Offices:****Atlanta**

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1740 Technology Drive  
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Fax/408-436-3924

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Phone (770) 409-3000 Fax (770) 409-3028

# HOMALITE DISPLAY FILTERS AND SPECIFICATIONS

## LOW REFLECTANCE CONTRAST ENHANCEMENT FILTERS

### Product Description

In designing instruments with LED, LCD, CRT, gas discharge, plasma or vacuum fluorescent displays, an important design consideration is the human engineering factor.

For optimum contrast and readability, Homalite™ display filters are available in colors designed to meet requirements of a wide variety of displays. Glare is reduced with a low reflectance surface cast into the material—it can't chip or peel. By increasing contrast and reducing glare, the display can be read easily and accurately under varied lighting conditions.

Because Homalite materials are thermosetting plastics, the display filters are more rigid and resistant to impact, heat, abrasion and chemical attack than other plastic filters.

All our filters can be cleaned with soap and water, acetone, chlorinated and other commercial solvents or common glass cleaning preparations.

Homalite representatives can provide technical assistance to meet your design requirements. Sample chips in various colors are available upon request.

### Grades of Material

All grades shown below are available with LR (low-reflectance) surface.

	Description	Properties	UL Flammability Classification
H-100	Thermosetting polyester. Available in all colors.	General purpose applications. Excellent resistance to chemical attack. Scratch-resistant.	UL94HB
H-101	Thermosetting polyester. Available in all colors.	For high temperature applications. This self-extinguishing, fire retardant grade offers good heat distortion resistance.	UL94V-0 (thicknesses 1/8" and over) UL94HB (thicknesses up to 1/8")
H-911	Allyl diglycol carbonate. Available in clear.	Highest optical qualities. Abrasion resistant—30 to 40 times more scratch-resistant than acrylics.	UL94HB

### INSTRUMENT DISPLAY FILTERS

#### Sizes and Forms

Homalite can fabricate display filters to meet your requirements. This includes cutting to size, drilling holes, milling slots, steps and beveled edges, etc. Parts can be silkscreened, mirrored or coated for RF/EMI shielding. See standard CRT filter sizes.

Homalite materials are available in standard thicknesses of 1/4", 3/32", and 1/8". Other thicknesses from 1/32" to over 2" are available upon request.

A protective, removable masking is available on one or both sides of fabricated parts. If masking is required, please specify when ordering.

If you choose to fabricate your own display filters, you can order Homalite materials in sheet form in two sizes: 21" x 31" and 33" x 45". Sheets will be supplied with masking on both sides. Instructions for fabrication are available upon request.

#### Filter Colors

Homalite filters are available in a wide range of standard colors which are designed for use with commonly available displays. Homalite can also color match and prepare filter material for specific application requirements or to du-

plicate the color of existing filters. Choosing the proper color will give sharp, clear characters with enhanced contrast between the information displayed and the background.

#### Light Emitting Displays and CRT's

An important consideration in choosing the filter shade is the environment where the instrument will be used. For instance, if the display will be viewed in bright sunlight, you would select a darker shade than if the display were used in a room with fluorescent

lighting. Standard colors and spectral curves are as displayed. However, we would be pleased to match a specific color or work with you on a shade that meets your special application requirements.

#### Liquid Crystal Displays

Although LCD's do not emit light, reduction of glare from ambient light greatly improves readability. Homalite materials with the

LR finish in clear or light gray (1295) are recommended for this type of display.

### Spectral Transmission Data

Color	Shade	% of Transmission	Wave-length Nanometers
Gray	1245	45	N/A
	1250	22	N/A
	1265	30	N/A
	1295	60	N/A
Green	1425	25	565
	1436	36	500
	1440	40	565
	1452	50	505
Red	1600	44	655
	1670	71	655
Amber	1709	24	575
	1720	34	565
	1726	46	565
	1795	25	565
Blue	1500	55	450
	1558	80	440

### Low Reflectance Surface

Homalite filters reduce specular reflection associated with conventional face plates and filters. Unlike other filters, the low glare surface of Homalite filters is cast into the material. This surface is not a lamination or coating, so it cannot separate, chip, peel or rub off.

The Homalite low-reflectance surface, referred to as "LR", minimizes glare and improves readability.

Two low-reflectance surfaces are available.

**LR-72**—The most light diffusing surface. For mounting as close as possible to the light source, up to 1/2" distance.

**LR-92**—For mounting from 1/2" to 2" from the light source.

### CRT FILTERS

Typical filter configurations for CRT sizes 5" to 19" are shown below in contoured and rectangular shapes. For 5" to 15" filters, the standard thickness is 1/16". For 19" filters, we recommend 3/32" thickness material. Other thicknesses available upon request.

Homalite will fabricate filters to the exact size and shape requirement of specific monitors. For best results, please include measurements (width, length and spherical radius) to ensure proper fit. A mechanical assembly drawing of the monitor showing dimensions and mounting arrangements can be useful in establishing the proper configuration for your filter.

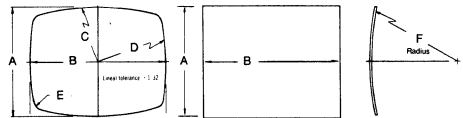
Filters can be supplied with or without adhesive tape for mounting.

When ordering filters, the letter C or R after the (Diagonal) Filter Size denotes contoured or rectangular shape. The spherical radius shown for each size applies to both contoured and rectangular

Contoured

Rectangular

Curvature



Standard Dimensions*	Filter Size (Diagonal)				
	5"	9"	12"	15"	19"
A	3.62	5.87	7.88	9.50	12.87
B	4.62	7.97	10.32	11.83	15.97
C	14.19	22.00	39.00	60.00	15.00
D	13.38	22.00	18.00	49.00	32.60
E	0.44	0.68	0.75	0.81	1.50
F	14	27	25 or 24	25 or 24	47/21**

\* All linear tolerances ±.030"  
Curvature radius tolerance (F) ±1"

\*\* Compound Radius

## HOMALITE DIVISION

Brandywine Investment Group, Corp.

11 BROOKSIDE DRIVE  
WILMINGTON, DELAWARE 19804, U.S.A.  
(302) 652-3686 • 800-346-7802  
FAX: (302) 652-4578 • 800-884-8777

**Send For Engineering Bulletin 126-128 for Spectral Transmission Curves and Engineering Bulletin 135 for Material Properties Chart**

### How to Order

When placing an order for Homalite filters, please include the following information:	Example
1. Material grade	H 100
2. Type of LR surface	LR 72
3. Color number (or clear)	1265
4. Masking required (one side or both sides)	2 Sides
5. Size:	
For fabricated filters, indicate width x length, thickness and tolerances. Please include drawing if available (Preferred)	10" x 8" ±.030" x .062" ±.015"
For sheet material, indicate either 21" x 31" or 33" x 45" and thickness	21" x 31"
For standard CRT applications, include diagonal size and whether filter shape is contoured (C) or rectangular (R)	12" R

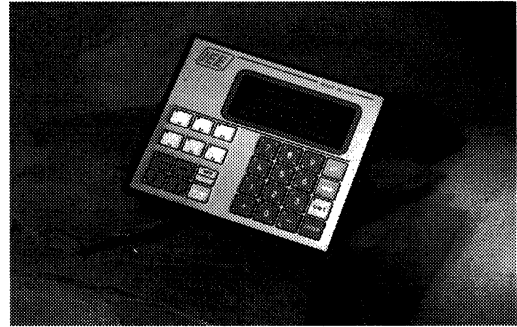
## Industrial Electronic Engineers, Inc.

# Displays and Integrated Panels

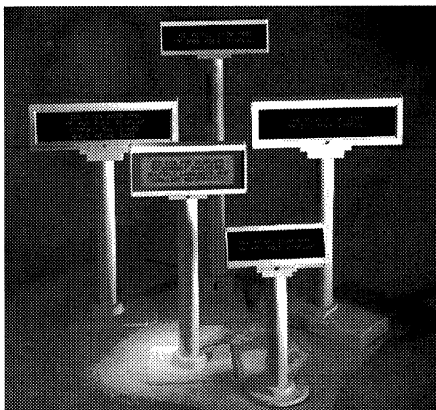
IEE offers a broad range of standard and custom display and integrated panel products for commercial and industrial applications.



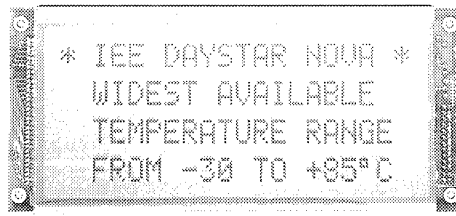
VF Dot Matrix and Segmented Modules



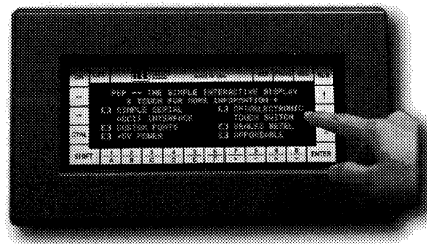
PLC-compatible Operator Interface Terminals



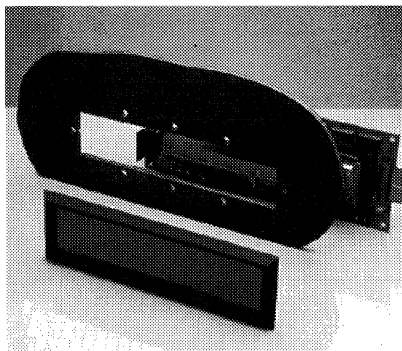
VF and LCD POS Pole Displays



LCD Modules

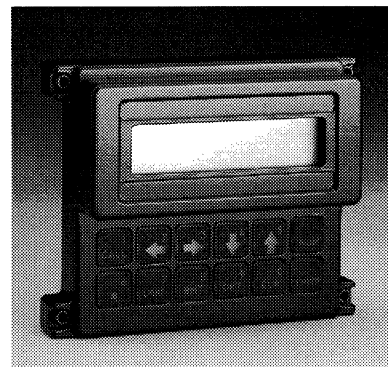


VF Interactive Touch Displays



Bezel/Filter Systems

Custom Front Panel Assemblies



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 Toll Free 800-422-0867 • Tel 818-787-0311 • Fax 818-901-9046  
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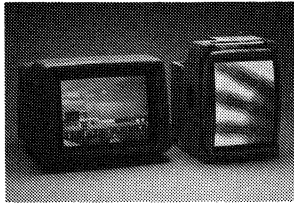


# CRT & EL FLAT PANEL DISPLAYS

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## CRT DISPLAYS

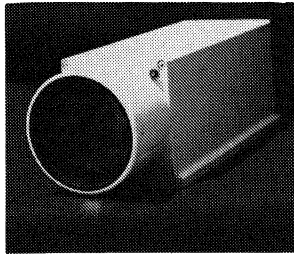
### 2048 X 1536 Viewable Pixels/200 Mhz Video



#### GMA 201/GMA 212

Digitally controlled dynamic focus and astigmatism. Clear bright flicker free displays. Landscape and portrait aspect models using Tektronix patents.

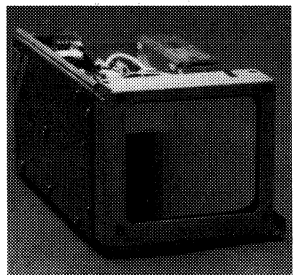
### One Inch CRT Display with Biocular Lens



#### RD01M5-317

The RD01 series provides an exceptionally small and light weight display for portable and compact installation applications. The biocular lens provides a crisp, bright, finely detailed virtual image for the viewer at distances from a few inches to several feet.

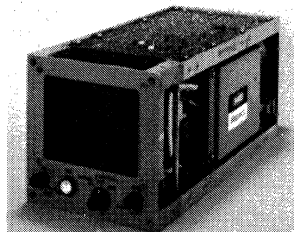
### High Performance Six Inch CRT Display



#### RD06M5-222

The RD06 series is a high brightness, sunlight readable, high-resolution display packaged in a compact, ruggedized, open frame assembly. These displays have outstanding gray scale capability and circuitry accommodating either RS-170 or CCIR line scan operation.

### U.S. Air Force Flight Line Tester

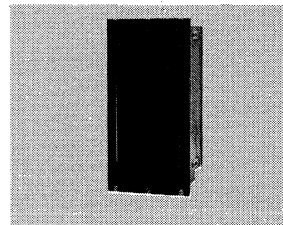


#### RD06J5X-276

6" diagonal display with selectable 15.75kHz, 26.25kHz horizontal scan rates or stroke mode; 20MHz video BW; high resolution; 28/300vdc.

## ELECTROLUMINESCENT PANEL

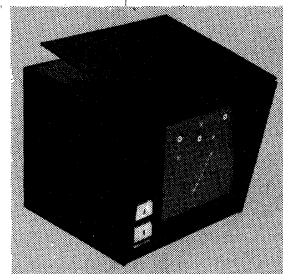
### U.S. Navy Electronic Surveillance System



#### EL66M48

High brightness; 4 level gray scale, MIL-STD-1553B compatible

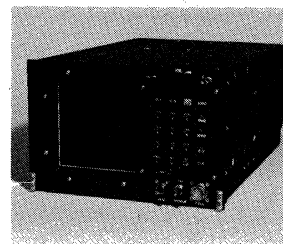
### U.S. Army Vulcan Gun



#### EL66M44

High brightness; Custom interface; Used in rugged conditions: dust, rain & vibration

### U.S. Navy EA6B Communication Jamming System



#### EL66J44A-064

High brightness; alpha numeric and graphic controller

MODEL	DISPLAY RESOLUTION	PEAK LUMINANCE*	CASE DIM. (METRIC)	ACTIVE PANEL AREA (METRIC)
EL66M44	256x256	110 FT-L	6"x6"x5" (150x150x130mm)	4"x4" (3.838x3.838) (97.5x97.5mm)
EL66M48	256x512	100 FT-L	6"x10"x3" (150x250x75mm)	4"x8" (3.838x7.676) (97.5x195mm)

\*Unfiltered

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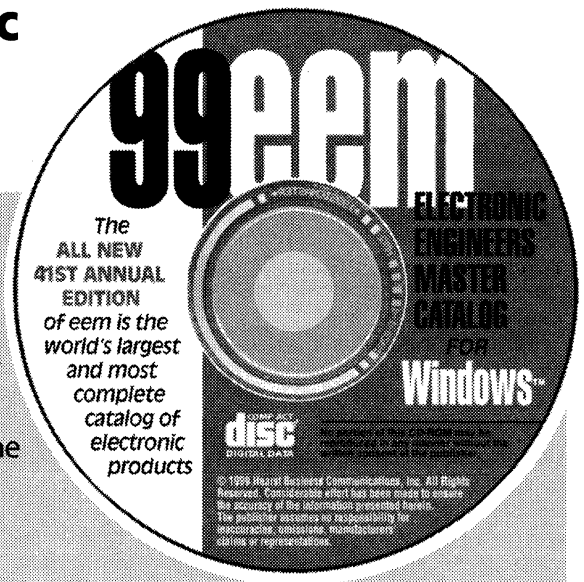
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# Liquid Crystal Displays

## Capability

Wide Temperature Operation:  
 First Minima Technology:  
 Low Power:  
 Custom Design:  
 Large Area Displays:

## Benefit

-40 to 104°C  
 Widest viewing, fast response  
 CMOS drive, long battery life  
 Uniquely identifies your product  
 Sign and video applications

## Custom Design Services

LXD will design and manufacture custom displays to meet your special requirements. Possibilities include large area displays up to 13.5 inches square. special characteristics, legends and symbols which convey the exact information that you intend for your application.

Our application staff is available for consultation on design criteria and will help guide your selections to achieve the best mix of performance and economy,

LXD will prepare and submit engineering documents from our CAD design system for your approval, which then become a part of the permanent record and act as a control documents on the design.

Prototype displays are produced using production tooling, equipment, methods and procedures. You can be assured that parts that you evaluate and qualify are "production quality" in every respect.

## 100% Domestic Manufacture

Every display that we sell is manufactured in our new 37,000 square foot factory near Cleveland, Ohio. A modern clean room facility and automated in-line process provide consistent quality and reliability in the finished product.

Critical and proprietary chemical formulations are maintained and produced in our on-site chemistry laboratory. These compounds make it possible for

LXD displays to withstand test conditions of 121°C and 15PSI, superheated steam, for over 100 hours without failure, (testing performed without polarizers). Domestic manufacture also means that you face a shorter pipeline for material. Access and responsiveness are improved with phones being serviced until 6:00 PM (Eastern) for your convenience.

## Quality Philosophy

"Quality" is more than a buzz-word, it is a state of mind that can be found throughout the LXD organization. We have implemented defined quality measures at every stage in our production process. Statistical Process Control, SPC, methods monitor activity in the factory and warn of variations in process or procedure.

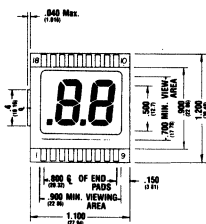
Materials are qualified and with each new receipt inspected to assure continued conformance to specification. Vendor control and feedback are an

integral part of LXD's quality program. Lot control throughout the factory allows traceability back to the raw materials.

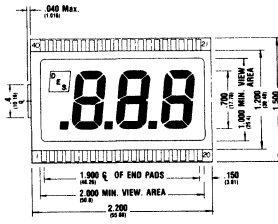
100% of the product going through the factory receives inspection for electrical and mechanical characteristics. Aesthetic criteria are evaluated at several stages prior to shipment and special handling procedures and protective packaging are used to prevent damage.

## Direct Drive Displays

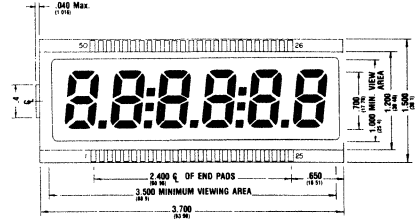
Part #29



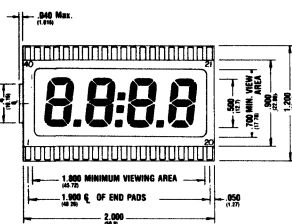
Part #58



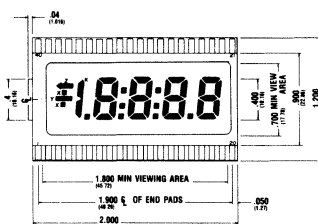
Part #70



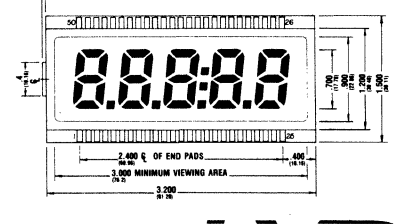
Part #44



Part #45



Part #57



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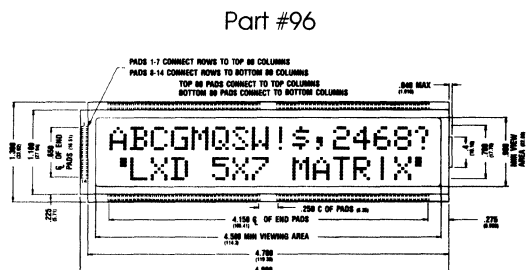
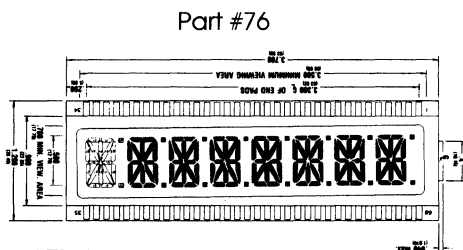
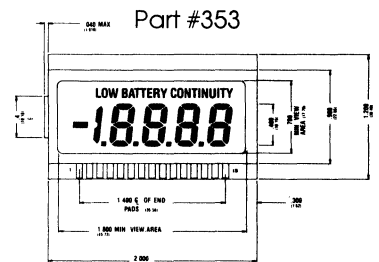
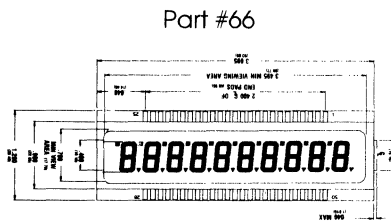
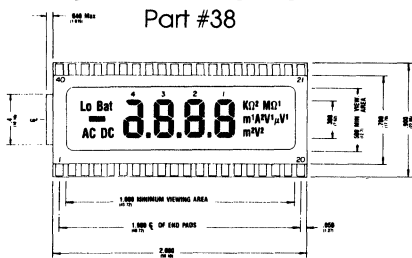


# Liquid Crystal Displays

## Standard Product Selector Guide and Index

	Number Of Digits/ Characters	LXD Base P/N	Descriptors (Description)	Drive	Package Size (Inches)			Digits Characters Height (Inches)
					Width	Glass Height		
						Larger	Smaller	
7-Segment	2	29	None	Dir.	1.10	1.2	0.9	0.500
	2	28	None	Dir.	1.50	1.5	1.2	0.700
	3	48	None	Dir.	2.00	1.2	0.9	0.500
	3	58	LOBAT	Dir.	2.10	1.5	1.2	0.700
	3.5	33	<-+, -	dir.	2.00	0.9	0.7	0.350
	3.5	41	LOBAT,+,-	Dir.	2.00	1.2	0.9	0.500
	3.5	43	<-+, -	Dir.	2.00	1.2	0.9	0.500
	3.5	51	LOBAT,+,-	Dir.	2.75	1.5	1.2	0.700
	3.5	53	<-+, -	Dir.	2.75	1.5	1.2	0.700
	3.5	83	<-+, -	Dir.	3.70	1.8	1.5	1.000
	4	34	None	Dir.	2.00	0.9	0.7	0.350
	4	44	None	Dir.	2.00	1.2	0.9	0.500
	4	54	None	Dir.	2.75	1.5	1.2	0.700
	4	84	None	Dir.	3.70	1.8	1.5	1.000
	4.5	35	<-+, -	Dir.	2.00	0.9	0.7	0.300
	4.5	45	<-+, -	Dir.	2.00	1.2	0.9	0.400
	4.5	49	LOBAT,+,-	Dir.	2.00	1.2	0.9	0.400
	4.5	55	<-+, -	Dir.	2.75	1.5	1.2	0.600
	4.5	85	<-+, -	Dir.	3.70	1.8	1.5	0.800
	5	47	None	Dir.	2.00	1.2	0.9	0.400
5	57	None	Dir.	3.20	1.5	1.2	0.700	
5	87	None	Dir.	4.50	1.8	1.5	1.000	
6	36	None	Dir.	2.50	0.9	0.7	0.350	
6	60	None	Dir.	2.75	1.2	0.9	0.500	
6	70	None	Dir.	3.70	1.5	1.2	0.700	
8	65	None	Dir.	3.70	1.2	0.9	0.500	
7-Segment Multiplex	4.0	38	KΩ, MΩ, mAV, μA, mV LOBAT, AC, DC, -	1/2	2.00	0.9	0.7	0.300
	4.5	353	Low Battery, Continuity, -	1/3	2.00	0.9	0.7	0.400
	8.0	69	None	1/4	3.70	1.2	0.9	0.500
	10.0	66	None	1/3	3.70	1.2	0.9	0.400
16-18 Segment	4	78	None (16 Segment)	Dir.	3.70	1.5	1.2	0.700
	4	77	None (18 Segment)	1/3	3.70	1.5	1.2	0.700
	8	76	None (18 Segment)	1/3	3.70	1.2	0.9	0.500
	8	350	None (18 Segment)	1/3	2.756	0.866	0.669	0.275
Bar Graph	40	91	(2 Rows of 20 Bars)	-	3.70	1.8	1.5	0.300
5x7 Dot Matrix	1x8	93	(5x7 Dot Matrix)	1/7	2.60	0.9	0.7	0.300
	1x16	94	(5x7 Dot Matrix)	1/7	4.80	0.9	0.7	0.300
	2x16	96	(2-line, 5x7 DM)	1/7	4.80	1.3	1.1	0.300
	1x20	99	(5x7 Dot Matrix)	1/7	5.90	0.9	0.7	0.300

### Multiplexed Displays



LXD, inc. • 7650 First Place, Cleveland, Ohio 44146 • 216-786-8700  
 Fax: 216-786-8711 Sales: 1-800-786-8710

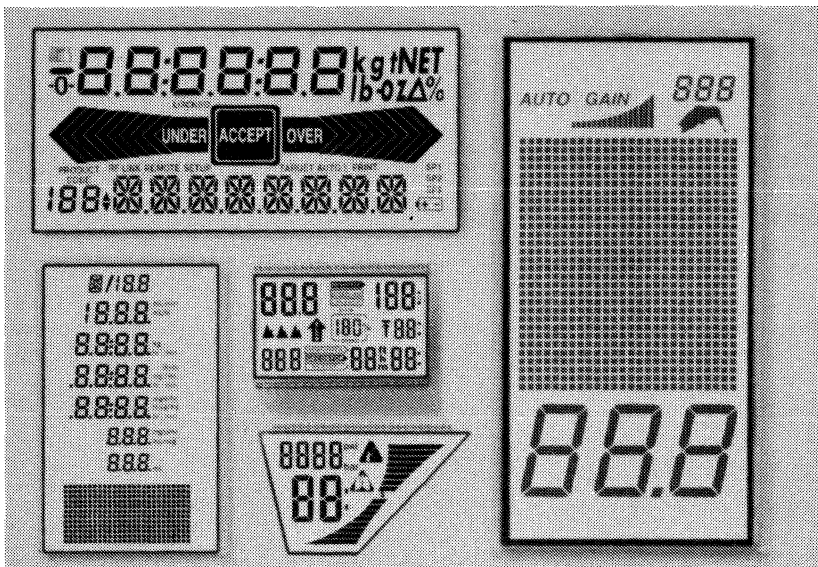
# OCULAR *Liquid Crystal Displays*

## High Quality Custom And Standard LCD Products At Competitive Pricing

### Custom LCD (glass)

#### FEATURES

- Flexible design, incorporating virtually any icons and enunciators
- Glass size ranges from 1/2 to 50 square inches
- Wide selection of fluid to match the exact voltage, multiplexing, and temperature requirements
- Devices are available in TN and STN technology
- Available with heat seal connector
- Ocular also supply backlight, elastomer connector and bezel as a kit



Ocular designs, manufactures, and delivers on time custom LCDs that meet performance and quality standards for industrial, commercial, and military applications.

Ocular specializes in producing custom LCDs from design through manufacturing. Our design-to-prototype service is available for a modest, one time tooling cost. Experienced, on-site applications engineers work with customers to design the most cost-effective display solution to meet their specific requirements.

We generate all drawing and artwork using our custom computer-aided design tool. This ensures a high degree of design accuracy and minimizes design cycle time. Since the type and size of the display images are determined by each individual application, Ocular designs custom LCDs that display a full range of graphic elements, such as bargraphs, graphic patterns, and symbols.

Ocular's flexible manufacturing process enables us to satisfy low to high volume production quantities of our custom devices.

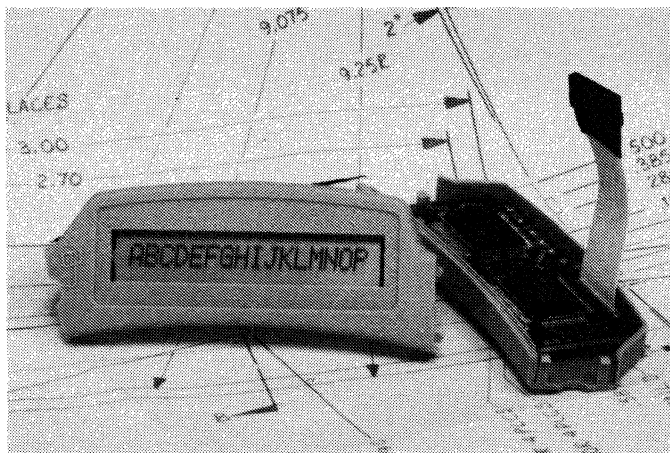
### Custom LCD Modules

Built to your specifications, Ocular's custom LCD modules significantly reduce your manufacturing overhead associated with the assembly of LCD's and the LCD driver electronics. It helps streamline your manufacturing costs and increases your production output.

Our engineers are highly experienced and can help you to design a module that is cost effective and reliable. Our flexible manufacturing line can handle virtually any size requirements. We are geared to serve you whether your volume requirements are in the 100's or 100,000's.

#### Ocular Custom Module Features:

- COB or SMT Technology
- Economical
- Reliable and High Quality
- Optional Backlighting
- Keypads and Other Hardware
- Rugged Metal or Injection Molded Plastic Housing
- Software Development At An Affordable Cost



746 Lingco Drive, Richardson, TX 75081 • Tel: 972-437-3888 • Fax: 972-437-2562  
Email Address: [lcd@ocularusa.com](mailto:lcd@ocularusa.com) • Home Page: <http://www.ocularusa.com>



### Standard Alphanumeric LCDs Module

Ocular dot-matrix alphanumeric modules come in a wide variety of sizes and configurations. Selection ranging from 1x16 to 4x40 character format. The general purpose modules are available in TN, STN, or enhanced STN grey mode technology and with optional LED backlight. Wide temperature option is also available. We will install value added options such as cable connectors to your specification.



**FEATURES**

- Wide viewing, TN, or STN technology
- Optional LED backlight
- On board controller with various display functions
- Char. generator ROM with up to 160 characters/symbols
- CG RAM display up to 8 custom char.
- +5V power supply



DISPLAY FORMAT	PART NUMBER	FONT	CHARACTER HEIGHT	VIEW. WINDOW	EXTERNAL DIM.	THICKNESS*		MOUNT.HOLE
				W X H	W X H	NON BL	BLK LGT	W X H
8 x 2	OM0821	5 x 8	4.7	30.4 x 13.9	40 x 35.4	3.6	NA	36 x 30
8 x 2	OM0822	5 x 8	5.95	32 x 16	54 x 37	6.5	6.5	49 x 32
16 x 1	OM1611	5 x 8	5.9	65 x 13.8	80 x 36	4.7	10	75 x 31
16 x 2	OM1621	5 x 8	5.6	61 x 15.8	84 x 44	5.4	8.5	76 x 36
16 x 2	OM1622	5 x 8	8.0	99 x 23.9	122 x 44	5.5	8.6	115 x 37
16 x 2	OM1624	5 x 8	4.3	65 x 13.8	80 x 36	4.7	10	75 x 31
16 x 2	OM1625	5 x 8	4.1	58 x 13.2	70 x 30.3	5.9	5.9	67 x 27.3
16 x 2	OM1626	5 x 8	4.9	61 x 15.8	85 x 30	5.4	9	82 x 24
16 x 2	OM1627	5 x 8	5.6	61 x 15.8	80 x 36	5.9	5.9	75 x 31
16 x 3	OM1632	5 x 8	4.7	61.3 x 18	91.4 x 39.6	6.6	6.6	84.8 x 33
16 x 4	OM1641	5 x 8	4.7	61.8 x 25.2	87 x 60	5.4	10	82 x 55
20 x 2	OM2021	5 x 8	5.6	83 x 18.6	115 x 36	5.4	10	108 x 29
20 x 2	OM2023	5 x 8	9.2	123 x 23	146 x 43	5.4	9.4	139 x 36
20 x 4	OM2041	5 x 8	4.7	76 x 27.5	98 x 60	5.3	10	93 x 55
20 x 4	OM2042	5 x 8	7.65	47.5 x 107.7	64 x 127	5.3	10	59 x 122
24 x 2	OM2421	5 x 8	5.6	93.5 x 15.8	118 x 36	5.3	10	113 x 31
40 x 2	OM4021	5 x 8	5.6	152.5 x 16.5	182 x 33.5	5.4	11	175 x 26.5
40 x 2	OM4023	5 x 8	4.2	121.4 x 13.2	132.1 x 34.8	5.3	9.9	127 x 29.7
40 x 4	OM4041	5 x 8	4.9	147 x 29.5	190 x 54	5.3	10	183 x 47

\* Thickness dimensions measured from top of PCB to top of bezel. Dimension in mm

### Graphic Modules

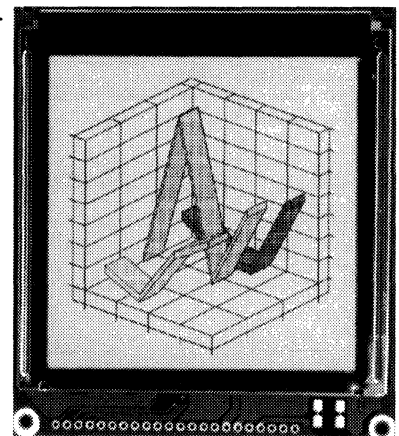
Ocular graphic display modules are designed to be user friendly. Some models feature Ocular's COB technology for ultra low profile, light weight and minimized package dimension. Ocular graphic modules are available in STN, FSTN and GSTN (blue image on grey background) with EL, CCFL or LED backlight\*. For models not shown on this page, please contact Ocular for the expanding line of standard graphic modules.

Ocular also understands that in some applications, semi customization or full customization off the standard models may resolve specific mechanical and electrical design constraints.

Ocular is specialized in graphic module **customization** at affordable NRE cost.

MODEL	RESOLUTION	OUTLINE	WINDOW	DUTY	CONTROLLER
OG 10321*	100x32	55x27.1	50x18.5	1/33	Built in SED1561
OG 13331*	134x33	98x60	74.7x27.5	1/33	Built in SED1561
OG 10651*	102x65	95x58	62x44	1/65	Built in SED1560
OG 12641	128x64	95x58	62x44	1/64	T6963C, not incl.
OG 24641	240x64	180x65	132x39	1/64	Built in T6963C
OG 24642	240x64	180x65	132x39	1/64	Generic, not incl.
OG 12121	128x128	86x95	67.4x67.4	1/128	Built in SED1335
OG 24121	240x128	144x104	114x64	1/128	Generic, not incl.
OG 19191	192x192	86x95	67.4x67.4	1/192	Generic, not incl.

† Not all backlight options are available in all models.  
\* These modules come with on board Vlcd generator, temperature compensation circuit, software adjustable contrast, display RAM and inverse video function.



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Ph: 219-477-4488  
Fax: 800-852-0106

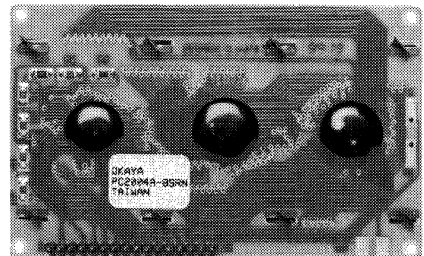
# SUPERTWIST

## ALPHA/NUMERIC AND GRAPHIC DOT MATRIX LCD MODULES

### PRODUCT SELECTOR 97L

Fax Back Document #2002

- Lower Cost Chip-on-Board Models
- Wide Operating Temp. of -20 to +70°C
- Integral Low Power LED, EL or CCFT Backlight
- LED Current-Limiting Resistor On Board Option
- Large Characters Available — 9.6/12.7/14.5mm
- 4 or 8 Bit Parallel Interface
- 1, 2 or 4 Lines of 8, 12, 16, 20, 24 or 40 Characters
- Grey, Yellow or Blue Mode Displays
- Straight/Right Angle Pin or Box Headers Options
- Backlight Connection via Main Cable or Separate Input
- Built-in Negative Supply Voltage Option
- Temperature Compensation On-Board Option
- Graphic Modules With Intelligent Controller Options



 **OKAYA**

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CHARACTER MODULE SELECTION CHART

PC Models = COB CMOS LSI

● Available / — Unavailable

For Neg Volts only, add NV
For Neg Volts + Temp. Comp., add NT

Table with columns: Basic Model Ident., Display Format Char. x # Lines, 5 x 8 Character Size Incl. Cursor WxH mm, Driving Duty Cycle, Frame Viewing Area WxH mm, PCB Size WxH mm, TN Type Temp. Range (Nrm, Wide), STN Type Temp. Range (Nrm, Wide), Backlight Options (EL, LED), Neg Volts Temp. Comp. Built-in, Connection Style Location, Fax Back Document Number.

\* PC2404B USES CONTROLLER NJR6426

GRAPHIC MODULE SELECTION CHART

PC Models = SMT CMOS LSI

● Available / — Unavailable

For Neg Volts only, add NV
For Neg Volts + Temp. Comp., add NT

Table with columns: Basic Model Ident., Display Matrix WxH Pix, Pix WxH mm, Frame Viewing Area WxH mm, Driving Duty Cycle, PCB Size WxH mm, Built-in Controller, STN Type Temp. Range (Nrm, Wide), Backlight Options (EL, LED), Neg Volts Temp. Comp. Built-in, Connection Style Location, Fax Back Document Number.

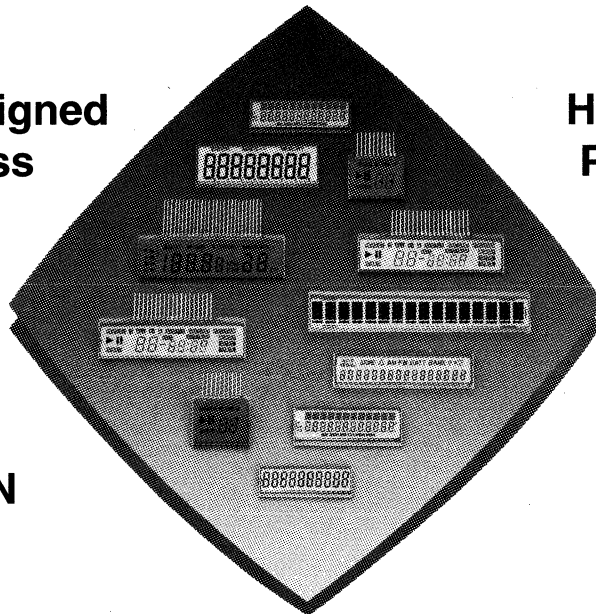
KS0107/8 ARE EQUIVALENT TO HD61202/3 LC7981 IS EQUIVALENT TO HD61830B

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# OKAYA ELECTRIC AMERICA, INC.

**Custom Designed  
LCD Glass**

**High Volume  
Production**



**TN - STN**

**ISO-9001**

**■ TYPICAL CHARACTERISTICS OF LIQUID CRYSTAL MATERIALS:**

LIQUID TYPE	STATIC	1/2 DUTY	1/3 DUTY	1/4 DUTY	1/5 DUTY	1/6 DUTY	STATIC	1/2 DUTY	1/3 DUTY	UNIT	
RELIABLE GRADE	CONSUMER						HIGH RELIABILITY				
OPERATING TEMPERATURE	-10°C ~ 55°C						-20°C ~ 80°C			°C	
STORAGE TEMPERATURE	-20°C ~ 60°C						-30°C ~ 85°C			°C	
AC VOLTAGE	10						20			V	
DC VOLTAGE	3.5									V	
OPERATING VOLTAGE	3 ~ 5	3	3 ~ 4.5	3	6.5	6.5	3 ~ 5	3 ~ 4.5	4.5	V	
OPERATING CURRENT	1.2 ~ 1.5	1.2	1.2 ~ 1.5	1.2	1.5	1.5	1.2 ~ 1.5	1.2 ~ 1.5	1.5	μA/cm <sup>2</sup>	
RESPONSE RISE TIME / FALL TIME	+40°C	60/50	50/120	80/110	80/100	80/80	120/80	50/50	60/75	100/90	m.s.
	+25°C	120/110	100/130	120/120	150/120	120/100	150/100	80/70	100/100	120/100	
	0°C	600/400	450/380	400/350	700/350	300/200	400/300	400/250	300/350	300/280	
	-20°C	1200/900	780/580	1500/800	1600/700	800/500	1000/600	800/500	700/1000	600/500	
	-10°C							2500/1500	2000/2500	1700/1500	

Wide temperature range and super high reliability LCD are also available upon request

**■ ENVIRONMENTAL CHARACTERISTICS OF LCD PANELS (WITH POLARIZERS):**

		COMMERCIAL	HIGH RELIABILITY
HIGH TEMPERATURE EXPOSURE		240 HRS AT 60°C	360 HRS AT 85°C
LOW TEMPERATURE EXPOSURE		240 HRS AT -20°C	500 HRS AT -30°C
EXPOSURE AT HIGH TEMPERATURE AND HIGH HUMIDITY	40°C/90% RH	240 HOURS	500 HOURS
	60°C/90% RH	48 HOURS	240 HOURS
HIGH TEMPERATURE OPERATION		240 HRS AT 50°C	500 HRS AT 80°C
LOW TEMPERATURE OPERATION		240 HRS AT -10°C	500 HRS AT -20°C

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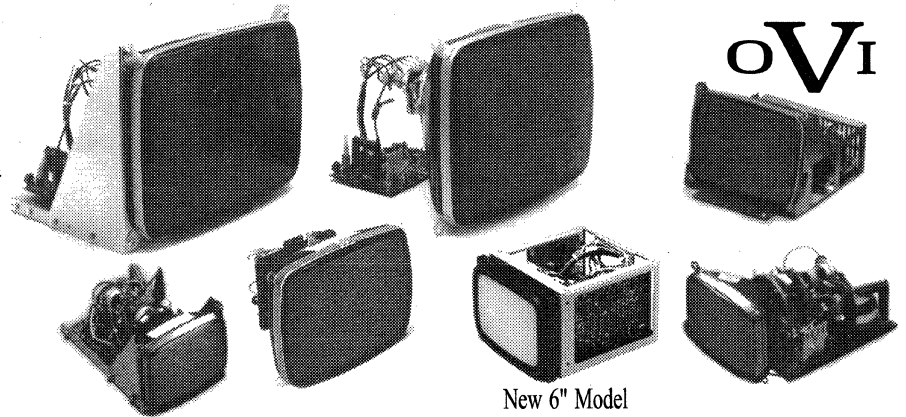
Hearst Business Communications, Inc./UTP Division

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# Omni Vision High Quality Monochrome Monitors

## Have it your way! Chassis, Kit & Tube Mount Configurations

*Is your existing design being discontinued/price escalated by your supplier? We will Retrofit your existing design, economically and with our upgraded features. Fax your specs today.*



### We will duplicate or customize to your input signal & mechanical requirements

#### Quality Features

#### Specifications

- All circuitry on one PCB for reliability
- Accepts TTL or Composite Video signals
- All controls easily accessible from monitor top
- Highlighted Video feature compatible with the IBM PC/compatible Highlighted Video
- Display thermally stabilized
- Electronic horizontal video centering
- Protected against incorrectly applied sync signals
- Display can be run without signal applied
- Vertical oscillator easily changed from 47 to 63 Hz.
- Vertical sync input polarity easily changed
- 0°, 5° or 10° tilt standard on 7", 9" and 12" chassis models
- Meets UL, CSA and DHHS rules on radiation

- Input Signals:**
- TTL**  
 Signal: Positive Polarity +2.5V to +5.0V. Reverse polarity signals may require board modification  
 Video Input Impedance: 470 ohms  
 Bandwidth: Within 3dB from 10Hz to 26MHz  
 Vertical Input Impedance: greater than 1K ohms  
 Typical Signal: 180 microseconds  
 Acceptable Range: 100 to 1200 microseconds  
 Horizontal Input Impedance: Greater than 6K Ohms  
 Typical Signal: 4.5 microseconds  
 Acceptable Range: 2.5 to 30 microseconds

#### Options

- Wide range of Phosphors
- Remote Brightness and Contrast
- Kit form or space saving chassis
- 120 VAC Power Supply
- +12VDC power connector
- 10 or 20 pin header
- TTL/Composite Video on one board

- Composite Video:**  
 Signal: 0.7V to 1.8V of composite peak to peak video  
 Input Impedance: 75 ohms  
 Bandwidth: Within 3db from 10Hz to 26MHz

- Geometric Distortion:**  
 Within 2% EIA standard DOT/Ball chart. Variation between adjacent characters <10% in alphanumeric display application.

- Scanning Frequencies:**  
 Factory adjusted for operation within 1kHz of center frequencies at 15.7kHz, 18.6kHz, 21.6kHz, 31.5kHz or 44 kHz.

Monitor Size	Mount Style	CRT SPECIFICATIONS			Power @12VDC	Center Resolution	Dimensions (Inches)			Weight (Lbs)	
		Neck	Deflection	View Area			Height	Width	Depth	Kit	Shipping
5" Diagonal	Chassis	20mm	70°	15 in <sup>2</sup> max	650mA	650 Lines	4.60	4.88	8.61	3.0	4.5
6" Diagonal	Chassis	20mm	70°	20 in <sup>2</sup> max	950mA	650 Lines	4.50	6.00	7.15	4.0	5.5
7" Diagonal	Chassis	20mm	85°	26 in <sup>2</sup> max	1150mA	700 Lines	5.90	7.95	8.20	10.0	12.0
9" Diagonal	Chassis	20mm	85°	35 in <sup>2</sup> max	1150mA	750 Lines	7.25	9.50	9.50	10.0	12.0
12" Diagonal	Chassis	20mm	90°	55 in <sup>2</sup> max	1250mA	900 Lines	9.25	11.50	11.00	11.0	13.0
14" Diagonal	Chassis	20mm	90°	88 in <sup>2</sup> max	1250mA	900 Lines	10.00	12.45	16.70	12.0	14.0



### OMNI VISION INC.

CRT Monitor Specialists since 1986

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# Omni Vision **COLOR** monitors . . . . . . solid electrical/mechanical design, *Your Way!*

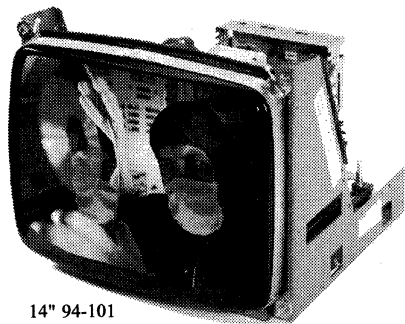
*We will duplicate or customize your mechanical footprint to your requirements.*

## Chassis, Kit & Tube Mount Configurations

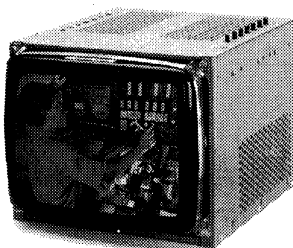
Omni Vision continues to provide cost effective monitors featuring quality, reliability and flexibility to meet your specific electrical and mechanical requirements in a timely fashion.

- G10 (FR4) plated-through PCB upgrade available
- Microprocessor control, auto sync, auto display adjust
- 16 gauge chassis with neck board support
- Operating temperature range: 0-55°C.
- 24 Hour Burn-in
- Auto ranging power input: 100 to 240 VAC
- Monochrome monitors, 5" to 14" also available

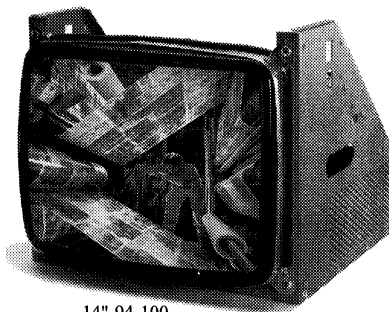
*Standard PCB: Single Sided. • Upgrade PCB: G10 (FR4) Plated Through Holes: 10" and 14".*



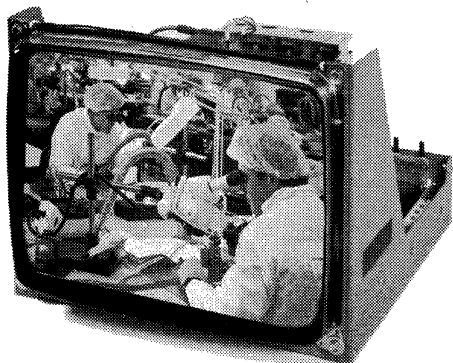
14" 94-101



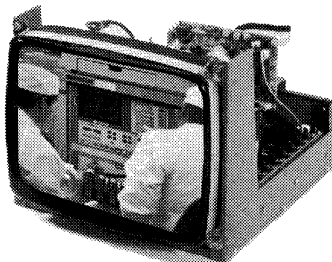
10" 94-300



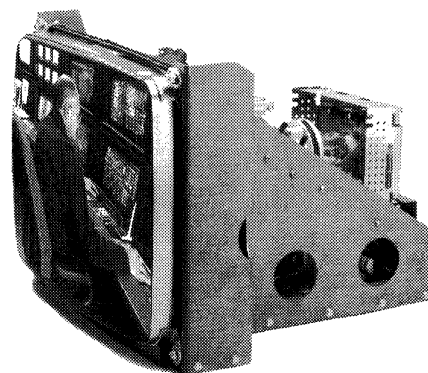
14" 94-100



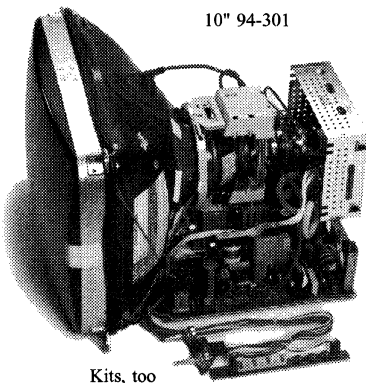
15" 94-201



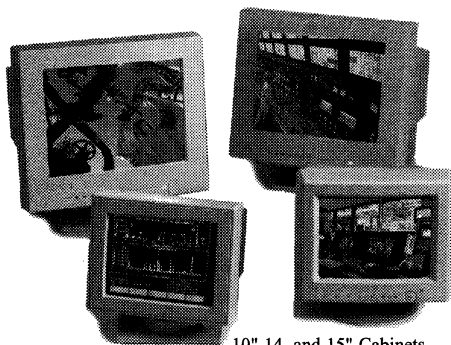
10" 94-301



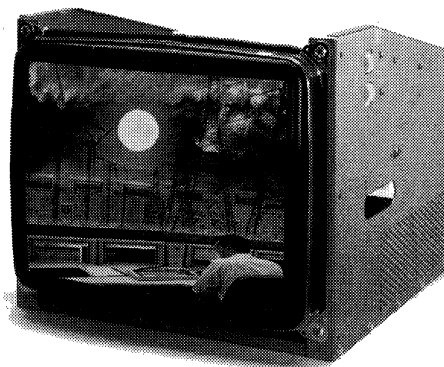
15" 94-202



Kits, too



10" 14, and 15" Cabinets



15" 94-200

# OVI

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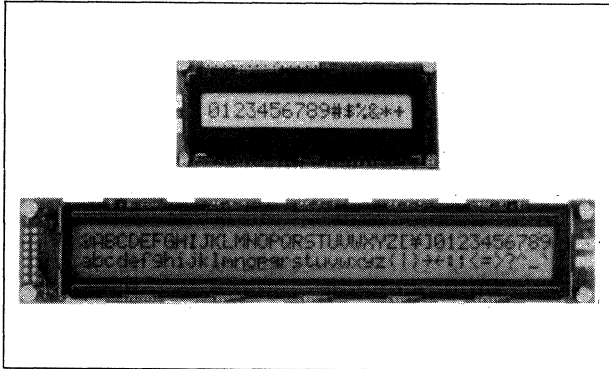
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# Optrex Corporation.

## LIQUID CRYSTAL DISPLAY MODULE

### Character Type/DMC Series



#### Features

- (1) 8-bit or 4-bit MPU interface is available.
- (2) 160 JIS type characters such as Alpha-Numeric, Kana and 32 special characters and symbols can be displayed by internal character generator (ROM).
- (3) Random symbols can be displayed by internal character generator (RAM).
- (4) Many instructional functions by means of program such as "clear display," "home cursor," "on/off cursor," "blink character," "shift display," "shift cursor," "read/write display data," etc. are available.
- (5) Compact and light weight design enable easy assembly on device.
- (6) Single "+5V" power supply (except for Extended Temperature Type).
- (7) Low power consumption, 3 V Logic Operation.
- (8) European Font available upon request.

#### Standard Module Formats: Available In-Stock Today

Display Format	Type No.	Display Fonts (W x H mm)	Character Size (W x H mm)	Viewing Area (W x H x D mm)	Module Dimensions
16 characters x 1 line	DMC16105LY	5 x 8 dots	3.20 x 5.95	64.5 x 13.0	80.0 x 36.0 x 15.0
	DMC16106C*	5 x 8 dots	3.20 x 5.95	64.5 x 13.0	80.0 x 36.0 x 10.0
	DMC16117A	5 x 8 dots	3.20 x 5.95	64.5 x 13.0	80.0 x 36.0 x 10.0
	DMC16128	5 x 7 dots + Cursor	4.84 x 9.66	99.0 x 13.0	122.0 x 33.0 x 11.0
	DMC16128NY-LY	5 x 8 dots + Cursor	4.84 x 9.66	99.0 x 13.0	122.0 x 33.0 x 15.7
	DMC16129	5 x 7 dots + Cursor	4.84 x 9.66	99.0 x 13.0	122.0 x 33.0 x 11.0
16 characters x 2 lines	DMC16188NY-LY	5 x 8 dots	6.00 x 14.54	120.0 x 23.0	151.0 x 40.0 x 14.2
	DMC16202NY-LY1	5 x 8 dots	2.95 x 5.55	61.0 x 16.0	84.0 x 45.0 x 15.1
	DMC50292NY-LYB	5 x 8 dots	2.95 x 5.55	64.5 x 13.8	80.0 x 36.0 x 12.5
	DMC16204NY-LY	5 x 8 dots	2.95 x 5.55	59.5 x 16.0	80.0 x 40.0 x 16.1
	DMC16205NY-LY	5 x 8 dots	2.95 x 5.55	59.5 x 16.0	88.0 x 34.0 x 10.9
	DMC16207N-B*	5 x 8 dots	2.95 x 5.55	61.0 x 16.0	84.0 x 44.0 x 11.0
	DMC16230NY-LYB	5 x 7 dots + Cursor	4.84 x 9.66	99.0 x 24.0	122.0 x 44.0 x 14.5
16 characters x 4 lines	DMC16249B*	5 x 8 dots	2.95 x 4.35	64.5 x 13.8	80.0 x 36.0 x 11.0
	DMC16433	5 x 8 dots	2.95 x 4.75	61.8 x 25.2	87.0 x 60.0 x 11.0
20 characters x 2 lines	DMC20215A	5 x 8 dots	3.20 x 5.55	83.0 x 18.6	116.0 x 44.0 x 11.0
	DMC20261ANY-LYB	5 x 8 dots	3.20 x 5.55	83.0 x 18.6	116.0 x 37.0 x 11.0
	DMC50218N-B	5 x 8 dots	3.20 x 5.55	83.0 x 18.6	116.0 x 37.0 x 11.0
20 characters x 4 lines	DMC20434N-B	5 x 8 dots	2.95 x 4.75	76.0 x 25.2	98.0 x 60.0 x 11.0
	DMC20481NY-LYB	5 x 8 dots	2.95 x 4.75	76.0 x 25.2	98.5 x 61.0 x 15.6
	DMC50244N-B	5 x 8 dots	2.95 x 4.75	71.6 x 25.2	82.5 x 48.0 x 9.5
24 characters x 2 lines	DMC24227N-B	5 x 8 dots	3.20 x 5.55	93.5 x 15.8	118.0 x 36.0 x 11.0
	DMC50149NYU-LYB	5 x 8 dots	3.20 x 5.55	93.5 x 15.8	121.5 x 33.5 x 16.1
40 characters x 2 lines	DMC40218N-B*	5 x 8 dots	3.20 x 5.55	152.5 x 16.5	182.0 x 33.5 x 11.0
	DMC40267NYS-LYB	5 x 8 dots	3.20 x 5.55	147.5 x 11.5	182.0 x 34.5 x 15.1
40 characters x 4 lines	DMC40457NY-LYB	5 x 8 dots	2.78 x 4.89	147.0 x 29.5	190.0 x 54.0 x 13.6
	DMC40457	5 x 8 dots	2.78 x 4.89	147.0 x 29.5	190.0 x 54.0 x 10.0

OPTREX LCD Character Modules are available in many non-standard resolutions and backlight options as well as in standard TN, N-TN and FSTN Technologies.

Type	Operating Temp.	Storage Temp.
Normal Temp.	0°C ~ +50°C	-20°C ~ +70°C
Extended Temp.	-20°C ~ +70°C	-30°C ~ +80°C

• FOR ON-SITE DEMONSTRATIONS AND IN-DEPTH TECHNICAL ASSISTANCE REGARDING STANDARD AND CUSTOM DISPLAY REQUIREMENTS, PLEASE CONTACT US FOR AN IMMEDIATE RESPONSE:



OPTREX AMERICA, INC.  
44180 PLYMOUTH OAKS BLVD., PLYMOUTH, MI 48170-2584

For Information Please Contact:

**EASTERN & CENTRAL STATES:** Tel: 734-416-8500  
FAX: 734-416-8520

**WESTERN STATES:** Tel: 310-378-3841  
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# Optrex Corporation.

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- (2) Compact, Light, Thin.
- (3) Graphic, Figure, and Character display.
- (4) High contrast, Wide viewing angle.
- (5) Black and White and Color Technology.
- (6) Choices of EL, LED or CCT Backlighting.

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#### Standard Graphic Modules

Dot Pixels (W x H)	Type No.	Module Dimension (W x H x D mm)	Viewing Area (W x H mm)	Driving (duty)
128 x 32	DMF50426NJ-SLY	75.0 x 41.5 x 8.5	60.0 x 21.3	1/32D
128 x 64	DMF50051N-SEW	78.0 x 80.0 x 10.3	62.0 x 44.0	1/64D
	DMF50202NY-LY	95.0 x 58.0 x 15.5	62.0 x 44.0	1/64D
	<b>DMF50427NYJ-SLY</b>	75.0 x 52.7 x 8.5	55.0 x 27.5	1/64D
160 x 128	DMF5001NF	129.0 x 102.0 x 12.8	101.0 x 82.0	1/128D
	DMF5001NY-LY	129.0 x 102.0 x 12.8	101.0 x 82.0	1/128D
	DMF5003NY-FW	152.0 x 112.0 x 23.0	101.0 x 82.0	1/128D
240 x 64	<b>DMF5005NY-LY</b>	180.0 x 65.0 x 17.6	132.0 x 39.0	1/64D
	<b>DMF5005N</b>	180.0 x 65.0 x 12.0	132.0 x 39.0	1/64D
	DMF5010NB-FW	200.0 x 66.0 x 23.0	132.0 x 39.0	1/64D
	<b>DMF50316ZNF-FW-1</b>	180.0 x 70.0 x 14.0	132.0 x 39.0	1/64D
240 x 128	<b>DMF50773NF-FW</b>	170.0 x 95.0 x 16.7	126.0 x 70.0	1/64D
256 x 128	DMF682AN-EW	147.0 x 116.0 x 12.0	127.0 x 70.0	1/64D
	DMF6104NB-FW	167.0 x 116.0 x 24.0	127.0 x 70.0	1/64D
320 x 240	<b>DMF50081ZNB-FW</b>	139.0 x 120.0 x 13.2	103.0 x 79.0	1/240D
	<b>DMF50174NF-FW</b>	174.0 x 112.0 x 14.0	122.0 x 92.0	1/240D
	<b>DMF50840NF-FW</b>	174.0 x 112.0 x 14.0	122.0 x 92.0	1/240D
	<b>DMF50944NCU-FW</b>	162.0 x 112.2 x 12.3	119.0 x 90.0	1/240D
640 x 200	DMF50036NFU-FW	270.0 x 142.0 x 13.5	231.0 x 105.0	1/200D
640 x 400	DMF50262NF-FW	255.0 x 147.0 x 7.0	196.0 x 123.0	1/200D
640 x 480	DMF50260NF-FW-15	260.0 x 174.0 x 7.0	196.0 x 148.0	1/240D



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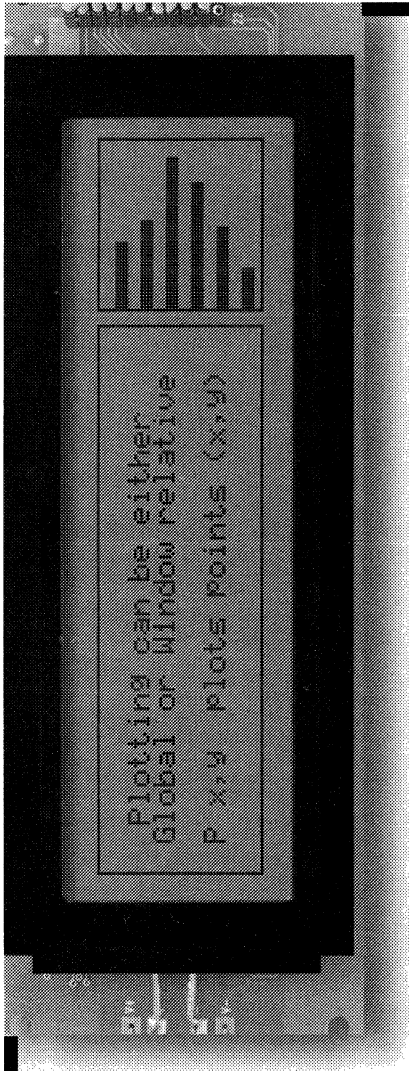
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**P O L Y T R O N I X M O D U L E S E R I E S**

## Character Modules

Display Format (Char.xLine)	Model #	Fonts	Module Size (WxHxT1/T2) T1/T2=none with LED	Effective Viewing Area (WxH)	Character Size (WxH)	Dot Size (WxH)	Driving Method (Duty)	Gross Weight (g)	Process & Color						
									TN	STN Yellow	STN Gray	FSTN	None	EL	LED
10x3	PVC-1003011WL	5x7 dots	40.0x28.6x4.4	32.3x18.5	2.45x3.8	0.45x0.5	1/23	10	X	X	X	○	X	X	X
16x1	PVC-160101B	5x7 dots with cursor	80.0x36.0x9.5/13.5	64.5x14.0	3.07x6.56	0.55x0.75	1/16	25	○	○	○	X	○	X	○
	PVC-160102	5x10 dots with cursor	80.0x36.0x—/14.0	63.5x15.8	3.21x8.76	0.61x0.76	1/11	34	○	○	○	X	X	X	○
	PVC-160104P	5x7 dots with cursor	122.0x33.0x9.5/13.0	99.0x13.0	4.84x8.06	0.92x1.10	1/16	52	○	○	○	X	○	X	○
16x2	PVC-160202	5x7 dots with cursor	80.0x36.0x9.5/13.0	64.5x13.8	2.95x4.75	0.55x0.55	1/16	30	○	○	○	X	○	○	○
	PVC-160203A	5x7 dots with cursor	84.0x44.0x9.5/13.0	61.0x17.0	2.95x5.55	0.55x0.65	1/16	34	○	○	○	X	○	○	○
	PVC-160203B	5x7 dots with cursor	84.0x44.0x9.5/13.0	61.0x17.0	2.95x5.55	0.55x0.65	1/16	34	○	○	○	X	○	○	○
	PVC-160203C	5x7 dots with cursor	84.0x44.0x9.5/—	63.0x19.0	2.95x5.55	0.55x0.65	1/16	34	○	○	○	X	○	○	X
	PVC-160203E	5x7 dots with cursor	84.0x44.0x—/13.0	61.0x17.6	2.95x5.55	0.55x0.65	1/16	34	○	○	○	X	X	X	○
	PVC-160204A	5x7 dots with cursor	85.0x36.0x9.5/13.0	65.0x17.4	2.95x5.55	0.55x0.66	1/16	31.5	○	○	○	X	○	○	○
	PVC-160204B	5x7 dots with cursor	84.0x36.0x—/13.0	65.0x17.4	2.96x5.56	0.56x0.66	1/16	34	○	○	○	X	X	X	○
	PVC-160205Q	5x7 dots with cursor	122.0x44.0x9.5/13.0	99.0x24.0	4.84x9.66	0.92x1.10	1/16	50	○	○	○	X	○	○	○
PVC-160206	5x7 dots with cursor	85.0x30.0x9.5/13.0	62.0x16.0	2.78x4.89	0.50x0.55	1/16	30	○	○	○	X	○	○	○	
16x4	PVC-160401	5x7 dots with cursor	87.0x60.0x9.5/13.0	61.8x25.2	2.95x4.75	0.55x0.55	1/16	65	○	○	○	X	○	○	○
20x2	PVC-200201	5x7 dots with cursor	116.0x39.0x9.5/—	83.0x18.6	3.20x5.55	0.60x0.65	1/16	42	○	○	○	X	○	X	X
	PVC-200202	5x7 dots with cursor	116.0x37.0x9.5/15.7	83.0x18.6	3.20x5.55	0.60x0.65	1/16	42	○	○	○	X	X	X	○
	PVC-200203	5x7 dots with cursor	116.0x37.0x9.5/13.0	83.0x18.6	3.20x5.55	0.55x0.55	1/16	42	○	○	○	X	○	○	○
20x4	PVC-200401	5x7 dots with cursor	99.0x60.0x9.5/13.0	76.0x25.2	2.95x4.75	0.55x0.55	1/16	60	○	○	○	X	○	○	○
	PVC-200403B	5x7 dots with cursor	98.0x60.0x—/14.0	76.0x25.2	3.20x5.55	0.60x0.65	1/16	80	○	○	○	X	X	X	○
24x2	PVC-240201	5x7 dots with cursor	113.0x36.0x9.5/—	93.5x16.0	3.20x5.55	0.60x0.65	1/16	46	○	○	○	X	○	X	X
	PVC-240202	5x7 dots with cursor	118.0x36.0x9.5/14.0	93.5x16.0	3.20x5.55	0.60x0.65	1/16	47	○	○	○	X	○	○	○
40x2	PVC-400201Q	5x7 dots with cursor	182.0x33.5x9.5x13.0	154.5x16.5	3.20x5.55	0.50x0.65	1/16	75	○	○	○	X	○	○	○
40x4	PVC-400401	5x7 dots with cursor	190.0x54.0x9.5/13.0	147.0x29.5	2.78x4.89	0.50x0.55	1/16	125	○	○	○	X	○	○	○
	PVC-400402B	5x7 dots with cursor	160.0x47.0x9.5/—	140.0x29.0	2.70x4.35	0.50x0.50	1/16	80	○	X	X	X	○	X	X

## Graphic Modules

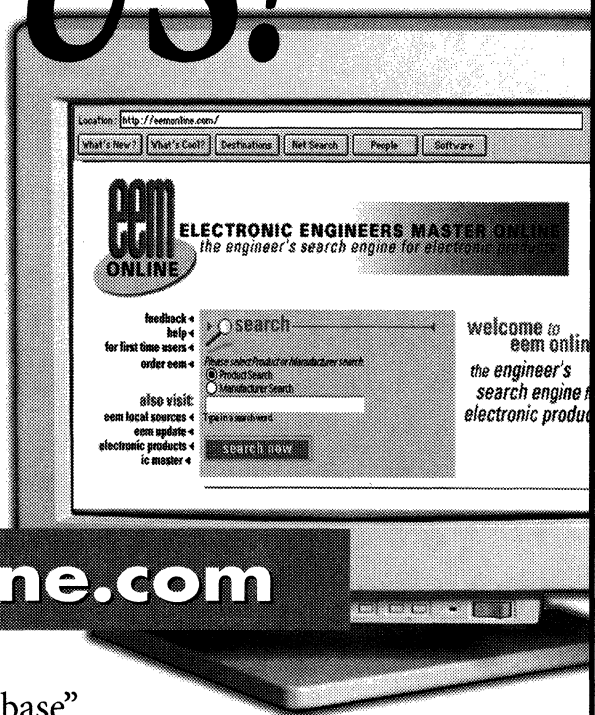
Display Format (Dot)	Model #	Module Size (WxHxT1/T2) T1/T2=none with LED	Effective Viewing Area (WxH)	Dot Pitch (WxH)	Dot Size (WxH)	Driving Method (Duty)	Gross Weight (g)	Backlight			DC/DC Converter	Built-In Controller	Remark
								None	EL	LED			
100x65	PVG100601	54.2x50.0x12.5	45.96x29.86	0.46x0.46	0.42x0.42	1/66	—	X	X	○	X	Tab Type	With LED Only
122x32	PVG120304PW	65.1x25.6x5.7/—	60.5x18.5	0.42x0.47	0.38x0.43	1/32	20	○	○	X	○/X	SED-1520	Yellow STN
	PVG120303PY	64.5x29.1x—/5.5	54.86x19.1	0.40x0.45	0.38x0.41	1/32	25	X	X	○	X	SED-1520	
128x32	PVG120301P	85.0x45.0x9.5/13.0	71.0x21.0	0.52x0.52	0.48x0.48	1/32	30	○	○	○	X	—	
128x64	PVG120603A	93.0x70.0x8.5/13.0	70.7x38.8	0.52x0.52	0.48x0.48	1/64	65	○	○	○	X	HD-61202	EL Model size 93x70x9.5
	PVG120603B	93.0x70.0x8.5/13.0	70.7x38.8	0.52x0.52	0.48x0.48	1/64	65	○	○	○	○	HD-61202	EL Model size 93x70x9.5
	PVG120604P	75.0x67.7x—/9.6	60.0x32.5	0.43x0.43	0.4x0.4	1/128	—	X	X	○	○	—	
128x128	PVG121202A	88.4x88.4x9.5/—	69.0x69.0	0.50x0.50	0.46x0.46	1/128	85	○	○	X	X	Hitachi HD61830	
	PVG121202B	88.4x88.4x9.5/—	69.0x69.0	0.50x0.50	0.46x0.46	1/128	85	○	○	X	X	Toshiba T6963C	
160x150	PVG161501P	78.5x78.5x9.5/—	53.0x50.0	0.30x0.30	0.26x0.26	1/150	60	○	○	X	X	—	
160x160	PVG161603Q	89.2x85.0x9.5/13.5	62.0x62.0	0.38x0.38	0.34x0.34	1/160	65	○	○	○	X	—	
192x64	PVG190602A	120.0x62.0x9.5/13.0	100.0x37.0	0.50x0.50	0.46x0.46	1/64	80	○	○	○	X	Hitachi HD-61202	
	PVG190602B	120.0x62.0x9.5/13.0	100.0x37.0	0.50x0.50	0.46x0.46	1/64	80	○	○	○	○	Hitachi HD-61202	
240x24	PVG240201P	188.0x52.0x10.0/—	156.0x20.0	0.60x0.65	0.55x0.60	1/24	100	○	X	X	X	—	
	PVG240601	188.0x52.0x10.0/—	132.6x39.0	0.53x0.53	0.48x0.48	1/64	120	○	○	X	X	—	
240x64	PVG240602A	180.0x65.0x10.0/14.5	132.6x39.0	0.53x0.53	0.48x0.48	1/64	120	○	○	○	X	Toshiba T6963C	
	PVG240602B	180.0x65.0x10.0/14.5	132.6x39.0	0.53x0.53	0.48x0.48	1/64	120	○	○	○	○	Toshiba T6963C	
320x200	PVG322007W	110.39x54.41x7.4	79.97x43.98	0.25x0.22	0.22x0.195	1/200	—	○	○	X	○	Tab Type	With EL Only

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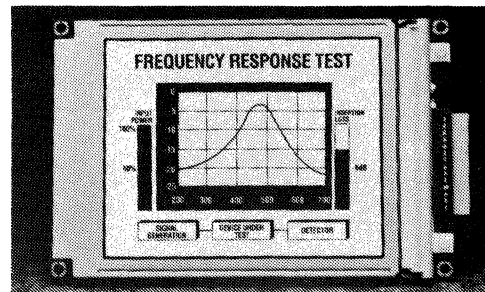
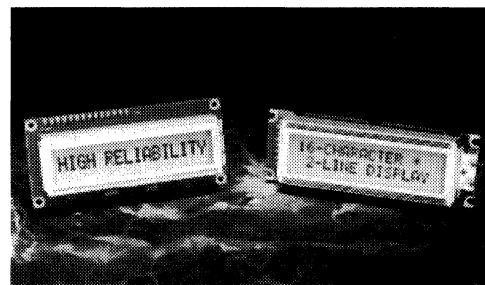
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## LIQUID CRYSTAL DISPLAY



### CHARACTER MODULES

#### OPTIONS

- 5 x 7 Dot Matrix plus cursor
- Character generator and data RAM on board
- 4 or 8 bit parallel interface
- Single 5 volt input
- EL or LED backlighting available
- Wide temperature option available
- Low cost, compact, lightweight design

Model	No. Characters x No. Lines	Outside Dim. (H x V x T)	Character Size (H x V)	Dot Size (H x V)
L1671	16 x 1 line	80.0 x 36.0 x 11.3	3.07 x 5.73	0.55 x 0.75
L1672	16 x 2 lines	85.0 x 30.0 x 10.0	2.78 x 4.27	0.50 x 0.55
L1682	16 x 2 lines	80.0 x 36.0 x 11.3	2.95 x 3.80	0.50 x 0.10
L1692	16 x 2 lines	122.0 x 44.0 x 11.3	4.84 x 8.06	0.92 x 1.10
L2032	20 x 2 lines	116.0 x 37.0 x 11.3	3.20 x 4.85	0.60 x 0.65
L2034	20 x 4 lines	98.0 x 60.0 x 11.6	2.95 x 4.15	0.55 x 0.55
L2462	24 x 2 lines	118.0 x 36.0 x 11.3	3.20 x 4.85	0.60 x 0.65
L4052	40 x 2 lines	182.0 x 33.5 x 11.3	3.20 x 4.85	0.60 x 0.64
L4044	40 x 4 lines	190.0 x 54.0 x 10.1	2.78 x 4.27	0.50 x 0.55

All dimensions in mm

1 = 0.55

### GRAPHIC MODULES

#### OPTIONS

- STN, FSTN and Color technology
- Reflective, Transflective, or Transmissive
- Positive or Negative image available
- 4 or 8 bit parallel interface
- Ultra low power consumption
- EL, LED or CFL backlighting available
- Wide temperature option available

Model	DOT Format (H x V)	Outside Dim. (H x V x T)	Viewing Area (H x V)	Dot Size (H x V)
G1213 <sup>3</sup>	128 x 32	75.0 x 42.0 x 6.8	60.0 x 21.0	0.40 x 0.48
G121C	128 x 128	86.0 x 95.0 x 7.0	67.0 x 67.0	0.46 x 0.46
G1216 <sup>3</sup>	128 x 64	75.0 x 53.0 x 6.8	60.0 x 33.0	0.40 x 0.40
G191C	192 x 128	98.0 x 86.0 x 13.4	78.0 x 54.0	0.33 x 0.33
G191D	192 x 192	86.0 x 95.0 x 7.0	67.0 x 67.0	0.30 x 0.30
G2436	240 x 64	180.0 x 75.0 x 11.3	134.0 x 41.0	0.49 x 0.49
G242C <sup>1,2</sup>	240 x 128	180.0 x 110.0 x 15.1	134.0 x 76.0	0.47 x 0.47
G321D <sup>1,2</sup>	320 x 200	166.0 x 134.0 x 15.1	128.0 x 110.0	0.34 x 0.48
G321E	320 x 240	150.0 x 96.0 x 14.0	103.0 x 80.0	0.27 x 0.27
G324E	320 x 240	166.0 x 134.0 x 15.1	128.0 x 110.0	0.32 x 0.39
G648D	640 x 200	270.0 x 150.0 x 12.0	239.0 x 104.0	0.32 x 0.46
G649D <sup>3</sup>	640 x 200	260.0 x 122.0 x 15.7	216.0 x 83.0	0.30 x 0.36

All dimensions in mm

1. Available with built-in controller 2. Includes CFL-edgelight 3. Built-in Data RAM

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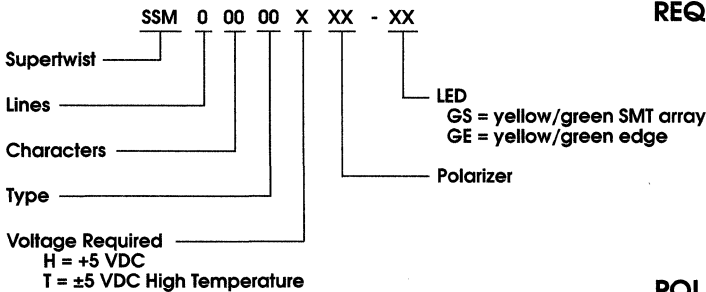
# SUPERTWIST LCD MODULES

## SUPERTWIST LCD SELECTION CHART

PART NUMBER	LINE X CHARACTER	OVERALL SIZE (MM)	VIEWING AREA (MM)	CHAR. SIZE (MM)	DUTY CYCLE	POLARIZER (1)	BACK LIGHT	OPER TEMP PWR SPLY (2)
SSM11623	1 X 16	(80 X 36)	(58.7 X 8.7)	(5.5)	1/8	GA/YA/GB/YB	EL	H
SSM11685	1 X 16	(80 X 36)	(59.6 X 6.6)	(5.73)	1/16	GA/YA/GB/YB/BE	EL/LED	H
SSM11687	1 X 16	(151 X 40)	(114.0 X 14.5)	(14.5)	1/16	GA/YA/GB/YB/BE	EL/LED	H/T
SSM11688	1 X 16	(85 X 36)	(59.5 X 8.2)	(8.2)	1/16	GA/GB	EL/LED	H
SSM11689	1 X 16	(80 X 36)	(59.5 X 6.0)	(5.95)	1/16	GA/YA/GB/YB/BE	EL/LED	H/T
SSM11691	1 X 16	(122 X 33)	(94.8 X 9.7)	(9.7)	1/16	GA/GB/YA/YB/BE	EL/LED	H/T
SSM11692	1 X 16	(85 X 36)	(59.5 X 7.2)	(6.4)	1/16	YB/YB	EL/LED	H
SSM12082	1 X 20	(180 X 40)	(142.8 X 14.5)	(14.5)	1/16	GA/GB	EL/LED	H/T
SSM12461	1 X 24	(118 X 36)	(89.4 X 8.2)	(5.5)	1/16	GA/YA/GB/YB	EL	H
SSM12483	1 X 24	(208 X 40)	(171.6 X 14.5)	(14.5)	1/16	GA/GB	EL/LED	H
SSM14061	1 X 40	(182 X 34)	(147.5 X 8.2)	(5.5)	1/11	GA/YA/GB/YB	EL	H
SSM20821	2 X 8	(58 X 32)	(25.2 X 10.7)	(3.8)	1/16	GA/GB/YA/YB	EL/LED	H
SSM21281	2 X 12	(56 X 32)	(37.9 X 11.7)	(5.5)	1/16	GA/YA/GB/YB	LED	H/T
SSM21684	2 X 16	(84 X 44)	(56.2 X 11.5)	(5.5)	1/16	GA/YA/GB/YB/BE	EL/LED	H/T
SSM21685	2 X 16	(85 X 36)	(56.2 X 11.5)	(5.5)	1/16	GA/YA/GB/YB/BE	EL/LED	H/T
SSM21686	2 X 16	(122 X 44)	(94.8 X 20.0)	(9.6)	1/16	GA/YA/GB/YB/BE	EL/LED	H/T
SSM21687	2 X 16	(80 X 36)	(58 X 10)	(4.4)	1/16	GA/YA/GB/YB/YF	EL/LED	H/T
SSM21688	2 X 16	(85 X 30)	(56.2 X 15.2)	(5.6)	1/16	GA/YA/GB/YB	EL/LED	H
SSM22081	2 X 20	(116 X 37)	(83.0 X 11.5)	(5.6)	1/16	YB/BE	EL/LED	H/T
SSM22082	2 X 20	(180 X 40)	(142.8 X 20.7)	(9.7)	1/16	GA/GB/YA/YB	EL/LED	H/T
SSM22482	2 X 24	(208 X 40)	(171.6 X 20.6)	(9.6)	1/16	GA/GB/YA/YB	EL/LED	H
SSM22483	2 X 24	(118 X 36)	(89.4 X 8.8)	(4.45)	1/16	GA/GB/YA/YB	EL/LED	H/T
SSM24083	2 X 40	(182 X 34)	(147.5 X 11.5)	(5.6)	1/16	GA/GB/YA/YB/BE	EL/LED	H/T
SSM41682	4 X 16	(87 X 60)	(56.2 X 20.8)	(4.15)	1/16	GA/YA/GB/YB/BE	EL/LED	H/T
SSM42081	4 X 20	(99 X 60)	(70.4 X 20.8)	(4.8)	1/16	GA/YA/GB/YB/YF	EL/LED	H/T
SSM42083	4 X 20	(191 X 86)	(136 X 43.7)	(9.80)	1/16	GA/YA/GB/YB	EL/LED	H/T
SSM44082	4 X 40	(280 X 88)	(239.2 X 63.7)	(12.69)	1/16	GA/YA/GB/YB/BE	EL/LED	H/T
SSM44083	4 X 40	(190 X 54)	(140.5 X 23.2)	(4.89)	1/16	GA/YA/GB/YB/BE	EL/LED	H/T

\* All parts are also available in Standard "TN" Fluids

### DISPLAY ORDERING INFORMATION

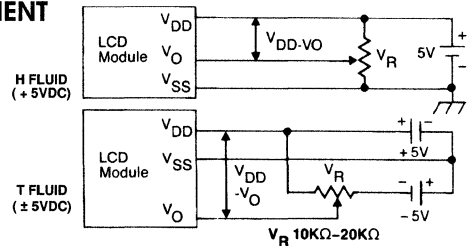


### TEMPERATURE RANGE: (2)

	<b>"H"</b>	<b>"T"</b>
Operating:	0°C + 40°C	-20°C + 70°C
Storage:	-20°C + 70°C	-40°C + 80°C

"H" indicates that both are available.

### POWER SUPPLY REQUIREMENT



### POLARIZER TYPES (1)

- GA** = Reflective/Positive image  
Dark Blue on Light Gray  
No EL Lamp
- YA** = Reflective/Positive image  
Dark Blue on Yellow Green  
No EL Lamp
- GB** = Transflective/Positive image  
Dark Blue on Light Gray  
With EL Lamp
- YB** = Transflective/Positive image  
Dark Blue on Yellow Green  
With EL Lamp
- BE** = Transmissive/Negative image  
White on Dark Blue  
With EL Lamp
- YF** = Transmissive/Positive image  
Dark Blue on Yellow Green  
With EL Lamp





See Our Website at: [www.shellyinc.com](http://www.shellyinc.com)

DISPLAYS • LED's • LAMPS

# SHELLY LCD GRAPHIC DISPLAY MODULES

## SHELLY, YOUR ONE SOURCE STOP FOR DISPLAY PRODUCTS

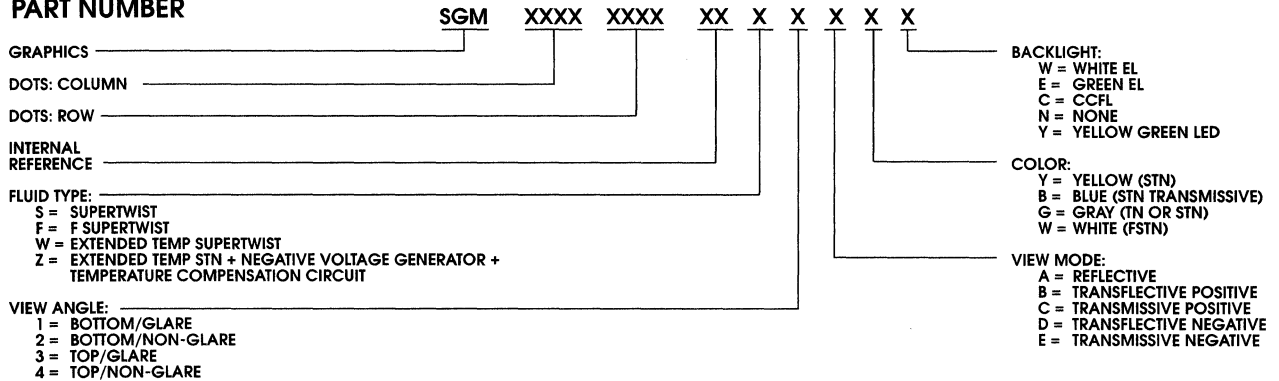
- STN, F-STN modes available.
- EL, LED or CFL Backlighting.
- Gray, Yellow, Blue or White background.
- Extended Temperature Range Available.
- Consult factory for sizes not shown.

### GRAPHIC LCD DISPLAY MODULES

PART NUMBER	DISPLAY FORMAT	OVERALL SIZE (mm)	VIEWING AREA (mm)	DOT PITCH (mm)	BACK-LIGHT	OPERATING TEMP (°C)
SGM01280064	128 X 64	93 X 70 X 8.8	72 X 40	.52 X .52	EL/LED	0 +50
SGM01280128A6	128 X 128	88 X 83 X 5.7	64 X 64	.50 X .50	EL	0 +50
SGM02400064C3	240 X 64	180 X 65 X 12	132 X 39	.53 X .53	EL	0 +40
SGM02400064E6	240 X 64	154 X 57 X 11	108 X 29	.42 X .42	EL/LED	-20 +70
SGM02400128E6	240 X 128	144 X 104 X 14	108 X 58	.45 X .45	EL/CFL/LED	0 +50
SGM03200240D6	320 X 240	148 X 120 X 22	115 X 86	.36 X .36	CFL	0 +50
SGM06400480Q1	640 X 480	186 X 121 X 6.5	122 X 86	.19 X .10	CFL	+5 +40
SGM06400480S1	640 X 480	230 X 155 X 5	172 X 130	.26 X .26	CFL	0 +45

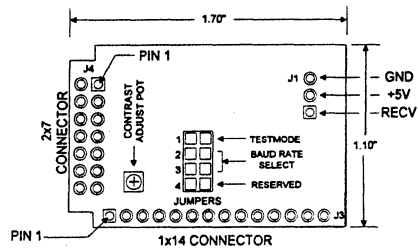
NOTE: CONSULT FACTORY FOR SIZES NOT SHOWN OR EXTENDED TEMPERATURE RANGES.  
STORAGE TEMP: -20°C TO +60°C (TYP). WIDE TEMP MODULES ADD ±10°C TO OPERATING RANGE.

### PART NUMBER



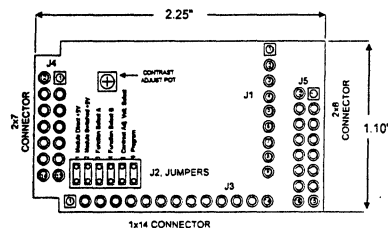
### LCD SIM; Serial Interface Module

- RS-232 or TTL Serial Communications
- Automatic Word Wrap for 2 and 4 line
- Cursor Movement Control Codes
- LCD standalone Self-Test Display
- Onboard negative Vo generation option
- Selectable baud rates of 2400 to 19200
- LCD Display Formats Supported from 1x8 to 4x20



### LCD Message Module

- 16 Discrete User-definable Messages
- 25 character memo field for product I.D. serialization
- Individual Message Blinking
- LCD standalone Self-Test Display
- ELIMINATES HOST COMPUTER





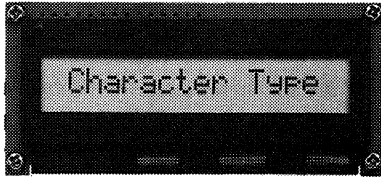
# STANLEY ELECTRIC CO., LTD.

## LCD/CHARACTER DOT MATRIX

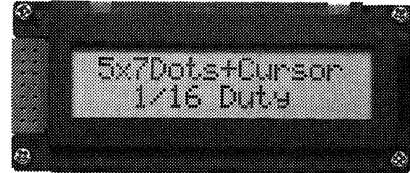
### LCD/Character Dot Matrix GML Series

Stanley has developed LCDs which are characterized by high contrast and wide viewing angle. For dot matrix modules Stanley has developed two types, TN and STN with five variations. For general applications the TN type is the most common. For applications that require higher contrast and wider viewing angles the STN type is recommended.

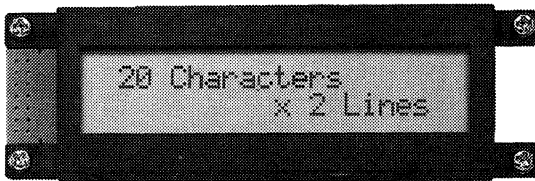
**GML1610A**



**GML1620A**



**GML2020A**



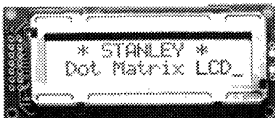
**GML1640AG**



Part Number	Number of Characters	Module Dimensions (WxHxD)	Effective Viewing Area (WxH)	Character Size (WxH)	Dot Size (WxH)	Duty Cycle	Backlight	LCD Mode
GML1610A	16x1	80x36x10.3	64.5x13.0	3.20x5.95	0.60x0.70	1/16	Reflective	TN
GML1620A	16x2	85x36x10.0	63.5x15.8	3.20x5.55	0.60x0.65	1/16	Reflective	TN
GML2020A	20x2	115x36x10.0	83.0x18.6	3.20x5.55	0.60x0.65	1/16	Reflective	TN
GML1610AG	16x1	80x36x10.3	64.5x13.0	3.20x5.95	0.60x0.70	1/16	Reflective	STN
GML1620AG	16x2	85x36x10.0	63.5x15.8	3.20x5.55	0.60x0.65	1/16	Reflective	STN
GML2020AG	20x2	115x36x10.0	83.0x18.6	3.20x5.55	0.60x0.65	1/16	Reflective	STN
GML1640AG	16x4	77x51x10.5	61.8x25.2	2.95x4.75	0.55x0.55	1/32	Reflective	STN
GML1620ASLY	16x2	85x36x15.0	63.5x15.8	3.20x5.55	0.60x0.65	1/16	LED	STN

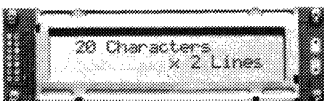
### LCD/Character Dot Matrix GMD Series

#### ■ Reflective GMD1620A



Part Number	Number of Characters	Module Dimensions (WxHxD)	Effective Viewing Area (WxH)	Character Size (WxH)	Dot Size (WxH)	Duty Cycle	LCD Mode
GMD1610F	16x1	80x36x10.3	64.5x13.8	3.11x6.60	0.59x0.79	1/16	TN
GMD1620A	16x2	85x36x10.5	63.5x15.8	3.20x5.55	0.60x0.65	1/16	TN
GMD2020A	20x2	115x36x10.5	83.0x18.6	3.20x5.55	0.60x0.65	1/16	TN
GMD1640C	16x4	77x51x11.0	61.8x25.2	2.95x4.75	0.55x0.55	1/16	TN

#### ■ LED Backlighting GMD2020ALY



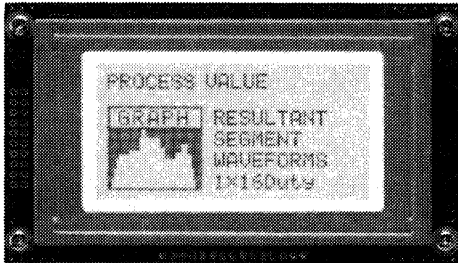
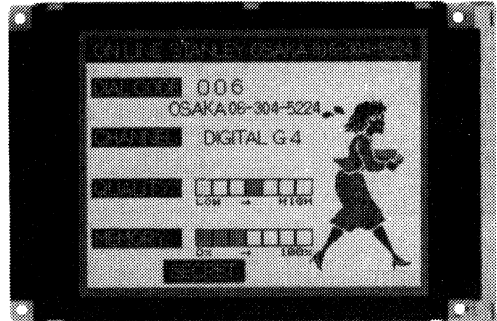
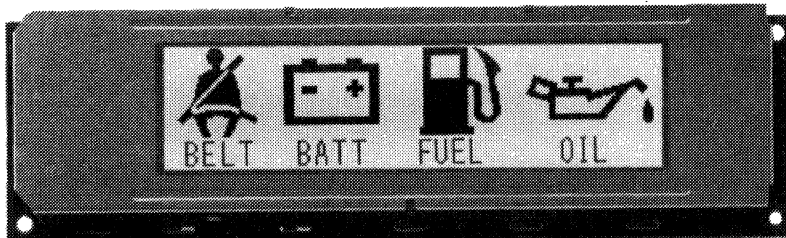
Part Number	Number of Characters	Module Dimensions (WxHxD)	Effective Viewing Area (WxH)	Character Size (WxH)	Dot Size (WxH)	Duty Cycle	LCD Mode
GMD1610FLY	16x1	80x36x15	64.5x13.8	3.11x6.60	0.59x0.79	1/16	TN
GMD1620ALY	16x2	85x36x15	63.5x15.8	3.20x5.55	0.60x0.65	1/16	TN
GMD2020ALY	20x2	115x36x16	83x18.6	3.20x5.55	0.60x0.65	1/16	TN

Stanley Electric Sales of America, Inc. ■ 2660 Barranca Parkway, Irvine, CA 92606

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**STANLEY****STANLEY ELECTRIC CO., LTD.****LCD/GRAPHIC DOT MATRIX****LCD/Graphic Dot Matrix GMF Series (Graphic Type)****FEATURES**

- Fast response time of 50 msec (in both rise time and fall time) even with simple matrix drive.
- Built-in temperature compensation circuit retains good visibility even when the ambient temperature changes.
- Easy replacement of backlight units (GMF32024H type only).

**GMF12064ASLY****GMF32024FBTW****GMF25064ABTW****DISPLAYS**

Part Number	Number of Dot	Module Dimensions (WxHxD)	Effective Viewing Area (WxH)	Dot Pitch (WxH)	Duty Cycle	Backlight	Recommended Inverter
GMF12048BBTW	128x48	132x60x19	90.0x36.0	0.67x0.67	1/64	CFLx1	120606A
GMF12064ASLY	128x64	113x65x13	73.4x38.8	0.52x0.52	1/64	LED	-
GMF12064BSLY	128x64	113x65x13	73.4x38.8	0.52x0.52	1/64	LED	-
GMF25064ABTW	256x64	205x58x26	127.5x33.5	0.48x0.48	1/64	CFLx1	120607A
GMF25012GBTW	256x128	194x96x22	127.5x68.0	0.48x0.48	1/128	CFLx1	13586A
GMF25012HBTW	256x128	194x96x22	127.5x68.0	0.48x0.48	1/128	CFLx1	13586A
GMF32024HBTW	320x240	167x110x12	121.0x91.0	0.36x0.36	1/240	CFLx1	14391
GMF32024HFTW	320x240	167x110x12	121.0x91.0	0.36x0.36	1/240	CFLx1	14391
GMF32024ABTW	320x240	150x96x14	103.0x79.0	0.30x0.30	1/240	CFLx1	12794A
GMF32024BSLY	320x240	134.5x117x14	103.0x79.0	0.30x0.30	1/240	LED	-
GMF64020ABTW	640x200	259.5x104x15.5	218.0x74.0	0.33x0.33	1/200	CFLx1	14117A

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# STANLEY ELECTRIC CO., LTD.

## CFL (COLD CATHODE FLUORESCENT LAMPS)

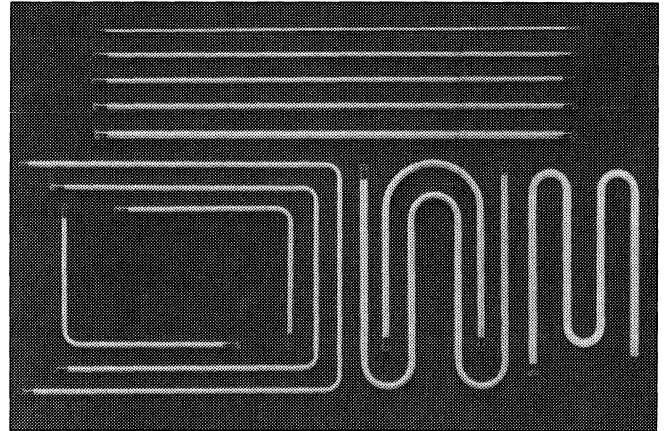
Ensuring that displays are clearly and accurately viewed, Stanley designs and manufactures backlighting modules including Cold Cathode Fluorescent Lamps, light pipes and inverters. The CFLs are also used for office automation equipment and other lighting applications.

### FEATURES

- High brightness, high efficiency, low power consumption and long life.
- Wide variety of lamp types.
- Durable and excellent blinking characteristics, ideal for eraser, scanner and automotive applications.
- Quick start at low temperature.

### APPLICATIONS

- Backlighting for LCD.
- Light source for eraser and scanner.
- Illumination source for instrumental panel.
- Light source for other types of displays, decorating lights.



### ■ CFL Characteristics

Lamp Type	Outer DIA (mm)	Inner DIA (mm)	Tube Length (mm)	Tube Current (mA)	Tube Voltage (V)	Tube Power Consumption (W)	Brightness (cd/m <sup>2</sup> )	Min. Life
CTY20P	Ø2.0	Ø1.4	60~300	4	220~740	0.9~3.0	41,000	13,000
CTY20S			60~300	4	230~750	0.9~3.0	41,000	10,000
CTY22P	Ø2.2	Ø1.6	60~300	5	210~650	1.1~3.3	37,000	13,000
CTY22S			60~300	5	220~660	1.1~3.3	37,000	10,000
CBZ23J	Ø2.3	Ø1.8	60~300	5	200~620	1.0~3.1	34,000	15,000
CTZ23S			60~300	5	210~630	1.1~3.2	34,000	20,000
CTY23J			60~300	5	205~640	1.0~3.2	35,000	25,000
CBZ26 (CBZ3)	Ø2.6 (Ø3.0)	Ø2.0	60~420	5	180~820	0.9~4.1	30,500(29,000)	15,000
CBZ26J (CBZ3J)			60~420	5	190~830	1.0~4.2	30,500(29,000)	15,000
CBY26 (CBY3)			60~420	5	185~830	0.9~4.2	31,500(30,000)	17,000
CBY26J (CBY3J)			60~420	5	195~840	1.0~4.2	31,500(30,000)	17,000
CBY26L (CBY3L)			60~420	5	195~840	1.0~4.2	31,500(30,000)	25,000
CTY26S (CTY3S)			60~420	5	195~840	1.0~4.2	31,500(30,000)	20,000
CTY26J (CTY3J)			60~420	5	195~840	1.0~4.2	31,500(30,000)	30,000
			60~420	7	190~720	1.3~5.0	38,000(36,500)	18,000
CBS4	Ø4.1	Ø2.9	60~620	5	180~980	0.9~4.9	17,000	15,000
CBS48	Ø4.8	Ø3.8	60~620	6	220~920	1.3~5.5	12,000	10,000
CBS62L	Ø6.2	Ø4.6	60~620	8	215~900	1.7~7.2	15,000	10,000

### ■ CFL Inverters

Type No.	No. of CFL	Input Voltage (V)	Starting Voltage (Vms)	Output Current (mAms)	Lighting Frequency (kHz)	Dimensions W x H x D	Applicable Overall Length by CFL Tube Diameter			Corresponding LCD
							2.3mm	2.6mm / 3.0mm	4.1mm	
13585A	1	12	900	5	55	87 x 27 x 7	-----	60 130	60 160	
13586A	1	12	1,200	5	55	87 x 27 x 7	110 190	110 180	130 220	GMF25012GBTW & GMF25012HBTW
13587A	1	12	1,350	5	55	87 x 27 x 7	-----	150 220	-----	
14117A	1	12	1,500	5	35	87 x 27 x 8.5	-----	180 240	180 260	GMF64020ABTW
13591A	1	12	900	5 x 2	55	87 x 27 x 7	60 110	60 125	60 140	
13594A	2	12	1,000	5 x 2	55	87 x 27 x 7	-----	-----	110 165	
13592A	2	12	1,200	5 x 2	55	87 x 27 x 7	110 155	100 160	130 195	
120606A	1	12	650	6	30	44 x 27 x 17	-----	-----	-----	GMF12048BBTW
120607A	1	12	650	7	30	44 x 27 x 18	-----	-----	-----	GMF25064ABTW
12794A	1	5	1,300	7	60	35 x 37 x 11	-----	150 220	-----	GMF32024ABTW

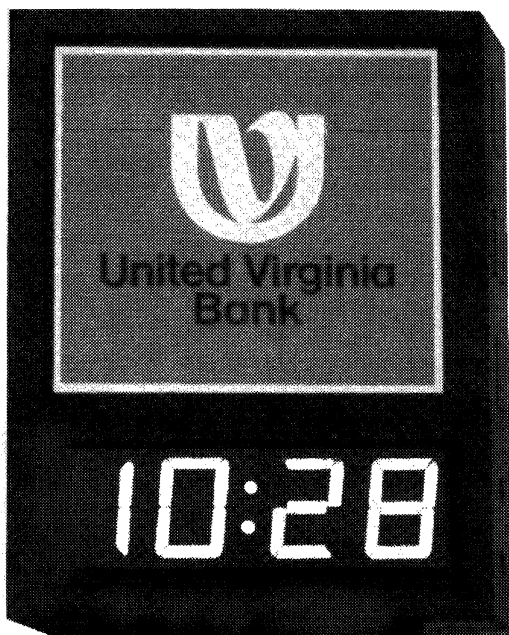
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# SIGNALEX®

# DISPLAYS

- **7-Segment Displays (1.5" to 24")**
- **35 Dot Alphanumeric/Graphic Displays**
- **LED Enhanced**

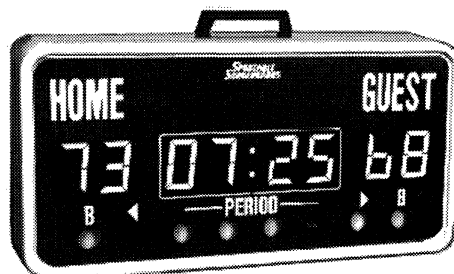


## About the SIGNALEX line of electromagnetic displays and components

SIGNALEX manufactures a complete line of high visibility electromagnetic and LED enhanced electromagnetic displays. These high performance, low maintenance displays can be used indoors or out in temperatures ranging from  $-40^{\circ}\text{C}$  to  $+75^{\circ}\text{C}$ . The standard 7-segment displays with letters from 1.5" high to 24", the alphanumeric/graphic displays and the new line of LED enhanced "High Visibility" displays are all described in detail in the next six pages.

The complete SIGNALEX series provides energy saving features that draw power only at the instant of charge and require no power to maintain continuous indication. In addition, they provide low maintenance, long life and dependability.

UNIVERSITY OF MINNESOTA			
WOMENS 400 YARD IND. MEDLEY			
	8	7	1
1. NEWTON, LYNN	4:26.23	8	
2. CLARK, KRISTEN	4:25.31	6	
3. DEGEMA, LINDA	4:23.12	4	
4. GEHRS, MINDY	4:20.25	2	
5. WOLFE, SUSAN	4:18.60	1	
6. ANDERSON, LISA	4:21.31	3	
7. HAISLET, CHARORA	4:24.17	5	
8. ELDEGARD, ANNE	4:25.37	7	

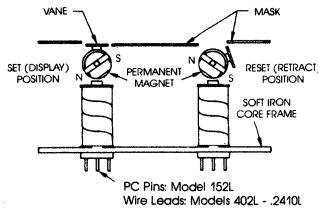
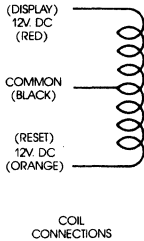


# SIGNALEX®

# 7-SEGMENT DISPLAY

## PRINCIPLE OF OPERATION

The magnet is either attracted or repelled, turning the rotor and vane with it. In either display or reset position the magnetic circuit is stable so that the vane can remain in either position with no power in the coil. The permanent magnet pole is attracted to the soft iron core which will hold the vane in position until a reverse pulse is passed.



SIGNALEX displays operate on a well-proven electromagnetic principle. A short pulse in a coil produces a magnetic field that acts upon a permanent magnet located in a rotor, part of which is the vane itself.

The rotor and magnet assemblies are the only moving parts in the display. Their light weight and low inertia give fast response time. High lubricity plastic bearings are used.

DISPLAY SIZES	1 1/2"	4"	6"	9"
SIGNALEX MODEL	152L	402L	602L	900L
Character Size H x W	1-9/16" x 15/16" (40 x 24 mm)	4-1/16" x 2-5/16" (103 x 59 mm)	6-1/16" x 3-9/16" (154 x 91 mm)	9" x 6" (229 x 152 mm)
Vane Width	5/32" (4 mm)	7/16" (11 mm)	11/16" (17 mm)	1-1/8" (28 mm)
Frame Size H x W	1-7/8" x 1-5/16" (49 x 33 mm)	5" x 3-1/4" (127 x 83 mm)	7-1/4" x 5-1/8" (184 x 130 mm)	11" x 8-1/4" (279 x 210 mm)
Pulse Length, min.	30 ms	50 ms	90 ms	150 ms
Pulse Power, Each Vane	0.35 W	0.93 W	1.4 W	3.6 W
Viewing Dist., max.	50 Feet (15 Meters)	160 Feet (50 Meters)	240 Feet (75 Meters)	360 Feet (110 Meters)
Weight	2-1/4 oz. 65 gm.	8-1/2 oz. 240 gm.	12-2/3 oz. 360 gm.	1-1/2 lbs. 680 gm.

DISPLAY SIZES	12"	18"	24"
SIGNALEX MODEL	1200L	1810L	2410L
Character Size H x W	12" x 8" (305 x 203 mm)	18" x 12" (46 x 31 cm)	24" x 16" (61 x 41 cm)
Vane Width	1-1/2" (38 mm)	2-1/4" (5.7 cm)	3" (7.6 cm)
Frame Size H x W	14" x 11" (356 x 279 mm)	21" x 16 1/2" (533 x 419 mm)	28" x 22" (711 x 559 mm)
Pulse Length, min.	200 ms	300 ms	400 ms
Pulse Power, Each Vane	3.6 W	9.0 W	9.0 W
Viewing Dist., max.	480 Feet (150 Meters)	720 Feet (220 Meters)	960 Feet (300 Meters)
Weight	2-1/4 lbs. 1020 gm.	4-1/2 lbs. 2. kg	6 lbs. 2.7 kg

U.S. Patent Nos. 3,886,545; 4,117,478  
U.S. Design Patent 249,985 and Patents Pending

**Operation:** Individually controlled segments, pulse-operated through a bi-stable circuit.  
**Voltage:** 12V. DC +/- 10% standard. Other voltages available.  
**Coils:** Bifilar wound with 3 leads per segment. Model 152L has terminal pins for direct PCB mounting.  
**Temperature:** -40°C to +75°C.  
**Relative Humidity:** Up to 95% R.H. at any temperature in the range, provided no condensation present.  
**Power to Maintain Display:** None  
**Vane Colors:** White, Saturn-Yellow, Orange-Red Fluorescents. Black background standard. Other high-visibility colors available.  
**Maximum Coil Temperature:** +105°C



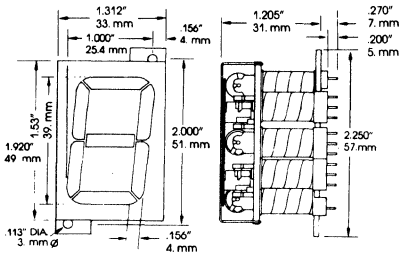
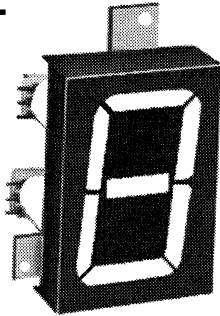
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PHONE: (516) 666-8000 FAX: (516) 666-8039



**SIGNALEX®**

# 7-SEGMENT

**Model  
152L**



The SIGNALEX 152L is used world wide in readout applications for toll booths, clocks, gas pumps, arcade games, oil rig instrumentation, currency exchange panels, and industrial controls. Since SIGNALEX readouts draw no power while maintaining position, they are ideal for battery powered systems as well as AC.

**Connections:** 3 per coil  
(1 display, 1 reset, 1 common)

**Pulse Power:** 31 ma at 12V

**Pulse Length:** 30 ms min.,  
display or reset

**Character Slope:** 5°

**Visibility:** Up to 70° either side of  
perpendicular to the front face.

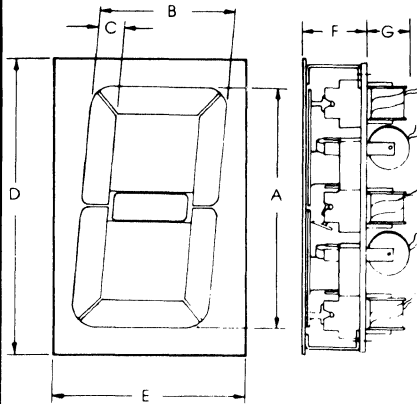
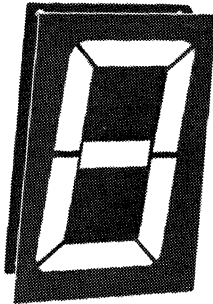
**Temperature Range:** -40°C to +75°C

**Materials:** Front Mask: steel

Bearings: polyester

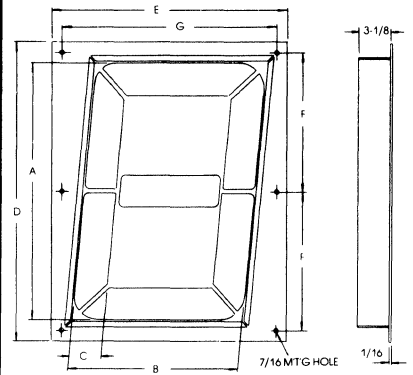
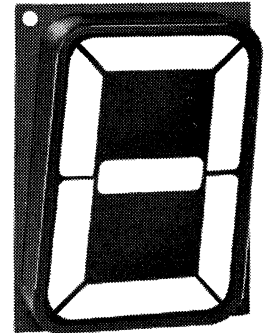
**Hazardous Areas:** Recognized by  
Underwriters Labs. No. MH10471,  
BASEEFA Class 2 No. 4054 J

**Models  
402L & 602L**



(in. Dim.)	402L	602L
A	4 1/16	6 1/16
B	2 5/16	3 9/16
C	7/16	11/16
D	5	7 1/4
E	3 1/4	5 1/8
F	1 1/16	1 5/16
G	3/4	3/4
H	4 1/2	6 1/2
I	2 5/8	4 1/2
J	3 1/8	5

**Models  
900L & 1200L**

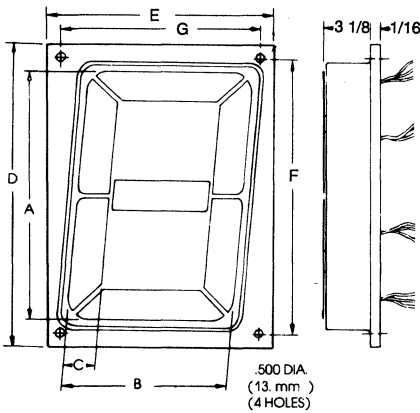
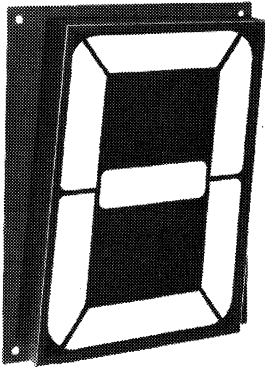


(in. Dim.)	900L	1200L
A	9	12
B	6	8
C	1 1/8	1 1/2
D	11	14
E	8 1/4	11
F	5	6 1/2
G	7 1/4	10

**SIGNALEX®**

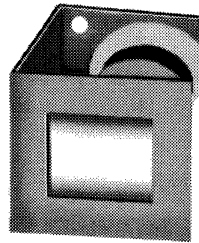
# DISPLAYS

## Models 1810L & 2410L



(in. Dim.)	1810L	2410L
A	18	24
B	12	16
C	2 1/4	3
D	21	28
E	16 1/2	22
F	19 1/2	26
G	15	20

### Type A Indicator

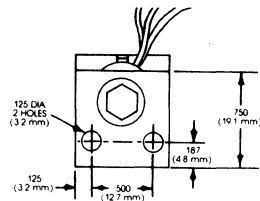
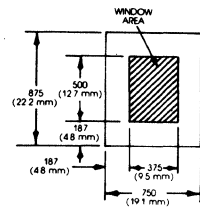
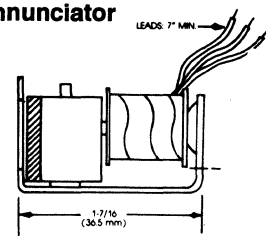


The Type A indicator is a bi-stable electromagnetic annunciator showing alternate display faces in its window, in any position. It is driven in either direction by 1.1 watt pulses as short as 30 ms and remains in its last position without power input until pulsed to the opposite position.

SIGNALEX Type A indicators are used in hospitals, apartment houses, commercial call boards, circuit indicators, alarm systems and a variety of other applications.

## Indicators & Annunciators

### Annunciator



U.S. Patent No. 3,936,818

- Window Size:** 3/8" H x 1/2" W (9.5mm x 12.7mm)
- Displays Per Window:** 2
- Operating Temp. Range:** -40°C to +75°C
- Operating Mode:** Bi-stable, pulsed
- Minimum Pulse Length:** 30ms. either display
- Power/Pulse:** 1.1W
- Max. Coil Temperature:** +105°C
- Coil Resistance:** 125.Ω ±10%
- Standard Voltage:** 12V DC
- Standard Colors:** Black & White, Yellow, Red (others available)
- Leads:** 7" minimum

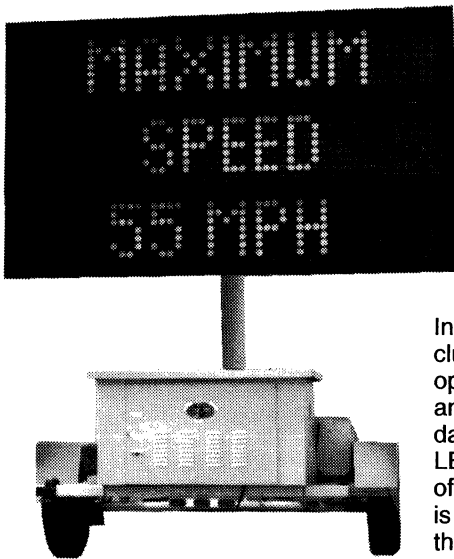


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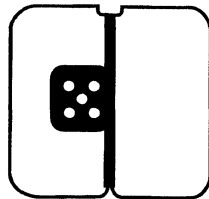
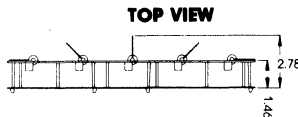
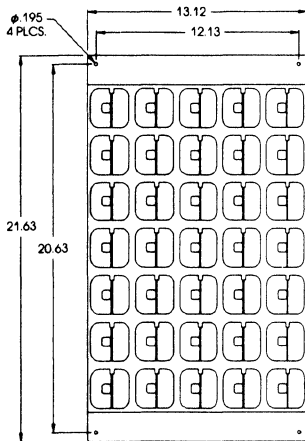
# DISPLAYS

(LED/FIBER OPTIC ENHANCED)

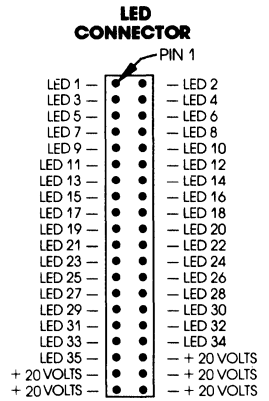
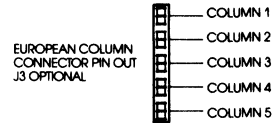


SIGNALEX introduces an LED enhanced electro-magnetic display designed for use in critical highway applications where optimum viewing is required under adverse conditions.

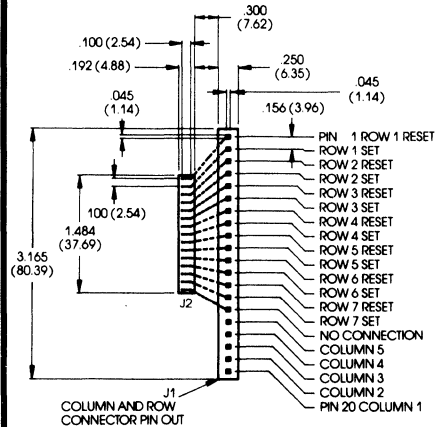
Individually addressable LED clusters shine through small openings on the reflective surface and enhance the displays during daytime viewing. At night, the LED's become the primary source of illumination. A fiber optic version is also available. Please consult the factory with your requirements.



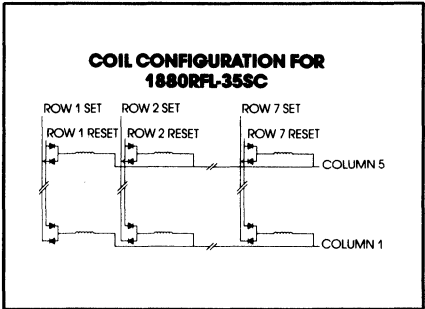
ONE CLUSTER OF 5 LED'S PER ELEMENT



- NOTES: 1. J1 PIN 1 TIED TO J2 PINS 1 AND 2  
J1 PIN 2 TIED TO J2 PINS 3 AND 4, ETC.
- 2. J3 PINS 1 THRU 6, 7 THRU 12, 13 THRU 18, 19 THRU 24, 25 THRU 30 TIED TOGETHER

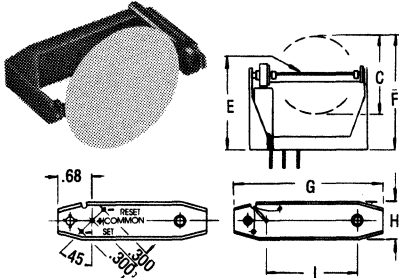


<b>Coil Resistance:</b>	7 ohms +/-10%	<b>Character Height:</b>	18.00"	457mm
<b>Coil Winding:</b>	Single Coil	<b>Character Width:</b>	12.75"	324mm
<b>Coil Voltage:</b>	20 vdc nominal	<b>Matrix Thickness:</b>	1.65"	42mm
<b>Current:</b>	2.85 amperes	<b>Swing Angle:</b>	2.90"	74mm
<b>Pulse Length:</b>	2 ms	<b>Dot Diameter:</b>	2.25"	57mm
<b>Matrix Height:</b>	21.63" (557mm)	<b>Maximum Coil Temp.:</b>	220F	104C
<b>Matrix Width:</b>	13.12" (333mm)	<b>Operating Temp.:</b>	(-40° to +167F)(-40° to 75°C)	
<b>LED Voltage:</b>	20 vdc max.	<b>Operating Rel. Humidity:</b>	Up to 95% at 167° or 75°C provided no condensation	
<b>LED Current:</b>	20ma nominal	<b>Standard Colors:</b>	White, Saturn Yellow, Red	
<b>Light Source:</b>	5 LED's/element			

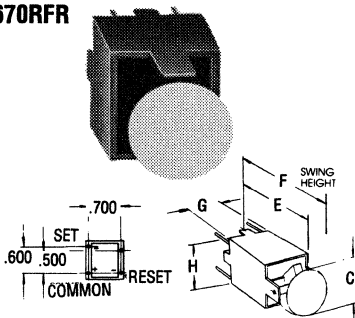


# 35 DOT ALPHANUMERIC DISPLAYS & ELEMENTS

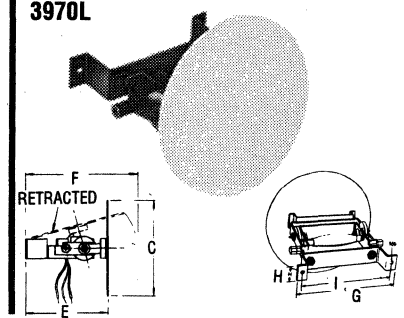
972-1872RFR



670RFR



3970L

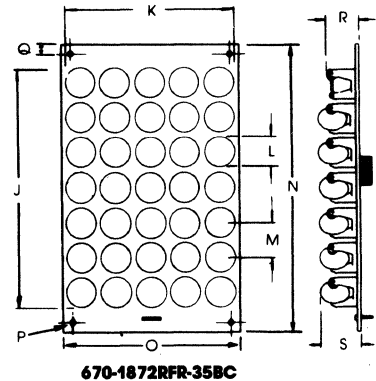


Model Number	Dim. A Char. Hgt. in./mm.	Dim. B Char. Width in./mm.	Dim. C Dot Dia. in./mm.	Dim. D Dot Pitch in./mm.	Dim. E Display Hgt. in./mm.	Dim. F Swing Hgt. in./mm.	Dim. G Length in./mm.	Dim. H Width in./mm.	Dim. I Mounting in./mm.
670RFR	6.00 152	4.25 108	.75 19.0	.875 22.2	1.33 33.8	1.57 39.7	.84 21.3	.84 21.3	- -
972RFR	9.00 230	6.37 162	1.12 28.0	1.31 33.3	1.45 36.8	2.10 53.3	1.81 46.0	.75 19.0	.596 15.1
1272RFR	12.00 300	8.50 216	1.50 38.0	1.75 44.5	1.45 36.8	2.29 58.2	2.24 56.9	.75 19.0	1.026 26.1
1672RFR	16.00 406	11.37 289	2.00 51.0	2.34 59.5	1.45 36.8	2.54 64.5	2.74 69.6	.75 19.0	1.526 38.8
1872RFR	18.00 457	12.75 324	2.25 57.0	2.62 66.7	1.45 36.8	2.66 67.6	2.99 76.0	.75 19.0	1.776 45.1
3970L	39.50 1000	28.00 711	5.00 127.0	5.75 146.0	4.30 109.2	5.87 149.1	4.50 114	1.0 25.4	4.000 102.0

Model Number	Dim. J Char. Hgt in./mm.	Dim. K Char. Width in./mm.	Dim. L Dot Dia. in./mm.	Dim. M Dot Pitch in./mm.	Dim. N Matrix Hgt. in./mm.	Dim. O Matrix Width in./mm.	Dim. P Mtg. Hole in./mm.	Dim. Q Hole Offset in./mm.	Dim. R Thickness in./mm.	Dim. S Swing Hgt. in./mm.
670RFR-35BC	6 152	4.25 108	.75 19	.875 22.2	7.75 197	4.25 114	.178 4	.25 6	1.35 34	1.57 39.7
972RFR-35BC	9 230	6.37 162	1.12 28	1.31 33.3	11.87 301	6.53 166	.195 5	.25 6	1.80 43	2.07 52.6
1272RFR-35BC	12 300	8.50 216	1.50 38	1.75 44.5	15.00 386	8.72 224	.195 5	.50 13	1.80 43	2.25 57.2
1672RFR-35BC	16 406	11.37 289	2.00 51	2.34 59.4	19.50 502	11.69 301	.195 5	.50 13	1.80 43	2.54 64.5
1872RFR-35BC	18 457	12.75 324	2.25 57	2.62 66.7	21.63 557	13.09 337	.195 5	.50 13	1.80 43	2.66 67.6

SIGNALEX individual alphanumeric are bi-stable electromagnetic displays which require only a very short pulse to change position. Inherent latching memory requires no power except during the moment of change. The magnetic design permits operation of most models using 12 vdc with a 2 msec. pulse and, at higher voltages, at 1 msec. or less.

The standard 7x5 matrix of 35 dots gives full alphanumeric capability, and is available in sizes which can create characters 6", 9", 12", 16", 18", 39" high. The flexibility of SIGNALEX individual alphanumeric permits the creation of custom displays. In addition to the standard (7x5) format, the 28-dot (7x4) numeric format, a 23-dot (7 bar) format, or other desired shapes may be used.



	670RFR 35BC	972-1872 RFR-35BC
Pulse Length, Min./12V	2ms	2ms
Pulse Length, Min./18V	1ms	1ms
Max. Duty Cycle, 12V	5%	5%
Current Each Dot, 12V	680ma	580ma
Coil Res. Ctr. to ea. Side	17.5 ohms	20.5 ohms
Coil Winding	Center Tapped Coil	
Coil Addressing	All models X-Y matrix	
Ground Polarity	Neg. Neg.	
Diodes	1N4004	1N4004
PCB Material	FR-4 or Equivalent	
Max. Coil Temperature	All models +105C	
Operating Temp. Range	All models -40C to +90C	
Operating Rel. Humidity	Up to 95% at +90°C	
Standard Colors	White, Yellow, Red	



P.O. Box 220M, Bay Shore, New York 11706  
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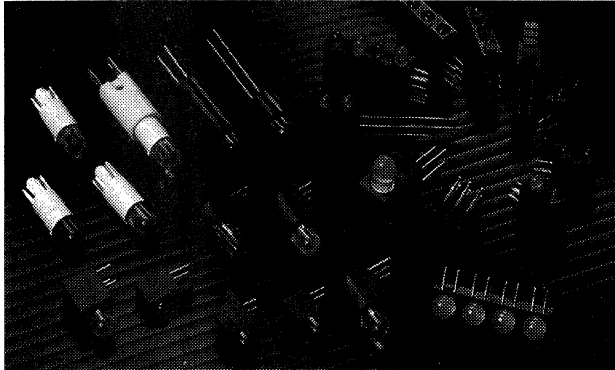
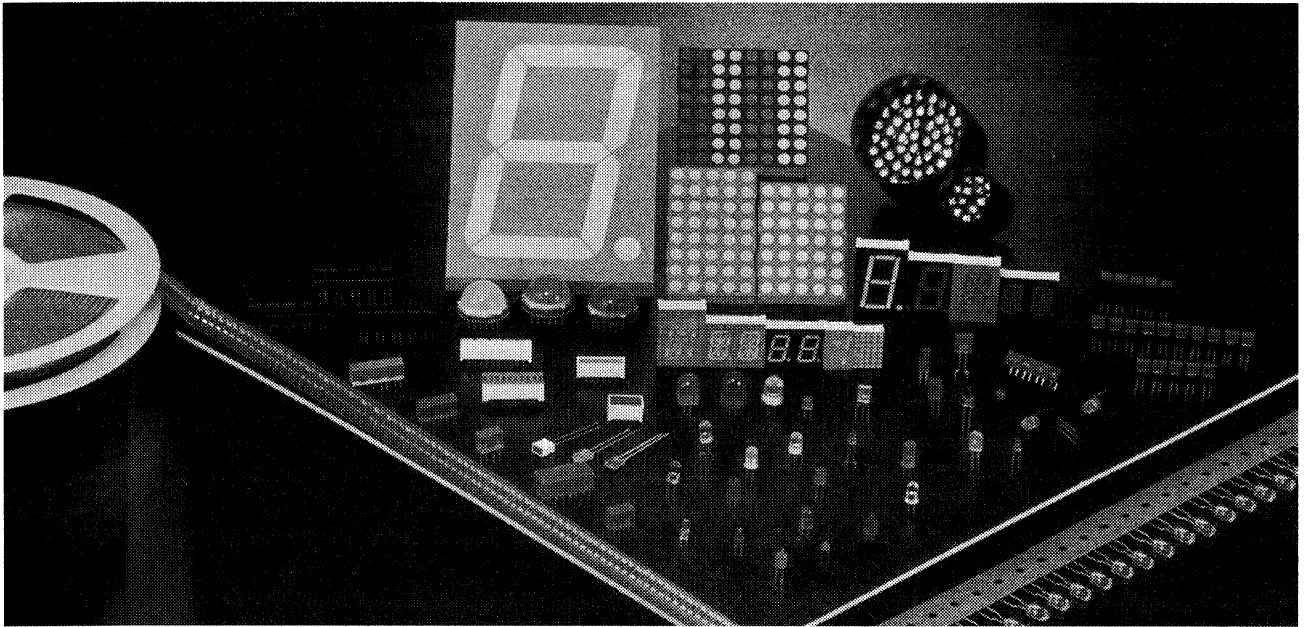
**SUN LED CO.**

20793 E. Valley Blvd. #C, Walnut, CA 91789

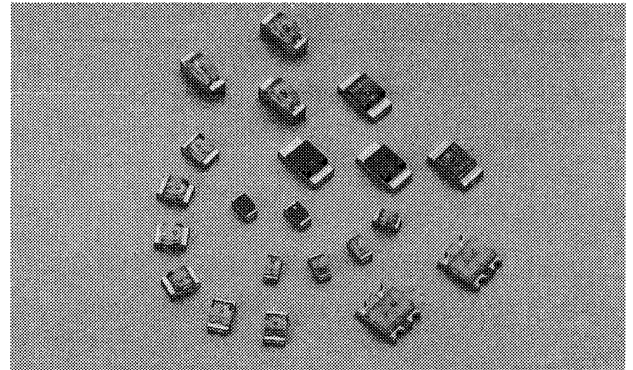
Tel: 909-598-8266 • Fax: 909-598-4966

Website: www.sun-led.com

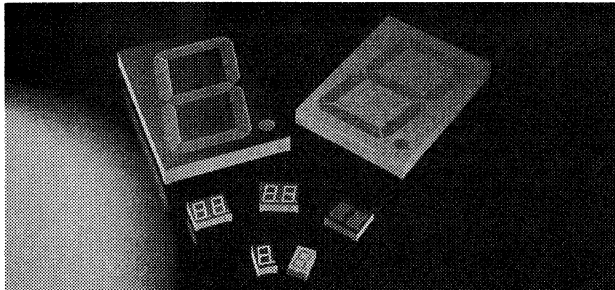
E-mail: sales@sun-led.com

**CBI LEDs**

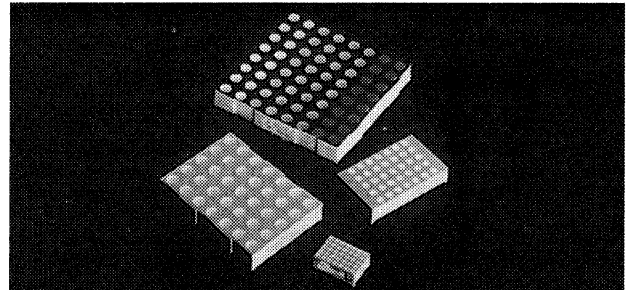
- T1 & T1 3/4 size from single to quad-level available
- Various color combinations and types including bi-color
- High voltage socket-base LEDs available
- Prompt delivery and fast lead time

**Surface Mount LEDs**

- Packages include: 1206, 0805, 1210, 0603, and more
- Low Profile. (.75mm package height available)
- Available in variety of intensity and colors including Blue (GaN)
- Ideal for backlighting purpose and coupling to light pipes
- Fast delivery and competitive price for high volumes

**Numerical & Alphanumeric LED Displays**

- Sizes from 0.3" ~ 7"
- Digits from 1 ~ 4
- 100% Bin Sorted/Coded
- Tri-color for digit  $\geq 1.5$ "

**Dot Matrix Displays**

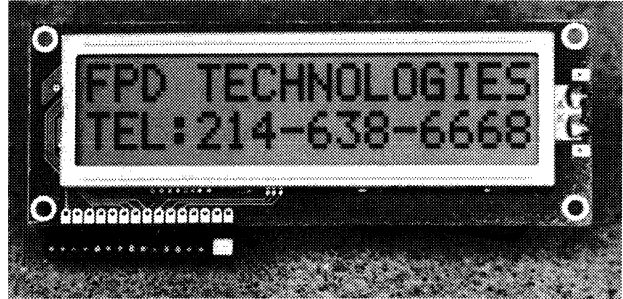
- Sizes from 0.3" ~ 7"
- 4x4, 5x7, 5x8, 8x8 pixels available
- Colors available from single to tri-color
- 100% Bin Sorted/Coded

Please contact us for technical information and samples

# TERAS Display Industries FPD Technologies Inc. *a subsidiary of Wande, Inc*

**Your Complete LCD & LCM Solution**

**Taking you from  
Concept to Design  
to Production with  
Reliability**

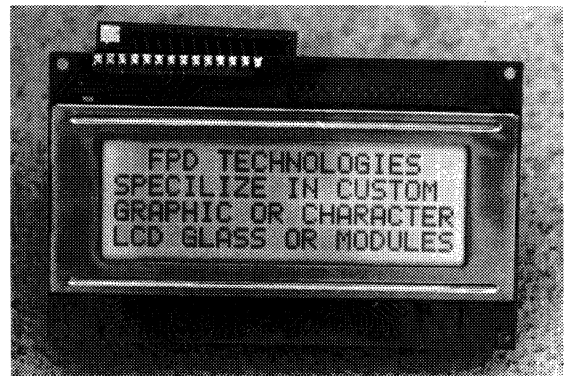


## Manufacturing Capabilities:

- \* High Resolution: Dot Matrix Displays capable of producing less than 0.30 mm pitch with 0.03mm resolution.
- \* Module making capabilities: TAB, COB (chip-on-board), COG (chip-on-glass), and COF (chip on flex).
- \* High Contrast: 10 and up.
- \* Back Light: EL (Electro Lumicent), LED (Light Emitting Diode), and CCF (Cold Cathode Flourecent).
- \* Display types: Reflective, Transmissive, and Trans-reflective.

## Product

- \* Graphic or text Super Twist Nematic STN LCD or STN LCD modules.
- \* Twisted Nematic (TN) displays for normal, industrial or extreme enviromental applications.
- \* Dichroic displays for use in the instrumentation application.



## Advantages

- \* Better service with fast response ,shorter lead time and on time delivery because of strategic manufacturing locations.
- \* Competitive prices due to high yields. Teras Display and FPD Technologies both use advanced full automated in-line production lines created by WANDE Inc. that provides better yields, pricing and quality displays.

**TERAS Display Industries / FPD Technologies Inc.**

**4525 Production Drive, Dallas, Tx 75235**

**Tel: 214-637-8887 or 214-638-6668 Fax: 214-638-8887**

**website: [www.wande-inc.com](http://www.wande-inc.com)**



# TNG Industry (U.S.A.) Inc.

13840 Magnolia Avenue/ Chino/CA 91710  
Tel/ 909-590-5465 • Fax / 909-590-5469 **800-TNG-7789**  
Internet: <http://www.tngusa.com> • E-mail: [sales@tngusa.com](mailto:sales@tngusa.com)



Certificate No.  
QSC-4158

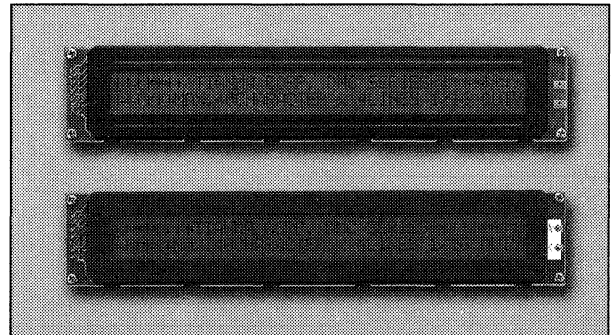
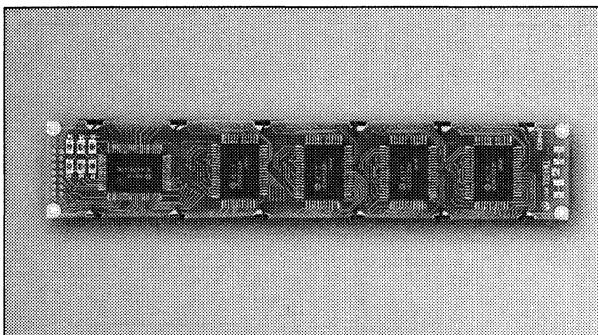
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the Dutch  
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Certification  
Rev. No. 24

**ISO 9001 & 9002  
Certified**

# Your Solution To LCD Displays

## CHARACTER DISPLAY MODULES COMPARATIVE TABLE

Item	Display Format Chars x Lines	Module Size WxHxT (mm)	Effective Display Area WxH(mm)	Character Size WxH(mm)	Dot Size	Controller
<b>TM81A</b> series	8x1	54.0x37.0x11.0	32.0x16.0	2.9x7.6	0.6x0.5	HD44780 or equivalent
<b>TM82A</b> series	8x2	58.0x32.0x12.0	35.0x15.0	2.45x5.0	0.45x0.5	HD44780 or equivalent
<b>TM161A</b> series	16x1	80.0x36.0x11.0	64.5x13.5	3.20x5.95	0.6x0.7	HD44780 or equivalent
<b>TM161B</b> series	16x1	80.0x36.0x11.0	64.5x13.5	3.20x5.95	0.6x0.7	HD44780 or equivalent
<b>TM161E</b> series	16x1	85.0x36.0x11.0	63.5x15.8	3.20x7.15	0.6x0.75	HD44780 or equivalent
<b>TM161F</b> series	16x1	122.0x33.0x11.0	99.0x13.0	4.84x9.66	0.92x1.1	HD44780 or equivalent
<b>TM162A</b> series	16x2	80.0x36.0x11.0	64.5x13.5	2.95x4.35	0.55x0.5	HD44780 or equivalent
<b>TM162B</b> series	16x2	66.0x37.0x11.3	50.0x12.0	2.54x4.00	0.46x0.43	HD44780 or equivalent
<b>TM162C</b> series	16x2	80.0x36.0x11.0	64.5x13.5	2.95x4.35	0.55x0.5	HD44780 or equivalent
<b>TM162D</b> series	16x2	84.0x44.0x11.0	61.0x15.8	3.0x5.63	0.56x0.66	HD44780 or equivalent
<b>TM162I</b> series	16x2	84.0x44.0x11.0	61.0x15.8	3.00x5.63	0.56x0.66	HD44780 or equivalent
<b>TM162J</b> series	16x2	85.0x36.0x10.5	64.5x13.8	2.95x5.00	0.55x0.55	HD44780 or equivalent
<b>TM162G</b> series	16x2	122.0x44.0x11.0	99.0x24.0	4.84x9.66	0.92x1.10	HD44780 or equivalent
<b>TM164A</b> series	16x4	87.0x60.0x11.0	61.7x25.2	2.95x4.75	0.55x0.55	HD44780 or equivalent
<b>TM201A</b> series	20x1	182.0x33.5x11.0	154.3x15.3	6.70x9.40	1.3x1.3	HD44780 or equivalent
<b>TM202A</b> series	20x2	115.6x39.7x11.0	83.0x18.6	3.25x5.63	0.61x0.66	HD44780 or equivalent
<b>TM202G</b> series	20x2	116.0x37.0x13.0	83.0x18.6	3.20x5.55	0.60x0.65	HD44780 or equivalent
<b>TM202I</b> series	20x2	116.0x37.0x11.0	83.0x18.6	3.25x5.63	0.61x0.66	HD44780 or equivalent
<b>TM204A</b> series	20x4	98.0x60.0x12.0	76.0x25.2	2.95x4.75	0.55x0.55	HD44780 or equivalent
<b>TM241A</b> series	24x1	118.0x36.0x11.0	93.5x15.8	3.20x8.20	0.6x0.7	HD44780 or equivalent
<b>TM242A</b> series	24x2	118.0x36.0x11.0	93.5x15.8	3.20x5.55	0.6x0.65	HD44780 or equivalent
<b>TM402A</b> series	40x2	186.2x34.5x11.0	153.5x16.5	3.28x5.69	0.60x0.65	HD44780 or equivalent
<b>TM402C</b> series	40x2	182.0x33.5x11.0	154.4x15.8	3.20x5.55	0.60x0.65	HD44780 or equivalent
<b>TM404A</b> series	40x4	190.0x54.0x11.0	147.0x29.5	2.78x4.89	0.50x0.55	HD44780 or equivalent
<b>TM404B</b> series	40x4	190.0x54.0x11.0	147.0x29.5	2.78x4.89	0.50x0.55	HD44780 or equivalent





# TNG Industry (U.S.A.) Inc.

13840 Magnolia Avenue/ Chino/CA 91710  
 Tel/ 909-590-5465 • Fax / 909-590-5469 **800-TNG-7789**  
 Internet: <http://www.tngusa.com> • E-mail: [sales@tngusa.com](mailto:sales@tngusa.com)



## STANDARD LEAD TIME

- Counter Drawing: 7 working days
- LCD Module: 45 Working Days
- LCD Panel: 35 Working Days

## TYPE OF DISPLAY

### TN Type

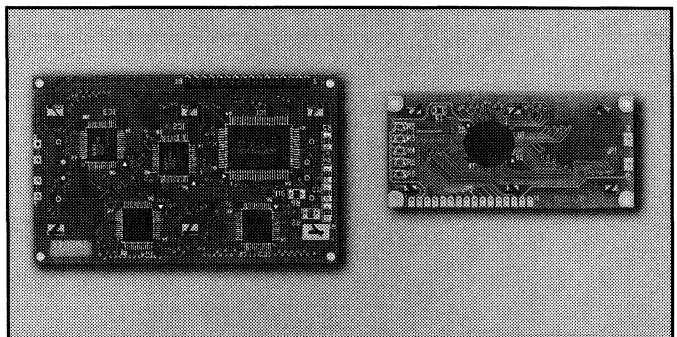
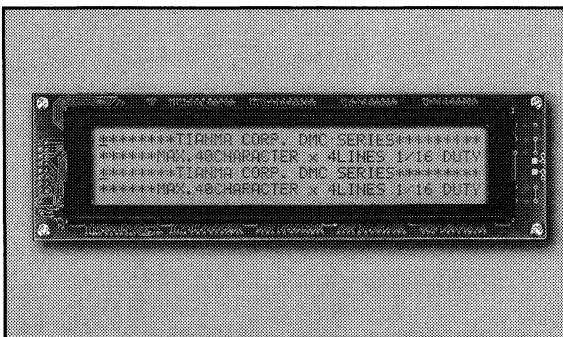
Positive Mode: Black Segments on Silver Gray Background  
 Negative Mode: Whiteish Segment on Black Background

### STN Type:

Yellow Mode: Dark Blue Segment on Yellow-Green Background  
 Blue Mode: White Segment on Blue Background  
 Grey Mode: Black Segment on Grey Background  
 B/W Mode (FSTN): Film Compensated, Black and White Display

## GRAPHIC TYPE STN DOT MATRIX LCD MODULES PRODUCT TABLE

Model No.	Dots	Module Size WxHxT(mm)	Effective Display area WxH (mm)	Dot Pitch WxH (mm)	Dot Size Supply	Duty	Power (v)	Controller
<b>TM10032A</b> Series	100x32	98.0x50.0x10.5	76.0x25.2	0.72x0.66	0.62x0.56	1/32	+5/-5	NJU6450
<b>TM12232A</b> Series	122x32	84.0x44.0x9.5	60.0x18.5	0.44x0.44	0.40x0.40	1/32	+5/-5	SED1520
<b>TM12832A</b> Series	128x32	75.0x41.5x10.0	60.0x21.3	0.43x0.51	0.40x0.48	1/64	+5/-10	HD61202
<b>TM12864A</b> Series	128x64	113.0x65.0x11.0	73.4x38.8	0.51x0.51	0.46x0.46	1/64	+5/-10	HD61202
<b>TM24064A</b> Series	240x64	180.0x75.0x11.0	132.0x39.0	0.53x0.53	0.48x0.48	1/64	+5/-10	None
<b>TM24064B</b> Series	240x64	180.0x65.0x12.0	132.0x39.0	0.53x0.53	0.49x0.49	1/64	+5/-10	T6963C
<b>TM24064F</b> Series	240x64	205.0x92.0x13.0	157.0x63.0	0.62x0.86	0.58x0.82	1/64	+5/-10	SED1335F
<b>TM24064G</b> Series	240x64	151.0x39.0x17.0	96.0x27.9	0.37x0.37	0.34x0.34	1/64	+5/-10	T6B66B
<b>TM48064A</b> Series	480x64	248.5x59.0x12.0	229.5x36.0	0.47x0.47	0.41x0.41	1/64	+5/-10	None
<b>TM240128A</b> Series	240x128	144.0x104.0x12.0	114.0x64.0	0.45x0.45	0.4x0.4	1/128	+5/-10	T6963C
<b>TM320240A</b> Series	320x240	143.0x96.8x12.0	104.0x79.3	0.3x0.3	0.27x0.27	1/240	+5/-25	None





# LCD DISPLAYS

## Character LCDs

STN : Yellow, Gray, Blue Negative  
Type : Reflective, Transflective, Transparent,

Back Light : LED, EL  
Packaging : PWB, COB, COG

UM	MODEL NUMBER	NUMBER OF CHARACTERS CHRS X LINES	TYPE	CHARACTER SIZE W X H (mm)	DISPLAY FORMAT	DUTY	DISPLAY AREA W X H (Max) (mm)	MODULE SIZE W X H X T (Max) (mm)
	0801S1	8 X 1	COB	2.95 X 5.55	5 X 7 + CUR	1/8	33.2 X 9.5	40.0 X 19.7 X 7.8
	0801S6	8 X 1	COB	4.20 X 6.95	5 X 7 + CUR	1/8	46.0 X 12.0	59.0 X 25.8 X 8.3
	0802A1	8 X 2	PWB	2.95 X 5.55	5 X 8	1/16	31.8 X 15.5	34.8 X 27.5 X 7.3
	0802N0	8 X 2	PWB	2.95 X 5.55	5 X 8	1/16	35.0 X 17.0	58.0 X 32.0 X 11.0
	1601SB	16 X 1	PWB	2.95 X 5.55	5 X 7 + CUR	1/16	60.5 X 15.5	85.0 X 32.6 X 10.0
	1601S3	16 X 1	PWB	2.95 X 5.55	5 X 7 + CUR	1/16	60.5 X 15.5	80.0 X 36.0 X 10.0
	1601S4	16 X 1	COB	2.95 X 5.55	5 X 7 + CUR	1/16	61.0 X 16.0	85.0 X 35.0 X 9.5
	1601N0	16 X 1	PWB	3.07 X 6.56	5 X 8	1/16	64.5 X 13.5	80.0 X 36.0 X 11.0
	1601A0	16 X 1	PWB	4.96 X 8.01	5 X 7	1/16	99.0 X 13.0	115.0 X 35.0 X 10.0
	1602A0	16 X 2	PWB	2.30 X 4.15	5 X 7 + CUR	1/16	42 X 8.5	60.0 X 47.8 X 10.0
	1602S0	16 X 2	PWB	2.95 X 5.55	5 X 8	1/16	60.5 X 15.5	85.0 X 32.6 X 10.0
	1602S1	16 X 2	PWB	2.95 X 5.55	5 X 8	1/16	60.5 X 15.5	84.0 X 44.0 X 10.0
	1602S2	16 X 2	PWB	3.21 X 4.51	5 X 7 + CUR	1/16	63.5 X 16.0	85.0 X 36.0 X 9.6
	1602S3	16 X 2	PWB	2.95 X 5.55	5 X 8	1/16	60.5 X 15.5	80.0 X 36.0 X 10.0
	1602S5	16 X 2	COB	2.95 X 5.55	5 X 8	1/16	61.0 X 16.0	85.0 X 35.0 X 9.5
	1602N0	16 X 2	PWB	2.95 X 4.35	5 X 8	1/16	64.5 X 13.5	80.0 X 36.0 X 11.0
	1602N1	16 X 2	COG	2.95 X 5.15	5 X 8	1/16	61.0 X 15.7	65.0 X 27.7 X 2.7
	1604S0	16 X 4	PWB	2.95 X 4.75	5 X 8	1/16	62.0 X 26.0	77.0 X 51.0 X 11.0
	1604N0	16 X 4	PWB	2.95 X 4.75	5 X 7 + CUR	1/16	58.2 X 25.2	80.0 X 45.5 X 9.0
	2002A0	20 X 2	COB	3.20 X 5.55	5 X 8	1/16	83.0 X 18.6	116.0 X 37.0 X 9.0
	2002S1	20 X 2	PWB	3.05 X 4.925	5 X 8	1/16	87.5 X 16.0	116.0 X 32.5 X 9.0
	2002S3	20 X 2	PWB	3.20 X 5.55	5 X 8	1/16	87.5 X 16.0	116.0 X 32.5 X 9.0
	2002N0	20 X 2	PWB	3.20 X 5.55	5 X 8	1/16	83.0 X 18.6	116.0 X 38.0 X 11.0
	2002N1	20 X 2	COG	3.20 X 5.55	5 X 8	1/16	77.0 X 16.5	81.0 X 28.3 X 2.7
	2004A0	20 X 4	COB	2.95 X 4.75	5 X 8	1/16	76.0 X 25.2	98.0 X 60.0 X 9.0
	2004N0	20 X 4	PWB	2.95 X 4.75	5 X 8	1/16	76.0 X 25.2	98.0 X 60.0 X 11.0
	2004N1	20 X 4	PWB	2.95 X 4.75	5 X 8	1/16	66.6 X 20.2	80.0 X 45.5 X 8.5
	2402S3	24 X 2	PWB	3.20 X 5.55	5 X 8	1/16	93.5 X 15.8	118.0 X 36.0 X 10.0
	4001S1	40 X 1	PWB	3.20 X 8.20	5 X 11	1/11	154.0 X 15.4	182.0 X 33.0 X 10.0
	4002S1	40 X 2	PWB	3.20 X 5.55	5 X 8	1/16	154.0 X 15.4	182.0 X 33.0 X 10.0
	4004A0	40 X 4	PWB	2.80 X 4.91	5 X 8	1/16	140.47 X 29.5	182.0 X 54.0 X 10.3
	8004A1	80 X 4	PWB	2.30 X 4.15	5 X 7 + CUR	1/16	227.0 X 33.0	290.0 X 88.0 X 15.0

## Graphic LCDs

STN : Yellow, Gray, Blue, B/W, C (RGB)  
Type : Reflective, Transflective, Transparent,

Back Light : LED, EL, CFL  
Packaging : PWB, COB, COG

UG	GRAPHIC MODE	TYPE	DISPLAY AREA	MODULE SIZE	UG	GRAPHIC MODE	TYPE	DISPLAY AREA	MODULE SIZE
MODEL NUMBER	NO. OF DOTS H X V		W X H (Min) (mm)	W X H X T (Max) (mm)	MODEL NUMBER	NO. OF DOTS H X V		W X H (Min) (mm)	W X H X T (Max) (mm)
00906N0	96 X 64	PWB	59.0 X 30.69	82.0 X 48.5 X 10.5	02412N0	240 X 128	PWB	110.2 X 62.0	145.0 X 90.0 X 13.0
01012S1	104XCX120	PWB	58.6 X 45.4	98.0 X 71.5 X 12.0	02418S1	240 X 180	PWB	59.2 X 45.4	103.0 X 70.5 X 7.0
01203N3	128 X 32	COG	43.0 X 16.0	49.0 X 30.0 X 2.7	03224S1	320 X 240	PWB	107.2 X 78.4	148.3 X 100.0 X 14.1
01205S2	128 X 56	PWB	61.7 X 26.1	85.0 X 38.0 X 13.5	03224S2	320 X 240	PWB	122.0 X 92.0	167.0 X 109.0 X 14.1
01206A2	128 X 64	COB	53.2 X 27.6	66.8 X 47.8 X 7.5	03224S3	320 X 240	PWB	119.2 X 90.4	164.0 X 118.2 X 7.0
01606N0	160 X 64	PWB	61.8 X 35.6	77.7 X 61.4 X 11.0	03224S4	320 X 240	PWB	85.6 X 65.2	130.5 X 92.2 X 7.0
01612N0	160 X 120	TAB	48.0 X 36.4	70.0 X 60.55 X 3.0	03224S5	320XCX240	PWB	119.2 X 90.4	161.5 X 128.5 X 12.0
01912C0	192 X 128	PWB	112.0 X 81.0	154.0 X 110.0 X 13.8	04806S1	480 X 64	PWB	218.0 X 36.0	260.0 X 51.0 X 9.5
02016S1	208XCX160	PWB	86.1 X 66.4	125.0 X 102.6 X 12.0	04832S1	480 X 320	COG	118.6 X 80.0	134.5 X 95.6 X 2.0
02404S1	240 X 40	PWB	147.0 X 29.5	190.0 X 54.0 X 12.0	06420C0	640 X 200	PWB	195.0 X 105.0	233.0 X 128.0 X 24.5
02406S1	240 X 64	PWB	132.5 X 39.5	180.0 X 75.0 X 12.0	06448C0	640 X 480	PWB	107.0 X 81.0	162.0 X 103.0 X 5.7
02406S3	240 X 64	PWB	132.5 X 39.5	180.0 X 65.0 X 13.0	06448C1	640 X 480	PWB	169.0 X 128.0	234.0 X 153.7 X 6.2
02406S5	240 X 64	PWB	132.5 X 39.5	180.0 X 65.0 X 17.0	06448C2	640 X 480	PWB	127.2 X 97.4	188.7 X 120.6 X 6.2
02406S7	240 X 64	PWB	132.5 X 39.5	180.0 X 65.0 X 16.6	06448C3	640 X 480	PWB	197.0 X 149.0	245.0 X 174.0 X 5.0
02406S8	240 X 64	COG	110.8 X 42.8	124.8 X 56.8 X 2.0	06448C4	640 X C X 480	PWB	98.0 X 74.0	158.0 X 99.0 X 10.5
02406N0	240 X 64	PWB	117.0 X 37.0	149.0 X 57.0 X 12.0	06448C5	640 X C X 480	PWB	160.0 X 121.0	215.0 X 146.0 X 10.0

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# DISPLAYS

- **Plasma Panels**

Dot Matrix Modules, Segmented, Bar Graphs

- **Infrared Touch Panels**

## EEM DESCRIPTIONS

### DC PLASMA DISPLAYS:

- Complete Display Modules
- Dot Matrix
- Graphic Systems
- Segmented with or without Drivers
- Meters and Bar Graphs
- Wide Viewing Angle
- Good Contrast and High Brightness
- Easily Customized
- Proven to be Rugged and Reliable
- Standard Input Power and Interface
- Established Technology

### INFRARED TOUCH PANELS:

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- Fits Most Flat Panel Displays
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- Sealed for Environmental Resistance
- Software Driver Support

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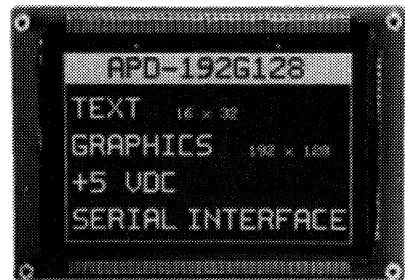
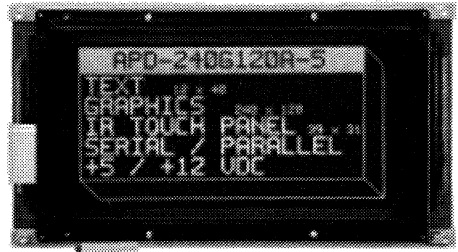
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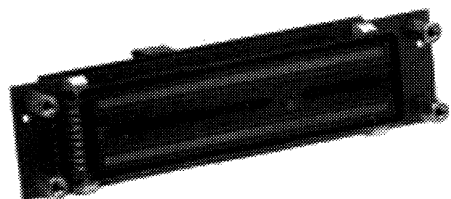
## INTERNET



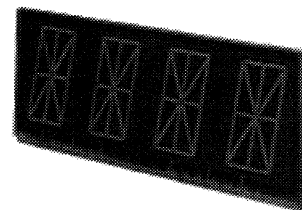
DOT MATRIX MODULES



INFRARED TOUCH PANELS



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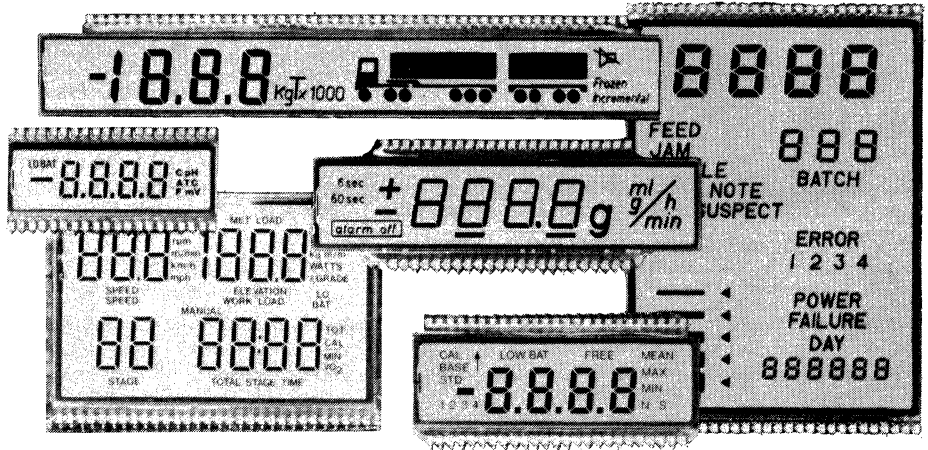
Voice: (213) 738-8700 • Fax: (213) 738-5340 • E-mail: [sales@vle.com](mailto:sales@vle.com) • [www.varitronix.com](http://www.varitronix.com)

## Standard & Custom Designs - Glass, Modules & Turn Key Projects LIQUID CRYSTAL DISPLAYS

### Custom Designs

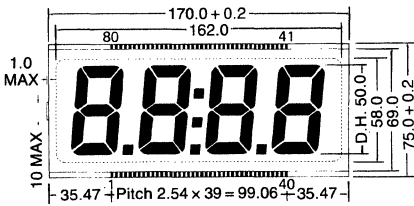
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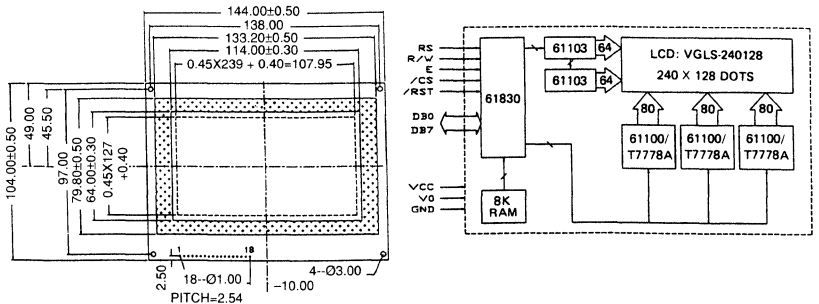
### Numeric LCD

VI-50402-DP Large 2-inch digit



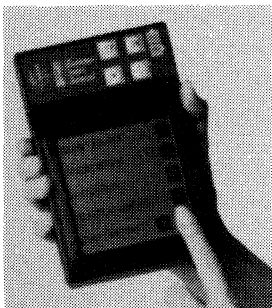
### Graphic LCD Modules

MGLS-240128 240 x 128 DOTS



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The Direct Contact Touch Screen



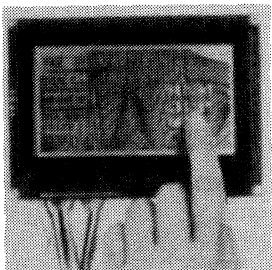
• **Excellent Visibility and Durability**

• **Low Power Consumption**

• **Low Cost DCTS technology**

• **High Sensitivity**

• **High Reliability**



Model	Dots	Dot Size W X H	Dot Pitch	Effective Viewing Area	Module Size
MGLS - 8032B	80x32	0.43x0.43	0.48x0.48	46x18	84x44
MGLS - 8464	84x64	0.50x0.50	0.55x0.55	51x40	90x60
MGLS - 10032A	100x32	0.50x0.60	0.55x0.65	60x26.5	75x54
MGLS - 10032B	100x32	0.62x0.56	0.72x0.66	76x25.2	98x50
MGLS - 10032D	100x32	0.38x0.43	0.43x0.48	46x18.4	65x28.4
MGLS - 12032A	120x32	0.6x0.425	0.65x0.475	60x26.5	75x54
MGLS - 12032B	120x32	0.56x0.55	0.61x0.60	76x25.2	98x50
MGLS - 12864	128x64	0.39x0.55	0.44x0.60	62x44	78x70
MGLS - 12864T	128x64	0.39x0.55	0.44x0.60	62x44	78x70
MGLS - 16080	160x80	0.39x0.39	0.42x0.42	72.3x37.8	87x54
* MGLS - 128128	128x128	0.50x0.50	0.55x0.55	73x73	92x106
* MGLS - 19264	192x64	0.36x0.36	0.41x0.41	84x31	100x60
* MGLS - 24064	240x64	0.48x0.48	0.53x0.53	132x39	176x65
* MGLS - 32064	320x64	0.36x0.36	0.41x0.41	136.8x33.60	165x45
* MGLS - 240128	240x128	0.40x0.40	0.45x0.45	114x64	144x104
MGLS - 320240	320x240	0.33x0.33	0.36x0.36	122x92	170x106
MGLS - 640200	640x200	0.24x0.30	0.27x0.33	181.4x76	200x89.3

Built-in Graphic Controller and 8K SRAM

For options refer to next page

\*Available with touch-screen



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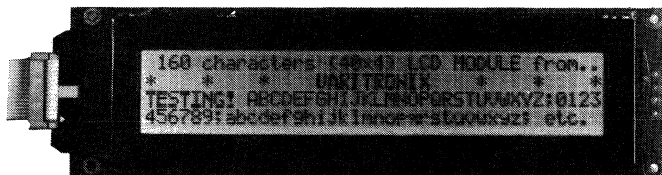
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## Standard & Custom Designs - Glass, Modules & Turn Key Projects

### Alpha-Numeric Modules



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- Wide temperature supertwist (SBE)
- High Contrast
- Wide viewing angle
- Internal character generator
- LED, EL & CCFL backlighting
- Character height ranging from 3mm to 12.7mm.

Character x Lines	Model	Duty	Character** Size W x H	View Area W x H	Module Size W x H
8 x 1	MDL(S)-81809	1/8	6.45 x 10.75	61.00 x 15.80	84.00 x 34.50
8 x 2	MDL(S)-82603	1/16	2.10 x 3.40	26.52 x 12.20	33.68 x 44.40
12 x 2	MDL(S)-12268K	1/25	9.10 x 9.93	123.0 x 23.00	146.0 x 43.00
12 x 4	MDL(S)-12433P	1/32	2.05 x 3.55	41.00 x 19.10	48.00 x 49.00
16 x 1	MDL(S)-16163	1/16	1.85 x 3.15	36.00 x 10.00	53.00 x 20.00
16 x 1	MDL(S)-16165	1/16	2.65 x 5.50	52.00 x 11.00	68.00 x 34.00
16 x 1	MDL(S)-16166	1/16	3.15 x 6.30	64.50 x 13.80	80.00 x 36.00
16 x 1	MDL(S)-16119	1/11	3.15 x 8.70	64.50 x 13.80	80.00 x 36.00
16 x 1	MDL(S)-16168	1/16	4.84 x 9.22	99.00 x 13.00	122.00 x 33.00
16 x 1	MDL(S)-161612	1/16	5.90 x 12.70	119.40 x 18.70	154.40 x 43.50
16 x 1	MDL(S)-161615	1/16	6.00 x 14.54	120.00 x 23.00	151.00 x 40.00
16 x 2	MDL(S)-16263	1/16	1.85 x 3.15	36.00 x 10.00	53.00 x 20.00
16 x 2	MDL(S)-16264	1/16	2.54 x 4.00	48.60 x 12.00	65.50 x 36.70
16 x 2	MDL(S)-16265	1/16	2.95 x 5.55	61.00 x 15.80	84.00 x 44.00
16 x 2	MDL(S)-16265B	1/16	2.95 x 5.55	61.00 x 15.80	80.00 x 36.00
16 x 2	MDL(S)-16265BVK	1/16	2.95 x 5.55	61.00 x 15.80	80.00 x 36.00
16 x 2	MDL(S)-16265C	1/16	2.95 x 5.55	61.00 x 15.80	72.00 x 36.00
16 x 2	MDL(S)-162S65	1/16	2.95 x 5.55	61.00 x 15.80	85.00 x 32.60
16 x 2	MDL(S)-162D65	1/16	3.15 x 5.75	63.50 x 15.80	85.00 x 36.00
16 x 2	MDL(S)-16268	1/16	5.40 x 9.30	113.00 x 23.00	160.00 x 52.00
16 x 2	MDL(S)-16268B	1/16	4.84 x 9.22	99.00 x 23.00	122.00 x 43.00
16 x 2	MDL(S)-16268C	1/16	4.84 x 9.22	99.00 x 23.00	122.00 x 44.00
16 x 4	MDL(S)-16465	1/16	2.95 x 4.75	61.80 x 25.20	87.00 x 60.00
20 x 1	MDL(S)-20188	1/8	4.84 x 9.22	123.00 x 13.00	146.00 x 33.00
20 x 1	MDL(S)-20189	1/8	6.70 x 11.50	154.00 x 15.30	182.00 x 33.50
20 x 1	MDL(S)-201812	1/16	5.90 x 12.70	147.00 x 18.70	182.00 x 43.50
20 x 1	MDL(S)-201615	1/8	6.00 x 14.54	149.00 x 23.00	180.00 x 40.00
20 x 2	MDL(S)-20263	1/16	1.85 x 3.15	46.00 x 10.00	65.00 x 20.00
20 x 2	MDL(S)-20265	1/16	3.20 x 5.55	83.00 x 18.60	116.00 x 37.00
20 x 2	MDL(S)-20268	1/16	4.84 x 9.22	123.00 x 23.00	146.00 x 43.00
20 x 2	MDL(S)-20269	1/16	5.92 x 9.52	149.00 x 23.00	180.00 x 40.00
20 x 2	MDL(S)-202612	1/16	5.90 x 12.70	147.00 x 35.20	182.00 x 60.00
20 x 4	MDL(S)-20433	1/32	1.85 x 3.15	18.40 x 46.00	28.40 x 65.00
20 x 4	MDL(S)-20464	1/16	2.90 x 4.75	76.00 x 25.20	98.00 x 60.00
20 x 4	MDL(S)-20464B	1/16	2.30 x 4.03	60.00 x 22.00	77.00 x 47.00
20 x 4	MDL(S)-20468	1/16	4.84 x 9.22	123.00 x 42.50	146.00 x 62.50
20 x 4	MDL(S)-204612	1/16	5.90 x 12.70	147.00 x 65.40	182.00 x 90.00
24 x 1	MDL(S)-24166	1/16	3.15 x 6.30	98.00 x 13.80	126.00 x 36.00
24 x 1	MDL(S)-24119	1/11	3.15 x 8.70	98.00 x 13.80	126.00 x 36.00
24 x 2	MDL(S)-24265	1/16	3.20 x 5.15	93.50 x 15.80	118.00 x 36.00
24 x 2	MDL(S)-24269	1/16	5.40 x 8.70	159.30 x 23.00	190.00 x 42.00
40 x 2	MDL(S)-40263	1/16	1.85 x 3.15	46.00 x 18.40	65.00 x 28.40
40 x 2	MDL(S)-40266	1/16	3.15 x 5.50	154.00 x 15.80	182.00 x 33.50
40 x 2	MDL(S)-402614	1/16	5.20 x 16.38	245.00 x 38.00	285.00 x 56.00
40 x 4	MDL(S)-40466	1/16	3.14 x 5.50	154.40 x 27.60	196.00 x 56.00
40 x 4	MDL(S)-404610	1/16	5.00 x 10.44	253.70 x 56.60	288.30 x 77.50

#### OPTIONS:

- \* Reflective, Transflective, or Transmissive mode
- \* Extended Temperature Range (Available for Some Models)

- \* High Stability Polarizers
- \* Positive or Negative mode
- \* EL or LED & CCFL backlighting

- \* STN Versions: Yellow, Silver, Blue Mode
- \* 6 or 12 O'clock Version
- \* Touch Panel overlay



# LCD SPECIALISTS

World Trade Services provides you with graphic or character LCD modules for any application you may have with a host of choices from standard products to the most intricate custom design imaginable. Our manufacturing techniques allows World Trade Services to offer extremely competitive pricing while offering the highest possible quality and reliability in addition to fast delivery schedules. Our technical staff is readily available for pre and post sales support to insure your complete and long-standing satisfaction.

In order to maintain our competitive edge, our LCD modules are manufactured in a fully automated production facility featuring SMT. Our North American sales, technical support and stocking facility along with our low cost Asian manufacturing allows World Trade Services to provide you with one of the lowest price / performance ratios available.



## CAPABILITIES

World Trade Services offers hundreds of standard LCD types and sizes. Below is a table listing some of the various standard character and graphic modules available. In addition, there are many other standard LCD types available for specialized applications such as clocks, calculators, instruments, telecommunication equipment, home appliances, office automation equipment, games, etc. World Trade Services also specializes in custom solutions to fit virtually any LCD requirement. Our Sales and Technical staff will be more than happy to discuss your requirements to enable us to provide an LCD to solve your specific application needs.

## FEATURES

- Easy Install
- Wide Temperature Range
- High Contrast
- Wide Viewing Angle
- Backlight (EL or LED)
- Low Voltage / Low Power
- High Reliability & Quality
- Highly Competitive Prices

## APPLICATIONS

- Consumer electronics modules; i.e. watches, calculators, games, toys
- Instrumentation modules; i.e. for temperature, time, voltage measurement
- Informative display; i.e. dot matrix LCD modules
- Telecommunication LCD modules; i.e. telephones, pagers, fax machines

Character Modules								
Characters x Lines	Module Size			Viewing Area		Character Size		
	Width	Height	Depth	Width	Height	Width	Height	
8 x 1	88	44	10	61	15.8	6.45	10.75	
8 x 2	58	32	8	35	16	2.96	5.56	
16 x 1	80 - 122	26 - 36	8.8 - 12	61 - 99	13 - 16	2.95 - 4.9	5.56 - 8.06	
16 x 2	80 - 122	29.5 - 44	8.8 - 15	61 - 99	13.8 - 24	2.95 - 4.84	4.35 - 9.66	
16 x 4	87	60	9.7 - 10	61.8 - 62	25.2 - 25.5	2.95	4.75	
20 x 1	105 - 182	33.5 - 39	11 - 12	84 - 154	13 - 15.3	3.2 - 6.7	5.2 - 11.5	
20 x 2	115 - 116	36 - 37	8.8 - 15	83 - 85	18.5 - 18.6	3.2	4.85 - 5.55	
20 x 4	98 - 118	43 - 60	8.8 - 14.5	76 - 77	25.2 - 26.3	2.78 - 2.95	4.75 - 4.89	
24 x 1	126	36	10.6	100	13.8	3.07	6.56	
24 x 2	118	36	8.8 - 11	93.5	15.8 - 16	3.15 - 3.2	4.45 - 5.55	
24 x 4	125	39	9.7	97	32	5.56	2.96	
40 x 1	182	33.5 - 38.5	11	152.5 - 154.5	15.8 - 16.5	3.05	6.56	
40 x 2	180	32 - 33.5	8.8 - 11	152.5 - 158.8	15.3 - 16.5	3.15 - 3.2	5.50 - 5.55	
40 x 4	190 - 215	55 - 60	10 - 17.5	147 - 160	29.5 - 34	2.78 - 3.20	4.85 - 4.89	
80 x 2	258.8	38.9	11	222	16.5	2.20	4.35	

Graphic Modules								
Dot Number W x H (Dsp)	Module Size			Viewing Area		Dot Size		
	Width	Height	Depth	Width	Height	Width	Height	
120 x 32	104.9	49.5	12	80.52	31.5	0.53	0.53	
122 x 32	65.1 - 84	27.1 - 44	5.05 - 10	54.8 - 80.5	18.5 - 19.5	0.36 - 0.48	0.36 - 0.48	
128 x 32	110	65	12.0	78	25	0.51 - 0.52	0.51 - 0.52	
128 x 64	78 - 113	65 - 70	8.5 - 12	62 - 73.4	38.8 - 44	0.38 - 0.55	0.38 - 0.48	
128 x 128	84.4 - 88.4	88.4 - 100	11 - 14	62 - 69	62 - 69	0.40 - 0.46	0.40 - 0.46	
160 x 80	87	54	15.3	72.3	37.8	0.38	0.38	
240 x 32	180	55	10	114	23	0.48	0.48	
240 x 64	180	65 - 75	10 - 12	132 - 133	39 - 40	0.48 - 0.49	0.48 - 0.49	
240 x 128	144 - 176	96 - 104	10.3 - 14	34 - 132	64 - 76	0.42 - 0.49	0.42 - 0.49	
256 x 128	147 - 200	110 - 116	12	127 - 128	66.5 - 70	0.43 - 0.44	0.43 - 0.44	
320 x 64	200	45.2	15	176	33	0.44	0.44	
320 x 240	139 - 167	109 - 120	9 - 13.2	103 - 121	79 - 92	0.33	0.33	
480 x 64	250	73	12	246	38	0.45	0.45	
640 x 200	256 - 270	110 - 128	12	232 - 240	79 - 106	0.29 - 0.33	0.33 - 0.43	
640 x 400	250 - 270	145 - 198	9 - 12	197 - 236	125 - 153.6	0.3	0.3	
640 x 480	244 - 260	158 - 172	8 - 10	179 - 197	135 - 150	0.24 - 0.27	0.24 - 0.27	

World Trade Services, 200 Butterfield Dr., Ashland, MA 01721, Tel:(508)231-0777, Fax:(508)231-0861

# XCEL CORPORATION

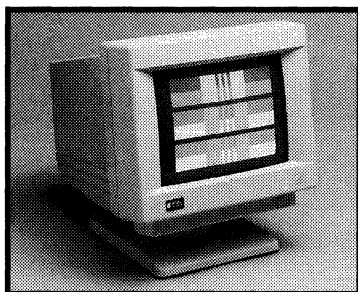
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## CUSTOMIZED FOR OEM APPLICATIONS

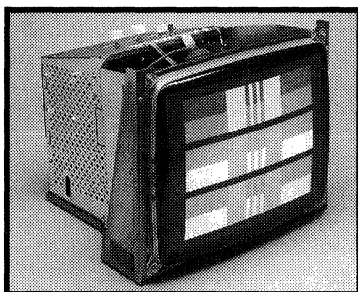


## HIGH QUALITY - LOW COST COLOR MONITORS TO FIT YOUR SPECIFIC MOUNTING REQUIREMENTS.

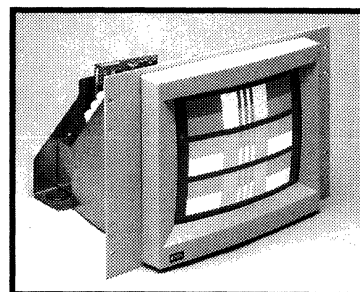
Our XCEL-Lite line of Super VGA and XGA monitors is targeted toward OEM customers who wish to lower the cost of their monitor by designing their system around standard electronic interfaces, video formats, and chassis form factors.



**STANDARD ENCLOSURE**



**OPEN FRAME**



**RACK MOUNT**

## GENERAL SPECIFICATIONS

- Open frame, fully enclosed and panel mounted steel chassis or private labeled plastic enclosures.
- Screen Sizes: 9", 10", 14", 15", 17", 20" and 21".
- Non-glare CRT on all models.
- Flat square tubes on the 15" and 17" models.
- Operating temperature: 0°C to 50°C on all models.
- CRT resolutions of .27 and .28 DPI.
- Non-interlaced flicker free scan rates on all models.
- Resolutions of 640 x 480, 800 x 600, 1024 x 768, 1280 x 1024 and 1600 x 1280 available.
- Video bandwidths from 65 MHz to 150 MHz.
- Low Radiation models meet the MPR-II specification.
- Autosynch (Multisynch): Automatic Horizontal Scan Frequency sensing and switching on all models.
- Automatic Vertical Refresh Rates from 50 Hz to 152 Hz.
- Universal power supply with automatic sensing and switching on all models: 50/60 Hz, 90-136 VAC & 180-260 VAC.
- Automatic Degaussing at start up on all models.
- Operator Controls: Analog - Power Switch, Brightness, Contrast, V-Size, V-Position, H-Size, H-Position. Digital programmable controls with up to 15 memory positions to achieve auto-sizing when changing among various kinds of graphic standards. On screen programming in some models.
- PC & MAC Interfaces through D-sub 15 pin connectors.

XCEL is an international corporation comprised of vertically integrated electronics companies that design and manufacture standard and custom input and Display components, peripherals, and fully integrated input, Display and Control Subsystems.

### XCEL Corporation

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# Monochrome & Color Monitors Designed For The Real World!



The Clear Image People

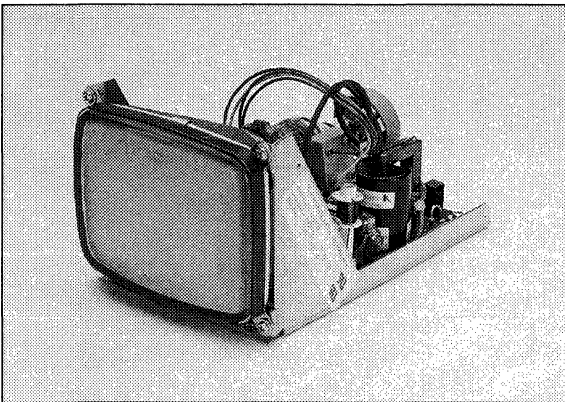
## EXPERIENCE

Since 1989, our team of skilled professionals has been designing and assembling video display monitors with advanced designs, improved performance, greater long-term reliability and increased mechanical rigidity to withstand stressful environments. Our "design-through-installation" service philosophy guarantees customer satisfaction. Our products are used in industrial control, medical instruments, test equipment, visual aid devices, on-board tracking systems, point-of-sale terminals and naval tactical displays.

## GENERAL PRODUCT FEATURES

- Rugged Industrial Grade Construction (withstand harsh temperatures & vibration)
- Dual Sided Plated Through Hole PCB's
- 100% Elevated Temperature Burn-in
- Derated Component Design
- Operating Temperature Range of 0 to 55°C
- MTBF of 100,000 Hours
- Modern Circuit Design
- Power & Signal Connector Options
- Available Approvals:  
UL, CUL, DHHS & TUV
- Designed, Manufactured & Serviced in the U.S.A.

## MONOCHROME MONITORS



### FEATURES

- Dynamic Focus
- Single PCB Control Circuitry
- Automatic Vertical & Horizontal Sync.
- TTL, Composite Video or RS-422 Input
- Sizes Ranging From 5 to 17 Inches

### OPTIONS

- Kit, Chassis or Cabinet Configurations
- 12, 15 or 110/220 Volt Regulated Power
- Unregulated DC Input
- Remoted Brightness & Contrast
- Standard or Dark Glass CRT's
- Multiple Phosphors Available

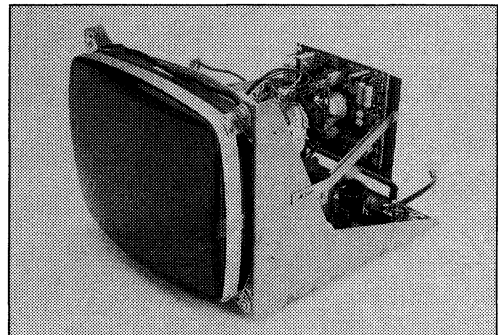
## COLOR MONITORS

### FEATURES

- Automatic Degaussing
- Auto. CRT Bias Circuit for Color Tracking
- Automatic Configuring of VGA, SVGA and 8514 Interlaced Modes
- 85-265 VAC Universal Input
- Sizes Ranging From 12 to 27 Inches

### OPTIONS

- Kit, Chassis or Cabinet Configurations



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## LAMPS AND INDICATOR LIGHTS

Manufacturer	Starting EEM Page No.	Light Type									Accessories/Hardware				Features			
		Incan- descent	LED	Neon	Fluores- cent	Electro- lumines- cent	Intra- red	Kryp- ton	Ultra violet	Xenon	Sockets/ Holders/ Clips	Caps & Lenses	In- verters	Panel Mount	Relamp- able PC Mount	Assem- bles	Rectan- gular	Water- proof
American Bright Optoelectronics Corp.	B•1090		✓							✓				✓	✓	✓	✓	✓
AND (LED Products)	B•1091		✓															
APM Hexseal Corp.	B•1094	✓												✓				
Arcoelectric Corp.	B•1092	✓	✓	✓									✓		✓	✓	✓	✓
Bulbtronics	B•1095	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Chicago Miniature Lamp, Inc.	B•1096	✓	✓	✓						✓			✓	✓	✓	✓	✓	✓
Data Display Products	B•1100		✓										✓	✓	✓			✓
Electrodynamics, Inc.	B•1105		✓										✓	✓				
Gilway Technical Lamp	B•1106	✓	✓	✓	✓				✓	✓	✓	✓	✓			✓	✓	
Hamamatsu Corp.	B•1116										✓	✓						
Idea, Inc.	B•1118		✓											✓		✓		
Inter-Market	B•1121	✓	✓	✓										✓		✓		
JKL Components Corp.	B•1122	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	✓
Lamptronix Co. Ltd.	B•1124	✓§*		✓§*						✓	✓	✓	✓	✓	✓			
Luminescent Systems, Inc.-NH	B•1125					✓												
Lumitex, Inc.	B•1126	✓	✓	✓			✓						✓	✓	✓	✓	✓	✓
Metro Mark	B•1128					✓							✓		✓			
Mytech Corporation	B•1130					✓												
Oxley, Inc.	B•1132		✓	✓		✓	✓							✓		✓		✓
Para-Light (USA) Corp.	B•1134		✓									✓						
Poly-Optical Products, Inc.	B•1135	✓	✓							✓								
Schurter Inc.	B•1136	✓	✓	✓	✓			✓					✓	✓	✓	✓	✓	✓
Shokai Far East Limited	B•1137	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓			
Sloan Company	B•1139	✓	✓	✓									✓	✓	✓	✓	✓	✓
Stanley Electric Co.	B•1145		✓		✓			✓									✓	✓
Sun Led Co.	B•1153		✓					✓						✓	✓			✓
The Specialty Bulb Co.	B•1144	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓					
Visual Communications	B•1154	✓	✓					✓					✓	✓	✓	✓	✓	✓
World Products, Inc.	B•1161		✓			✓		✓						✓		✓	✓	✓



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### AXIAL AND FORMED LEADS

Part No. & Diagram				Electro-Optical Data			
Axial Leads		Gull-Wing	York Lead	Z Bend	Color	V <sub>F</sub> at 10mA	I <sub>V</sub> (mcd)
BL-X4361	BL-X4361+F7	BL-X4361+F8	BL-X4361+F9	H.E. red	2.0	30.0	
BL-X2361	BL-X2361+F7	BL-X2361+F8	BL-X2361+F9	green	2.2	45.0	
BL-X3361	BL-X3361+F7	BL-X3361+F8	BL-X3361+F9	yellow	2.1	25.0	
BL-XF361	BL-XF361+F7	BL-XF361+F8	BL-XF361+F9	sup. red	2.0	150.0	
BL-XK361	BL-XK361+F7	BL-XK361+F8	BL-XK361+F9	sup. yellow	2.1	250.0	

**ISO 9002 Certified**

**Production Capacity:**  
Lamp: 80KK/month  
Display: 6KK/month  
SMT: 7KK/month

**T&R package available:**  
LED lamps  
SMT

### T-1 (3mm)

Diagram	Part No.	Emitting Color	Lens Appear.	V <sub>F</sub> at 20mA	I <sub>V</sub> (mcd) at 20mA
	BL-B4531E	H.E. red	red diff.	2.0	40.0
	BL-B2131E	green	green diff.	2.2	70.0
	BL-B3131E	yellow	yellow diff.	2.1	60.0
	BL-B4131E	orange	orange diff.	2.0	60.0
	BL-B8131E	amber	amber diff.	2.0	70.0

### T-1 3/4 (5mm)

Diagram	Part No.	Emitting Color	Lens Appear.	V <sub>F</sub> at 20mA	I <sub>V</sub> (mcd) at 20mA
	BL-B4534	H.E. red	red diff.	2.0	80.0
	BL-B2134	green	green diff.	2.2	80.0
	BL-B3134	yellow	yellow diff.	2.1	80.0
	BL-B4134	orange	orange diff.	2.0	80.0
	BL-B8134	amber	amber diff.	2.1	120.0

### ULTRA BRIGHT

Diagram	Part No.	Emitting Color	Lens Appear.	V <sub>F</sub> at 20mA	I <sub>V</sub> (mcd) at 20mA
	BL-BF334	sup. red	water clear	2.0	1500.0
	BL-BK334	sup. yellow	water clear	2.1	2000.0
	BL-BJ334	sup. orange	water clear	2.0	1800.0
	BL-B7334-UB	sup. blue	water clear	5.0	130.0

### RECTANGULAR-2X5X7MM/2.4X5.0X8.6MM

Diagram	Part No.	Emitting Color	Lens Appear.	V <sub>F</sub> at 20mA	I <sub>V</sub> (mcd) at 20mA
	BL-R4532N-T	H.E. red	red diff.	2.0	6.0
	BL-R2132N-T	green	green diff.	2.2	7.0
	BL-R3132N-T	yellow	yellow diff.	2.1	5.0
	BL-R4632T	H.E. red	red trans.	2.0	90.0
	BL-R2432T	green	green trans.	2.2	110.0
	BL-R3432T	yellow	yellow trans.	2.1	80.0

### DUAL CHIP & BLINKING LED

Diagram	Part No.	Emitting Color	Lens Appear.	V <sub>F</sub> at 20mA	I <sub>V</sub> (mcd) at 20mA
	BL-BEG201	H.E. red/green	white diff.	2.0/2.2	25.0/35.0
	BL-BYG201	yel/green	white diff.	2.1/2.2	20.0/35.0
	BL-BEG204	H.E. red/green	white diff.	2.0/2.2	35.0/45.0
	BL-BYG204	yel/green	white diff.	2.1/2.2	30.0/45.0
	BB-B4574	H.E. red	red diff.	-	12.0
	BB-B2174	green	green diff.	-	15.0
	BB-B3174	yellow	yellow diff.	-	10.0
	BB-B6174	sup. red	red diff.	-	25.0

### LCD BACKLIGHT

Diagram	Part No.	Emitting Color	Lens Appear.	V <sub>F</sub> at 20mA	I <sub>V</sub> (mcd) at 20mA
	BL-L46G1	H.E. red	red trans.	4.0	8.0
	BL-L64G1	sup. red	red trans.	3.5	35.0
	BL-L24G1	green	green trans.	4.5	18.0
	BL-L34G1	yellow	yellow trans.	4.5	12.0
	BL-L43H1	H.E. red	water clear	2.0	7.0
	BL-L63H1	sup. red	water clear	1.7	32.0
	BL-L23H1	green	water clear	2.2	16.0
	BL-L33H1	yellow	water clear	2.1	11.0

### PCB LED

Diagram	Part No.	Emitting Color	Lens Appear.	V <sub>F</sub> at 20mA	I <sub>V</sub> (mcd) at 20mA
	BL-C41/11-37N	H.E. red	red diff.	2.0	90.0
	BL-C41/1G-37N	green	green diff.	2.2	90.0
	BL-C41/1Y-37N	yellow	yellow diff.	2.1	70.0
	BL-C41A/11-37N	H.E. red	red diff.	2.0	90.0
	BL-C41A/1G-37N	green	green diff.	2.2	90.0
	BL-C41A/1Y-37N	yellow	yellow diff.	2.1	70.0
	BL-C9/11-31E	H.E. red	red diff.	2.0	40.0
	BL-C9/1G-31E	green	green diff.	2.2	50.0
	BL-C9/1Y-31E	yellow	yellow diff.	2.1	60.0
	BL-C32/11-31N	H.E. red	red diff.	2.0	12.0
	BL-C32/1G-31N	green	green diff.	2.2	12.0
	BL-C32/1Y-31N	yellow	yellow diff.	2.1	11.0
	BL-C34/21-31E	H.E. red	red diff.	2.2	40.0
	BL-C34/2G-31E	green	green diff.	2.2	70.0
	BL-C34/2Y-31E	yellow	yellow diff.	2.1	60.0
	BL-C36/1EG-04	HER/green	white diff.	2.0/2.2	35.0/45.0

### SMT

Diagram	Part No.	Emitting Color	Lens Appear.	V <sub>F</sub> at 20mA	I <sub>V</sub> (mcd) at 20mA
	BL-HD32	sup. red	water clear	1.7	54.0
	BL-H232	green	water clear	2.2	18.0
	BL-H332	yellow	water clear	2.1	21.5
	BL-H432	h.e. red	water clear	2.0	14.5
	BL-HK32	sup. yellow	water clear	2.0	72.0
	BL-HJ32	sup. orange	water clear	2.0	72.0
	BL-H732-UB	sup. blue	water clear	5.0	30.0

### 20MM ROUND LED

Diagram	Part No.	Emitting Color	Lens Appear.	V <sub>F</sub> at 20mA	I <sub>V</sub> (mcd) at 20mA
	BL-B6E520-3P	H.E. red	red diff.	4.0	150.0
	BL-B6G120-3P	green	green diff.	4.5	180.0
	BL-B6Y120-3P	yellow	yellow diff.	4.2	120.0
	BL-B6D120-3P	sup. red	red diff.	3.4	200.0

### 1.8MM TOWER LED

Diagram	Part No.	Emitting Color	Lens Appear.	V <sub>F</sub> at 20mA	I <sub>V</sub> (mcd) at 20mA
	BL-S4548	H.E. red	red diff.	2.0	4.0
	BL-S2148	green	green diff.	2.2	5.0
	BL-S3148	yellow	yellow diff.	2.1	3.0

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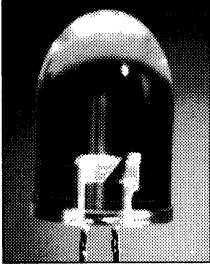
\*\*\*Please call us for catalog, sample, cross reference, technical support, and custom type LED/Display.\*\*\*

Also see AMERICAN BRIGHT in DISPLAYS Section.

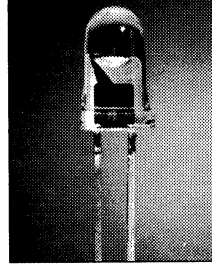


# LED Products

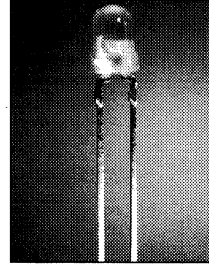
**T-3 Package  
(10mm)**



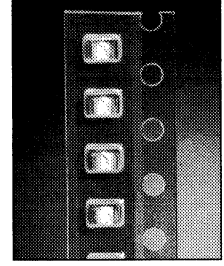
**T-1 3/4 Package  
(5mm)**



**T-1 Package  
(3mm)**



**Surface Mount  
Package**



## ULTRA BRIGHT LED LAMPS

Type	Peak $\lambda$ (nm)	LED Color	Lens Color	Typ mcd @20 mA	View Angle
<b>10mm (T-3) Package</b>					
AND190HAP	612	Amber	Clear	18000	4
AND190GCP	567	Green	Clear	700	4
AND191GCP	567	Green	Milky Diffused	180	20
AND190WOP	620	Orange	Clear	18000	4
AND190AOP	620	Orange	Clear	12000	4
AND190HRP	644	Red	Clear	15000	4
AND190CRP	660	Red	Clear	13000	4
AND191CRP	660	Red	White Diffused	720	20
AND190HYP	590	Yellow	Clear	18000	4
AND190VYP	590	Yellow	Clear	13000	4
AND190AYP	590	Yellow	Clear	6000	4
<b>5mm (T-1 3/4) Package</b>					
AND180HAP	612	Amber	Clear	7000	8
AND157HAP	612	Amber	Clear	2000	22
AND156HAP	612	Amber	Clear	1000	30
AND156EOP	612	Amber	Clear	700	30
AND183HGP	574	Green	Clear	2500	8
AND183HPGP	562	Green	Clear	680	8
AND240GCP	567	Green	Clear	780	20
AND158HGP	574	Green	Clear	370	22
AND135PGP	567	Green	Clear	410	30
AND180TOP	620	Orange	Clear	4100	8
AND180AOP	620	Orange	Clear	3000	8
AND156AOP	620	Orange	Clear	800	30
AND180HRP	644	Red	Clear	6000	8
AND180HSP	623	Red	Clear	8000	8
AND180CRP	660	Red	Clear	4100	8
AND130CRP	660	Red	Clear	2300	16
AND120CR	660	Red	Clear	1280	20
AND157HRP	644	Red	Clear	1900	22
AND155CRP	660	Red	Clear	1280	30
AND134CR	660	Red	Red Diffused	680	50
AND116CR	660	Red	Milky Diffused	208	70
AND180HYP	590	Yellow	Clear	8000	8
AND180TYP	590	Yellow	Clear	4100	8
AND180AYP	590	Yellow	Clear	2500	8
ANDS4E38XX	590	Yellow	Clear	3500	17
AND157HYP	590	Yellow	Clear	2300	22
AND157AYP	590	Yellow	Clear	800	22
AND156HYP	590	Yellow	Clear	1200	30
AND156AYP	590	Yellow	Clear	350	30
AND156EYP	590	Yellow	Clear	800	30

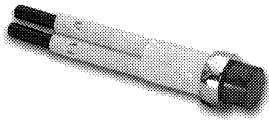
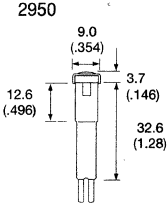
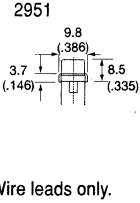
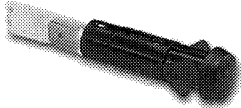
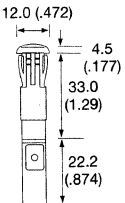
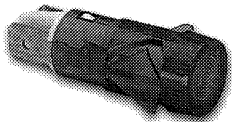
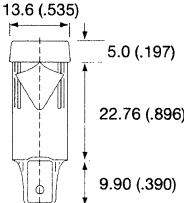
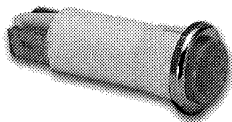
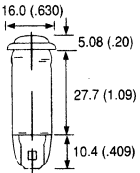
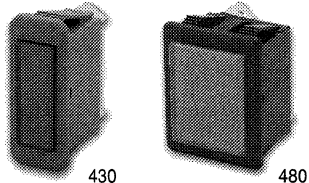

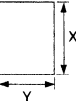
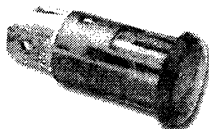
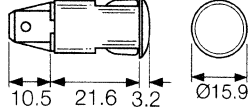
Type	Peak $\lambda$ (nm)	LED Color	Lens Color	Typ mcd @20 mA	View Angle
<b>3mm (T-1) Package</b>					
AND262HA	612	Amber	Clear	300	80
AND262OA	612	Amber	Clear	150	70
AND160NG	567	Green	Clear	320	10
AND262GC	567	Green	Clear	50	70
AND262HR	644	Red	Clear	210	80
AND125CR	660	Red	Clear	400	60
AND126CR	660	Red	Milky Diffused	150	65
AND262RA	660	Red	Clear	150	70
AND262HY	590	Yellow	Clear	300	70
AND262YA	590	Yellow	Clear	80	70
<b>SURFACE MOUNT Package Flat &amp; Dome Lens</b>					
AND4RA	660	Red	Clear/Flat	40	150
AND4SA	635	Red	Clear/Flat	5	150
AND4OA	612	Amber	Clear/Flat	60	150
AND4YA	590	Yellow	Clear/Flat	60	150
AND4GA	570	Green	Clear/Flat	15	150
AND4G	567	Green	Clear/Flat	9	150
AND4PGA	555	Green	Clear/Flat	2	150
AND5RA	660	Red	Clear/Dome	450	30
AND5SA	635	Red	Clear/Dome	25	40
AND5OA	612	Amber	Clear/Dome	400	40
AND5YA	590	Yellow	Clear/Dome	300	40
AND5GA	570	Green	Clear/Dome	75	40
AND5G	567	Green	Clear/Dome	45	40
AND5PGA	555	Green	Clear/Dome	12	40
<b>MULTI-COLOR 5mm (T-1 3/4) Package</b>					
AND176RAG	660/567	R/G	Clear	500/150	30
AND178RAG	660/567	R/G	Clear	500/150	30
AND116SG	635/565	R/G	Clear	7/5	80
<b>7.5 mm (T-2 1/4) Package</b>					
AND186RAG	660/567	R/G	Clear	500/150	36
AND188RAG	660/567	R/G	Clear	500/150	36
<b>SPECIAL SHAPE 2.5 x 5 mm Arched</b>					
AND233CRP	660	Red	Clear	800	15
AND233GCP	567	Green	Clear	250	25
<b>DUAL CHIPS 5 mm (T-1 3/4) Package</b>					
AND256CRZ	660	Red	Clear	350	60
AND256GC	567	Green	Clear	90	90

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**INDICATOR LIGHTS**

MODEL	SPECIFICATIONS				DIMENSIONS	
<p><b>2950 SERIES</b></p> 	SERIES	VOLTAGE	CURRENT	EST. LIFE	<p>2950</p> 	<p>2951</p> 
	FL (incand.)	12V AC/DC 28V AC/DC	80ma 40ma	15,000 hrs. 7,000 hrs.		
	LE (LED)	1.7 to 28V DC	20ma	100,000 hrs.		
	NL (neon)	125 or 250VAC	1.2-1.9ma	25,000 hrs.		
	PANEL CUTOUT DIAMETER 8.0 (0.315) PANEL THICKNESS 0.8-1.6 (0.031-0.063)					Wire leads only.
<p><b>276 SERIES</b></p> 	SERIES	VOLTAGE	CURRENT	EST. LIFE		TERMINALS: 6.3mm tab 4.8mm tab 18 AWG wire
	FL (incand.)	12V AC/DC 28V AC/DC	80ma 40ma	15,000 hrs. 7,000 hrs.		
	LE (LED)	1.7 to 28V DC	20ma	100,000 hrs.		
	NL (neon)	125 or 250VAC	1.2-1.9ma	25,000 hrs.		
	PANEL CUTOUT DIAMETER 9.5 (0.375) PANEL THICKNESS 0.80-2.40 (0.031-0.094)					
<p><b>2820/2870 SERIES</b></p> 	SERIES	VOLTAGE	CURRENT	EST. LIFE		TERMINALS: 6.3mm tab 4.8mm tab 18 AWG wire
	FL (incand.)	12V AC/DC 28V AC/DC	80ma 40ma	15,000 hrs. 7,000 hrs.		
	LE (LED)	1.7 to 28V DC	20ma	100,000 hrs.		
	NL (neon)	125 or 250VAC	1.2-1.9ma	25,000 hrs.		
	MODEL	CUTOUT	PANEL THICKNESS			
	2820	12.0	0.8/2.5			
	2870	12.7	0.8/2.0			
<p><b>67 SERIES</b></p> 	SERIES	VOLTAGE	CURRENT	EST. LIFE		TERMINALS: 6.3mm tab 4.8mm tab 18 AWG wire
	FL (incand.)	12V AC/DC 28V AC/DC	80ma 40ma	15,000 hrs. 7,000 hrs.		
	LE (LED)	1.7 to 28V DC	20ma	100,000 hrs.		
	NL (neon)	125 or 250VAC	1.2-1.9ma	25,000 hrs.		
	PANEL CUTOUT DIAMETER 12.7 (0.500) PANEL THICKNESS 1.14 (0.044)					
<p><b>430/480 SERIES</b></p> 	CUTOUT(430)	Y	X			TERMINALS: 6.3mm tab 4.8mm tab
	A	12.2/12.3	27.2/27.3			
	B	11.0/11.1	30.0/30.1			
	L	11.0/11.1	30.0/30.1			
	R	14.0/14.1	28.2/28.58			
	CUTOUT (480)	Y	X			TERMINALS: 6.3mm tab 4.8mm tab
	A	22.3/22.4	27.2/27.3			
	B	22.1/22.2	30.0/30.1			
	L	22.1/22.2	30.0/30.1			
	R	22.62/25.4	28.2/28.58			
	Available voltages: 12 to 250V					
<p><b>589/2821 SERIES</b></p> 	SERIES	VOLTAGE	CURRENT	EST. LIFE		TERMINALS: 6.3mm tab 4.8mm tab 18 AWG wire
	FL (incand.)	12V AC/DC 28V AC/DC	80ma 40ma	15,000 hrs. 7,000 hrs.		
	LE (LED)	1.7-28 VDC	20ma	100,000 hrs.		
	NL (neon)	125 or 250VAC	1.2-1.9ma	25,000 hrs.		
	MODEL	CUTOUT	PANEL THICKNESS			
	579	14.0	0.8/2.5			
	589	12.7	0.8/1.5			
	2821	12.0	0.8/2.5			
	2821	12.7	1.1/2.5			

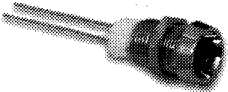
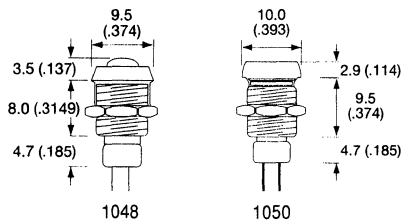
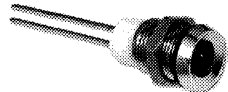
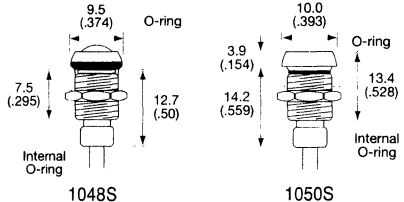
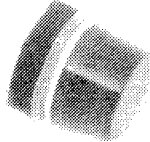
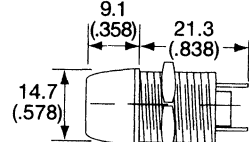

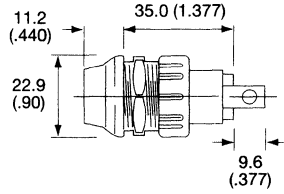

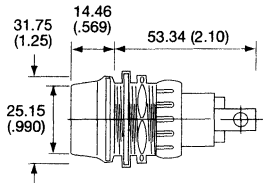


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**LAMP HOLDERS**

MODEL	SPECIFICATIONS	DIMENSIONS																				
<p><b>LH1000 SERIES</b> LED Indicators</p> 	<p>Available with or without LED lamp. LED or PVC leads available. LED lamp type: 5mm Voltage range: 1.7 to 28VDC Brass body with black or chrome finish. Panel mounting hole: 8.0 (0.315) Panel thickness: 5.5 (0.216)</p>	 <p>1048      1050</p>																				
<p><b>LH1000S SERIES</b> LED Indicators</p>  <p>SEALED TO IP66</p>	<p>Available with or without LED lamp. LED or PVC leads available. LED lamp type: 5mm Voltage range: 1.7 to 28VDC Brass body with black or chrome finish. Panel mounting hole: 8.0 (0.315) Panel thickness: 5.5 (0.216)</p>	 <p>1048S      1050S</p>																				
<p><b>LHM 62 SERIES</b></p> 	<p>Lamp holders can be ordered with lamps installed or without lamps. Lamp replaces from front of panel. Lamp type: T1<sup>3</sup>/<sub>4</sub> midget flange. Solder terminals. Supplied with fiber washer and nylon hex nut. Nylon body; polycarbonate lens.</p> <table border="1"> <thead> <tr> <th>LAMP NO.</th> <th>VOLTS</th> <th>WATT/AMP</th> <th>EST. LIFE</th> <th>MSCP</th> </tr> </thead> <tbody> <tr> <td>381</td> <td>6</td> <td>0.20A</td> <td>20,000 hrs.</td> <td>0.40</td> </tr> <tr> <td>382</td> <td>14</td> <td>0.08A</td> <td>15,000 hrs.</td> <td>0.30</td> </tr> <tr> <td>387</td> <td>28</td> <td>0.04A</td> <td>7,000 hrs.</td> <td>0.30</td> </tr> </tbody> </table> <p>Panel mounting hole: 12.7 (0.500) Panel thickness: 9.6 (0.375)</p>	LAMP NO.	VOLTS	WATT/AMP	EST. LIFE	MSCP	381	6	0.20A	20,000 hrs.	0.40	382	14	0.08A	15,000 hrs.	0.30	387	28	0.04A	7,000 hrs.	0.30	
LAMP NO.	VOLTS	WATT/AMP	EST. LIFE	MSCP																		
381	6	0.20A	20,000 hrs.	0.40																		
382	14	0.08A	15,000 hrs.	0.30																		
387	28	0.04A	7,000 hrs.	0.30																		
<p><b>LH 382/LH 392 SERIES</b></p> 	<p>Lamp holder available with or without lamp. Lamp replaces from front or rear of panel. Tab terminals: 6.35 (0.250). Nylon body; polycarbonate lens. Lamp type: T3<sup>3</sup>/<sub>4</sub> min. bayonet.</p> <table border="1"> <thead> <tr> <th>LAMP NO.</th> <th>VOLTS</th> <th>WATT/AMP</th> <th>EST. LIFE</th> <th>MSCP</th> </tr> </thead> <tbody> <tr> <td>47</td> <td>6</td> <td>0.15A</td> <td>3,000 hrs.</td> <td>0.52</td> </tr> <tr> <td>1892</td> <td>14</td> <td>0.12A</td> <td>1,000 hrs.</td> <td>0.75</td> </tr> <tr> <td>1829</td> <td>28</td> <td>0.07A</td> <td>1,000 hrs.</td> <td>0.62</td> </tr> </tbody> </table> <p>Panel mounting hole: 19.0 (0.748) Panel thickness: 6.3 (0.250) Black bezel Model LH 382 Chrome bezel Model LH 392</p>	LAMP NO.	VOLTS	WATT/AMP	EST. LIFE	MSCP	47	6	0.15A	3,000 hrs.	0.52	1892	14	0.12A	1,000 hrs.	0.75	1829	28	0.07A	1,000 hrs.	0.62	
LAMP NO.	VOLTS	WATT/AMP	EST. LIFE	MSCP																		
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1892	14	0.12A	1,000 hrs.	0.75																		
1829	28	0.07A	1,000 hrs.	0.62																		
<p><b>LH 692 SERIES</b></p> 	<p>Lamp holder available with or without lamp. Lamp replaces from front or rear of panel. Tab terminals: 6.35 (0.250). Polycarbonate lens. Brass chrome-plated body. Lamp type: T3<sup>3</sup>/<sub>4</sub> min. bayonet.</p> <table border="1"> <thead> <tr> <th>LAMP NO.</th> <th>VOLTS</th> <th>WATT/AMP</th> <th>EST. LIFE</th> <th>MSCP</th> </tr> </thead> <tbody> <tr> <td>47</td> <td>6</td> <td>0.15A</td> <td>3,000 hrs.</td> <td>0.52</td> </tr> <tr> <td>1892</td> <td>14</td> <td>0.12A</td> <td>1,000 hrs.</td> <td>0.75</td> </tr> <tr> <td>1829</td> <td>28</td> <td>0.07A</td> <td>1,000 hrs.</td> <td>0.62</td> </tr> </tbody> </table> <p>Panel mounting hole: 25.4 (1.00) Panel thickness: 8.7 (0.342)</p>	LAMP NO.	VOLTS	WATT/AMP	EST. LIFE	MSCP	47	6	0.15A	3,000 hrs.	0.52	1892	14	0.12A	1,000 hrs.	0.75	1829	28	0.07A	1,000 hrs.	0.62	
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# COLOR FILTER ALTERNATIVE

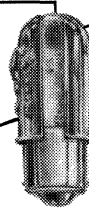
Better than paint and plastic caps, more color choices than LED's

Take any clear miniature incandescent lamp, slip on a SiliKromes® filter, and presto — instant color. Made in the U.S.A., these lightweight silicone rubber boots not only make standard lamps transmit any color you want, they make them work harder and last longer, providing new flexibility, reliability and economy for lighting applications.

## SILIKROMES® ADVANTAGE

Paint applied to glass can chip, crack or peel, and it does not offer any containment protection against shattering.

Conventional plastic filters are susceptible to melting and discoloration due to fading.



SILIKROMES® colored silicone rubber lamp filters won't chip, crack, melt, peel or fade. They remain colorfast and pliant even after 10,000 hours. SILIKROMES® cushion lamps against shock and vibration. Strong enough to contain broken glass in the event of bulb shattering.

### TYPICAL APPLICATIONS:

- Dashboards
- Decorative Lighting
- Pinball Machines
- Annunciator Panels
- Security Systems
- Electronic Games
- Instrument Lighting
- Signal Lights
- Automotive Lighting
- Lighted Switches
- Medical Electronics
- Consumer Products

## SPECIFICATIONS



SILIKROME®	GRADE	
	COMMERCIAL	MILITARY
<b>Available Standard Colors</b>	Red, Green, Blue, Lunar White, Amber, Yellow	For military color version, see chart below.
<b>Material</b>	Silicone Rubber	Silicone Rubber conforming to ZZ-R-765 Class III GR 50
<b>Temperature Range</b>	-112°F to +400°F (-80°C to +204°C)	-160°F to +450°F (-106°C to +260°C)
	* -112°F to +575°F (-80°C to +302°C)	
<b>Shelf Life</b>	25 Years (minimum)	
<b>Resistant to</b>	Salt spray, weather, sunlight, ozone, and most acids	
<b>Physical Characteristics</b>	Flexible, non-breakable, re-usable. Acts as shock mount. Protects against shattering. Easy to mount.	

Application conditions (e.g. lamp intensity, diffuser characteristics, ambient lighting, etc.) typically define the requirements for lamp filter color intensity and transmission. SILIKROMES® can be made to satisfy most applications. We will be pleased to produce custom colors to meet your precise needs.

\*For T-5 size only.

### MILITARY GRADE COLOR SELECTION CHART

SILIKROMES® will produce colors which conform to the following Military Specifications:

MILITARY SPECIFICATION	COLOR	APM Color Code Recommended for	
		.012 Wall	.023 Wall
MIL-L-25467	Red	R-3	R-14-13
MIL-P-7788	Red	R-3	R-14-13
MIL-L-27160	White		
	Correcting Blue	LW-4	LW-1
M22885/12-01**	Blue		B-12-4
M22885/12-02**	Green		G-1
M22885/12-03**	Red		R-16-4
M22885/12-04**	White		LW-17-14
M22885/12-05**	Yellow		Y-3-3
MIL-C-25050	Red	R-5	
	Yellow		Y-1
	Green		G-13-25
	Blue		B-1
	White		LW-17-14
BuWeps Dwg. 2295235	Red	R-2-12	R-2
	Yellow	Y-1-12	Y-1
	Green	G-1-12	G-1
	Blue	B-1-12	B-1
	White	LW-1-12	LW-1

\*\*QPL per MIL-S-22885/12

## HOW TO ORDER

**Commercial Grade SILIKROMES®**

To order a standard red SILIKROME® for a T-5 lamp, specify APM p/n 1813/46 Red(C)

**Military Grade SILIKROMES®**

To order a red SILIKROME® for a G-3½ lamp which meets MIL-L-25467, specify APM p/n 1813/26 R-14-13 (M)

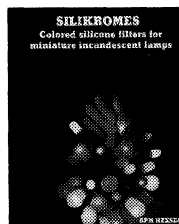
Diagram	Lamp Size	APM Part No.	Overall Height	OD	Wall Thickness
	T-1-3/4	†1813/1	9/32"	9/32"	.023"
	T-1-3/4 T-3-1/4 G-3-1/2	1813/2 1813/8 1813/26	5/16" 11/16" 27/64"	1/4" 7/16" 7/16"	.023" .023" .023"
	T-1-3/4	1843/2	9/32"	19/64"	.023"
	T-5	1813/46	1-3/32"	5/8"	.023"
	T-1 T-3/4 T-3-1/4 T-1-3/4 T-1	1813/22 1813/23 1813/27 1813/31 1813/34	19/64" 7/32" 11/16" 23/64" 5/16"	5/32" 1/8" 13/32" 1/4" 1/8"	.012" .012" .023" .023" .012"
	T-2	1813/14	13/64"	9/32"	.012"
	T-2 T-2	1813/15 1813/20	13/64" 27/64"	9/32" 9/32"	.012"
	S8	1813/16	1-7/32"	1-3/64" ID: 19/32"	.023"
	S6	1813/17	1-15/64"	51/64" ID: 31/64"	.023"

†Meets mounting requirement of MIL-S-22885/12



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### CUSTOM COLORS & SIZES

APM can produce SILIKROMES® to match your chromaticity specifications. For special color requirements or lamp sizes not shown, please consult your factory.

Ask For SILIKROME® Catalog SK100



**Worldwide Sources and Sales,  
Computerized Cross-Referencing  
& Identification**

# Light Bulbs, Sockets, Ballasts for All Applications!

## INDICATOR LAMPS

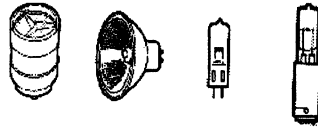


### Foreign & Domestic

Halogen, Xenon, Miniature & Sub-Miniature, Neon, Fluorescent, Incandescent, Telephone Slide, Indicator Lights and Cartridge Lamps

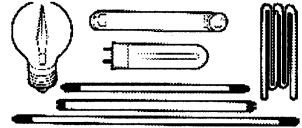
For: Communications, Automotive, Aircraft, Marine, Railroad, Alarm Systems, Elevators, PC Boards, Instrumentation Panels, Electrical & Consumer Products

## FIBER OPTIC, LOW VOLTAGE HALOGEN & XENON



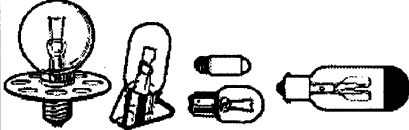
Xenon, Metal Halide, Halogen MR 11 & MR16 Reflector Types (Available with Transverse & Axial Filaments) Lamps For: Point Sources, Projection Systems, Calibration, Microscopes, Audio Visual & Overhead Projectors, Microfiche, Searchlights, Inspection, Test Equipment, Heat Simulation, Medical and Dental

## GERMICIDAL LAMPS



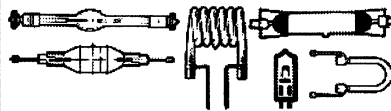
Cold Cathode & Hot Cathode, Slimline, U-Shaped and Grid Short-Wave UV Lamps For: Water Sterilization, Control of Bacteria and Algae, Food Processing, Manufacturing of Cosmetics & Pharmaceuticals, Clean Rooms, Research, Industrial Waste Water, Sanitation, Operating Room, Eprom Erasing & Curing

## OPHTHALMIC LAMPS



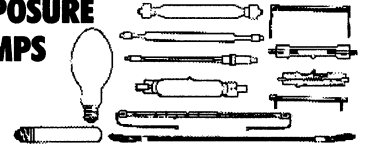
All Slit and Fiber Optic Lamps For: Lensometers, Otoloscopes, Vertometers, Retinoscopes, and Ophthalmoscopes

## GRAPHIC ARTS, REPROGRAPHIC & PRINTING LAMPS



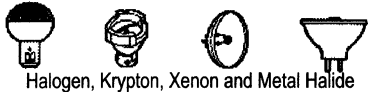
Metal Halide, Halogen, UV, Fluorescent, Xenon and IR Lamps for: Color Separators, Platemakers, Typesetters, Scanners, Paper Cutters, UV Curing and IR Drying

## UV CURING & INFRA-RED EXPOSURE LAMPS



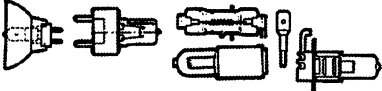
Ultraviolet (Long Wave) Light Sources, Capillary, Blacklight, Blacklight Blue, Infrared, Halogen, Metal Halide & Medium Pressure Mercury Arc Lamps For: UV Curing, Ink Drying, Silk-screening, Laminating, Exposure Systems, Plate Making, PC Board Mfg., Wood Finishing, Metal Decorating, Communications, Clean Room, Inspection, Electronics, Laboratory Research, Analysis, General Laboratory

## MEDICAL, SURGICAL & OPERATING ROOM LAMPS



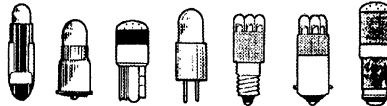
Halogen, Krypton, Xenon and Metal Halide

## DENTAL LAMPS



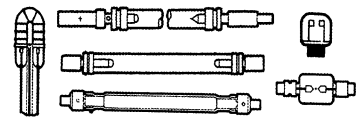
Halogen, UV Curing and Bonding Lamps.

## DISCRETE & BASED LED LAMPS



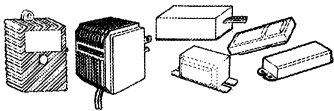
Industry Standard Incandescent Replacement LED's. Single and Multi-chip (Cluster Type). **Wide range of Bases:** Subminiature & Miniature Flange, Groove, Screw, Bayonet, Wedge, Bi-pin. Available in Red, Green, Amber, Yellow, Blue, White. Various intensities are available and built-in resistors offer a range of voltages. **Bulb Sizes Available:** T1, T1 3/4, T3 1/4, and Telephone Slide Sizes are: T4.6, T5.5, T6.8, T2.

## FLASH AND LASER LAMPS



Lamps For: Phototypesetting, Printing, and Semiconductors. Strobes for: Industrial Fabrication, Surgical, Machine Vision, Safety Devices, Inspection

## BALLASTS & TRANSFORMERS Foreign & Domestic



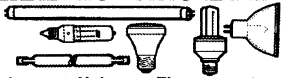
CE, VDE, CSA, UL, etc. Ballasts for Fluorescent, HID, Germicidal, Sign, Compact Fluorescent, Electronic / Magnetic Foreign Voltages Available. Step Down Transformers from 120/220 V to 12/24V

## STARTERS and IGNITORS Foreign and Domestic



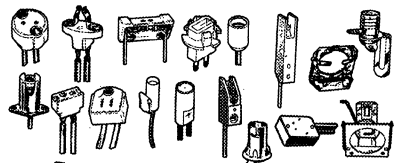
CE, VDE, CSA, UL, etc. Fluorescent, Sign, Metal Halide and High Pressure Sodium

## GENERAL LIGHTING LAMPS, ETC.



Incandescent, Halogen, Fluorescent and HID Lamps For: Energy Saving, Color Corrected and Decorative.

## SOCKETS Foreign & Domestic



CE, VDE, CSA, UL, etc. **Halogen:** Bipin, Double/Single Ended, **Fluorescent:** Bipin (Mini/Medium), Slimline, RDC, **Miniatures:** Wedge, Midget Groove, Single/Double Contact Bayonet. **Incandescent:** Candelabra, Intermediate, Medium, Mogul Screw. **Foreign Bases:** European lamp sockets available.

Call our technical specialists to discuss your application.

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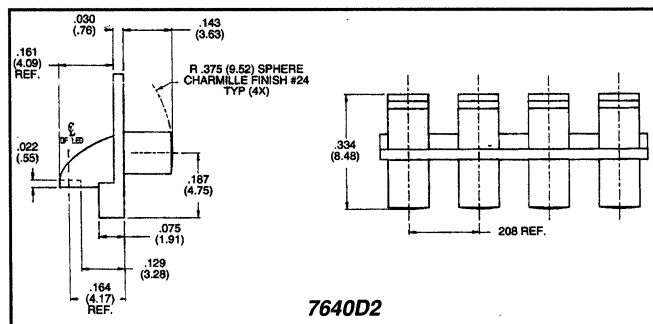
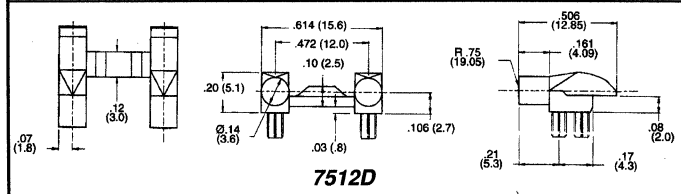
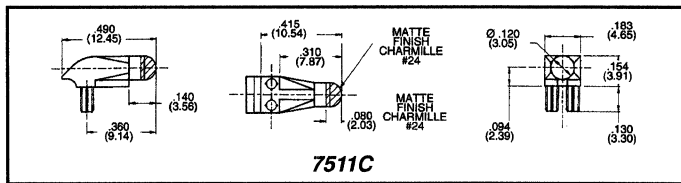
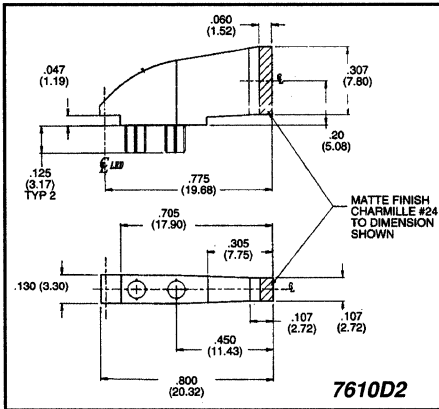
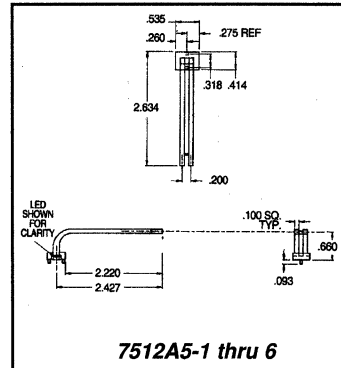
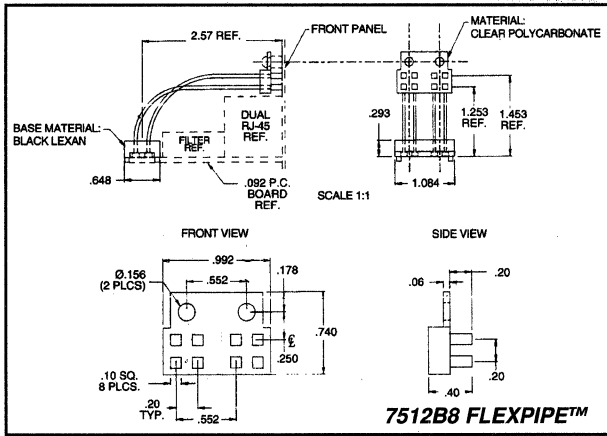
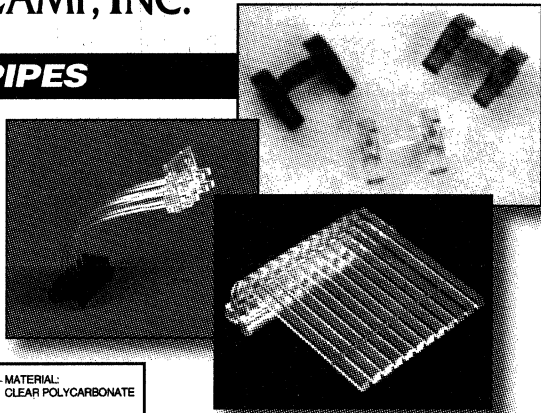


# CHICAGO MINIATURE LAMP, INC.

WHERE INNOVATION COMES TO LIGHT

## Bright•Pipes™ OPTICAL LIGHT PIPES

- Precision engineered with *ray tracing* for bright, optically precise even indication and attractive appearance
- ESD protection from circuitry for exceptional reliability
- Optimized for use with Bright•Chips™ SMT LEDs
- High contrast and wide viewing angle for greater visibility
- Parts inserted after reflow to permit LED pad inspection before assembly
- Compliance to UL94V standards
- High visibility
- All dimensions in inches (mm)



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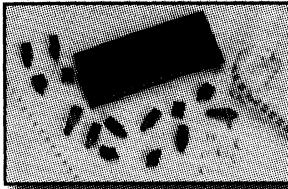




# CHICAGO MINIATURE LAMP, INC.

WHERE INNOVATION COMES TO LIGHT

## SURFACE MOUNT



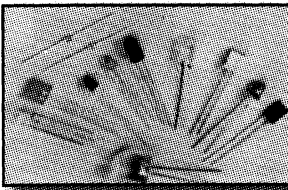
CML offers a wide variety of surface mount lighted components. Discrete, chip type LEDs are available in both vertical and right angle configurations. Single and dual chip versions are available in a variety of colors and intensities.

CML also provides unique, surface mount, right angle Circuit Board Indicator assemblies that improve positioning and visibility in high density applications.

All products are designed to withstand the most demanding process, environmental and reliability requirements. Contact us today with your requirements.

Configuration	Size	Product Series	Color								Characteristics				
			Red	Green	Yellow	Amber	Orange	Blue	Bi-Color	Diffused	Non-Diffused	Water Clear	Luminous Intensity Range (mcd)	Low Current	Integral Resistor
<b>Bright★Chips™</b>													All devices are packaged on tape and reel.		
	1210	CMD11204	♦	♦	♦	♦		♦			♦	1.0-12.0			
	1210	CMD113X4	♦	♦	♦	♦			♦		♦	1.6-22.0			
	3.5 x 2.8 mm	7002X	♦	♦	♦	♦					♦	1.5-17.0			♦
	1206	CMD11504	♦	♦	♦	♦					♦	1.7-2.5			
<b>Bright★Angles™</b>															
	T-3/4	6200T	♦	♦	♦	♦			♦	♦	♦	0.5-5.0		♦	♦
	T-3/4	6255T	♦	♦	♦	♦			♦	♦	♦	0.5-5.0		♦	♦
	T-1	6251T	♦	♦	♦				♦	♦		5.0-10.0			

## LED LAMPS



Light emitting diodes (LEDs) are available in a wide variety of package configurations, colors, intensities, and performance characteristics to suit nearly any application. LEDs provide superior performance under high shock and vibration conditions, achieve application lives in excess of 100,000 hours, and provide for low current operation. LEDs remain a primary choice for low voltage indication.

CML off-the-shelf products include state-of-the-art technologies such as low operating current, bi- and tri-color, sunlight visibility, flashing and integral resistor types. Contact us with your requirements today!

Configuration	Size	Color								Characteristics							
		Red	Green	Yellow	Amber	Orange	Blue	Bi-Color	Tri-Color	Diffused	Non-Diffused	Pale Tint	Water Clear	Luminous Intensity Range (mcd)	Low Current	Bi-Polar	Integral Resistor
	T-3/4	♦	♦	♦	♦				♦	♦	♦	♦	0.5-2.0	♦			
	T-1	♦	♦	♦			♦	♦	♦	♦	♦	♦	1.0-1000	♦	♦	♦	♦
	T-1 3/4	♦	♦	♦	♦				♦	♦	♦	♦	1.0-3000	♦	♦	♦	♦
	T-2 1/2	♦	♦	♦		♦			♦	♦		♦	20.0-3000				
	T-3 1/4	♦	♦	♦					♦	♦		♦	20.0-3000				
	Rectangular	♦	♦	♦	♦				♦	♦			1.0-6.0				
	Popsicle	♦	♦	♦	♦				♦	♦			1.0-3.5				
	Square	♦	♦	♦					♦	♦		♦	2.5-14.0				
	Cylindrical	♦	♦	♦					♦	♦			1.0-16.0				
	Low Profile	♦	♦	♦		♦			♦	♦			0.4-15.0				

Products shown represent merely a sampling of the expansive lighted product line available from CML/IDI

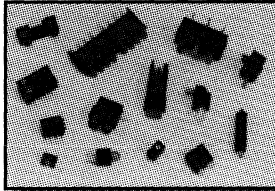
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# CHICAGO MINIATURE LAMP, INC.

WHERE INNOVATION COMES TO LIGHT

## CIRCUIT BOARD INDICATORS

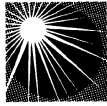


Circuit board indicators provide unique packaging and mounting solutions for LEDs in your application. Circuit Board Indicators offer quick, uniform, secure mounting of LEDs to the printed circuit board.

CML offers one of the broadest assortments of Circuit Board Indicators in the industry, including single and multiple LED configurations, as well as a wide variety of colors and performance characteristics. Many configurations include built-in stand offs to facilitate board cleaning and press-in-pins to assure secure mounting and positioning. We also offer unique gangable configurations providing for user customization. All CML Circuit Board Indicators are designed to meet or exceed the most rigorous industry process, environmental and reliability requirements. Contact us today!

Configuration	Size	Product Series	Color										Characteristics					
			Red	Green	Yellow	Amber	Orange	Bi-Color	Tri-Color	Diffused	Non-Diffused	Pale Tint	Wear Clear	Luminous Intensity Range (mcd)	Low Current	Bi-Polar	Integral Resistor	Gangable
	T-3/4	5350T	♦	♦	♦	♦									50-8.0	♦		♦
	T-3/4	5370T	♦	♦	♦	♦									50-8.0	♦		♦
	T-3/4	547	♦	♦	♦										50-8.0	♦		♦
	T-1	5600F	♦	♦	♦	♦					♦	♦		♦	1.0-1000	♦		♦
	T-1	CMW / CMC	♦	♦	♦					♦	♦			♦	1.0-1000	♦		♦
	T-1	5682F	♦	♦	♦	♦					♦	♦			1.0-1000			
	T-1	5680F	♦	♦	♦	♦									1.0-1000	♦		♦
	T-1	5693F	♦	♦	♦	♦					♦	♦			1.0-1000			
	T-1	5694F	♦	♦	♦	♦					♦	♦			1.0-1000			
	T-1 3/4	5380H	♦	♦	♦	♦			♦		♦	♦		♦	2.5-3000	♦	♦	♦
	T-1 3/4	5300H	♦	♦	♦	♦					♦	♦		♦	2.5-3000	♦	♦	♦
	T-1 3/4	CMI / CMO	♦	♦	♦			♦	♦		♦				2.5-3000	♦		♦
	T-1 3/4	5381H	♦	♦	♦	♦					♦	♦			2.5-3000	♦	♦	♦
	T-1 3/4	5670H	♦	♦	♦	♦					♦	♦		♦	2.5-3000	♦	♦	♦
	T-1 3/4	5305H	♦	♦	♦						♦	♦			5.0-7.0			
	Rectangular	5636D	♦	♦	♦						♦				1.0-6.0			
	Rectangular	5630D	♦	♦	♦						♦				1.0-6.0			
	Rectangular	CMV	♦	♦	♦						♦				1.0-6.0	♦		♦
	Rectangular	CMR	♦	♦	♦						♦				1.0-6.0	♦		♦
	Rectangular	CMS	♦	♦	♦						♦				1.0-6.0	♦		♦
	200-1.00" Stand-Off	SpaceSetter	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	1.0-3000	♦	♦	♦
		Multipak SpaceSetter	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	1.0-3000	♦	♦

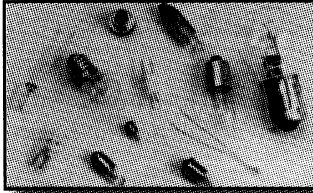
Products shown represent merely a sampling of the expansive lighted product line available from CML/IDI



# CHICAGO MINIATURE LAMP, INC.

WHERE INNOVATION COMES TO LIGHT

## INCANDESCENT LAMPS



CML Incandescent Lamps are available in a vast array of configurations and performance characteristics. The primary advantages of Incandescent Lamps are their bright white light output and their relative low cost. Because of their unique white light output, they are a preferred light source for backlighting, illumination and indication.

CML's broad range of Incandescent Lamps include sizes from .100" to 2" in diameter, operating voltages from 1 volt to 250 volts and light output as high as 10,000 candle power. All lamps are designed to meet or exceed the most rigorous industry requirements. Contact us today!

Configuration	Size	(Approximate Diameter)	Voltage Range	Light Output Range (MSCP)	Base Styles													
					Wire Terminal	Flange	Groove	Screw	Bayonet	Bi-Pin	Wedge	Slide	Neo-Wedge	Other				
	B-3 1/2 (.445")	1.9 - 12.5	15 - 5.23															
	B-6 (.780")	6.0 - 28.0	3.4 - 16.0															
	G-2 (.250")	7.0 - 28.0	.085 - .32															
	G-3 1/2 (.473")	1.25 - 28.0	.02 - 3.5															
	G-4 1/2 (.590")	1.25 - 28.0	.04 - 3.5															
	G-6 (.750")	6.5 - 32.0	3.0 - 6.0															
	S-6 (.750")	6.0 - 250.0	.95 - 4.8															
	S-8 (1.040")	4.0 - 45.5	3.0 - 40.0															
	S-11 (1.420")	6.2 - 28.0	32.0 - 50.0															
	T-3/4 (.094")	1.5 - 28.0	.01 - .20															
	T-1 (.125")	1.25 - 28.0	.005 - .25															
	T-1 1/4 (.168")	1.3 - 28.0	.006 - .63															
	T-1 1/2 (.197")	4.0 - 24.0	.024 - .72															
	T-1 3/4 (.230")	1.3 - 48.0	.01 - .70															
	T-2 (.275")	4.0 - 120.0	End Foot Candles															
	T-3 1/4 (.406")	1.35 - 130.0	.02 - 4.0															
	T-4 1/2 (.588")	6.3 - 28.0	1.5 - 9.0															
	T-5 (.625")	3.5 - 28.0	3.0 - 21.0															
	T-6 1/2 (.813")	6.0 - 150	8.4 - 4.1															
	T-7 (.875")	115 - 125	7.2 - 20.0															
	T-8 (1.060")	115 - 130	11.9 - 16.5															
	TL-3/4 (.094")	5	N/A															
	TL-1 (.125")	1.5 - 5.0	N/A															
	TL-1 3/4 (.230")	2.5 - 14.0	N/A															
	Axial T-2 (.250")	6.0 - 14.0	12 - 1.00															
	Axial T-4 (.500")	6.0 - 32.0	.12 - 3.00															
<b>Gas Filled</b>																		
	T-1 1/2 (.197")	1.5 - 12.0	5 - 2.5															
	T-2 3/4 (.406")	12	10															
	T-3 1/4 (.406")	28	40															
	T-5 (.625")	3.5 - 28.0	3.0 - 21.0															
	B-3 1/2 (.445")	1.9 - 12.5	15 - 5.23															
	Axial	10.0 - 28.0	60 - 230															

Products shown represent merely a sampling of the expansive lighted product line available from CML/IDI

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# Data Display Products

DDP® LEDs  
www.ddp-leds.com

- 100,000-hour life
- Low power consumption
- Shock and vibration resistance
- High reliability

Since 1970, Data Display Products has pioneered the design and development of LED technology to replace incandescent lamps without modification to existing equipment. In addition, DDP manufactures a wide range of packaged LEDs for front panel and board-level indication as well as backlighting of switches, lenses and legends. Our experienced applications engineers are available for technical support, to suggest and provide evaluation samples, or to design innovative custom LED solutions for specific applications.

To receive our full-line catalog, samples, or technical assistance please call: **1-800-421-6815**

## DDP® LED Lamps

### Custom LED Lamps

DDP applications engineers are readily available to answer technical questions regarding DDP® LED technology. Whether designing DDP® LEDs into new OEM products or replacing incandescent bulbs with solid-state DDP® LED lamps, Data Display Products will support your efforts with technical advice and free samples for evaluation.

If a custom design is required, DDP will build to your specification or design a product to fit your application.

e-mail: [techsupport@ddp-leds.com](mailto:techsupport@ddp-leds.com)



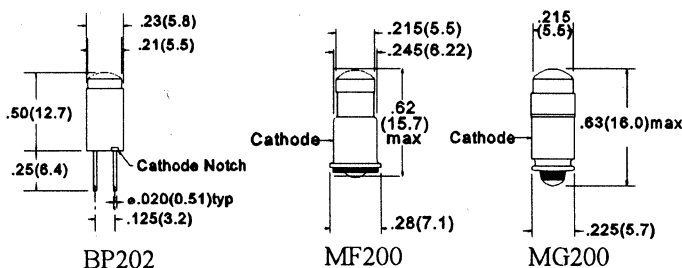
### T-1 3/4 Sub-Miniature Lamps

#### 6-Chip Colors

- Bright Red (660 nm)
- Red (630 nm)
- Orange (610 nm)
- Amber (585 nm)
- Yellow (570 nm)
- Green (565 nm)
- Red/Green (630/565 nm)

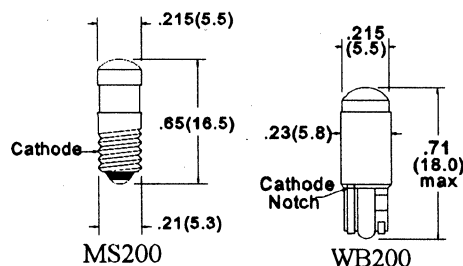
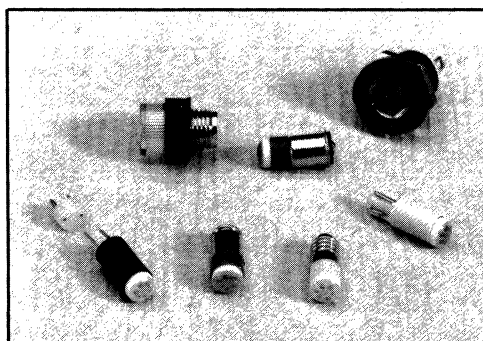
#### Voltage Selection

5 to 120 AC, DC or bi-polar



#### High Intensity Colors

- Red (635 nm)
- Orange (609 nm)
- Amber (592 nm)
- Green (520 nm)
- Blue (465 nm)



Note: All dimensions are in inches (mm).



# Data Display Products

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## DDP® LED Lamps

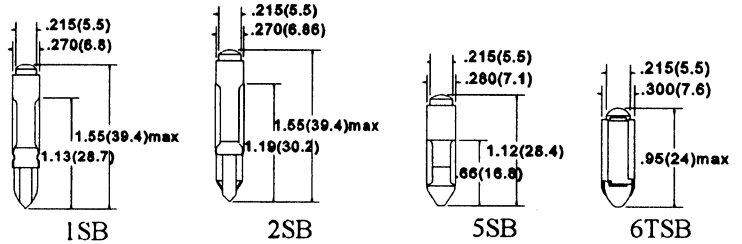
### Slide-Base Lamps

**6-Chip Colors**

- Bright Red (660 nm)
- Red (630 nm)
- Orange (610 nm)
- Amber (585 nm)
- Yellow (570 nm)
- Green (565 nm)
- Red/Green (630/565 nm)

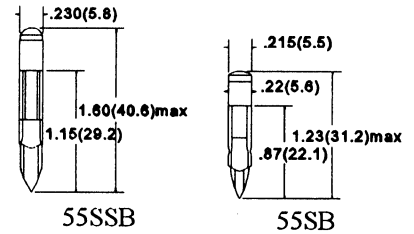
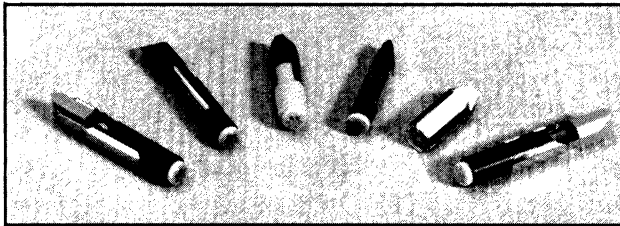
**Voltage Selection**

5 to 120 AC, DC or bi-polar



**High Intensity Colors**

- Red (635 nm)
- Orange (609 nm)
- Amber (592 nm)
- Green (520 nm)
- Blue (465 nm)



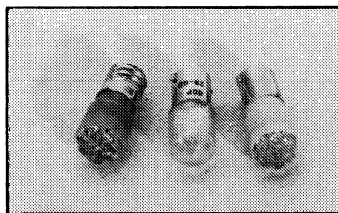
### T-3 1/4 Miniature Lamps

**7-Cluster Colors**

- Red (660 nm)
- Amber (605 nm)
- Amber/Yellow (580 nm)
- Yellow (570 nm)
- Green (555 nm)

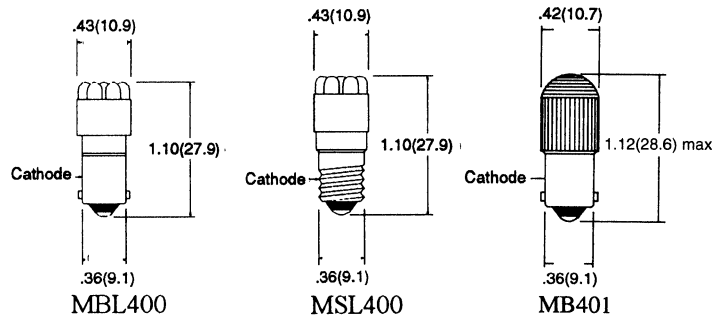
**Voltage Selection**

6 to 120 AC, DC or bi-polar



**MB401 Colors**

- Red (654 nm)
- Amber (592 nm)
- Green (520 nm)
- Blue (465 nm)



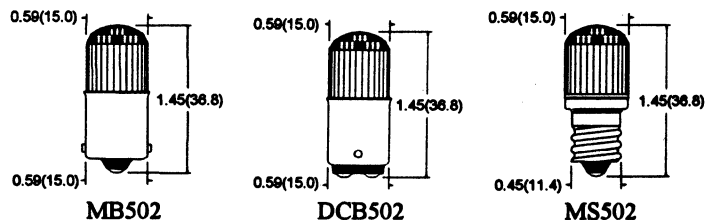
### T-4 1/2 Candelabra Lamps

**Colors**

- Red (635 nm)
- Orange (609 nm)
- Amber (592 nm)
- Green (520 nm)
- Blue (465 nm)

**Voltage Selection**

5 to 120 AC, DC or bi-polar



Note: All dimensions are in inches (mm).



# Data Display Products

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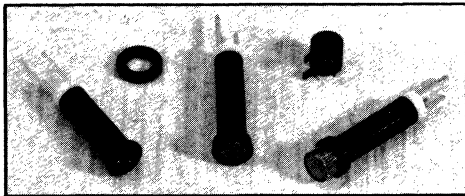
## DDP® Panel-Mount LEDs

### Cartridge Panel Lights

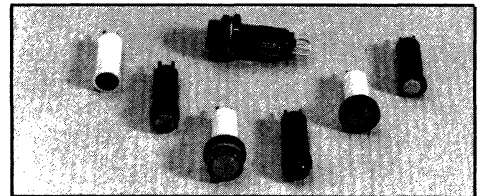
Mounting Diameter	Model	Colors	Voltage Selection
.190"	30 Series	Bright Red (660 nm)	2 to 120 AC, DC or bi-polar
.250"	40 Series	Red (630-635 nm)	
.290"	90 Series	Orange (610 nm)	
.312"	50 Series	Amber (585-605 nm)	
		Amber/Yellow (580 nm)	
		Yellow (570 nm)	
		Green (520-565 nm)	
		Blue (465 nm)	
		Red/Green (635/565 nm)	

**Standard Wire Option**  
6.0" total length/.50" stripped, red anode/black cathode, 24 AWG TPB stranded, UL1061 insulation. Contact factory for other lengths, gauges and colors.

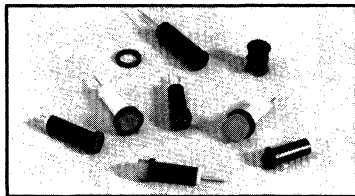
*Note: Some Colors and Voltages are not available with every Model.*



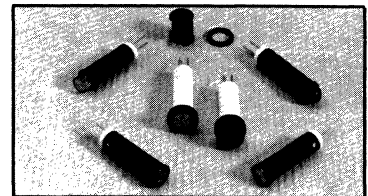
30 Series



90 Series



40 Series

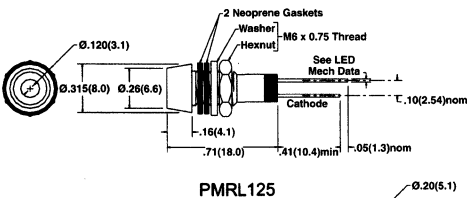
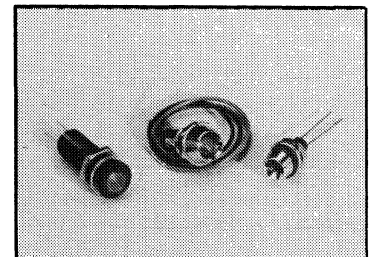


50 Series

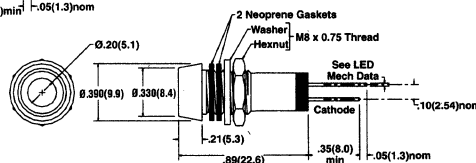
### Bolt-On Panel Lights

Mounting Diameter	Model	Colors	Voltage Selection
.230"	PMRL125	Bright Red (660 nm)	2 to 28 AC, DC or bi-polar (PMR125)
.312"	PMRL200	Red (635 nm)	
.375"	74S	Orange (610 nm)	2 to 120 AC, DC or bi-polar (PMR200 & 74S)
		Amber (583-605 nm)	
		Amber/Yellow (580 nm)	
		Yellow (570 nm)	
		Green (520-565 nm)	
		Blue (465 nm)	

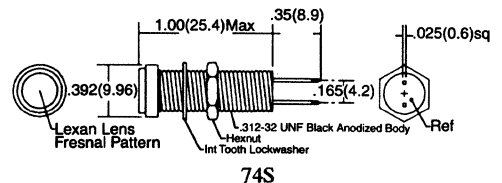
**Standard Wire Option**  
6.0" total length/.50" stripped, red anode/black cathode, 24 AWG TPB stranded, UL1061 insulation. Contact factory for other lengths, gauges and colors.



PMRL125



PMRL200



74S

Note: All dimensions are in inches (mm).

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# Data Display Products

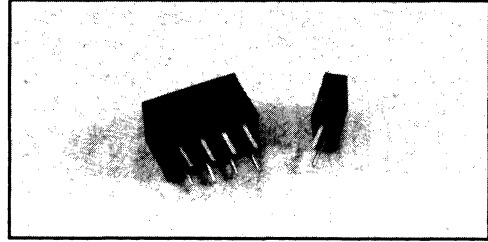
DDP® LEDs  
www.ddp-leds.com

## DDP® PCB-Mount LEDs

### Sub-Miniature

Red (635 nm)  
Amber (583 nm)  
Green (565 nm)

Voltage Selection  
1 to 24 DC

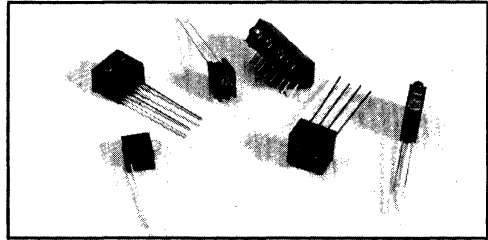


### T-1

Standard (20mA)  
Bright Red (660 nm)  
Red (635 nm)  
Amber (583-605 nm)  
Amber/Yellow (580 nm)  
Yellow (570 nm)  
Green (555-565 nm)

#### Options

Low Power (2mA)  
Bi-Color (Red/Green)  
5V or 12V Integrated Resistor

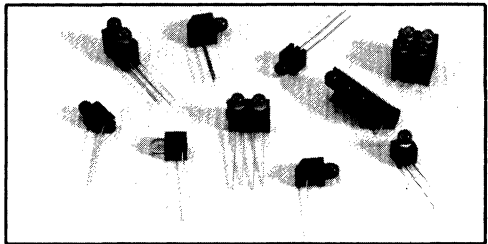


### T-1<sup>3/4</sup>

Standard (20mA)  
Bright Red (660 nm)  
Red (635 nm)  
Amber (583-605 nm)  
Amber/Yellow (580 nm)  
Yellow (570 nm)  
Green (555-565 nm)

#### Options

Low Power (2mA)  
Bi-Color (Red/Green)  
5V or 12V Integrated Resistor  
Tri-Color (Red/Amber/Green)



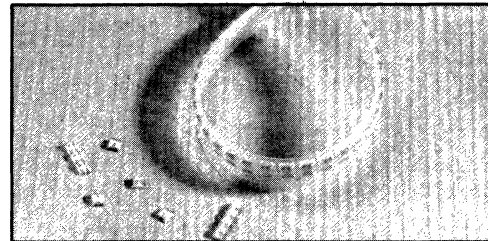
### Surface Mount

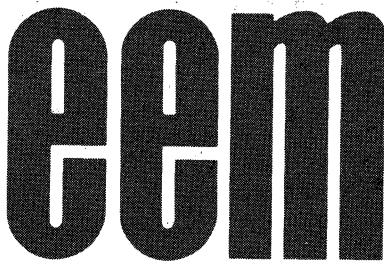
- Ceramic Substrate
- 8mm Tape & Reel

#### Options

Bright Red (660 nm)  
Red (630 nm)  
Orange (610 nm)  
Amber (585 nm)  
Green (565 nm)  
Orange/Green (610/565 nm)  
Bright Red/Green (660/565 nm)

Single-Chip  
Dual-Chip/Bi-Color





# CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity <sup>a</sup>	
						Wh/kg	Wh/dm <sup>3</sup>
<b>Primary:</b>							
Leclanche	Zn	MnO <sub>2</sub>	1.6	230	1.2	65	175
Magnesium	Mg	MnO <sub>2</sub>	2.0	270	1.5	100	195
Organic cathode	Mg	<i>m</i> -DNB	1.8	1,400	1.15	130	180
Alkaline MnO <sub>2</sub>	Zn	MnO <sub>2</sub>	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O <sub>2</sub> )	1.6	815	1.1	200	190
Li-organic electrolyte	Li	<sup>b</sup>	2.1-5.4	130-660	1.8-3.2	250	400
<b>Secondary:</b>							
Lead-acid	Pb	PbO <sub>2</sub>	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air <sup>c</sup>	Zn	Air (O <sub>2</sub> )	1.6	815	1.1	150	155
Cadmium-air <sup>c</sup>	Cd	Air (O <sub>2</sub> )	1.2	475	0.8	90	90
Zinc-O <sub>2</sub>	Zn	O <sub>2</sub>	1.6	610	1.1	130	120
H <sub>2</sub> -O <sub>2</sub>	H <sub>2</sub>	O <sub>2</sub>	1.23	3,000	0.8	45	65
<b>Reserve:</b>							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65 <sup>d</sup>
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95 <sup>d</sup>
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75 <sup>e</sup>
Thermal	Ca	<sup>b</sup>	2.8	240	2.6	10	20 <sup>f</sup>
Ammonia-activated	Mg	<i>m</i> -DNB	2.2	1,400	1.7	22	60 <sup>g</sup>
High- temperature	NA	S	2.1	685	1.8	200	<sup>h</sup>
Solid electrolyte	Li	S	2.2	1,150	1.8	200	<sup>i</sup>
	Ag	Polyiodide	0.66	...	0.6	180	75 <sup>j</sup>
<b>Fuel cell:</b>							
Hydrogen <sup>c</sup>	H <sub>2</sub>	Air	1.23	26,000	0.7		<sup>k</sup>
Hydrazine <sup>c</sup>	N <sub>2</sub> H <sub>4</sub>	Air	1.5	2,100	0.7	800 <sup>b</sup>	<sup>l</sup>
Methanol <sup>c</sup>	CH <sub>2</sub> OH	Air	1.3	1,400	0.9	175 <sup>b</sup>	185 <sup>m</sup>

<sup>a</sup> Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.

<sup>b</sup> Based on fuel consumption only.

<sup>c</sup> Weight of air not considered in computation of watt hours.

<sup>d</sup> Water-activated

<sup>e</sup> Automatically activated; high rate discharge; 2- to 10-min rate.

<sup>f</sup> Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.

<sup>g</sup> Four-minute discharge rate.

<sup>h</sup>  $\beta$ -alumina electrolyte, 300°C operation.

<sup>i</sup> Fused salt; 350°C operation.

<sup>j</sup> Solid RbAg<sub>4</sub>I<sub>5</sub> electrolyte.

<sup>k</sup> Several different cathode materials used.

<sup>l</sup> Fuel consumption is based on source of H<sub>2</sub>.

<sup>m</sup> Based on methanol battery-fuel supply in situ.

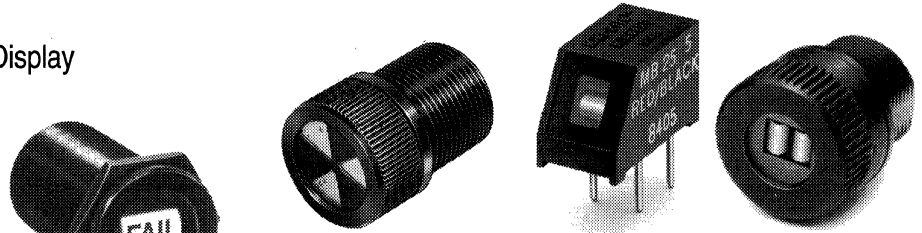


# Non-Volatile Status Indicators

Latching indicators display fault conditions for system maintenance

## Features:

- Electromagnetic Latching Display
- Electrical or manual reset
- Pulse Operated
- High Visibility
- Low Power
- Environmentally Sealed
- Rugged Packaging
- Custom Design
- Commercial & MIL-I-83287



*Status changes are indicated by high contrast color change.*

## MODELS:

- Ball Indicators - Electrical Reset
- Flag Indicators - Manual Reset
- Flag Indicators - Electrical Reset
- PCB Mount Indicators



# LED STATUS INDICATORS

Solid State Indicators Provide System Information

- Environmentally Sealed Standard
- Rugged Packaging
- Sunlight Readable
- Pinpoint or wide-angle viewing area
- EMI Shielding available
- Anti-Reflective Coating optional
- Panel Mount & Rear Mount Designs
- Models available to meet NVIS and Mil-spec requirements
- Custom Design

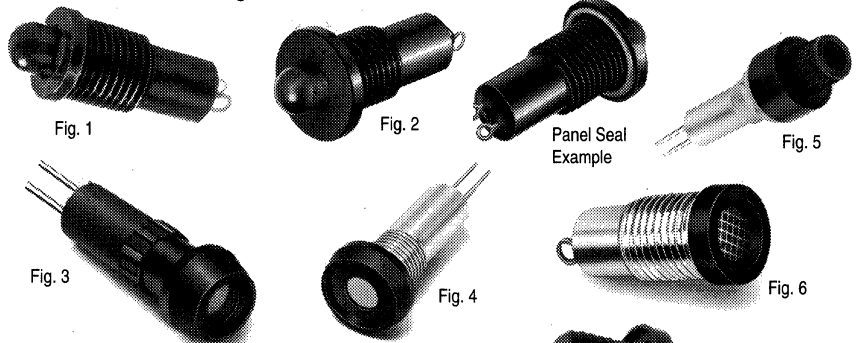
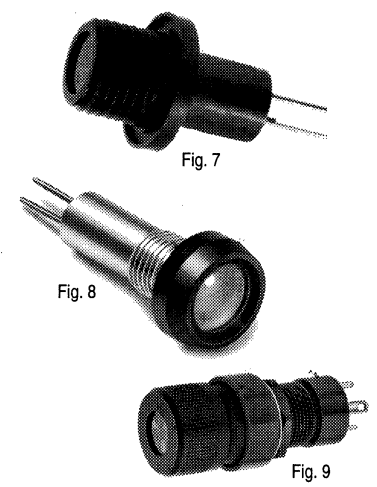


Fig. Models No.	Environ Sealed	Panel Seal	Rear Mount	Front Mount	Dim-able	Internal Resistors	Night Vision	Infrared Secure	EMI Shielded	Bi-Color LED
1. ML1600	•			•						
2. ML1610	•	•		•						
3. ML1618	•	•		•				•		
4. ML1619	•			•				•	•	
5. MLD1619	•			•	•			•		
6. ML1620/ML1630	•	•		•		•			•	
6. ML1622/ML1632	•	•		•		•			•	•
6. ML1623/ML1633	•	•		•		•			•	•
7. ML1634	•		•						Ⓞ	
7. ML1635	•		•						Ⓞ	•
7. ML1636	•		•						Ⓞ	
7. ML1638	•		•				•		Ⓞ	
8. ML1640	•			•				•		
3. ML1662	•			•			•		•	
9. ML1701 (Incandescent)	•			•				•		

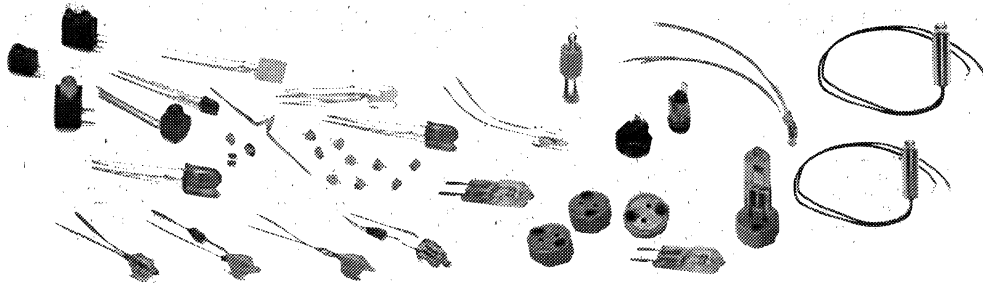
Notes: ① 3-Leaded. ② Internal Resistors for 28VDC usage. ③ MIL-L-85762 ④ DESC Dwg. 87019 & 85122  
 Ⓞ EMI Shielding available as a custom option.



## ELECTRODYNAMICS, INC. MINELCO PRODUCTS

1200 Hicks Road • Rolling Meadows, IL 60008 • Tel: 847.259.0740 • Fax: 847.255.3827 • www.electroD.com • email: info@electroD.com

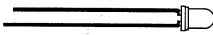
**There are thousands...maybe millions...of light sources out there.  
One is perfect for your application.**



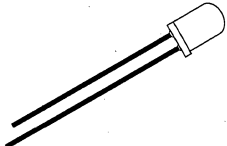
**We can help you find it.**

From UV to Visible and into the IR, our products span the spectrum. They include LEDs, Halogen, neon, lens end, miniature lamps, reflector assemblies and industrial illuminators. We are lamp specialists, and as long as you know our name, you don't have to be. We can help you find the right light source for your design or application. For our complete engineering catalog, call us today or contact us on the web.

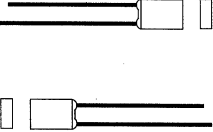
**T-1 LEDs (Very Bright)**

	Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing	1
			Minimum	Maximum		Typical	Maximum			
RED	E100	Clear	90mcd	200mcd	50°	2.1V	3.0V	625nm	1	
ORANGE	E102	Clear	90mcd	200mcd	50°	2.1V	3.0V	610nm	1	
YELLOW	E104	Clear	90mcd	200mcd	50°	2.2V	3.0V	585nm	1	
GREEN	E106	Clear	90mcd	200mcd	50°	2.2V	3.0V	565nm	1	
RED	E112	Diffused	36mcd	100mcd	60°	2.1V	3.0V	625nm	1	
ORANGE	E113	Diffused	36mcd	100mcd	60°	2.1V	3.0V	610nm	1	
YELLOW	E114	Diffused	36mcd	100mcd	60°	2.2V	3.0V	565nm	1	
GREEN	E116	Diffused	36mcd	100mcd	60°	2.2V	3.0V	563nm	1	

**T-1<sup>3/4</sup> LEDs (Very Bright)**

	Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing	2
			Minimum	Maximum		Typical	Maximum			
RED	E118	Diffused	36mcd	100mcd	60°	2.1V	3.0V	625nm	2	
ORANGE	E119	Diffused	36mcd	100mcd	60°	2.1V	3.0V	610nm	2	
YELLOW	E120	Diffused	36mcd	100mcd	60°	2.2V	3.0V	585nm	2	
GREEN	E121	Diffused	36mcd	100mcd	60°	2.2V	3.0V	565nm	2	

**Rectangular LEDs (2 x 5mm)**

	Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing	3
			Minimum	Maximum		Typical	Maximum			
RED	E226	Diffused	40.0mcd	80.0mcd	110°	1.85V	2.5V	660nm	3	
RED	E233	White	40.0mcd	80.0mcd	110°	1.85V	2.5V	660nm	3	
RED	E222	Diffused	0.5mcd	2.0mcd	110°	2.0V	2.5V	625nm	3	
ORANGE	E236	Diffused	3.2mcd	12.5mcd	110°	2.0V	2.5V	610nm	3	
YELLOW	E224	Diffused	2.0mcd	8.0mcd	110°	2.0V	2.5V	590nm	3	
YELLOW	E234	Diffused	7.0mcd	10.0mcd	110°	2.1V	2.5V	590nm	3	
GREEN	E225	Diffused	2.0mcd	8.0mcd	110°	2.0V	2.5V	565nm	3	
GREEN	E235	White	8.0mcd	16.0mcd	110°	2.1V	2.5V	565nm	3	

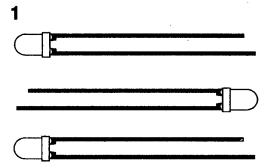
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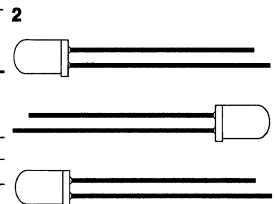
**Ultra Bright Red LEDs: T-1 and T-1<sup>3/4</sup>**

Part No.	Size	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing
			Minimum	Maximum		Typical	Maximum		
RED E169	T-1	Clear	360mcd	500mcd	50°	1.85V	2.5V	660nm	1
RED E170	T-1	Clear	500mcd	700mcd	50°	1.85V	2.5V	660nm	1
RED E171	T-1	Clear	700mcd	1000mcd	50°	1.85V	2.5V	660nm	1
RED E197	T-1	Clear	1200mcd	1400mcd	50°	1.85V	2.5V	660nm	1
RED E181	T-1 <sup>3/4</sup>	Clear	500mcd	1000mcd	30°	1.85V	2.5V	660nm	2
RED E183	T-1 <sup>3/4</sup>	Clear	1000mcd	2000mcd	30°	1.85V	2.5V	660nm	2
RED E184	T-1 <sup>3/4</sup>	Clear	2000mcd	3500mcd	30°	1.85V	2.5V	660nm	2
RED E301	T-1 <sup>3/4</sup>	Diffused	110mcd	200mcd	60°	1.85V	2.5V	660nm	2
RED E303	T-1 <sup>3/4</sup>	Diffused	200mcd	300mcd	60°	1.85V	2.5V	660nm	2
RED E304	T-1 <sup>3/4</sup>	Diffused	300mcd	500mcd	60°	1.85V	2.5V	660nm	2



**Ultra Bright Orange InGaAlP LEDs: T-1 and T-1<sup>3/4</sup>**

Part No.	Size	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing
			Minimum	Maximum		Typical	Maximum		
ORANGE E199	T-1	Trans.	500mcd	1600mcd	50°	1.8V	2.3V	620nm	1
ORANGE E194	T-1 <sup>3/4</sup>	Trans.	1300mcd	3500mcd	30°	1.8V	2.3V	620nm	2



**Ultra Bright Yellow InGaAlP LEDs: T-1 and T-1<sup>3/4</sup>**

Part No.	Size	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing
			Minimum	Maximum		Typical	Maximum		
YELLOW E198	T-1	Trans.	300mcd	1000mcd	50°	2.0V	5.5V	595nm	1
YELLOW E195	T-1 <sup>3/4</sup>	Trans.	400mcd	1600mcd	30°	2.0V	2.5V	595nm	2

**Super Bright Green LEDs: T-1 and T-1<sup>3/4</sup>**

Part No.	Size	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing
			Minimum	Maximum		Typical	Maximum		
GREEN E166	T-1	Clear	200mcd	300mcd	50°	2.2V	2.5V	565nm	1
GREEN E167	T-1 <sup>3/4</sup>	Clear	100mcd	200mcd	30°	2.2V	2.5V	565nm	2
GREEN E168	T-1 <sup>3/4</sup>	Clear	200mcd	300mcd	30°	2.2V	2.5V	565nm	2

**Mega Bright Green LEDs: T-1 and T-1<sup>3/4</sup>**

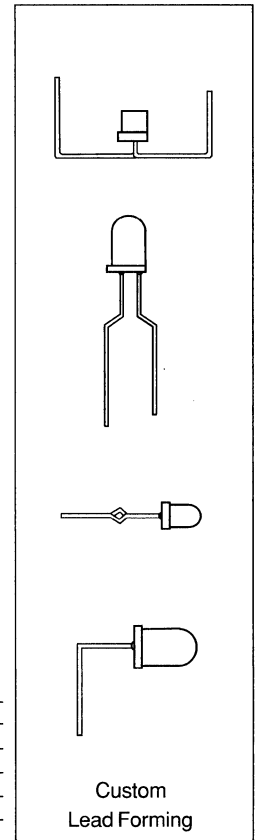
Part No.	Size	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing
			Minimum	Maximum		Typical	Maximum		
GREEN E902	T-1	Clear	2000mcd	3400mcd	15°	3.5V	4.0V	525nm	1
GREEN E903	T-1 <sup>3/4</sup>	Clear	3000mcd	5000mcd	20°	3.5V	4.0V	525nm	2

**Super Bright Blue GaN LEDs: T-1 and T-1<sup>3/4</sup>**

Part No.	Size	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing
			Minimum	Maximum		Typical	Maximum		
BLUE E472	T-1	Clear	20.0mcd	90.0mcd	20°	4.5V	5.5V	430nm	1
BLUE E474	T-1 <sup>3/4</sup>	Clear	60.0mcd	150.0mcd	16°	4.5V	5.5V	430nm	2

**T-1 and T-1<sup>3/4</sup> Low Current LEDs (2mA)**

Part No.	Size	Lens	Luminous Intensity at 2mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing
			Minimum	Maximum		Typical	Maximum		
RED E28	T-1	Diffused	8.0mcd	20.0mcd	60°	1.85V	2.50V	660nm	1
RED E30	T-1	Diffused	0.8mcd	2.0mcd	60°	2.00V	2.50V	625nm	1
YELLOW E31	T-1	Diffused	0.8mcd	2.0mcd	60°	2.10V	2.50V	590nm	1
GREEN E32	T-1	Diffused	0.8mcd	2.0mcd	60°	2.20V	2.50V	565nm	1
RED E29	T-1 <sup>3/4</sup>	Diffused	8.0mcd	20.0mcd	60°	1.85V	2.50V	660nm	2
RED E33	T-1 <sup>3/4</sup>	Diffused	0.8mcd	2.0mcd	60°	2.00V	2.50V	625nm	2
YELLOW E34	T-1 <sup>3/4</sup>	Diffused	0.8mcd	2.0mcd	60°	2.10V	2.50V	590nm	2
GREEN E35	T-1 <sup>3/4</sup>	Diffused	0.8mcd	2.0mcd	60°	2.20V	2.50V	565nm	2



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**T-1<sup>3/4</sup> Bi-Color LEDs (Common Cathode)**

	Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sup>1/2</sup>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing	1
			Minimum	Maximum		Typical	Maximum			
<b>RED &amp; GREEN</b>	E203	White Diffused	20.0 mcd	<b>90.0mcd</b>	60°	2.0V	2.5V	625nm	1	
			20.0 mcd	<b>70.0mcd</b>	60°	2.2V	2.5V	565nm	1	
<b>RED &amp; YELLOW</b>	E205	White Diffused	20.0 mcd	<b>90.0mcd</b>	60°	2.0V	2.5V	625nm	1	
			20.0 mcd	<b>60.0mcd</b>	60°	2.1V	2.5V	590nm	1	
<b>GREEN &amp; YELLOW</b>	E206	White Diffused	20.0 mcd	<b>70.0mcd</b>	60°	2.2V	2.5V	565nm	1	
			20.0 mcd	<b>60.0mcd</b>	60°	2.1V	2.5V	590nm	1	
<b>RED &amp; GREEN</b>	E231	White Diffused	100.0 mcd	<b>300.0mcd</b>	60°	1.85V	2.5V	660nm	1	
			40.0 mcd	<b>80.0mcd</b>	60°	2.2V	2.5V	565nm	1	
<b>RED &amp; GREEN</b>	E232	Clear	300.0 mcd	<b>700.0mcd</b>	30°	1.85V	2.5V	660nm	1	
			80.0 mcd	<b>200.0mcd</b>	30°	2.2V	2.5V	565nm	1	

**T-1<sup>3/4</sup> Bi-Color LED (Common Anode)**

	Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sup>1/2</sup>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing	2
			Minimum	Maximum		Typical	Maximum			
<b>RED &amp; GREEN</b>	E204	Diffused	3.2mcd	<b>8.0mcd</b>	60°	2.0V	2.5V	625nm	2	
			3.2mcd	<b>8.0mcd</b>	60°	2.2V	2.5V	565nm	2	

**T-1 Bi-Color LEDs (2 Leads and 3 Leads)**

	Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sup>1/2</sup>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing	3
			Minimum	Maximum		Typical	Maximum			
<b>RED &amp; GREEN</b>	E207	Diffused	8mcd	<b>40mcd</b>	60°	2.0V	2.5V	625nm	3	
			8mcd	<b>40mcd</b>	60°	2.2V	2.5V	565nm	3	
<b>RED &amp; YELLOW</b>	E208	Diffused	8mcd	<b>40mcd</b>	60°	2.0V	2.5V	625nm	3	
			8mcd	<b>40mcd</b>	60°	2.1V	2.5V	590nm	3	
<b>GREEN &amp; YELLOW</b>	E209	Diffused	8mcd	<b>40mcd</b>	60°	2.2V	2.5V	565nm	3	
			8mcd	<b>40mcd</b>	60°	2.1V	2.5V	590nm	3	
<b>RED &amp; GREEN</b>	E219	White Diffused	12.5mcd	<b>50mcd</b>	60°	2.0V	2.5V	625nm	4	
			12.5mcd	<b>50mcd</b>	60°	2.2V	2.5V	565nm	4	
<b>GREEN &amp; YELLOW</b>	E220	White Diffused	12.5mcd	<b>50mcd</b>	60°	2.2V	2.5V	565nm	4	
			12.5mcd	<b>50mcd</b>	60°	2.1V	2.5V	590nm	4	

**Jumbo Bi-Color LEDs: T-3<sup>1/4</sup>, (10mm)**

	Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sup>1/2</sup>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing	5
			Minimum	Maximum		Typical	Maximum			
<b>RED &amp; GREEN</b>	E187	White Diffused	100mcd	<b>300mcd</b>	50°	1.85V	2.5V	660nm	5	
			40mcd	<b>70mcd</b>	50°	2.2V	2.5V	565nm	5	
<b>RED &amp; GREEN</b>	E188	White Diffused	30mcd	<b>90mcd</b>	60°	2.0V	2.5V	625nm	5	
			20mcd	<b>50mcd</b>	60°	2.2V	2.5V	565nm	5	
<b>GREEN &amp; YELLOW</b>	E189	White Diffused	20mcd	<b>60mcd</b>	60°	2.2V	2.5V	565nm	5	
			20mcd	<b>60mcd</b>	60°	2.1V	2.5V	590nm	5	

**Jumbo LEDs: T-3<sup>1/4</sup>, (10mm)**

	Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sup>1/2</sup>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing	6
			Minimum	Typical		Typical	Maximum			
<b>RED</b>	E186	Diffused	550mcd	<b>650mcd</b>	60°	1.85V	2.5V	660nm	6	
<b>RED</b>	E176	Diffused	20mcd	<b>100mcd</b>	60°	2.0V	2.5V	625nm	6	
<b>YELLOW</b>	E177	Diffused	20mcd	<b>70mcd</b>	60°	2.1V	2.5V	590nm	6	
<b>GREEN</b>	E178	Diffused	20mcd	<b>70mcd</b>	60°	2.2V	2.5V	565nm	6	
<b>ORANGE</b>	E179	Diffused	400mcd	<b>1000mcd</b>	60°	2.2V	2.5V	620nm	6	

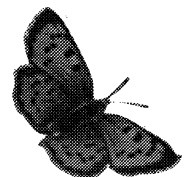
**Mini LEDs**

	Part No.	Lens	Luminous Intensity at 10mA		Viewing Angle 2θ <sup>1/2</sup>	Forward Voltage Peak		Wave Length	Drawing	7
			Min.	Maximum		Min.	Max.			
<b>RED</b>	E260	Translucent	20mcd	<b>60mcd</b>	130°	1.85V	2.5V	660nm	7	
<b>RED</b>	E261	Translucent	4mcd	<b>7mcd</b>	130°	2.0V	2.5V	625nm	7	
<b>ORANGE</b>	E262	Translucent	3mcd	<b>7mcd</b>	130°	2.0V	2.6V	610nm	7	
<b>YELLOW</b>	E263	Translucent	2mcd	<b>3.5mcd</b>	130°	2.1V	2.5V	590nm	7	
<b>GREEN</b>	E264	Translucent	10mcd	<b>16mcd</b>	130°	2.2V	2.5V	565nm	7	

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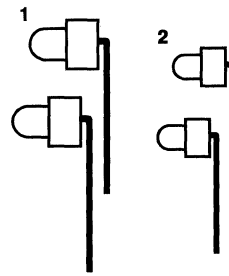
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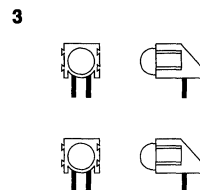
## Right Angle LEDs, T1 and T-1<sup>3/4</sup>

Part No.	Size	Lens	Luminous Intensity at 10mA		Viewing Angle 2θ <sup>1/2</sup>	Forward Voltage at 20mA		Peak Wave Length	Drawing	
			Min.	Maximum		Min.	Max.			
<b>RED</b>	E241	T-1 3/4	Diffused	12.5mcd	<b>32.0mcd</b>	60°	2.0V	2.5V	625nm	1
<b>ORANGE</b>	E242	T-1 3/4	Diffused	12.5mcd	<b>32.0mcd</b>	60°	2.0V	2.6V	610nm	1
<b>YELLOW</b>	E244	T-1 3/4	Diffused	5.0mcd	<b>20.0mcd</b>	60°	2.1V	2.5V	590nm	1
<b>GREEN</b>	E246	T-1 3/4	Diffused	5.0mcd	<b>20.0mcd</b>	60°	2.2V	2.5V	565nm	1
<b>RED</b>	E341	T-1	Diffused	12.5mcd	<b>32.0mcd</b>	60°	2.0V	2.5V	625nm	2
<b>GREEN</b>	E344	T-1	Diffused	5.0mcd	<b>20.0mcd</b>	60°	2.1V	2.5V	590nm	2
<b>YELLOW</b>	E346	T-1	Diffused	5.0mcd	<b>20.0mcd</b>	60°	2.2V	2.5V	565nm	2



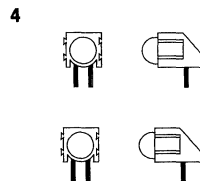
## Right Angle LEDs

Part No.	Lens	Luminous Intensity at 10mA		Viewing Angle 2θ <sup>1/2</sup>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing	
		Minimum	Maximum		Typical	Maximum			
<b>ULTRA BRIGHT RED</b>	EA22	Diffused	100mcd	<b>300mcd</b>	60°	1.85V	2.5V	660nm	3
<b>ULTRA BRIGHT RED</b>	EA27	Clear	1000mcd	<b>2000mcd</b>	30°	1.85V	2.5V	660nm	3
<b>YELLOW</b>	EA20	Diffused	5mcd	<b>20.0mcd</b>	60°	2.1V	2.5V	590nm	3
<b>GREEN</b>	EA21	Diffused	2mcd	<b>12.5mcd</b>	60°	2.2V	2.5V	565nm	3
<b>GREEN</b>	EA25	Diffused	20mcd	<b>60mcd</b>	60°	2.2V	2.5V	565nm	3



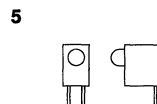
## Right Angle LEDs: Bi-Color

Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sup>1/2</sup>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing	
		Minimum	Maximum		Typical	Maximum			
<b>RED &amp; GREEN</b>	EA28	White Diffused	20mcd	<b>50mcd</b>	60°	2.0V	2.5V	625nm	4
<b>RED &amp; YELLOW</b>	EA29	White Diffused	20mcd	<b>50mcd</b>	60°	2.1V	2.5V	590nm	4
<b>GREEN &amp; YELLOW</b>	EA30	White Diffused	12.5mcd	<b>40mcd</b>	60°	2.2V	2.5V	565nm	4



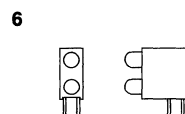
## T-1 Right Angle LEDs

Part No.	Size	Lens	Luminous Intensity at 10mA		Viewing Angle 2θ <sup>1/2</sup>	Forward Voltage at 20mA		Peak Wavelength at 20mA	Drawing	
			Min.	Typical		Min.	Max.			
<b>RED</b>	EA100	T-1	Translucent	360mcd	<b>500mcd</b>	50°	1.8V	2.5V	660nm	5
<b>YELLOW</b>	EA104	T-1	Translucent	20mcd	<b>100mcd</b>	50°	2.1V	2.5V	590nm	5
<b>GREEN</b>	EA106	T-1	Translucent	100mcd	<b>300mcd</b>	50°	2.2V	2.5V	565nm	5



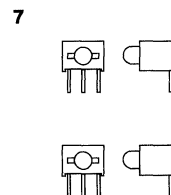
## Bi-Level Right Angle LEDs

Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sup>1/2</sup>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing	
		Minimum	Maximum		Typical	Maximum			
<b>ULTRA BRIGHT RED</b>	EA200	Diffused	100mcd	<b>300mcd</b>	60°	1.85V	2.5V	660nm	6
<b>GREEN</b>	EA201	Diffused	8mcd	<b>32mcd</b>	60°	2.2V	2.5V	565nm	6



## T-1 Right Angle, Low Profile, Bi-Color LEDs

Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sup>1/2</sup>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing	
		Minimum	Maximum		Typical	Maximum			
<b>RED &amp; GREEN</b>	EA202	White Diffused	8.0mcd	<b>40.0mcd</b>	60°	2.0V	2.5V	625nm	7
<b>GREEN &amp; YELLOW</b>	EA207	White Diffused	8.0mcd	<b>40.0mcd</b>	60°	2.2V	2.5V	565nm	7
<b>RED &amp; YELLOW</b>	EA208	White Diffused	8.0mcd	<b>40.0mcd</b>	60°	2.1V	2.5V	590nm	7



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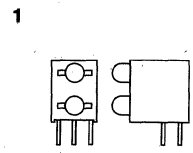
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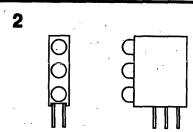
### T-1 Right Angle, Bi-Level, Bi-Color LEDs

Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing	
		Minimum	Maximum		Typical	Maximum			
<b>RED &amp; GREEN</b>	EA203	White	8.0mcd	<b>40.0mcd</b>	60°	2.0V	2.5V	625nm	1
		Diffused	8.0mcd	<b>40.0mcd</b>		2.2V	2.5V	565nm	
<b>GREEN &amp; YELLOW</b>	EA206	White	8.0mcd	<b>40.0mcd</b>	60°	2.2V	2.5V	565nm	1
		Diffused	8.0mcd	<b>40.0mcd</b>		2.1V	2.5V	590nm	
<b>RED &amp; YELLOW</b>	EA205	White	8.0mcd	<b>40.0mcd</b>	60°	2.0V	2.5V	625nm	1
		Diffused	8.0mcd	<b>40.0mcd</b>		2.2V	2.5V	590nm	



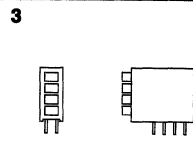
### Tri-Level T-1 LEDs

Part No.	Lens	Luminous Intensity at 10mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing	
		Minimum	Maximum		Typical	Maximum			
<b>RED</b>	EA331	Diffused	12.5mcd	<b>50.0mcd</b>	60°	2.0V	2.5V	625nm	2
<b>GREEN</b>	EA336	Diffused	12.5mcd	<b>50.0mcd</b>	60°	2.2V	2.5V	565nm	2



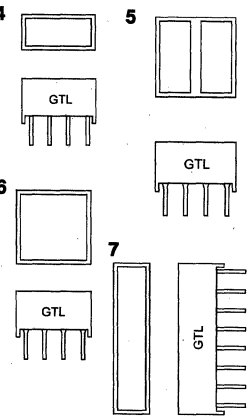
### Quad-Level, Mini LEDs

Part No.	Lens	Luminous Intensity at 10mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing	
		Minimum	Typical		Typical	Maximum			
<b>RED</b>	EA401	Diffused	2.0mcd	<b>12.5mcd</b>	100°	2.0V	2.5V	625nm	3
<b>YELLOW</b>	EA404	Diffused	2.0mcd	<b>5.0mcd</b>	100°	2.1V	2.5V	590nm	3
<b>GREEN</b>	EA406	Diffused	2.0mcd	<b>5.0mcd</b>	100°	2.2V	2.5V	565nm	3



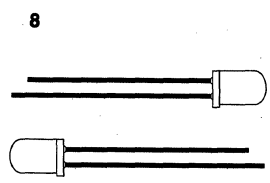
### LED Light Bars

Part No.	Lens	Size(mm)	Luminous Intensity at 20mA		Forward Voltage at 20mA		Peak Wave Length at 20mA	Dwg	
			Minimum	Maximum	Typical	Maximum			
<b>ULTRA BRIGHT RED</b>	E2010	Diffused White	8.89 x 3.81	15.0mcd	<b>40.0mcd</b>	1.85V	2.5V	660nm	4
<b>SUPER BRIGHT GREEN</b>	E2011	Diffused White	8.89 x 3.81	10.0mcd	<b>25.0mcd</b>	2.2V	2.5V	565nm	4
<b>RED &amp; GREEN</b>	E2020	Diffused White	8.89 x 8.89	15.0mcd	<b>40.0mcd</b>	1.85V	2.5V	660nm	5
				10.0mcd	<b>26.0mcd</b>	2.20V	2.5V	565nm	5
<b>ULTRA BRIGHT RED</b>	E2030	Diffused White	19.05 x 3.81	30.0mcd	<b>80.0mcd</b>	1.85V	2.5V	660nm	6
<b>SUPER BRIGHT GREEN</b>	E2031	Diffused White	19.05 x 3.81	20.0mcd	<b>50.0mcd</b>	2.2V	2.5V	565nm	6
<b>ULTRA BRIGHT RED</b>	E2040	Diffused White	8.89 x 8.89	30.0mcd	<b>80.0mcd</b>	1.85V	2.5V	660nm	7
<b>SUPER BRIGHT GREEN</b>	E2041	Diffused White	8.89 x 8.89	20.0mcd	<b>50.0mcd</b>	2.2V	2.5V	565nm	7



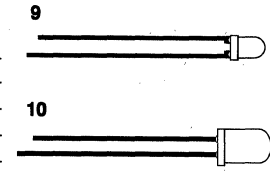
### T-1<sup>3/4</sup> 5 Volt, 12Volt, LEDs

Part No	Lens	Voltage Range		Luminous Intensity		Viewing Angle 2θ <sub>1/2</sub>	Peak Wave Length	Drawing
		Minimum	Maximum	Minimum	Maximum			
<b>RED</b>	E304-5V	Diffused	4.0VDC	6.0VDC	100mcd	500mcd	60°	8
<b>RED</b>	E304-12V	Diffused	9.5VDC	13.0VDC	100mcd	500mcd	60°	8
<b>YELLOW</b>	E149-5V	Diffused	4.0VDC	6.0VDC	5mcd	35mcd	60°	8
<b>YELLOW</b>	E149-12V	Diffused	9.5VDC	13.0VDC	5mcd	35mcd	60°	8
<b>GREEN</b>	E151-5V	Clear	4.0VDC	6.0VDC	20mcd	150mcd	30°	8
<b>GREEN</b>	E151-12V	Diffused	9.5VDC	13.0VDC	30mcd	60mcd	60°	8



### T-1, T-1<sup>3/4</sup> Infrared LEDs: 940nm, 880nm

Part No.	Size	Lens	Radiant Power at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 100mA	Drawing	
			Minimum	Typical		Typical	Maximum			
<b>Infrared</b>	E21	T-1	Clear	2.6mW/sr	<b>3.6mW/sr</b>	30°	1.2V	1.5V	940nm	9
<b>Infrared</b>	E22	T-1	Trans. Blue	3.2mW/sr	<b>7.0mW/sr</b>	30°	1.4V	1.7V	880nm	9
<b>Infrared</b>	E23	T-1 <sup>3/4</sup>	Clear	3.7mW/sr	<b>7.2mW/sr</b>	30°	1.2V	1.5V	940nm	10
<b>Infrared</b>	E24	T-1 <sup>3/4</sup>	Trans. Blue	5.0mW/sr	<b>10.0mW/sr</b>	30°	1.4V	1.7V	880nm	10



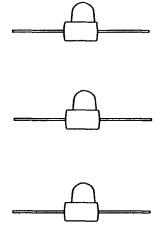
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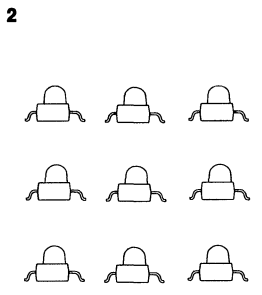
**Axial Lead LEDs**

	Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Dwg
			Minimum	Maximum		Typical	Maximum		
HIGH EFFICIENCY RED	E36A	Translucent	200.0mcd	<b>1000.0mcd</b>	30°	1.85V	2.50V	660nm	1
ULTRA BRIGHT RED	E39A	Translucent	20.0mcd	<b>100.0mcd</b>	30°	2.00V	2.50V	625nm	1
YELLOW	E37A	Translucent	20.0mcd	<b>70.0mcd</b>	30°	2.10V	2.50V	590nm	1
ULTRA BRIGHT YELLOW	E37B	Translucent	700.0mcd	<b>1300.0mcd</b>	30°	2.00V	2.50V	595nm	1
GREEN	E38A	Translucent	20.0mcd	<b>70.0mcd</b>	30°	2.20V	2.50V	565nm	1



**Gull Wing Surface Mount LEDs**

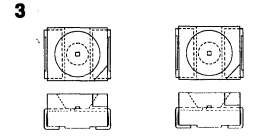
	Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Dwg
			Minimum	Maximum		Typical	Maximum		
ULTRA BRIGHT RED	E90	Translucent	200.0mcd	<b>1000.0mcd</b>	30°	1.85V	2.50V	660nm	2
HIGH EFFICIENCY RED	E91	Translucent	20.0mcd	<b>100.0mcd</b>	30°	2.00V	2.50V	625nm	2
YELLOW	E92	Translucent	20.0mcd	<b>70.0mcd</b>	30°	2.10V	2.50V	590nm	2
ULTRA BRIGHT YELLOW	E95	Translucent	700.0mcd	<b>1300.0mcd</b>	30°	2.00V	2.50V	595nm	2
GREEN	E93	Translucent	20.0mcd	<b>70.0mcd</b>	30°	2.20V	2.50V	565nm	2
PURE GREEN	E94	Clear	10.0mcd	<b>40.0mcd</b>	30°	2.25V	2.60V	555nm	2



Tape and Reel packaging is standard, 1500 LEDs per reel.

**Surface Mount LEDs (also available with 5V or 12V internal resistor)**

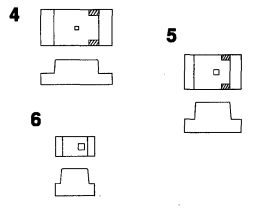
	Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Junction Capacities (V <sub>0</sub> =0 f=1MHz)	Peak Wave Lgth at 20mA	Dwg
			Minimum	Maximum		Typical	Max			
ULTRA BRIGHT RED	E70	Translucent	80.0mcd	<b>120.00mcd</b>	120°	1.85V	2.50V	95pF	660nm	3
HIGH EFFICIENCY RED	E71	Translucent	12.5mcd	<b>30.0mcd</b>	120°	2.00V	2.50V	12pF	625nm	3
YELLOW	E72	Translucent	8.0mcd	<b>20.0mcd</b>	120°	2.10V	2.50V	10pF	590nm	3
GREEN	E73	Translucent	12.5mcd	<b>30.0mcd</b>	120°	2.20V	2.50V	45pF	565nm	3
BLUE	E74	Translucent	2.0mcd	8.0mcd	120°	4.5V	5.5V	100pF	430nm	3
ORANGE	E78	Translucent	12.5mcd	<b>40.0mcd</b>	120°	2.00V	2.6V	15pF	610nm	3



Tape and Reel packaging is standard, 1500 LEDs per reel.

**Low Profile Surface Mount LEDs**

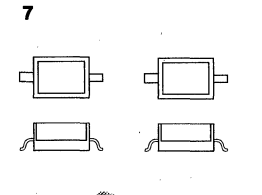
	Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Junction Capacities (V <sub>0</sub> =0 f=1MHz)	Peak Wave Lgth at 20mA	Dwg
			Minimum	Maximum		Typical	Max			
ULTRA BRIGHT RED	E510, E520, E530	Trans.	40.0mcd	<b>70.00mcd</b>	120°	1.85V	2.50V	95pF	660nm	4, 5, 6
HIGH EFFICIENCY RED	E511, E521, E531	Trans.	5.0mcd	<b>12.5mcd</b>	120°	2.00V	2.50V	12pF	625nm	4, 5, 6
YELLOW	E512, E522, E532	Trans.	3.2mcd	<b>8.0mcd</b>	120°	2.10V	2.50V	10pF	590nm	4, 5, 6
GREEN	E513, E523, E533	Trans.	3.2mcd	<b>12.5mcd</b>	120°	2.20V	2.50V	45pF	565nm	4, 5, 6



Tape and Reel packaging is standard, 2000 LEDs per reel.

**Surface Mount LEDs**

	Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Lgth at 20mA	Dwg
			Minimum	Maximum		Typical	Maximum		
ULTRA BRIGHT RED	E80	Translucent	70.0mcd	<b>100mcd</b>	90°	1.85V	2.50V	660nm	7
HIGH EFFICIENCY RED	E81	Translucent	12.5mcd	<b>20.0mcd</b>	90°	2.00V	2.50V	625nm	7
YELLOW	E82	Translucent	5.0mcd	<b>20.0mcd</b>	90°	2.10V	2.50V	590nm	7
GREEN	E83	Translucent	8.0mcd	<b>20.0mcd</b>	90°	2.20V	2.50V	565nm	7

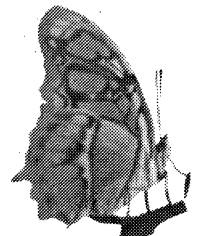


Tape and Reel packaging is standard, 1500 LEDs per reel.

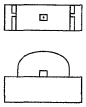
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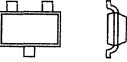


## Right Angle/Side Lighting Surface Mount LEDs

	Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Junction Capacities (V <sub>0</sub> =0 f=1MHz)	Peak Wave Lgth at 20mA	Dwg	1
			Minimum	Maximum		Typical	Max				
<b>ULTRA BRIGHT RED</b>	E540	Translucent	40.0mcd	<b>70.00mcd</b>	120°	1.85V	2.50V	95pF	660nm	1	
<b>HIGH EFFICIENCY RED</b>	E541	Translucent	5.0mcd	<b>12.5mcd</b>	120°	2.00V	2.50V	12pF	625nm	1	
<b>YELLOW</b>	E542	Translucent	3.2mcd	<b>8.0mcd</b>	120°	2.10V	2.50V	10pF	590nm	1	
<b>GREEN</b>	E543	Translucent	3.2mcd	<b>12.5mcd</b>	120°	2.20V	2.50V	45pF	565nm	1	


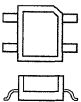


Tape and Reel packaging is standard, 2000 LEDs per reel.

## Surface Mount LEDs, SOT-23 Package

	Part No.	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing	2
		Minimum	Typical		Typical	Maximum			
<b>RED</b>	E40	1.0mcd	<b>3.5mcd</b>	140°	2.1V	2.8V	635nm	2	
<b>YELLOW</b>	E41	1.0mcd	<b>3.0mcd</b>	140°	2.1V	2.8V	585nm	2	
<b>GREEN</b>	E42	1.0mcd	<b>3.0mcd</b>	140°	2.1V	2.8V	565nm	2	

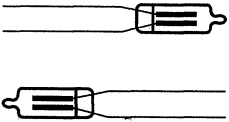
Tape and Reel packaging is standard, 3,000 per reel.

## Bi-Color Surface Mount LEDs

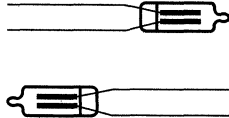
	Part No.	Lens	Luminous Intensity at 20mA		Viewing Angle 2θ <sub>1/2</sub>	Forward Voltage at 20mA		Peak Wave Length at 20mA	Drawing	3	4
			Minimum	Maximum		Typical	Maximum				
<b>RED &amp; GREEN</b>	E76	Clear	12.5mcd	<b>32.0mcd</b>	120°	2.0V	2.5V	625nm	3		
			12.5mcd	<b>32.0mcd</b>	120°	2.2V	2.5V	565nm			
<b>RED &amp; GREEN</b>	E86	White Diffused	8.0mcd	<b>50.0mcd</b>	90°	2.0V	2.5V	625nm	4		
			8.0mcd	<b>50.0mcd</b>	90°	2.2V	2.5V	565nm			

Tape and Reel packaging is standard, 1500 LEDs (E76), 1000 LEDs (E86), per reel.

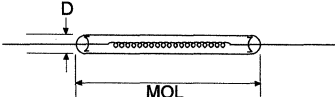
## Neon Glow Lamps (Standard and High Brightness)

Part No.	Color Off	Color On	Circuit Voltage	Breakdown V Maximum		Current mA	mcd	Series Resistor		Average Life (hours)	Diameter	Drawing	5
				AC	DC			115V	220V				
N513	Clear	Red	115/220	65	90	0.3	1.4	150KΩ	480KΩ	30,000	3.2mm	5	
N515	Clear	Red	115/220	65	90	0.3	1.4	150KΩ	480KΩ	40,000	4.2mm	5	
N516	Clear	Red	115/220	65	90	0.3	1.4	150KΩ	480KΩ	50,000	5.2mm	5	
N526	Clear	Red	115/220	65	90	0.3	1.4	150KΩ	480KΩ	50,000	6.0mm	5	
N517	Clear	Red	115/220	95	135	1.0	5.0	47KΩ	150KΩ	20,000	3.2mm	5	
N519	Clear	Red	115/220	95	135	1.0	5.0	47KΩ	150KΩ	20,000	4.2mm	5	
N520	Clear	Red	115/220	95	135	1.0	5.0	47KΩ	150KΩ	25,000	5.2mm	5	
N522	Clear	Red	115/220	95	135	1.0	5.0	47KΩ	150KΩ	25,000	6.0mm	5	

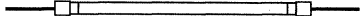
## Green Glow Lamps

Part No.	Color Off	Color On	Circuit Voltage	Breakdown V Maximum		Current mA	mcd	Series Resistor		Average Life (hours)	Diameter	Drawing	6
				AC	DC			115V	220V				
N507	White	Green	115/220	80	-	0.6	3.0	85KΩ	120KΩ	20,000	3.0mm	6	
N527	White	Green	115/220	85	110	1.2	3.0	47KΩ	120KΩ	15,000	4.2mm	6	
N521	White	Green	115/220	85	110	1.2	3.0	47KΩ	120KΩ	15,000	5.2mm	6	
N523	White	Green	115/220	85	110	1.2	3.0	47KΩ	120KΩ	15,000	6.0mm	6	

## Axial Lead Lamps

Part No.	Volts	Amps	M.S.C.P.	Hours	Filament Type	MOL	D	Drawing	7
7163	5.0	.115	0.15	40,000	C-8	17.5	3.2	7	
7160	6.3	.100	0.16	5,000	C-8	24.5	5.0	7	
7161	12.0	.100	0.40	5,000	C-8	20.0	4.2	7	

## Cold Cathode Fluorescent Lamps (Custom sizes also available)

Part No.	Starting Voltage	Lamp Voltage	Current mA	Brightness nt(cd/m <sup>2</sup> )	Effective Length(mm)	Life Hours	Inverter 5V	Inverter 12V	Drawing	8
<b>FL9065</b>	500Vrms	220Vrms	5.0	26,000 min.	35 min	10,000	IN5V1	IN12V1	8	
<b>FL9096</b>	500Vrms	300Vrms	5.0	26,000 min.	65 min	10,000	IN5V1	IN12V1	8	

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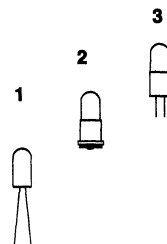
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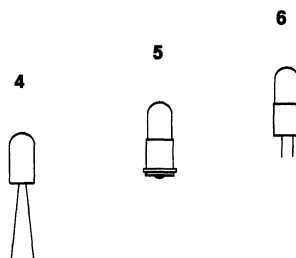
### T-3/4 Subminiature Lamps

Volts	Amps	M.S.C.P.	Hours	Part No. Wire Lead 1	Part No. Flanged 2	Part No. Bi-Pin 3
5.0	.060	.05	100,000	6833	8913	7114
5.0	.060	.15	3,000	6153	6183	7115
5.0	.075	.09	25,000	7133	8828	7116
5.0	.115	.20	5,000	7102	7123	7119
12.0	.060	.15	16,000	L51	L52	L53
14.0	.050	.13	16,000	L54	L55	L56
28.0	.024	.10	16,000	L57	L58	L59



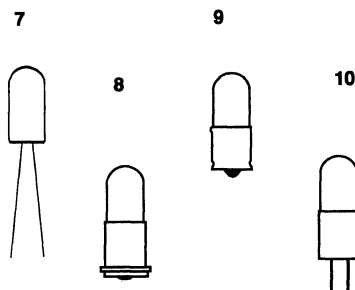
### T-1 Subminiature Lamps

Volts	Amps	M.S.C.P.	Hours	Part No. Wire Lead 4	Part No. Flanged 5	Part No. Bi-Pin 6
5.0	.021	.034	10,000	6022	8022	7022
5.0	.060	.15	5,000	6150	6180	7265
5.0	.075	.09	25,000	713	714	7714
5.0	.115	.15	40,000	715	718	7715
5.0	.125	.22	5,000	7216	7239	7268
10.0	.027	.10	10,000	7218	7240	8095
12.0	.060	.15	16,000	7219	32	8097
14.0	.065	.15	16,000	8111	8112	8098
18.0	.026	.15	16,000	7220	7241	8099
28.0	.024	.15	16,000	6838	6839	7839



### T-1 3/4 Subminiature Lamps

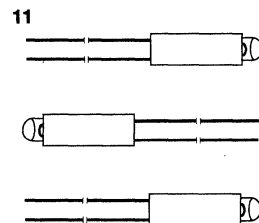
Volts	Amps	M.S.C.P.	Hours	Part No. Wire Lead 7	Part No. Flanged 8	Part No. Grooved 9	Part No. Bi-Pin 10
3.0	.03	.02	1,800	2156	7329	7343	7358
5.0	.06	.15	5,000	3151	3150	3152	3149
5.0	.115	.15	40,000	2203	7335	7348	7362
5.0	.19	.45	1,000	8784	7334	7350	7363
6.0	.04	.03	10,000	1730	345	8705	7945
6.0	.20	.60	1,000	1784	328	337	7328
6.0	.22	.63	3,000	1784L	7337	337L	7365
6.3	.04	.02	50,000	2180	380	7351	7380
6.3	.20	.40	50,000	2181	381	379	7381
6.3	.20	.55	3,000	2112	349	398	7349
10.0	.014	.002	10,000	1869	344	709	7344
10.0	.04	.08	5,000	2107	367	397	7367
11.0	.022	.03	10,000	8946	7338	7353	7369
12.0	.04	.12	10,000	2174	394	7354	7394
14.0	.08	.30	50,000	2182	382	386	7382
14.0	.08	.50	750	1705	330	336	7330
14.0	.100	.50	10,000	2162	8918	393	7373
18.0	.04	.15	10,000	2102	370	346	7370
22.0	.04	.30	2,000	8425	459	457	7459
28.0	.04	.20	50,000	2185	385	7355	7374
28.0	.04	.30	25,000	2187	387	388	7387
28.0	.04	.34	7,000	1764	327	334	7327



Additional subminiature lamps available. Please call for details

### Focused Lens-End Lamps

Part No.	Volts	Amps	Lux	Color Temp. (° Kelvin)	Hours	Vacuum or Gas	Filament Type	Base Type	Drawing
L1005	2.5	.350	1,550	2,200	25,000	V	C-6	Brass	11
L1023	2.5	.350	2,100	2,240	15,000	V	C-6	Brass	11
L1006	3.5	.450	1,600	2,230	30,000	G	C-6	Brass	11
L1024	3.5	.560	3,800	2,490	4,500	G	C-6	Brass	11
L1021	3.5	.600	12,000	2,850	100	Krypton	C-6	Brass	11
L1030	3.5	1.2	16,000	2,950	150	Halogen	C-6	Brass	11
L1007	5.0	.160	880	2,300	12,500	V	C-2R	Brass	11
L1025	5.0	.240	1,200	2,450	10,000	V	C-2R	Brass	11
L1041	5.0	1.35	17,000	2,800	1,500	Halogen	C-6	Brass	11



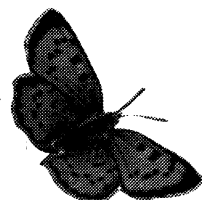
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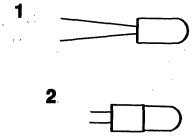
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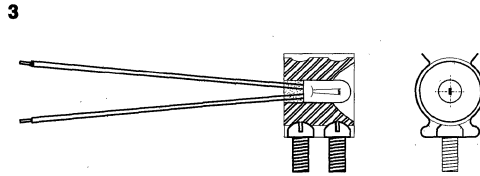
### T-3/4 and T-1 Visible/Infrared Lamps

Volts	Size	Amps	M.S.C.P.	Hours	Filament Type	Part No. Wire Lead 1	Part No. BI-Pin 2
5.0	T-3/4	0.115	0.150	40,000	CC-6	4115	4115-2A
5.0	T-1	0.045	0.060	10,000	CC-6	1045	1045-9A
5.0	T-1	0.060	0.050	100,000	CC-6	1600	1600-9A
5.0	T-1	0.115	0.150	40,000	CC-6	1150	1150-9A
5.0	T-1	0.140	0.200	18,000	CC-6	1088	1088-9A

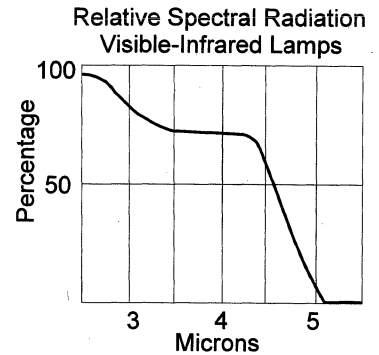


### MR3 Reflector Lamp Assemblies

Part Number	Volts	Amps	M.S.C.P.	Life Hours	Filament Type	Reflector	Drawing
1150-3	5.0	0.115	0.150	40,000	CC-6	Polished Aluminum	3
1088-3	5.0	0.140	0.200	18,000	CC-6	Polished Aluminum	3

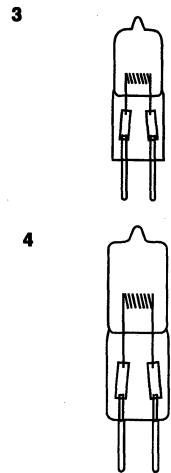


Also available with threaded reflector and lamp base for easy customization of focal distance.



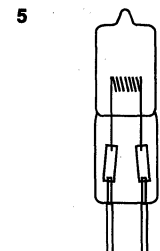
### Halogen Lamps

Part No.	Volts	Watts	Lumens	Color Temp. (° Kelvin)	Hours	Filament Type	D	Dimensions MOL	LCL	Base Type	Drawing
L7387	6.0	10	180	3,150	100	C-6	9.0	30	19.5	G-4	3
L6402	6.0	10	130	2,850	2,000	C-6	9.0	30	19.5	G-4	3
L6414	6.0	10	150	2,950	1,000	C-6	9.0	30	19.5	G-4	3
L7388	6.0	20	420	3,200	100	C-6	9.0	30	19.5	G-4	3
L7394A	6.0	20	325	2,950	2,000	C-6	9.0	30	19.5	G-4	3
L6415	12.0	10	120	2,800	2,000	C-6	9.0	30	19.5	G-4	3
L6416	12.0	15	210	2,900	1,000	C-6	9.0	30	19.5	G-4	3
L7401	12.0	20	420	3,150	250	C-6	9.0	30	19.5	G-4	3
L7404	12.0	20	350	3,000	2,000	C-6	9.0	30	19.5	G-4	3
L7414A	12.0	35	560	2,900	2,000	C-6	9.0	30	19.5	G-4	3
L7389A	12.0	50	900	3,000	2,000	C-6	11.0	44	30.0	GY6.35	4
L7386A	12.0	75	1,400	3,000	2,000	C-6	11.0	44	30.0	GY6.35	4
L7390A	12.0	100	2,000	3,000	2,000	C-BAR6	11.0	44	30.0	GY6.35	4
L7407	12.0	100	3,000	3,400	50	C-BAR6	11.0	44	30.0	G6.35	4
L6405	24.0	150	4,700	3,400	50	C-BAR6	13.5	50	32.0	G6.35	4



### Halogen Projection Lamps

Part No.	Volts	Watts	Lumens	Color Temp. Degrees Kelvin	Life In Hours	Filament Type	D	Dimensions MOL	LCL	Base Type	Drawing
L7418	24	250	6,750	3,250	300	C-Bar-6	14.5	57	33	GY6.35	5
L7419	36	400	14,000	3,400	50	C-Bar-6	18.0	60	36	GY6.35	5
L7420	36	400	10,500	3,250	300	C-Bar-6	19.5	60	36	GY6.35	5
L7421	120	100	1,900	3,000	200	CC-6	13.5	50	30	GY6.35	5
L7422	120	150	3,300	3,050	200	CC-6	13.5	50	30	GY6.35	5
L7423	120	250	5,750	3,100	300	CC-6	16.0	50	33	GY6.35	5



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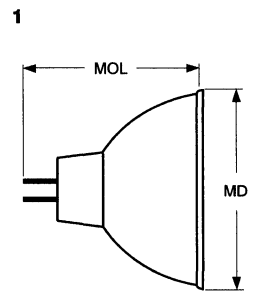
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### MR11 and MR16 Halogen Lamps with Dichroic Reflectors

Part No.	Volts	Watts	Color Temp. Degrees Kelvin	Life In Hours	Filament Type	Beam Angle	Dimensions		Lamp Type	Drawing
							MD	MOL		
L518	6.0	10	2,925	2,000	C-6	11°	36	35	GZ4	1
L524	6.0	20	2,925	2,000	C-6	10°	36	35	GZ4	1
L517A	12.0	12	2,925	2,000	C-6	8°	36	35	GZ4	1
L519	12.0	20	2,925	2,000	C-6	11°	36	35	GZ4	1
L514	12.0	35	2,950	2,000	C-6	12°	36	35	GZ4	1
L526	24.0	20	2,925	2,000	CC-6	15°	36	35	GZ4	1
L515	12.0	20	2,925	4,000	C-6	11°	50	45	GX5.3	1
L520	12.0	42	3,050	4,000	C-6	12°	50	45	GX5.3	1
L521	12.0	50	3,050	4,000	C-6	13°	50	45	GX5.3	1
L522	12.0	65	3,050	4,000	C-6	13°	50	45	GX5.3	1
L523	12.0	75	3,050	4,000	C-6	14°	50	45	GX5.3	1

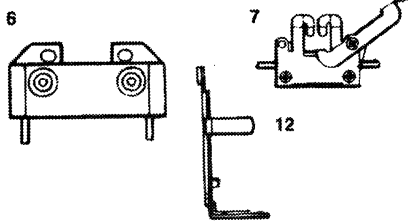
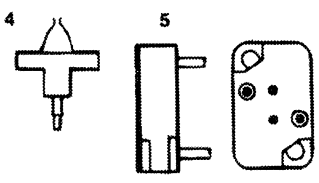
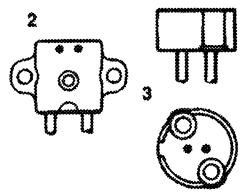
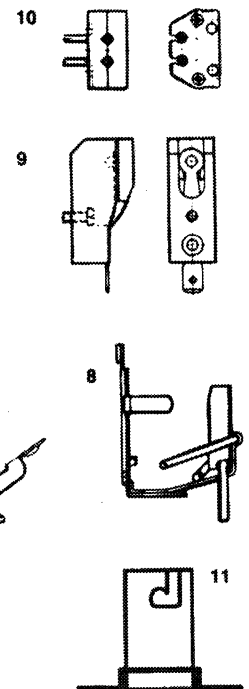


### MR16 Halogen Lamps with focused Ellipsoidal Dichroic Reflectors

Part No.	Volts	Watts	Color Temp. Degrees Kelvin	Life In Hours	Filament Type	Focal Distance	Dimensions		Lamp Type	Drawing
							MD	MOL		
L6408	12.0	75	3,000	1,500	C-8I	32	50	42	GZ6.35	1
L6409 (EKE)	21.0	150	3,250	200	CC-6	44	50	45	GX5.3	1

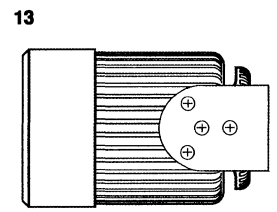
### Halogen Lamp Holders

Part No.	Halogen Lamp Base Types	Drawing
H9901	G-4, GZ4, MR-11	2
H9941	G-4, GZ4, MR-11	3
H997	G-4	4
H912	GY6.35, G6.35, MR-16	3
H701	GY6.35, G6.35, MR-16	5
H910	G6.35	6
H881	G6.35, GZ6.35	10
H9971	GY9.5, Snaplock	7
H705	GZ6.35, MR-16	8
H706	GX5.3, MR-16	8
H867	GY5.3, MR-16	8
H989	GX5.3, MR-16	3
H9431	R7s	9
HT258	Bayonet Double Contact	11
H707	MR16	12
H708	MR11	12



### Halogen Illuminators

Part No.	For Lamp Types	Maximum Diameter	Maximum Length	Material	Drawing
MR1100	MR11	2"	3 1/8"	CAST ALUMINUM	13
MR1600	MR16	2 3/4"	3 5/8"	CAST ALUMINUM	13



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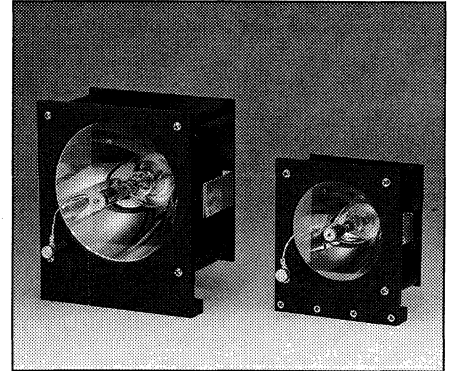
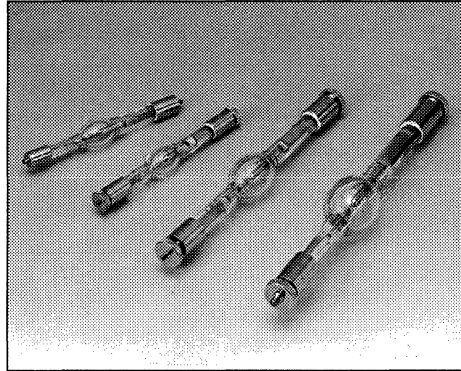


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## SUPER QUIET XENON LAMPS - CONTINUOUS MODE



Part Number	Wattage	Guaranteed Life*	Average Life	Arc Gap	Notes
L2193	35 W	1000 hours	2000 hours	1.0 mm	Barium-Impregnated Electrodes
L2194	75 W	1000 hours	2000 hours	1.3 mm	Barium-Impregnated Electrodes
L2274	150 W	1800 hours	3000 hours	2.0 mm	Barium-Impregnated Electrodes
L2480	300 W	1000 hours	2000 hours	3.0 mm	Barium-Impregnated Electrodes

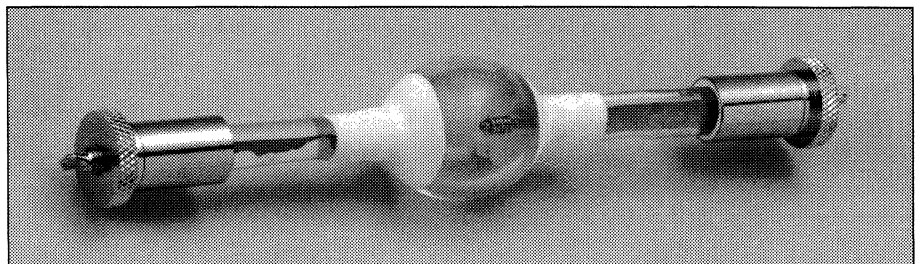
\*or 1 year, whichever comes first

## SUPER QUIET MERCURY-XENON LAMPS - CONTINUOUS MODE

Part Number	Wattage	Guaranteed Life*	Average Life	Arc Gap	Notes
L2481	75 W	500 hours	1000 hours	1.0 mm	Barium-Impregnated Electrodes
L2422	100 W	500 hours	1000 hours	1.3 mm	Barium-Impregnated Electrodes
L2423	200 W	1000 hours	2000 hours	2.0 mm	Barium-Impregnated Electrodes
L2483	350 W	500 hours	1000 hours	2.5 mm	Barium-Impregnated Electrodes

\*or 1 year, whichever comes first

## METAL HALIDE LAMPS



Part Number	Wattage	Average Life	Arc Gap	Notes
L5431	575 W	3000 hours	7.0 mm	Double Halogen Cycle
L6046	250 W	1000 hours	4.0 mm	Double Halogen Cycle
L6002	150 W	1000 hours	3.0 mm	Double Halogen Cycle

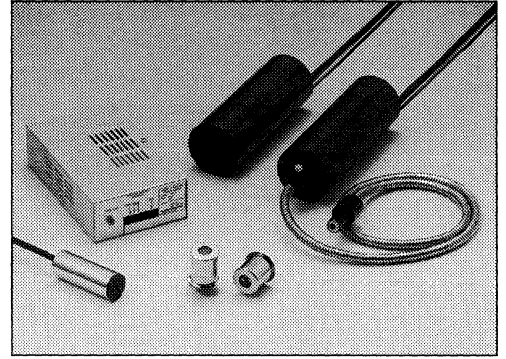
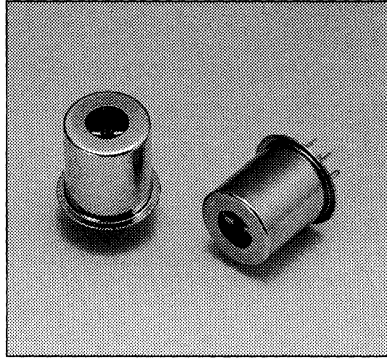
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## 60 W XENON FLASH LAMPS



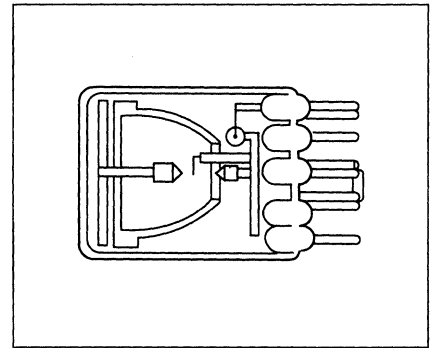
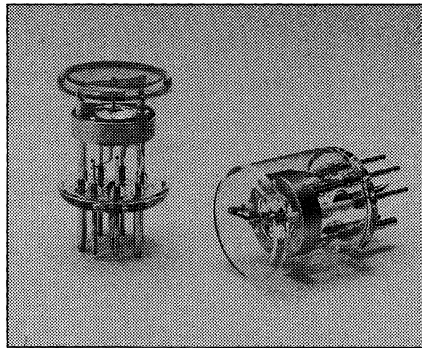
Part Number	Max Rep Rate	Guaranteed Life *	Arc Gap	Bulb Diameter	Notes
L6604	30 Hz	20 Million Flashes	3 mm	28.9 mm	Borosilicate Glass
L6605	30 Hz	20 Million Flashes	3 mm	28.9 mm	Sapphire Glass

\*or 1 year, whichever comes first

## ACCESSORIES FOR ABOVE LAMPS

Part Number	Product Name	Input Voltage	Package Size	Notes
E6647	Trigger Socket	-	28.5 Dia x 73.5 mm	High Voltage Transformer/Voltage Divider/Capacitors
C6096	Power Supply	24 v DC	49 x 108 x 174 mm	Output V: 300 V to 2000 Vdc/Stability: ±0.1 max.
E6611	Cooling Jacket	24 v DC	62.0 Dia x 175 mm	Must be used for the operation of more than 15W input
E7289	Capacitor Box	-	55 x 98 x 160 mm	Exclusive Main Discharge Capacitor (4μF)

## XENON FLASH LAMPS WITH INTEGRAL REFLECTOR



Part Number	Max Rep Rate	Guaranteed Life *	Arc Gap	Bulb Diameter	Notes
L4633	100 Hz	500 Million Flashes	1.5 mm	26 mm	w / Converting Reflector

\*or 1 year, whichever comes first

## POWER SUPPLIES FOR ABOVE LAMPS

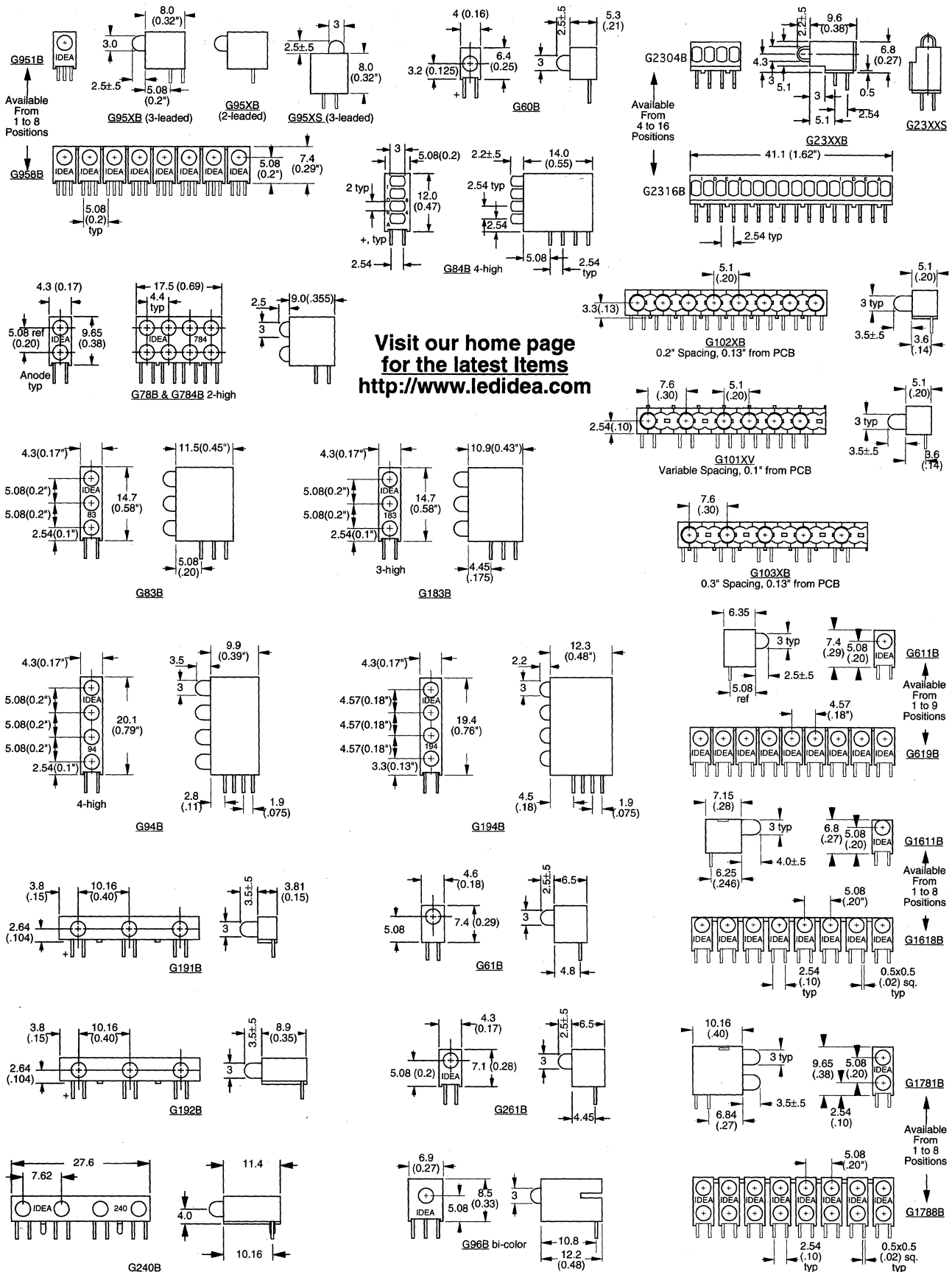
Part Number	Applicable Lamps	Package Size	Input Voltage	Notes
C3684	All Hamamatsu Xenon Flash Lamps*	157 x 102 x 45 mm	24 v DC	OEM Style, Output Capacity: 15W
C4479		265 x 210 x 60 mm	110 v AC	Bench-top Style
C5398		154 x 75 x 43 mm	12 v DC	OEM Style, Output Capacity: 5W
C5728		100 x 29 x 25 mm	12 v DC	OEM Style, Output Capacity: 10W

\*Trigger socket sold separately

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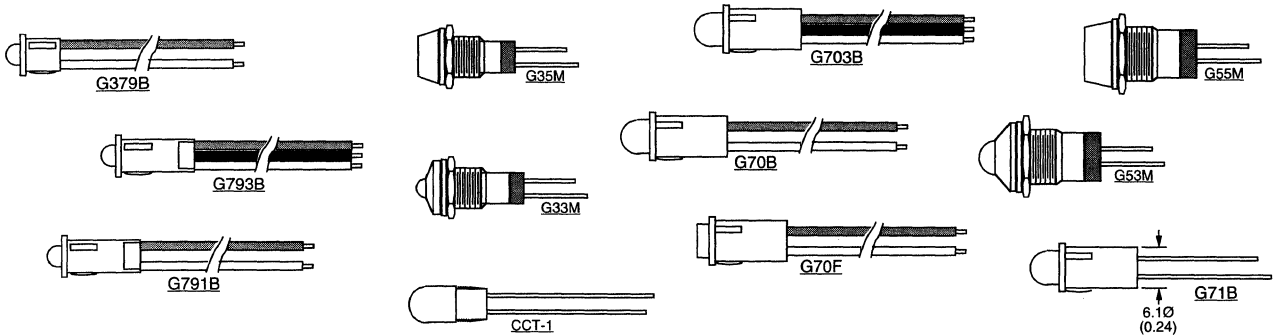
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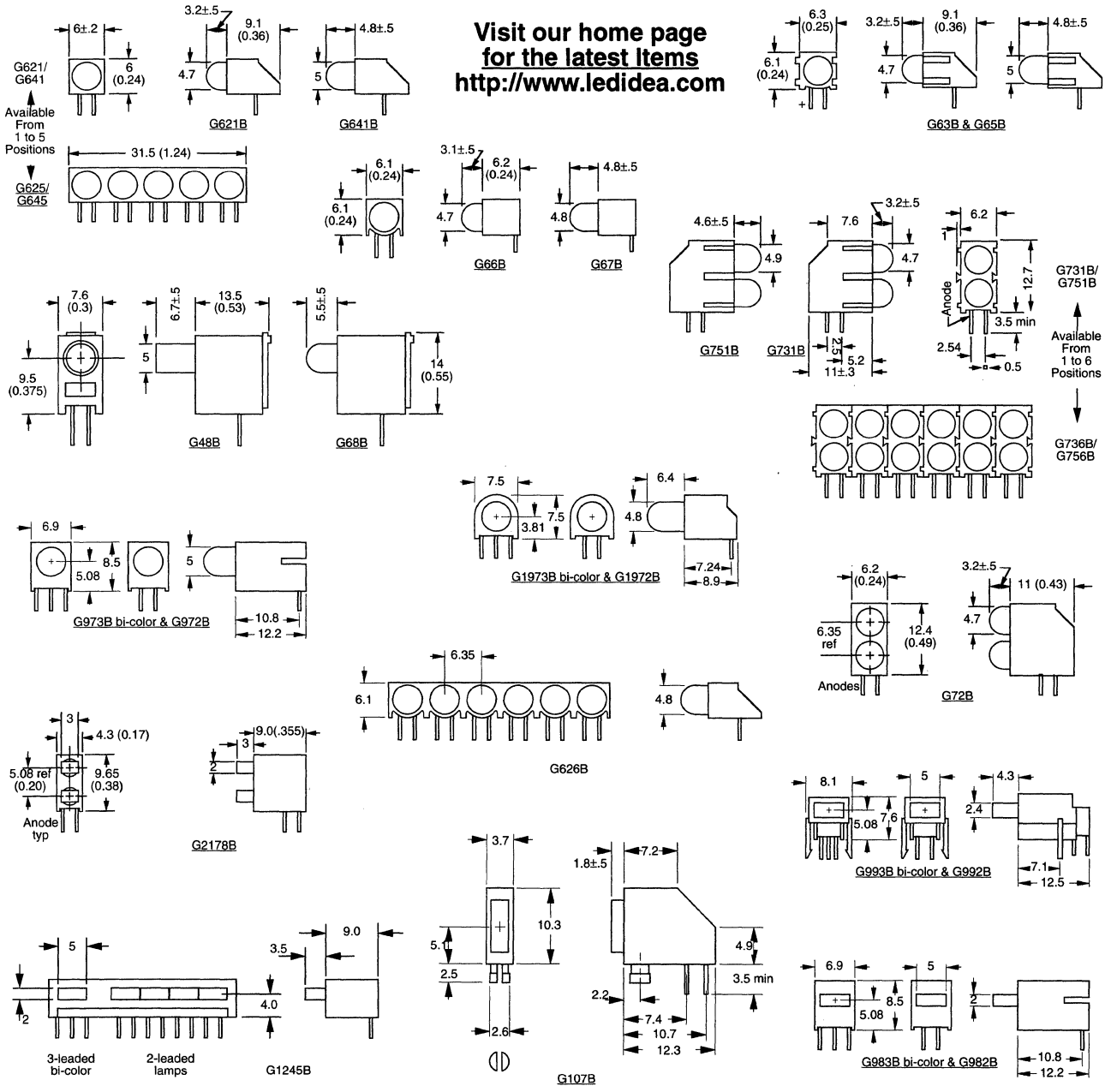


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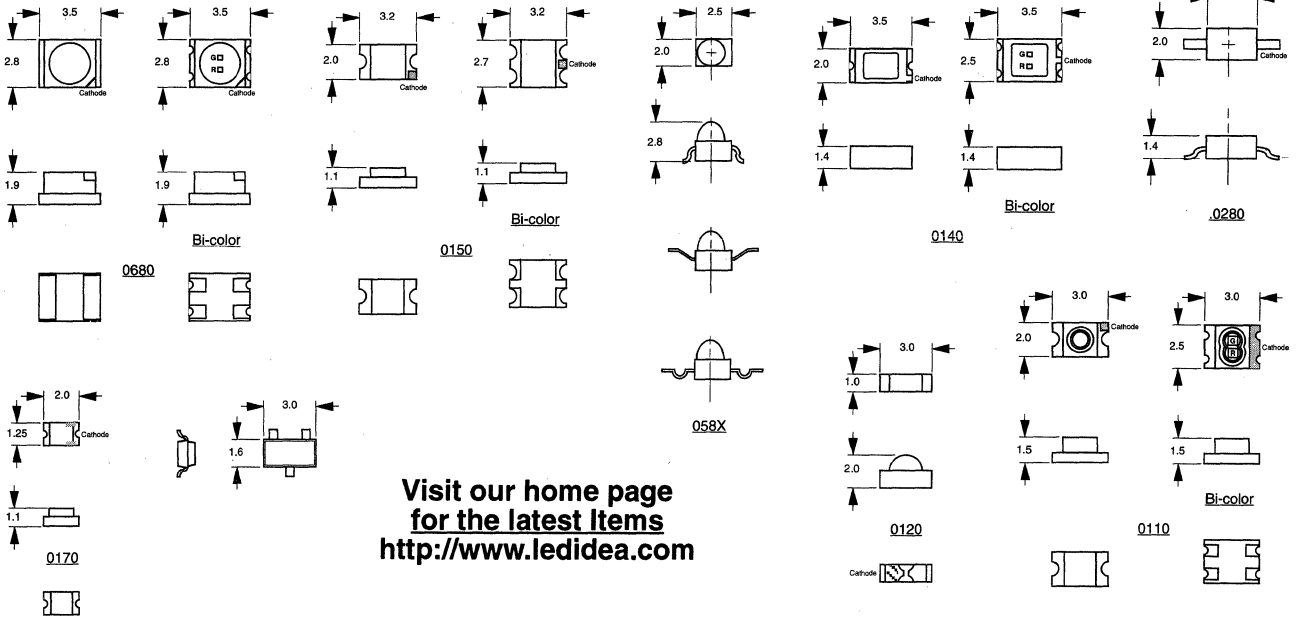


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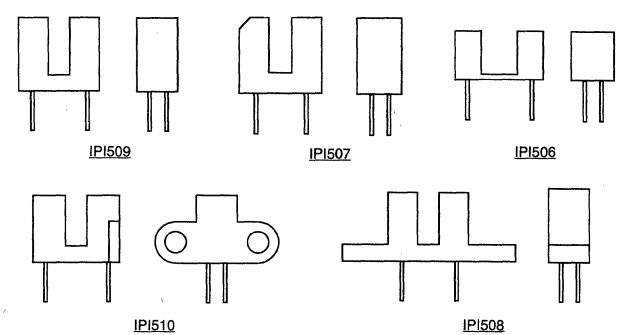
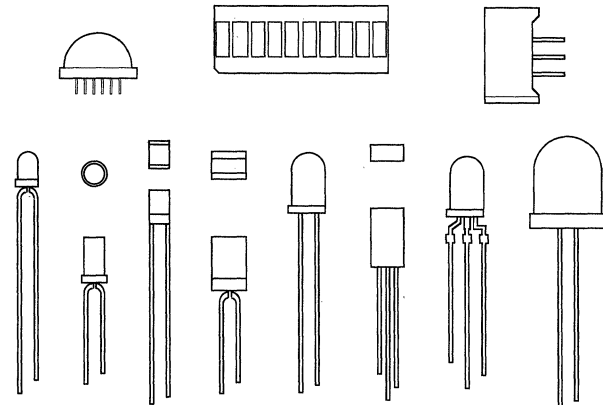


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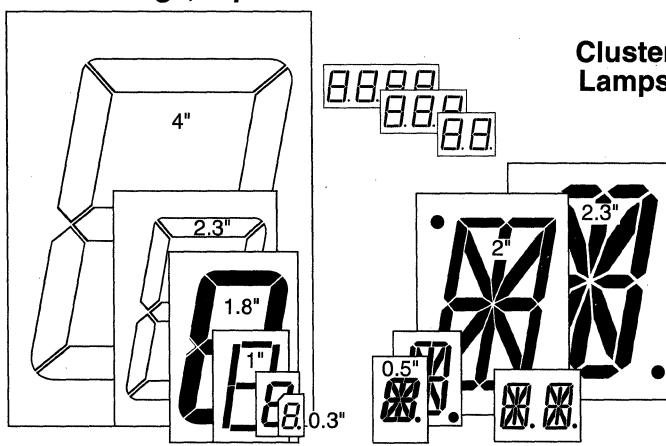


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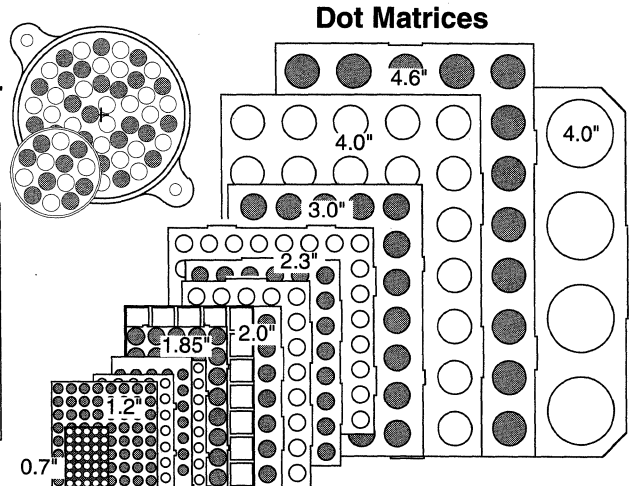


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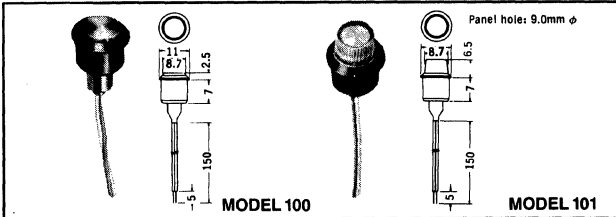




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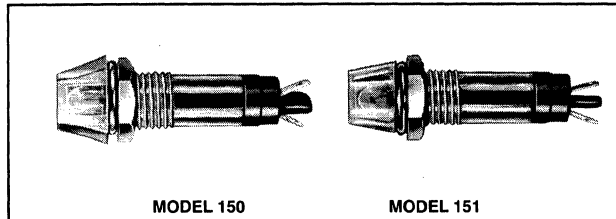
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## MODULAR INDICATORS

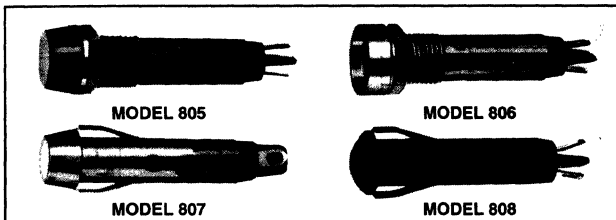


Modular concept provides low cost and great versatility. Rubber bushing snaps into 9mm panel cut out. Lens then snaps into bushing from front while light source fits in from behind.

## UNIVERSAL INDICATORS

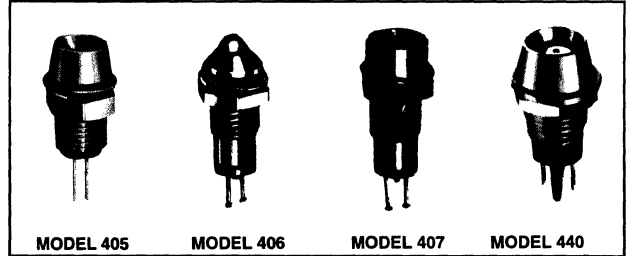


Attractive, low cost plastic assembly, mounts in 7mm hole with nut and washer supplied. Square or round in a variety of light sources and colors.

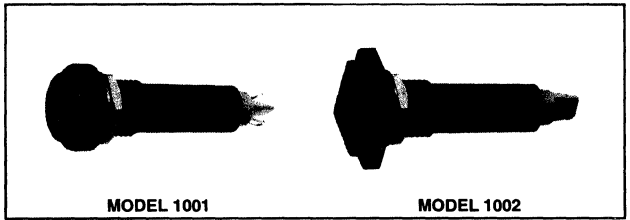


Mounts in 8mm panel hole. Models 805 and 806 mount with supplied nut and washer. Models 807 and 808 are snap-in. Variety of light sources and colors. Available in 6, 12, 24, 110 or 220V.

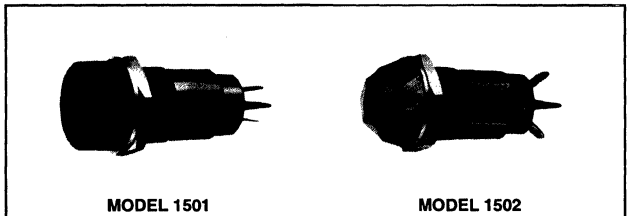
## SOLID STATE INDICATORS



All available in chrome plated brass or black anodized except 405 which is chrome only. Low current LED lamp. Model 406, 407 and 440 also available in 5, 12, and 24V.



Provides maximum light output in compact area. Mount in 10mm panel hole with nut and washer supplied. Available in 6, 12, 24, 110 and 220V. Square or round in a variety of light sources and colors.



Large indicator lights mount in 15mm panel hole with provided nut and washer. Available in wide variety of light sources and colors in 6, 12, 24, 110 and 220V.

## THUMBWHEEL SWITCHES

**MODEL AI IMLEC INDEXER PUSHBUTTON FRONT MOUNT**  
 The Imlec Indexer is a bi-directional push indexing front mount switch, 5/16" in width. Identical in size to our popular MF switches. With snap together banking and snap-in panel mounting. Pushbuttons above and below the legend allow the user to add or subtract from the count.

These 10- or 16-position switches are available in all popular codes.

**MODEL IF INTERMEDIATE FRONT MOUNT**  
 A rugged front mount switch with large digits, 1/2" wide module. Snap-in front mounting hardware. Available in most popular 10- and 16-position codes. Matte black finish with white legends on black wheel standard. Gloss finish, other wheel colors and legends available.

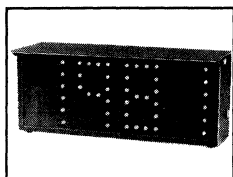
**MODEL BI MINI INDEXER PUSHBUTTON FRONT MOUNT**  
 The Mini Indexer is a bi-directional push indexing front mount switch. 0.30" in width. Similar to our Imlec Indexer but smaller in size. Features snap together banking and snap-in panel mounting. Pushbuttons above and below the legend allow the user to add or subtract from the count. Available in most popular 10-position codes.

**MODEL MF MINIATURE FRONT MOUNT**  
 The MF is our most popular, low cost, 5/16" wide Thumbwheel Switch. Slim, attractive, snap-in panel mounting requires no panel mounting hardware. Available in all popular 10- and 16-position codes. Matte black finish on high impact moldings, with white legend on black wheel standard.

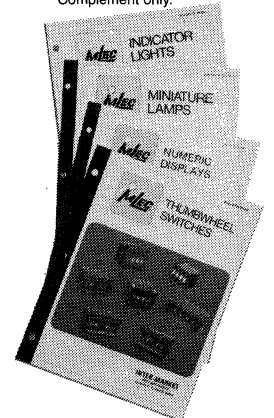
**MODEL TR THIN REAR MOUNT**  
 For applications that require a lot of switch in a small space, these 5/16" wide TR switches are ideal. Rear mount counterpart to our popular MF front mount switches. Available in most 10-position codes including Decimal, BCD, BCD plus Complement and Complement only.

**MODEL MR MINIATURE REAR MOUNT**  
 Popular rear mount switch, 1/2" wide module but lower profile than IR model. Available in matte black in most popular 10-position codes including Decimal, BCD, and BCD plus Complements.

## DIGITAL COUNTER DCL300



The Model DCL300 Digital Counter has four three-inch high digits composed of 18 individual LEDs. Provides exceptional visibility to 60 feet even under high overhead lighting conditions. Accepts your switch closure through miniature jack provided to count up to 9999. Ideal for any counting applications where results need to be seen from a distance. Eliminates need to be within several feet of counter to monitor production. Creates competition between similar assembly lines to improve output. Incandescent styles with 4, 6, 9, and 12 inch digit heights to accept BCD or analog input also available.

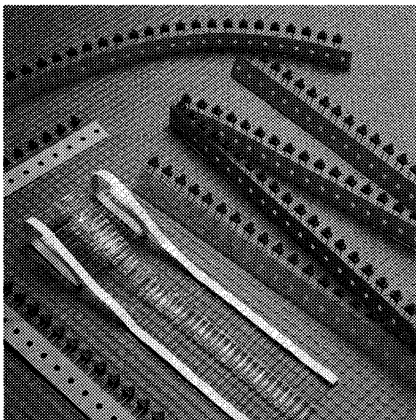


Contact us today for free catalogs, including complete specifications and ordering information. Your Fax request will be handled same day.

# If It Lights & You Need It, We Have It!

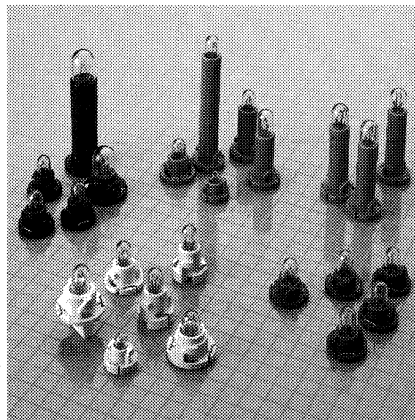
## JKL Miniature Lamps & Lighting Products

JKL Components Corporation offers the broadest selection of lamps and lighting accessories in the industry. We're a just-in-time supplier to many of the nation's highest volume OEM companies, and our facilities are certified to ISO 9001. Choose from over 5,000 JKL standards from stock. We also have the capability to produce customs, modified standards and complete assemblies. Call today!



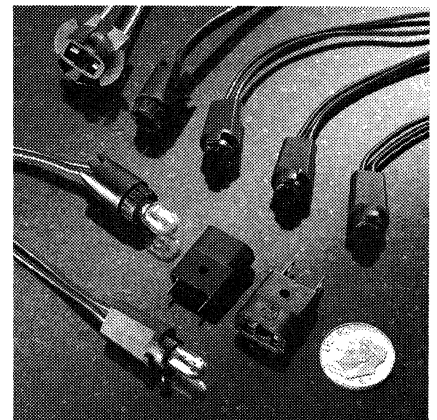
### Lamps for Automation

A revolutionary design breakthrough permits JKL to utilize glass envelope lamps safely and reliably with automatic insertion equipment. For the first time, this provides a practical and cost-effective solution to the time-intensive problems of manual lamp insertion in applications which are otherwise totally automated. Available in high volume quantities on special order to your specifications in surface mount or through board designs.



### Neo-Wedge® PC Board Lamp System

This patented design allows direct mounting of lamp assemblies into a PC board with a quarter turn twist/lock action, reducing labor costs and eliminating *all* secondary assembly operations. They are available in a variety of configurations, including a double contact version for single-sided boards that assures positive contact whether the lamp is pointing up or down. Ultra-bright gas filled lamps guaranteed for 2500 hours.



### Socket/Lamp Assemblies & Harnesses

JKL offers a wide selection of standard lamp sockets and socket/lamp assemblies for wedge base and bi-pin lamp sizes ranging from T1-1/2 to T3-1/4, available for delivery from stock. JKL also can provide multiple socket assemblies, custom produced to your specifications. High temperature sockets, specials, and complete design assistance are also available.

## JKL: One Source for All Your Lighting Requirements

- Miniature Fluorescent Lamps
- Wedge Base Lamps
- LED Indicators & Displays
- Miniature PC Board Lighting
- Quartz Halogen Lamps
- Colored Silicone Lamp Filters
- Miniature LED Devices
- Neon Glow Lamps
- Sub-Miniature Indicator Lamps
- Incandescent Lamps
- Xenon & Krypton Hi-Intensity Lamps
- Narrow Spectrum Ultraviolet Lamps
- Medical & Optical Lamps
- Aircraft Lamps & Accessories
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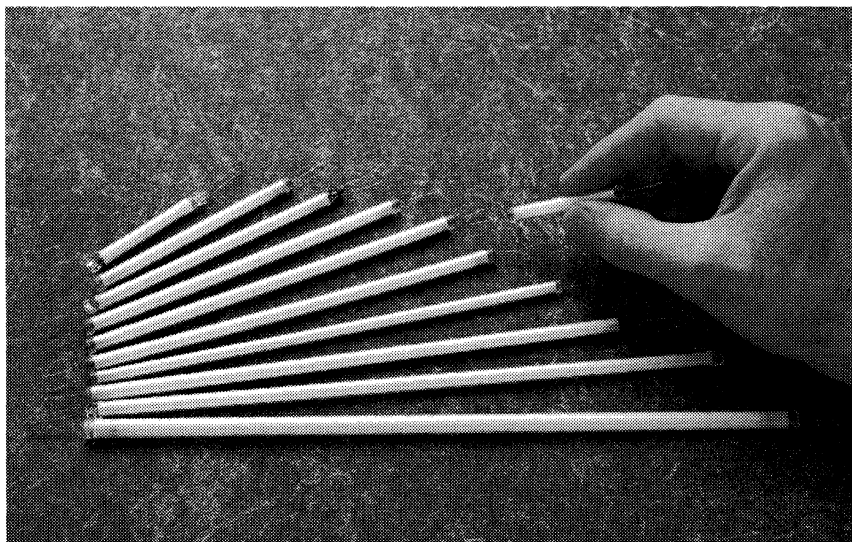
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# JKL – World's Broadest Line of Miniature Fluorescent Lamps & Inverters

Choose from the widest selection of miniature cold cathode, hot cathode and ultraviolet fluorescent lamps in the industry. JKL Lamps provide space-saving solutions for complex lighting requirements, offering up to 20,000 hours life at standard operating current and providing extremely stable electrical and optical characteristics. They also provide variable brightness, cool operation and low power consumption in a light-weight, low profile design. They are vibration and shock resistant to over 100 Gs. Wide selection of standard inverters. All available from stock. Call today!

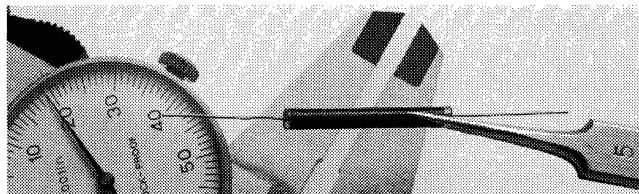


JKL produces many fluorescent lamps NOT listed in EEM, in diameters from 3mm and lengths up to 360mm, in CCFL, HCFL and UV models. Contact JKL engineering services for your particular requirement.

## COLD CATHODE FLUORESCENT LAMPS

Part Number	Dia. (mm)	Length (mm)	Lamp Voltage (Vrms)	Lamp Watts @5mA Arms	Starting Voltage (Typ)	Intensity (cd/m2)	Life Hours (Typ)
BF325-22	3.0	25	165	0.83	400	19,000	7,500
BF350-20	3.0	50	165	0.93	400	28,000	20,000
BF3100-20	3.0	100	270	1.35	665	28,000	20,000
BF3228-21	3.0	228	460	2.30	1150	28,000	20,000
BF3360-20	3.0	360	785	3.93	1500	28,000	20,000
BF650-20	6.5	50	170	0.85	390	6,500	20,000
BF6100-20	6.5	100	200	1.00	500	6,500	20,000
BF6200-20	6.5	200	290	1.45	725	6,500	20,000
BF6262-20	6.5	262	350	1.75	875	6,500	20,000

NOTE: Many other Standard JKL Fluorescent Lamps and Lamp Inverters are available from Stock. Please contact JKL Customer Service if you do not find your required part.

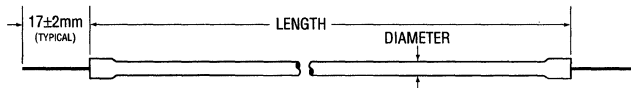


## ULTRAVIOLET FLUORESCENT LAMPS

Part Number	Dia. (mm)	Nom. Arc Length (mm)	Starting Length (mm)	Lamp Voltage (Vrms)	Output Watts @5mA Arms	Life mW/cm2 @25.4mm	Hours (Typ)
BF325-UV1	3.0	25	11	140	0.70	0.30	3,000
BF350-UV1	3.0	50	20	195	0.98	0.30	5,000
BF3100-UV1	3.0	100	70	270	1.35	0.25	5,000
BF3240-UV1	3.0	240	210	500	2.50	0.20	3,000
BF959-UV1/3	9.0	59	30	150	0.75	0.15	8,000

## INVERTERS FOR FLUORESCENT LAMPS

Inverter Part Number	Input Voltage
BXA-501/Kit	5VDC
BXA-12529	12VDC
BXA-12563 Dimming	12VDC



## JKL: One Source for All Your Lighting Requirements

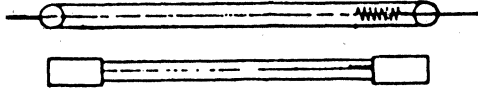
- Miniature Fluorescent Lamps
  - Wedge Base Lamps
  - LED Indicators & Displays
  - Miniature PC Board Lighting
  - Quartz Halogen Lamps
- Colored Silicone Lamp Filters
  - Miniature LED Devices
  - Neon Glow Lamps
  - Sub-Miniature Indicator Lamps
  - Incandescent Lamps
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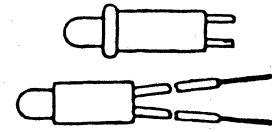
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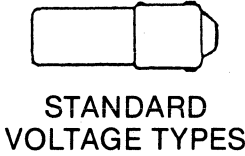
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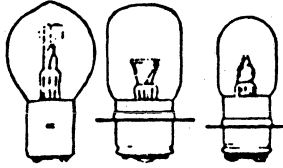
THIN LINE TYPES



CARTRIDGE TYPES



STANDARD VOLTAGE TYPES



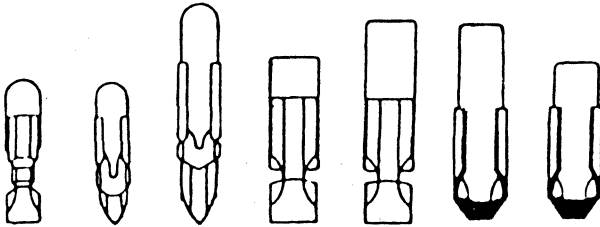
AUTO LAMPS



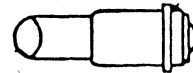
WEDGE BASE



SCREW BASE



TELEPHONE SLIDE BASE — ALL TYPES



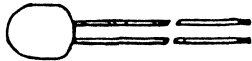
LENS END



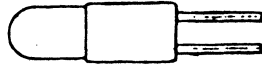
NEONS



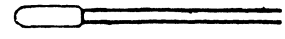
ALL GLASS INTEGRAL BI-PINS



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Full Range of Voltages: 1.5 to 120.0 Volts

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Complete Economy Line for Commercial Applications

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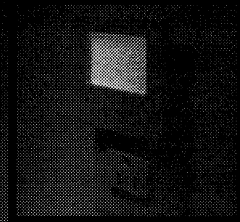
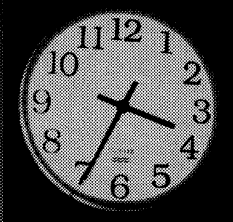
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TELEPHONE: 815 / 455-0400 FACSIMILE: 815 / 455-7916

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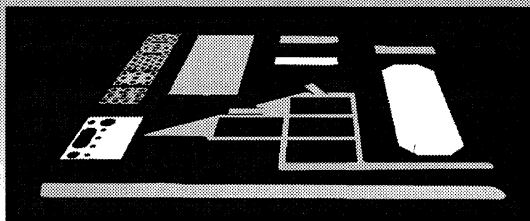
# LSI

## The brightest name in the electroluminescent industry.



LSI has been a leading force in the electroluminescence field for over 25 years and continues to set industry standards. Our EL lamps are used around the world in watches, LCD's, instrumentation graphics, automotive, aviation and other applications. Our lamps have earned the strongest reputation for reliability, longevity, uniformity and humidity resistance.

Recently, LSI introduced the unique MaxEL lamp which utilizes micro-encapsulation of the phosphor element and provides much greater flexibility for your lighting configurations and high volume applications. Enjoy the proven benefits of solid state lighting in new, cost effective lamps. Call us or visit our website now for the best and brightest product in your EL application!



#### MaxEL Specifications:

Colors	Green, White
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C
Operation	40-175v, 60-3KHz
Size	17.0" x 26.0" max; .5" x .5" min.
Bend Radius	.25"
Brightness Uniformity	±10%
Solder	Per MIL-STD-2000

# LSI... for glowing reviews!

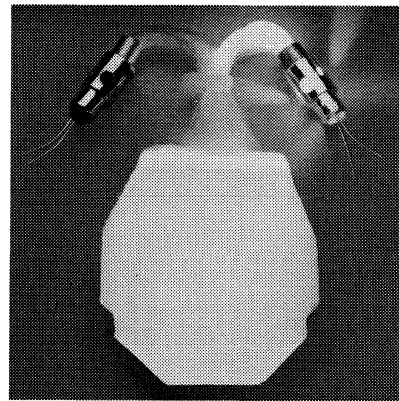
Luminescent Systems, Inc. [www.lumsys.com](http://www.lumsys.com)

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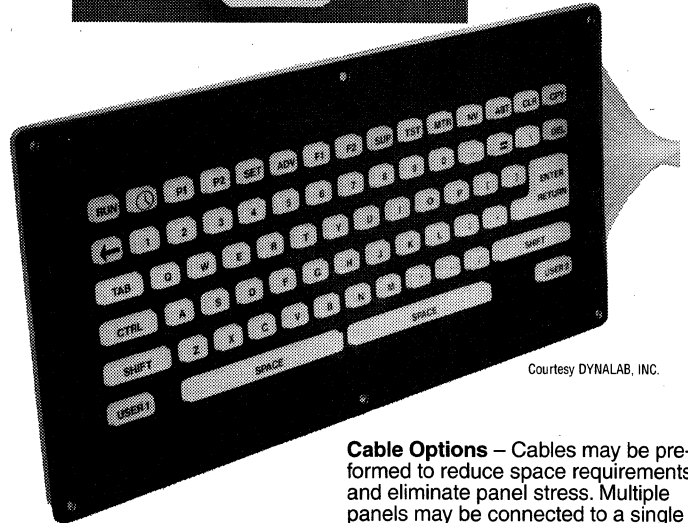
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# LUMITEX® Woven Fiber-Optic Backlighting for

- LCD's ■ Membrane switches
- Rubber keypads ■ Control panels



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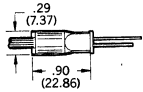
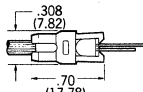
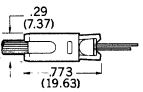
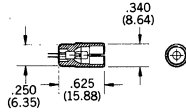
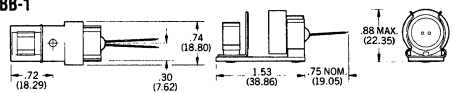
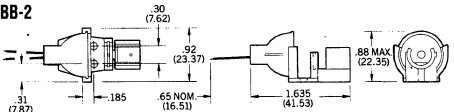


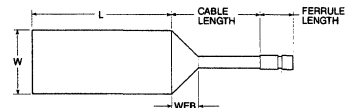
Courtesy DYIALAB, INC.

## Lumitex technology provides

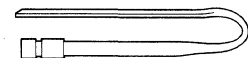
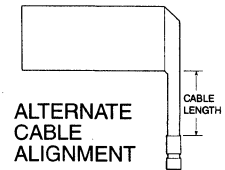
- Long life ■ Low power consumption ■ High intensity
- Uniform light emissions ■ Heat/EMI free

**Cable Options** – Cables may be preformed to reduce space requirements and eliminate panel stress. Multiple panels may be connected to a single source in control panels or automotive applications.

SOURCE TYPE	LAMP PART NO.	LAMP TYPE	POWER	LIFE/HOURS
<b>CUFF</b> 				
<b>LED ST-200 HOLDER</b> 	<b>LED ST-250 HOLDER</b> 	LUMITEX 165 Red LUMITEX 172 Green LUMITEX 156 Yellow LUMITEX 152 Amber	2.2VDC, 25mA 1.7VDC, 20mA 2.2VDC, 20mA 2.0VDC, 20-50mA	50,000 50,000 50,000 100,000
<b>DC-2</b> 	DC2-20mA	Incandescent	5V, 20mA	10,000
	DC2-60mA	Incandescent	5V, 60mA	25,000
	DC2-115mA	Incandescent	5V, 115mA	40,000
<b>BB-1</b> 	BB1-1.5	Incandescent	12V, 1.5 Watts	15,000
	BB1-2.5	Gas Filled	5V, 2.5 Watts	5,000
	BB1-4.22	Gas Filled	4.5V, 4.5 Watts	17,000
	BB1-4.85	Gas Filled	5V, 4.85 Watts	15,000
<b>BB-2</b> 	BB2-1.5	Incandescent	12V, 1.5 Watts	15,000
	BB2-2.5	Gas Filled	5V, 2.5 Watts	5,000
	BB2-4.22	Gas Filled	4.5V, 4.5 Watts	17,000
	BB2-4.85	Gas Filled	5V, 4.85 Watts	15,000



WEB dimension usually 1/2 panel width.



Minimum bend radius of fiber is 0.062". Actual cable bend radius may be greater.

**MATERIALS**  
 Fiber Core – Polymethyl Methacrylate  
 Fiber Cladding – Fluoropolymer  
 Weft – Acrylic Monofilament  
 Fiber Temperature Range: -50°C to +85°C

For a complete catalog or technical assistance call (440) 243-8401, 1-800-969-5483, Fax (440) 243-8402  
 E-Mail: [info@Lumitex.com](mailto:info@Lumitex.com)  
 Website: [www.Lumitex.com](http://www.Lumitex.com)

Lumitex Products are covered by Patents and Patents Pending



**Lumitex®, Inc.**

Light... in any form

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 Strongsville, OH 44136

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**Mechanical Features**

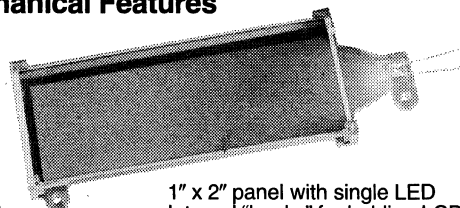
Lumitex's new SolidState molded lighting technology provides uniform, high output backlighting with very low power. Designed for use with standard LCD modules as well as chip-on-glass or "tab" driven LCD's, this patented product is ideal for high volume applications where power, brightness, and cost are prime design considerations.

Several patented features provide higher output with less power than traditional light pipes, arrays and EL's. Custom LED's and a unique "transition" area spread the light uniformly across the active area in a very thin package. Mechanical holding features may also be designed into the backlight to mount the LCD or other components, reducing assembly and material costs.

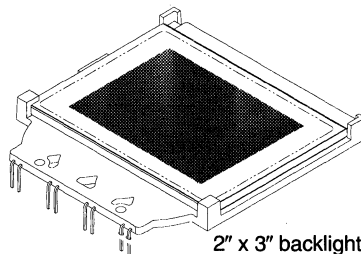
Panels as large as 3.5" x 5.0" can be uniformly backlit with as few as 5 LED's. Smaller panels designed for use with 1 or 2 line LCD modules require only a single LED. Single panels can light LCD and keypad combinations with as few as 2 LED's, greatly reducing the power required to backlight cellular phone or remote control products.



LCD and conductive rubber keypad lit with 2 red LED's



1" x 2" panel with single LED  
Integral "hooks" for holding LCD



2" x 3" backlight with "hooks and slides" for holding LCD

**Electrical Data**

Maximum recommended current 30mA (75°C). Pulse width modulation can allow higher RMS current and light output.

	Typical Operating power per LED	Minimum Forward Voltage	Wave Length
Red	58mW	1.8VDC	650nm
Amber	54mW	2.0VDC	595nm
Yellow-Green	64mW	2.3VDC	567nm
Blue	140mW	4.5VDC	440nm

**Technical Data**

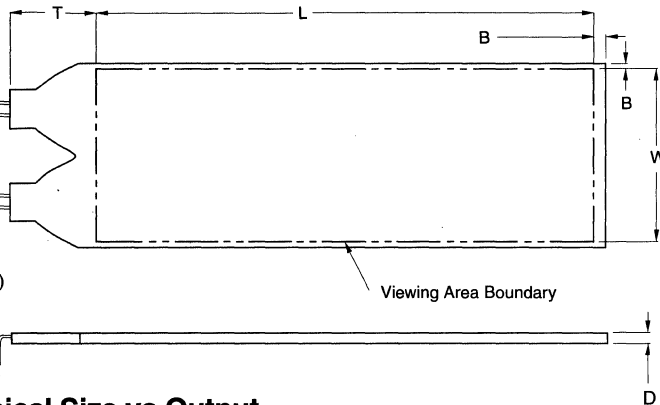
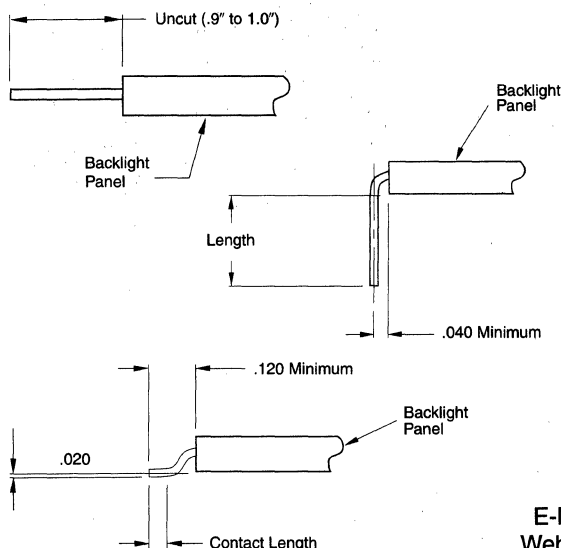
- Maximum Output Area Length (L)  
6 inches when lit from one side (152.4mm)  
12 inches when lit from both sides (304.8mm)  
(requires transition length on both sides)
- Maximum Output Area Width (W) 12 inches (304.8mm)
- Minimum Thickness (D) .060 inches (1.5mm)
- Minimum Boundary (B) .060 inches (1.5mm)
- Minimum Transition Length (T) .5 inches (12.7mm)  
Transition is dependent on LED spacing (E) and length (L)  
Contact Lumitex for specifics.

**Materials**

Optical grade acrylic is standard for panel. Polycarbonate is available upon request.

**Standard LED**

**Lead Connector Options**



**Typical Size vs Output**

Output Area Dimensions L x W (in.)	Transition Length (in.)	Number of LED's	Red Output (fL)	Amber Output (fL)	Yellow/Green Output (fL)
2.5 x 0.95	0.7	1	10.8	10.1	3.1
3.3 x 1.10	0.5	2	14.5	14.3	5.9
4.0 x 1.40	0.6	2	11.8	10.6	4.8
6.0 x 1.20	0.7	3	9.3	9.0	4.5
6.0 x 0.80	0.5	1	5.6	4.6	2.5
1.9 x 0.40	0.4	1	26.5	23.0	10.5
0.7 x 2.60	0.8	3	49.0	41.0	21.6

Note: Outputs in foot-Lamberts measured with LED's operating at 28mA.

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Lumitex Solid State is covered by US Patents 5005108 and 5136480 and other patents pending

**Lumitex, Inc.**

*Light... in any form*

8443 Dow Circle  
Strongsville, OH 44136

For more information or technical assistance call (440) 243-8401, 1-800-969-5483 or Fax (440) 243-8402.

E-Mail: info@Lumitex.com  
Website: www.Lumitex.com





# ELITE™ THE NEXT GENERATION OF ELECTROLUMINESCENT TECHNOLOGY

LIT TO WITHIN .025  
OF EDGES.

BRIGHT UNIFORM LIGHT  
OUTPUT WITHOUT BUS BARS.

EXTREMELY FLEXIBLE  
AND DURABLE.

SELECTIVE DEPOSITION  
PUTS LIGHT ONLY  
WHERE YOU WANT IT.

MULTIPLE COLORS  
IN ONE LAMP.

INDEPENDENTLY ADDRESS-  
ABLE SEGMENTS.

MOISTURE AND HUMIDITY  
RESISTANCE WITHOUT  
ACLAR™ PACKAGING.

GREATER EFFICIENCY  
PLUS LONGER LIFE.



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# POLYWELD™ TECHNOLOGY GIVES ELITE™ GREATER DESIGN FLEXIBILITY AND AFFORDABILITY



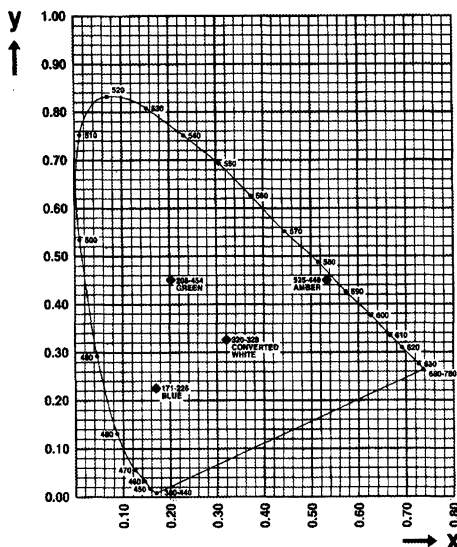
MetroMark's ELite™ product line is a new generation of electroluminescent (EL) lighting that gives engineers, designers and developers design flexibility and cost effectiveness never before possible. Thanks to our proprietary PolyWeld™ technology, ELite offers new opportunities to incorporate cool, bright, uniform panels of light into a wide variety of OEM and consumer applications.

The PolyWeld process allows selective deposition to create ELite lamps in any shape, so they're more efficient to operate and cost effective to produce. The PolyWeld process also creates an extremely thin polymer lamp that cannot delaminate, giving unsurpassed flexibility and durability. Plus, ELite is highly resistant to moisture and humidity, even without Aclar™ packaging.



"ISO-BASED" QUALITY CONTROL STANDARDS DELIVER THE HIGHEST LEVEL FOR QUALITY AND CONSISTENCY IN EL LIGHTING.

## Xy Color System



OUR ELITE PRODUCT LINE OFFERS ENGINEERS A BROAD RANGE OF COLOR OPTIONS.

## A WORLD OF NEW APPLICATIONS

Thanks to our patented processes, you can independently address different segments within the same lamp, without using adjacent space. ELite also allows for large illuminated areas without bus bars, and termination at any location on the lamp for enhanced compatibility with membrane switches and LCDs.

MetroMark is ready to provide you all the support you need, from consultation to fast, low-cost, soft tooled prototyping. And our high-speed production capacity and ISO-based quality control standards will meet the most stringent requirements. Call us with your specifications, and we'll show you how ELite lighting will have you seeing EL in a whole new light.

## WIDE RANGE OF OPERATION

Typical voltage:  
25 - 250 Vrms

Typical frequency:  
50 - 2000 Hz

## SUPERIOR LAMP CHARACTERISTICS @ 115V, 400Hz

Brightness  
(aviation green):  
17 foot-lamberts

Dynamic capacitance:  
0.003 microfarads  
per square inch

Current phase angle:  
78° leading

Power consumption:  
18 milliwatts per  
square inch

Minimum unlit edge  
width:  
.025 inches

Peripheral bus bar:  
none

Minimum thickness:  
~ 0.008 inches

ALL PRODUCTS  
MADE IN THE USA

(800) 680-5556 • FAX: (612) 935-5718  
11574 ENCORE CIRCLE • MINNETONKA, MN 55343-8862

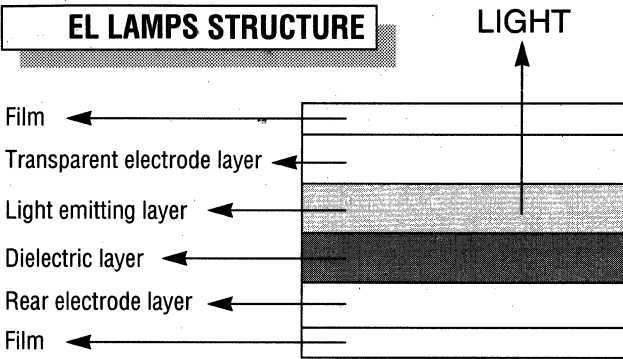
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# MYTECH CORPORATION

201-784-8867 • FAX: 201-784-8932

180 OLD TAPPAN ROAD, BLDG. 6, SUITE #1 • OLD TAPPAN • NEW JERSEY 07675

## ELECTRO-LUMINESCENT LIGHTING

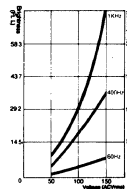


- ### FEATURES
- ▲ Thickness of 1.0mm~1.3mm
  - ▲ Flexible and light weight
  - ▲ Uniform brightness
  - ▲ Low power consumption
  - ▲ Safe to shock

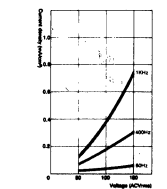
- ### APPLICATIONS
- ▲ Backlight for LCD
  - ▲ Light for various signals and indications
  - ▲ Interior decoration

### CHARACTERISTICS

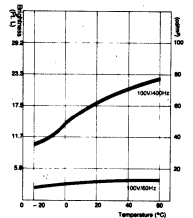
VOLTAGE/BRIGHTNESS



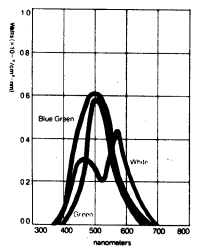
VOLTAGE/CURRENT DENSITY



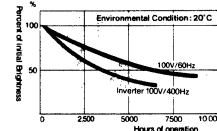
TEMPERATURE/BRIGHTNESS



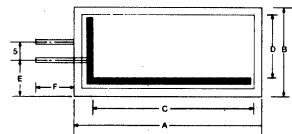
SPECTRUM



LIFE TIME



### SPECIFICATIONS



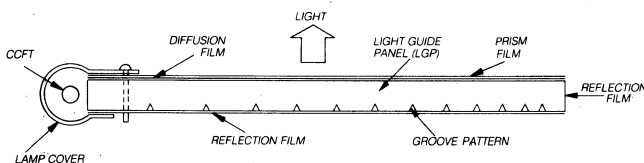
- A : C+10mm
- B : D+10mm
- C : MAX 320mm
- D : MAX 250mm
- E : 5mm~
- F : 5mm~25mm

## CCFT BACKLIGHT (COLD CATHODE FLUORESCENT TUBE)

### A Thinner, High Efficiency Backlight Unit With Original GROOVE Patterned Light Guide Panel

### STRUCTURE

(EDGE LIGHT TYPE)



Lamp provides light into the edge of Light Guide Panel. By the optically designed GROOVE pattern of LGP, light is emitted and scattered on the surface of LGP most efficiently. Diffusion film and reflection film improve brightness and uniformity of the backlight unit.

### FEATURES

- ▲ 20% higher brightness than a conventional unit
- ▲ Slim and light weight
- ▲ Low power consumption

### APPLICATIONS

- ▲ STN and TFT LCD backlight
- ▲ Backlight for various signals, indicators and advertisement

### SPECIFICATIONS

MODEL No.	Size (mm)	THICKNESS (mm)	LAMP (EA)	BRIGHTNESS (cd/m²)	UNIFORMITY (%)	LIFE TIME (h)
SPBL-063-20N-1	130x85	2	1	450	85 MIN.	10,000
SPBL-100-20N-1	205x150	2	1	400	85 MIN.	10,000
SPBL-079C-30P-1	160x120	3	1	1400	85 MIN.	10,000
SPBL-098C-40P-1	200x150	4	1	1400	85 MIN.	10,000
SPBL-098C-40P-2	200x150	4	2	2300	90 MIN.	10,000
SPBL-129C-80P-2	260x200	8	2	2800	90 MIN.	10,000
SPBL-146C-80P-4	290x230	8	4	2600	90 MIN.	10,000

\* Any size is available. \* Model number (SPBL-098C-40P-1)  
 SPBL : SHIN PYUNG BACKLIGHT 098C : 9.8 INCH DIAGONAL SIZE, COLOR  
 40 : 4 MM THICKNESS P : PRISM FILM (N : NO PRISM FILM)  
 1 : ONE LAMP

# MYTECH CORPORATION

201-784-8867 • FAX: 201-784-8932

180 OLD TAPPAN ROAD, BLDG. 6, SUITE #1 • OLD TAPPAN • NEW JERSEY 07675

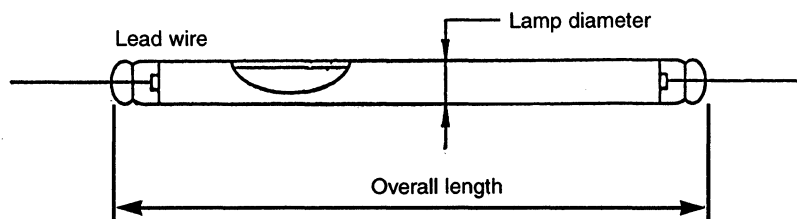
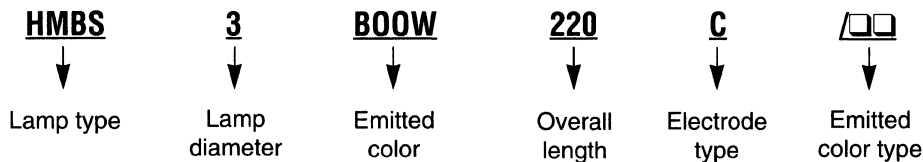
## COLD CATHODE FLUORESCENT TUBE

### COLD CATHODE LAMP TYPE

MODEL	LAMP DIAMETER (mm Ø)	OVERALL LENGTH (mm)	EFFECTIVE LENGTH (mm)	LAMP CURRENT (mA)	LAMP VOLTAGE (Vrms)	BRIGHTNESS (cd/m <sup>2</sup> )	AVERAGE LIFE (Hr.)
HMBTM2(N10W)130W	2.0	130	114	5	360	43000	13000
HMBTM2(N10W)220W	2.0	220	204	5	550	43000	13000
HMBTM22(N10W)130W	2.2	130	114	5	350	39000	13000
HMBTM22(N10W)220W	2.2	220	204	5	520	39000	13000
HMBS24(N10W)130GN	2.4	130	110	5	340	36000	15000
HMBS24(N10W)220GN	2.4	220	200	5	500	36000	15000
HMBS26(N10W)130GN	2.6	130	110	5	310	32000	15000
HMBS26(N10W)220GN	2.6	220	200	5	470	32000	15000
HMBS3(N10W)130C	3.0	130	105	5	310	30000	15000
HMBS3(N10W)220C	3.0	220	195	5	470	30000	15000
HMBS38(N10W)130C	3.8	130	100	5	300	21000	20000
HMBS38(N10W)220C	3.8	220	190	5	440	21000	20000
HMBS4(N10W)130C	4.1	130	100	5	290	15000	20000
HMBS4(N10W)220C	4.1	220	190	5	420	15000	20000
HMBS5(N10W)130C	4.8	130	110	5	280	13000	20000
HMBS5(N10W)220C	4.8	220	190	5	400	13000	20000
HMBSH4(N10W)130C	4.1	130	100	5	260	13000	20000
HMBSH4(N10W)220C	4.1	220	190	5	380	13000	20000
HMBSH5(N10W)130C	4.8	130	100	5	250	11000	20000
HMBSH5(N10W)220C	4.8	220	190	5	370	11000	20000
HMBSH6(N10W)130C	5.8	130	100	5	240	8000	20000
HMBSH6(N10W)220C	5.8	220	114	5	360	8000	20000

### COLD CATHODE MINIATURE FLUORESCENT COLOR LIGHT

- ▲ High brightness and high color rendering (Three-band fluorescent material is used.)
- ▲ Low consumption of electric power.
- ▲ Long life (Average 1000~2000Hr. in each standard current.)
- ▲ Low heating (10~25deg. in each standard current.)
- ▲ Excellent vibration and impact resistance.
- ▲ Adjustable brightness through use of dimming circuit. (Lamps current 1mA~)
- ▲ Small size and light weight (Lamp diameter 2.0~5.8mm Ø, Overall length 50~400mm.)
- ▲ For LCD back light  
It is most effectively used for LCD back light due to the characteristics of high brightness and high color rendering.
- ▲ For reading faxes  
It is suitable for reading due to stable luminous intensity distribution.
- ▲ For erasers of copying machines.
- ▲ For other displays.



MYTECH CORPORATION • Phone: 201-784-8867 • Fax: 201-784-8932

# Indicator Lamps



## LED Indicator Lamps

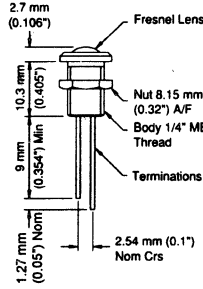
### Features

- Combines low cost with high performance
- 5 colors - including AlGaAs red
- Rugged metal body construction
- Corrosion resistant

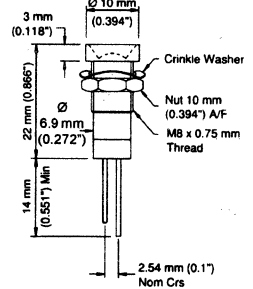
### Applications

- Industrial
- Permanent way safety equipment
- Mimic/mosaic panels
- Indoor/outdoor

OXL/CLH/63



OXL/CLH/80



Optical Characteristics	Type No.	Luminous Intensity Typical (mcd at 20 mA)					Viewing Angle
		AlGaAs Red	Red	Amber	Yellow	Green	
	OXL/CLH/63	65	45	-	45	45	45°
	OXL/CLH/80	70	24	14	24	22	60°
	OXL/CLH/80/N	240	125	-	140	120	24°
	Wavelength - all types typical	637	626	602	585	569	

Electrical Characteristics (All Types)		AlGaAs Red	Red	Amber	Yellow	Green
	Forward current (mA) max/typ	30/20	30/25	30/25	20/15	30/25
	Forward voltage (v) typ	1.8	2.2	2.2	2.2	2.3
	Reverse voltage (v) max	5.0	5.0	5.0	5.0	5.0

**Environmental:** Op. & Storage Temp: -20°C to 70°C, Mounting details: Chassis thickness: 5mm (0.197") max, recommended mounting torque: 1 Nm (0.74 lbf ft) **Materials:** Body OXL/CLH/80/-: brass-nickel plated, OXL/CLH/63/-: aluminium (optional - black anodised), Nut: brass - nickel plated **Styles/Options:** reflector, wide angle, focussed or wide angle emitter, anodised black body

## Ø10 mm Superbright Indicator Lamps

OXL/CLH/100/-

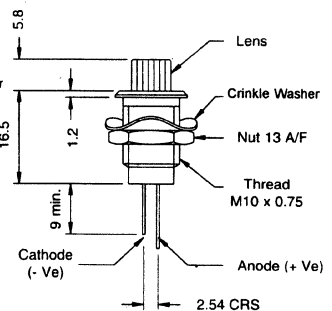
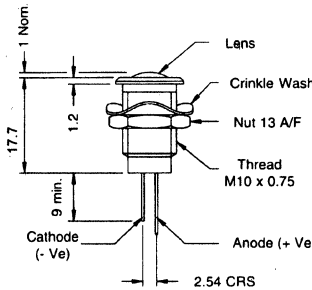
OXL/CLH/100/P

### Features

- Unique fresnel lens, increasing brightness and viewing angle
- Low profile panel mounting
- 5 superbright colors including AlGaAs Red
- Rugged brass, black chromed body
- ESD protection for semi-conductors

### Applications

- High reliability panel indicators
- High brightness alarm indications



Optical Characteristics	Type No.	Luminous Intensity Typical (mcd 20 mA)				
		AlGaAs Red	Red	Amber	Yellow	Green
	OXL/CLH/100	300	120	280	250	50
	OXL/CLH/100/CL	370	140	340	290	70
	OXL/CLH/100/P	250	110	130	150	30
	OXL/CLH/100/P/CL	300	130	135	165	35

Electrical Characteristics (all types)		AlGaAs Red	Red	Amber	Yellow	Green
	Forward current (mA) max/typ	30/20	30/25	30/25	30/20	30/25
	Forward voltage (v) typ @ 20 mA	1.8	2.2	2.2	2.2	2.3
	Reverse voltage (v) max	5	5	5	5	5

**Environmental:** Op. & Storage Temp: -20°C to 70 °C, Mounting Details: Chassis thickness: 1.5mm min, Recommended mounting torque: 1Nm **Materials** •Body: brass - black chromed •Nut: aluminium alloy •Terminations: silver plated or tin lead **Styles/Options:** tinted or water clear lens; voltage options available; Sunlight readable; optional 5 V to 28 V integral resistor.

## Segmented Indicator Lamps

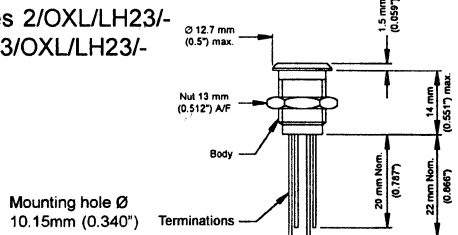
Types 2/OXL/LH23/- and 3/OXL/LH23/-

### Features

- Independently addressable 2 or 3 segments
- IP64 splash proof
- Ruggedised black chrome plated brass body
- Replaces three single indicators - saving panel space and assembly costs.

### Applications

- High density panel application
- Logic status indication
- Battery status indicators
- 3 phase indicator
- Shaft rotation indicators:



Luminous Intensity (per segment)	Segment Color					
	Red	Yellow	Green	Blue		
	Luminous Intensity, typical (mcd) at 20mA	10	12	15	10	
	Maximum Forward Current (mA)	30	30	30	35	
Electrical Characteristics	Forward Voltage, typical (Vd.c.)	2.2	2.2	2.2	3.0	
	Maximum reverse voltage (Vd.c.)	5.0	5.0	5.0	5.0	

**Environmental:** Op. & Storage Temp: -40 to 80°C, Sealing: BS5490 IP64, Mounting Details: Chassis Thickness: 8.0mm (0.315"), Recommended Mounting Torque: 1Nm (0.74 lbf ft), **Materials** •Body: brass, black chromed •Lens: polycarbonate •Nut: aluminium alloy **Options:** Wide range of color combinations including blue, sunlight readable; low current LED's.

Oxley Inc. 25 Business Park Drive, PO Box 814, Branford, CT 06405, USA

Tel: (203) 488-1033 Fax: (203) 481-6971 e-mail oxleyus@aol.com



# Indicator Lamps



## Military Sealed Indicator

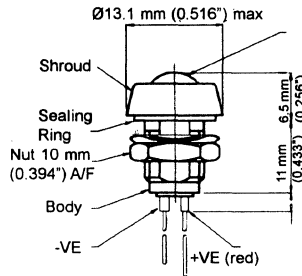
MIL80 range lamps, types PS/LH/8- and STR/LH/8-

### Features

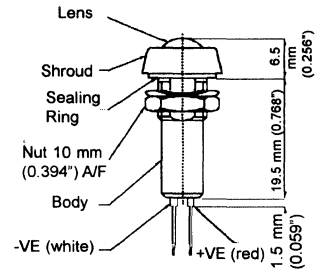
- High brightness, reliability
- Rugged glass and metal construction
- Sealed to IP 68
- 100% screening and burn-in
- Military temperature range
- Full color range

### Applications

- Military vehicles
- Battlefield and tactical communications equipment
- Safety critical industrial environments



Terminations 14 mm (0.551") to 20 mm (0.787") long



Terminations 8 mm (0.315") to 11 mm (0.433") long

Other Options	
Sunlight Visible	
NVG Compatible	
Neon Light Source	
Voltage Lamp (Integral Resistor)	
Special Functions, Flashing etc.	
DESC Approved	
Bipolar Multichip	

		AlGaAs Red	Red	Yellow	Green
Luminous Intensity Typical (mcd at 20 mA)	PS/LH/8, STR/LH/8	300	50	35	50
	PS/LH/8/SB, STR/LH/8/SB	1000	120	120	150
Electrical Characteristics (all types)	Forward Current (mA) max/typ	30/20	20/20	20/20	30/20
	Forward Voltage (v) typ	1.8	2.2	2.2	2.2
	Reverse Voltage (v) max	5.0	5.0	5.0	5.0

### Environmental

Op. temp: -40 to 85°C, Storage temp: -55 to 100°C, Sealing: BS2011 Pt2.1 Qa at 30 psi (=20m water) BS5490 IP 68  
 Mounting Details: Chassis thickness: 3.2mm (0.126") max, recommended mounting torque: 1 Nm (0.74 lbf ft)

### Materials

- Body & nut: aluminum alloy
- Shroud: aluminum alloy-black anodized
- Washer: tin plated beryllium copper alloy
- Sealing ring: PTFE
- Lens: glass

Styles/Options Electrostatic screen, choice of terminations

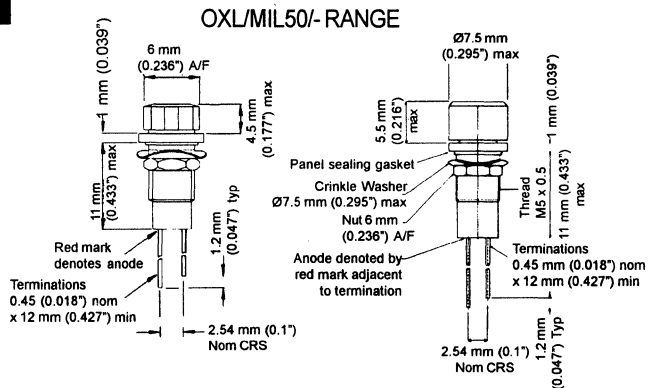
## Sub Miniature Lamp

### Features

- Ideal where panel space is at a premium
- 7.5mm (0.295") dia. low profile package
- Sealing to BS 5490 IP67
- Attractive anodised bezel
- High reliability-100% screened
- IC compatible low current capability
- 100% screening and burn-in

### Applications

- Portable instruments
- Outdoor displays
- Cockpit/crew station indicators/NVG users
- Control/power consoles



Type	Red	Yellow	Green	Blue
OXL/MIL50 (and-/SES)	20	20	20	2
OXL/MIL50/SB	30	30	30	-
OXL/MIL50/NVG10	-	-	10	-
OXL/MIL50/RAF	4	4	4	-

	AlGaAs Red	Red	Yellow	Green	Blue
Forward Current (mA) max/typ	30/20	30/20	20/20	20/20	30/20
Forward Voltage (v) typ	1.8	2.2	2.2	2.3	3
Reverse Voltage (v) max	5	5	5	5	5

Environmental: Op. and storage temp: -40 to 100°C, sealing: BS 2011 Pt 2.1 Qa at 15 Psi (equivalent to 10m water) BS 5490 IP 67, Chassis thickness: 1 mm (0.039") - 4 mm (0.157"), recommended mounting torque: 0.5 Nm (0.37 lbf ft), mounting hole: Ø5.0mm + 0.1 - 0.0 chassis should be clean and free from burrs

### Materials

- Body & nut: aluminum alloy
- Sealing Ring: fluorocarbon rubber
- Shroud: aluminium alloy - black anodised
- Lens: glass

Styles/Options: diffused or clear lens (superbright); sunlight visible; electrostatic screen; NVG compatible

Oxley Inc. 25 Business Park Drive, PO Box 814, Branford, CT 06405, USA

Tel: (203) 488-1033 Fax: (203) 481-6971 e-mail oxleyus@aol.com



# PARA LIGHT

Para Light (USA) Corp.  
515 W. Allen Ave., #14 • San Dimas, CA 91773  
**909.305.2393 • FAX: 909.305.2389**

**TOLL-FREE: 888-LED-PARA or  
533-7272**

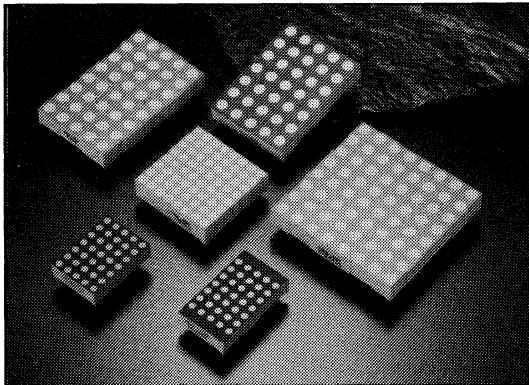
"PARA LIGHT ELECTRONICS CO., LTD." was established at 1987 chiefly manufacturing Light Emitted Diode series products-as "LED LAMPS, SEVEN SEGMENT DISPLAYS, DOT MATRIXS, LED LIGHT BAR & LCD BACK LIGHT." After ten years of efforts based on the purpose of automatic manufacturing to promote the marketing with high quality products and truehearded after sale-services, it's to be one of the leading optoelectronic components manufacturer & main supplier for users of domestic and oversea market all around the world.

According to the requirement of customers, Dynamic R&D of PARA LIGHT are forging the way ahead technological capability in order to develop new products, design and development of automatic machineries & new facility. Not only has developed its own automatic production process but also designed and fabricated the equipments used in production and testing. We can provide a completely reliable products because of High Grade Quality Control.

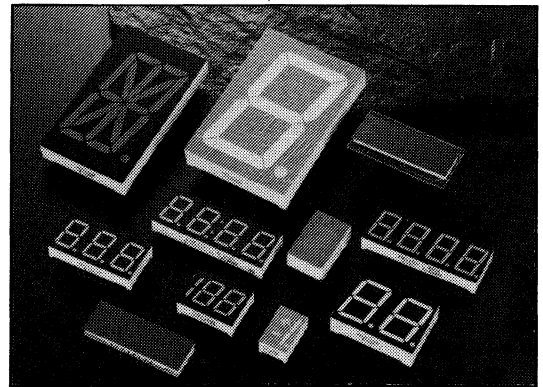


**Selection Guide** <http://paralightled.com>

*Call or Fax us for our  
latest catalog*



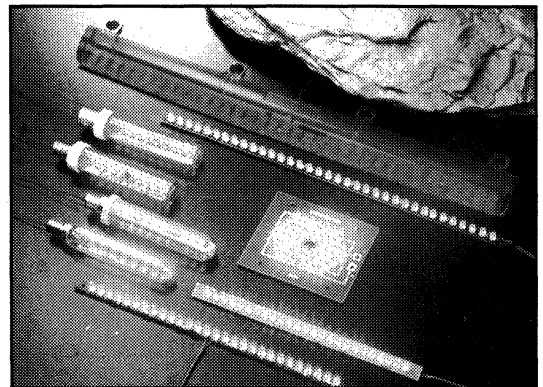
*LED Dot-Matrix*



*LED Displays*



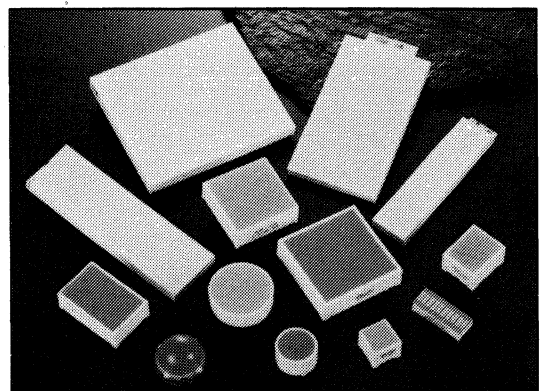
*LED Lamps*



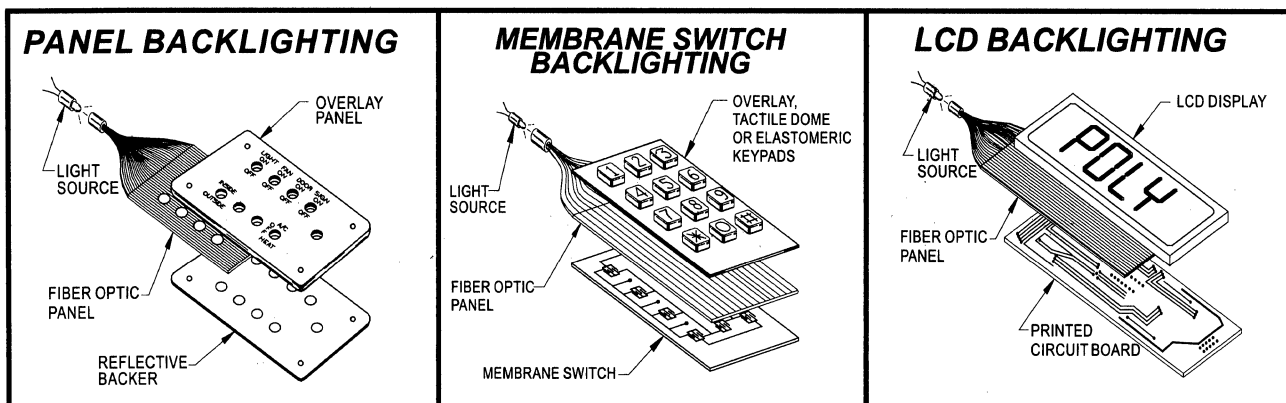
*Custom Design Assemblies*



*Custom Design*



*LCD Back Light & LED Light Bar*



### Major Advantages of Backlighting with Plastic Optical Fiber Devices:

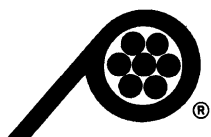
- Low Power - from 2VDC, 30mA
- Uniform Brightness
- Thin Profile (.013")
- EMI & Heat Free
- Low Tooling, NRE, Assembly & maintenance cost

*Poly-Optical Products, Inc.*, offers a diverse line of standard and custom plastic optical fiber products, including:

- Lumileen® plastic optical fiber
- PolyStamp® ribbons
- OptiBeam® light sources
- LumiGlo® large core optics
- Scanners
- PolyGlo® & UniGlo® panels
- Data transfer devices
- OptiBright® scintillating fibers
- Image & light guides
- PolyBright® molded acrylic light pipes

### COMPARISON OF PLASTIC OPTICAL FIBER BACKLIGHTING WITH ALTERNATIVE TECHNOLOGIES

FACTOR	PLASTIC OPTICAL FIBER	ELECTROLUMINESCENCE	LED ARRAY	COLD CATHODE FLOR. LIGHT
Longevity	Excellent. Fiber Optic Panel does not wear out. 5,000,000 actuations on a membrane switch	Poor. 1,000 to 4,000 hour "half life". Significantly less for temperatures of 40°C+ and humidity of 80%+	Excellent. 20K to 100K hours. Heat reduces life	Good. 10K hours
Minimal Thickness	.013"	.020"	.28"	.35"
Electro Magnetic Interference (EMI)	No	Yes	No	Yes
Tooling	Minimal with fast turnaround	Expensive with long lead time for changes	Moderate cost with good turnaround	High cost with long lead time
Cost per square inch of active area	&.20 to \$1.00 + light source	\$.80 to \$2.00 + inverter cost	\$2.00 to 4.50	\$.50 to \$1.50 + inverter cost
Maintenance	Replace bulb	Replace entire EL panel	Requires module dis-assembly	Disassemble and replace bulb
DC/AC Power inverter Required	No	Yes at \$2 to \$12 per unit	No	Yes at \$6.00 to \$20 per unit
Durability	Excellent. Very rugged	Good	Excellent	Fair
Installation	Connector	Solder or Connector	Connector	Connector
Power Consumption	Varies by light source. LED, vacuum, gas filled, and halogen	Moderate to high	High	Moderate to high
Moisture effect	None	Dark spots and shortened life	Minimal	Minimal
Shelf life degradation	No	Yes	No	No
Heat Generation	None at light panel. Heat at remote light source	Minimal. Heat at inverter	Moderate	None at light source. Heat at inverter
Color	Wide Variety	Standard green or white. Custom colors available	Limited to LED colors	White only



## **Poly-Optical® Products, Inc.**

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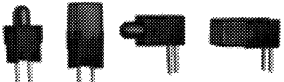

www.poly-optical.com  
E-mail: popi@ix.netcom.com

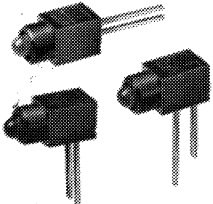
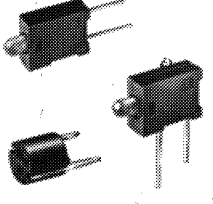
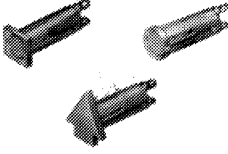
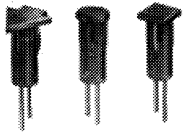
# SCHURTER

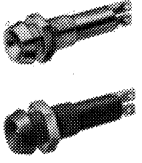
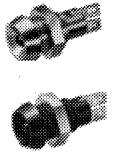
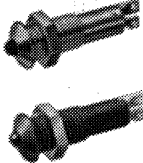
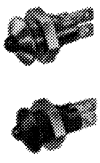
## Indicator Lights – Panel and Pcb Mount

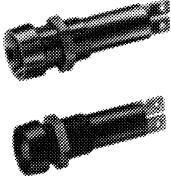

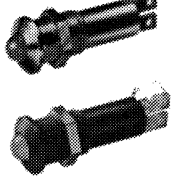

ISO 9001 / ISO 14001

	<i>Without LED (For 3mm T1 or 5mm T1-3/4 LED)</i>	<i>With LED (3mm T1 or 5mm T1-3/4)</i>
		
Pcb mount standoffs		
Series	ASL / AST	ASL / AST

	<i>Without LED (for 3mm T1 LED)</i>	<i>With LED (3mm T1)</i>	<i>With LED (3mm T1)</i>
			
Pcb mount standoffs			
Series	ASL / AST	ASL / AST	ASL / AST

	<i>For 3mm T1 or 5mm T1-3/4 LED</i>	<i>For 3mm T1 LED</i>	<i>Panel mount holders for incandescent lamp 12V or 24V, with solder terminals</i>	<i>Panel mount holders for 3mm T1 LED</i>
				
Pcb and panel mount Indicators				
Series	SRL	PBL / FMS	LMQ / LMR / LMP	LML

	<i>With internal reflector</i>		<i>With external reflector</i>	
				
Panel mount indicators (3mm LED) Solder terminals				
Series	LFM 3mm	LFM 3mm	LFM 3mm	LFM 3mm

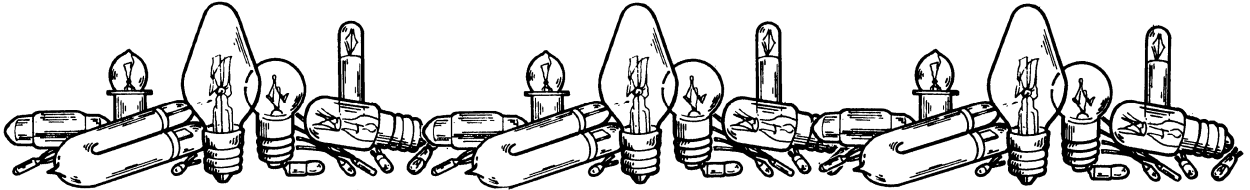
	<i>With internal reflector (sealed or unsealed)</i>		<i>With external reflector (sealed or unsealed)</i>	
				
Panel mount indicators (5mm LED) Solder terminals				
Series	LFM 5mm	LFM 5mm	LFM 5mm	LFM 5mm

**For order numbers, pricing, samples and technical information contact Schurter at 707-778-6311; Fax 707-778-6401; E-mail [info@schurterinc.com](mailto:info@schurterinc.com); Website <http://www.schurterinc.com>**



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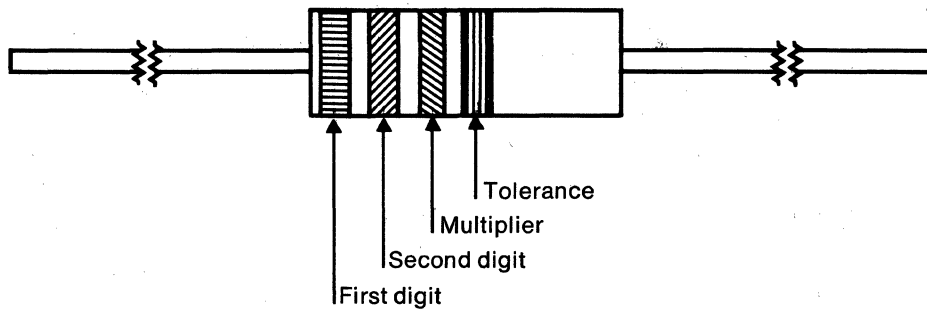


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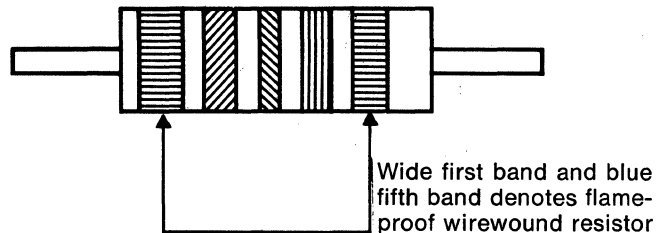
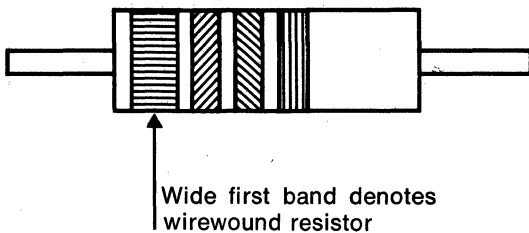
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## EIA/MIL Resistor Color Codes



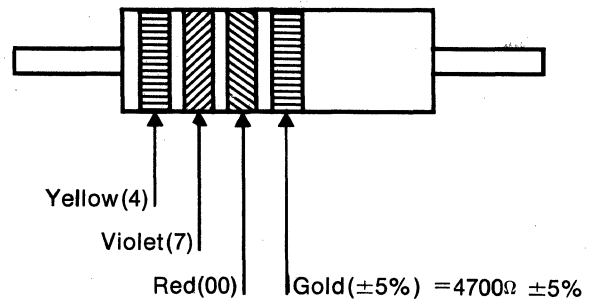
Color code for general-purpose industrial resistors

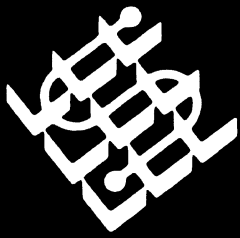


Color code for general-purpose wirewound resistors

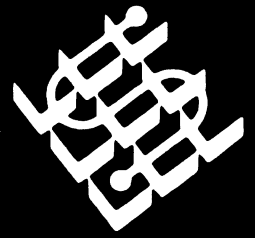
Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	± 10%
No color	—	—	± 20%

Example:



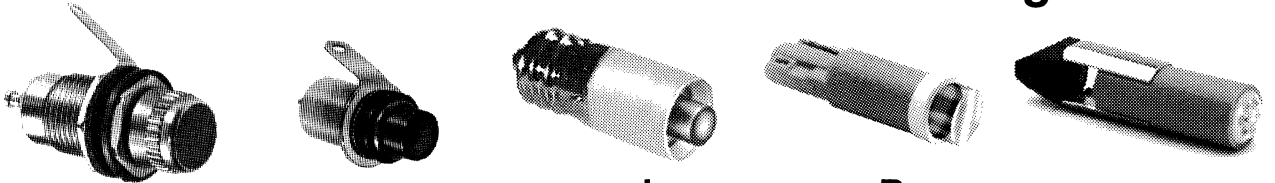


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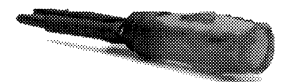
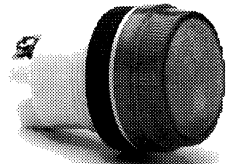
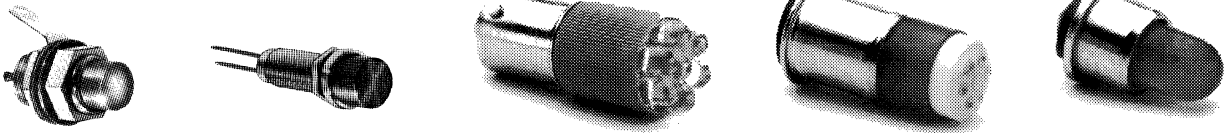
## Indicator Lights

“The Touch of Brilliance in Panel Design”



RELAMPABLE

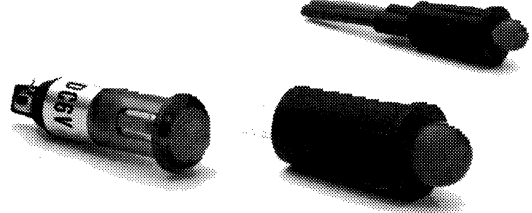
INCANDESCENT REPLACEMENTS



COMMERCIALS



SNAP-IN



### CUSTOM LED's

- ◆ 90° LED
- ◆ 12 VOLT LED
- ◆ SUPER BRIGHT WHITE LED'S
- ◆ ULTRA BRIGHT BLUE LED'S
- ◆ SUPER BRIGHT RED, GREEN, YELLOW, AMBER

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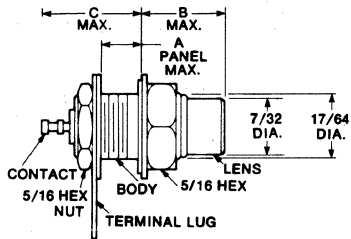
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**PANEL MOUNT FRONT RELAMP INCANDESCENT OR LED**

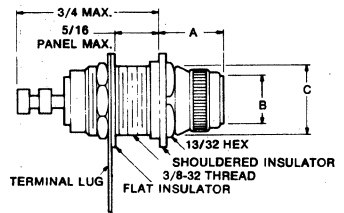
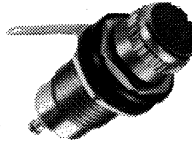
**MODEL 102-SI**



This is the two-terminal version of the basic 102-SI Model. It is created by the addition of special insulating hardware (above) which includes a solder lug as the second terminal.

**NOTE 1**—Both the 102S and the 102SI are available in four body styles: S-(above) provides a bright hex flange on the panel, SK-is a knurled flange, SS-a short low-profile hex, and SR-(above left) a small, plain flange.  
**NOTE 2**—The 102S and 102SI are available in several lens styles: Q, QB, DSC, DS, STD. (Contact Factory)  
**NOTE 3**—The 102 series can be furnished in a waterproof version, and can be RF shielded. (Contact Factory)

**MODEL 855-SI**

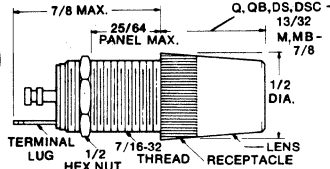
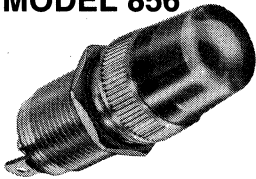


The 855-SI Model is the two-terminal version of the 855-S Model. It is created by the addition of special insulating hardware (above) which includes a solder lug as the second terminal.  
**NOTE:** Available in a variety of lense styles Contact factory for more information.

**MATERIAL & PROCESSES**  
**BODY**—Brass SAE 72 Nickel Plate QQ-N-290 Nylon MIL-M-20693  
**LENS**—Lexan LP-393 Butyrate LP-349 Nylon MIL-M-20693 Brass SAE 72 Aluminum 2024-T4 Nickel Plate QQ-N-290 Anodize MIL-A-8625  
**TERMINALS**—Brass SAE 72 Nickel Plate QQ-N-290

**PANEL MOUNT FRONT RELAMP INCANDESCENT OR LED**

**MODEL 856**

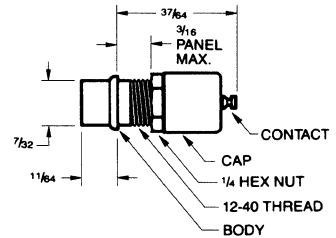


A two-terminal, front-relampable indicator light designed to use the T-1 3/4 midget flange based incandescent bulb or LED. An internal silicone-rubber pressure-pad maintains electrical contact inside the lamp body. It also provides an effective moisture seal front to back.  
**NOTE:** Available in lenses styles: Q, QB, DSC, DS, M and MB.

**MATERIAL & PROCESSES**  
**BODY**—Brass SAE 72 Nickel Plate QQ-N-290 Nylon MIL-M-20693 Delrin per LP-392  
**LENS**—Lexan LP-393 Butyrate LP-349 Nylon MIL-A-8 Nickel Plate QQ-N-290 Anodize MIL-A-8625  
**HDWE.**—Brass SAE 72 Nickel Plate QQ-N-290  
**TERMINALS**—Brass SAE 72 Tin Plate MIL-T-10727

**PANEL MOUNT REAR RELAMP INCANDESCENT OR LED**

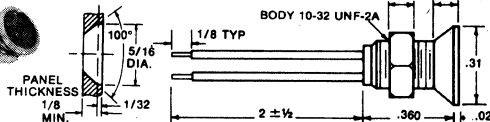
**MODEL 107**



Designed for rear replacement of T-1 size midget flanged base incandescent or LED lamps. Rugged construction allows operation at severe conditions. Available in different lens configurations. The two terminal version is the 107-SI.

**T-1 UNBASED INCANDESCENT/LED PANEL MOUNT FIXED LAMP**

**MODEL 109**

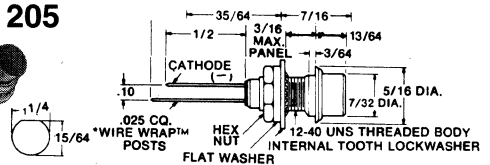
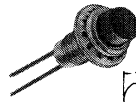


The new flush mount design can be used only with any T-1 size, LED or incandescent lamp, including the new super bright LED which gives luminous intensity and color never before possible in the T-1 size. LED colors include white, blue, red, green and amber with red, green amber, clear and white transparent and translucent lens, and are available with or without a resistor and RFI shielding. The incandescent models offer the brightness and variety of incandescent colors, including red, green, amber, blue, white and clear with either transparent or translucent lens, and the option of RFI shielding.

**MATERIAL & PROCESSES**  
**BODY**—Brass SAE 72 Nickel Plate QQ-N-290  
**LENS**—Lexan LP-393  
**TERMINALS**—26 AWG Stranded Cu. MIL-W-16878 24 AWG Solid Cu. MIL-W-16878  
**HARDWARE**—Brass SAE 72 Nickel Plate QQ-N-290

**PANEL MOUNT FIXED LAMP LED**

**MODEL 205**



This Series incorporate a red, green or amber T-1 size LED in an all-metal threaded body. Available with wire leads or wire wrap™ terminals. Two kinds of color contrast lenses are provided. When unlit, the white or clear lens material alone is visible. When lit, the color LED shows through plainly, giving the appearance of a lens which changes color. Built-in dropping resistors allow these units to be powered from sources up to 14VDC. Model 205 available with superbright LED. Available with flat sided "D" body for consistent terminal location and ease of tightening. \*Gardener-Denver

**MATERIAL & PROCESSES**  
**BODY**—Brass SAE 72 Nickel Plate per QQ-N-290  
**LENS**—Lexan LP-393 Nylon MIL-20693  
**TERMINALS**—Phosphor Bronze 3/4 Hard Tin Plate per MIL-T-10727  
Wire per MIL-W-16878 24 AWG Solid Cu. 26 AWG Stranded Cu.  
**HARDWARE**—Brass SAE 72 Spring Steel per MIL-W-6986 Nickel Plate per QQ-N-290

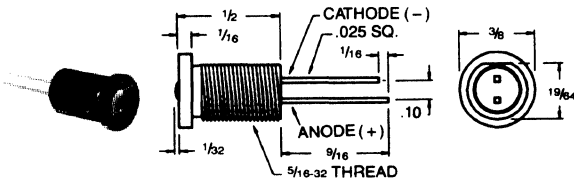


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**PANEL MOUNT LED**

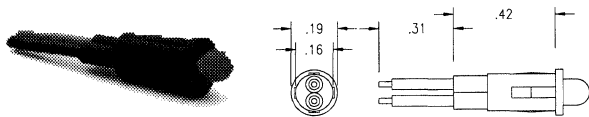
**MODEL 252**



Utilizes hermetically sealed solid state LEDs with high brightness and wide viewing angle. Can be supplied with standard, JAN Qualified, or JANTX LEDs. It can also be supplied with a current limiting resistor depending on your particular requirement. The Model 253 is supplied with an O-ring for proper panel sealing.

**SNAP-IN PANEL LED**

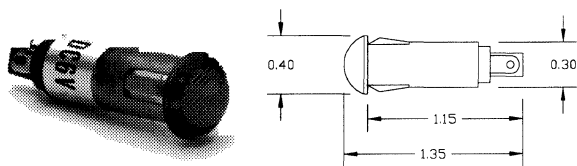
**MODEL 150**



The 150 Model incorporates a LED in a variety of colors. The press snap-in design requires no mounting hardware and is designed for a 5/32" mounting hole. Supplied standard with 6" wire leads, although any length may be ordered. This model can also be supplied with a current limiting resistor.

**SNAP-IN PANEL MOUNT**

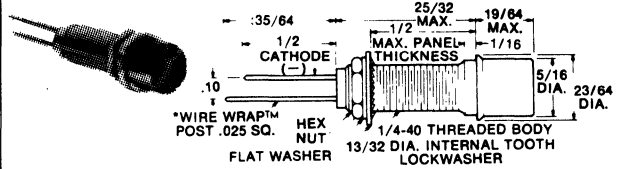
**MODEL 776**



Model 776 snap mount indicator is available in LED, Neon and incandescent lamps. Choice of colors included: Red, Green, and Amber. Suggested mounting hole diameter is 8mm. Available in a variety of voltages.

**PANEL MOUNT FIXED LAMP  
 HI-BRIGHT LED**

**MODEL 207**

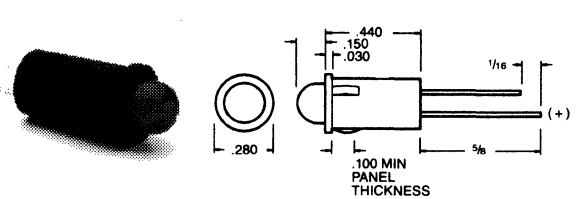


Utilizes a T-13/4 Hi-Bright LED. Permits 180° visibility, up to 100 mcd. The lens incorporates Fresnel rings and flutes which allow maximum distribution of light output. Also available with plain lens (no flutes or rings). Termination is by wire leads or wire-wrap™ post. Built-in dropping resistors allow these units to be powered from sources up to 28 VDC. Bodies can be rounded or "D" type.

**MATERIAL & PROCESSES**  
**BODY**—Brass SAE 72 Nickel Plate per QQ-N-290 Nylon per MIL-M-20693  
**LENS**—Lexan LP-393  
**TERMINALS**—Phosphor Bronze-3/4 Hard Tin Plate per MIL-T-10727  
 Wire per MIL-W-16878 24 AWG Solid Cu. 26 AWG Stranded Cu.  
 Hardware—Brass SAE 72 Spring Steel per MIL-W-6986 Nickel Plate per QQ-N-290

**SNAP-IN PANEL LED**

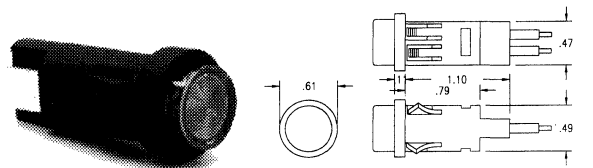
**MODEL 240**



This model uses high brightness LEDs mounted in easy press to fit bodies. Ideal for fast production, this model presses into place permanently, eliminating the need for mounting hardware. Uses straight terminal leads to which wires can be soldered directly or the leads can be hand soldered into PC boards either vertically or horizontally by bending the leads.

**SNAP-IN PANEL MOUNT**

**MODEL 500**



Model 500 incorporates a LED, Neon or incandescent lamp. With a Suggested 1/2" mounting hole, this snap-in indicator is designed for multiple panel thickness. Supplied with resistor allowing a variety of voltages.



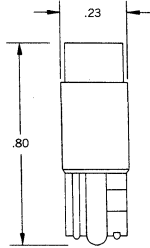
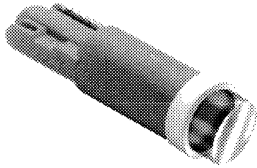
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**INCANDESCENT REPLACEMENT LED**

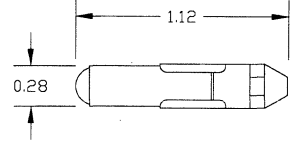
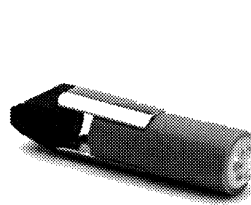
**WEDGE BASE MODEL 515**



Size: T-1 3/4  
 Mounting Base: Wedge  
 LED Type: Ultra Bright  
 Colors: White, Blue, Green, Red, Yellow, Amber  
 Direct Replacements: 85, 11, 56, 86, 74, 79, 84, & others  
 Model 513 available in Multi-chip LED

**INCANDESCENT REPLACEMENT LED**

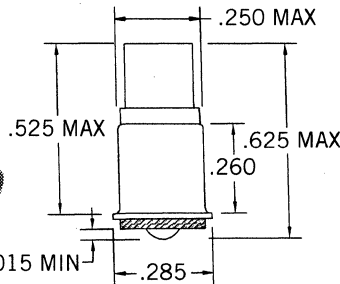
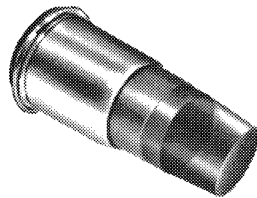
**TELEPHONE SLIDE MODEL 514**



This model 514 used extensively in the industry, can be provided in several lengths, colors, and voltages. Provides a wide viewing angle using a multi-chip LED.

**INCANDESCENT REPLACEMENT LED**

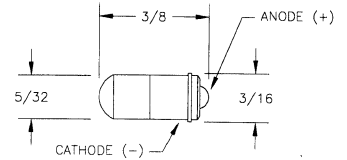
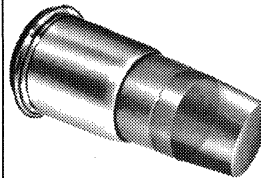
**MODEL 511**



Size: T-1 3/4  
 Mounting Base: Midget Flange  
 LED Type: Single Chip  
 Colors: White, Blue, Green, Red, Yellow, Amber  
 Direct Replacements: 327, 387, 783, 326, 6038, 330, 345, 377, & others  
 Model 510 available in Multi-chip LED

**INCANDESCENT REPLACEMENT LED**

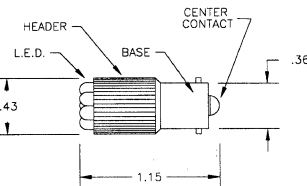
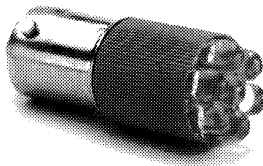
**MODEL 311**



Size: T-1  
 Mounting Base: Sub-Midget Flange  
 LED Type: Single Chip  
 Colors: White, Blue, Green, Red, Yellow, Amber  
 Model 310 available in Multi-chip LED

**INCANDESCENT REPLACEMENT LED**

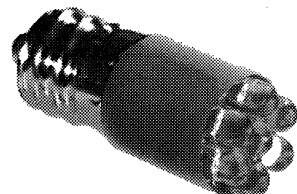
**MODEL 197**



Size: T-3 1/4  
 Mounting Base: Miniature Bayonet  
 LED Type: 6-3mm cluster and Single 5mm  
 Colors: White, Blue, Green, Red, Yellow, Amber  
 Direct Replacements: 120MB, 313, 356, 1818, 1820, & others

**INCANDESCENT REPLACEMENT LED**

**MODEL 159**



Size: T-3 1/4  
 Mounting Base: Miniature Screw  
 LED Type: 6-3mm cluster and Single 5mm  
 Colors: White, Blue, Green, Red, Yellow, Amber  
 Direct Replacements: 13, 14, 27, 31, 40, 46, 48, 50, & others



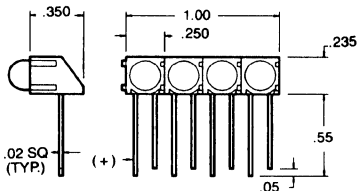
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**CIRCUIT BOARD MOUNT LED**

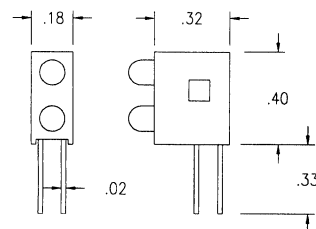
**MODEL 211**



Designed specifically for parallel mounting to printed circuit boards. Used where two or more indicator lights are needed in arrays of virtually any number. Close tolerance spacing makes assembly of the board with the front panel easy and trouble free.

**CIRCUIT BOARD MOUNT LED**

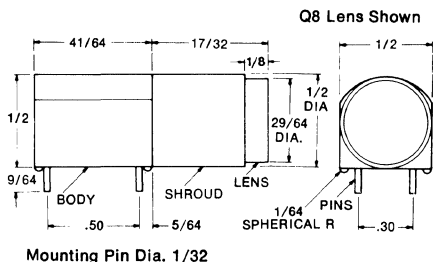
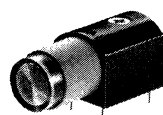
**MODEL 120**



Model 120 Bi-level incorporates two T-1 LED's and is available as individuals or in an array. Either top or bottom LED may be of any color or tint style

**CIRCUIT BOARD REPLACABLE LAMP**

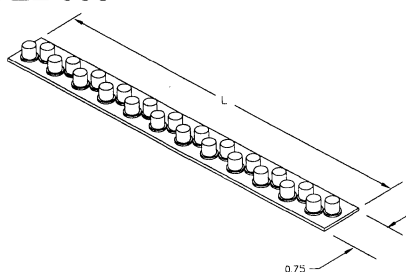
**MODEL 864**



Model 864 is designed for printed circuit board mounting and relampability. May used T1 3/4 LED or incandescent lamps. Lens removes for easy lamp replacement. Other models provide vertical mounting and T-1 lamp capability.

**BACK LIGHTING PCB**

**MODEL 900**



This versatile model 900LED board is used for a multitude of illumination needs. May be daisy chained to create lengths up to 50ft.. Available in White, Red, Blue, Amber, Yellow and Green. Voltages up to 28 Volts AC or DC.

**GENERAL INFORMATION**

- RFI shielding available with virtually all models.
- All materials meet or exceed applicable military specs.

- It is wise to avoid using blue or green lenses with neon lamps.
- Ultra-bright, multichip and other exotic lamps available.

**INCANDESCENT LAMP ELECTRICAL SPECIFICATIONS T-1 LAMPS**

LAMP	VOLTS	CURRENT (A)	MSCP	LIFE (K HRS.)	INDUSTRY STD. NO
FB60	5	.060	.050	100	685*
FB59	28	.024	.150	16	-
FB44	18	.026	.150	10	*MS-24515

**T-1 3/4 LAMPS**

327	28	.04	.340	4600	-
328	6	.20	.600	1000	-
387	28	.04	.300	7100	-

**NEON LAMP ELECTRICAL SPECIFICATIONS**

LAMP WITH RESISTOR	VOLTS A.C. OR D.C.	AMPS NOMINAL	WATTS NOMINAL	LIFE	RESISTOR
A1B	105-125	.03	1/25	25,000	220K
A1C	105-125	1.2	1/7	25,000	47K
A9A (NE-2E)	105-125	0.7	1/12	25,000	100K
C2A (NE-2H)	105-125	1.9	1/4	25,000	30K

NOTE: A1C and NE2H are high brightness. Other lamps available. Life figures for A.C.—Life at D.C. 1/2 A.C. (Approx.). 862 Series cannot be supplied with resistor. We suggest that you do not order neon with Green or Blue lenses. **IMPORTANT:** The lamps shown represent the most popular types normally requested. **MANY OTHER LAMPS ARE AVAILABLE—PLEASE CONTACT FACTORY.**

**COLOR TABLE**

LENS MATERIAL	LEXAN	LEXAN	GENERAL PURPOSE	BUTYRATE
Color	Transparent	Translucent	Translucent	Transparent
Red	RL	RLUC	R	RTP
Green	GL	GLUC	G	GTP
Blue	BL	BLUC	B	BTP
Amber	AL	ALUC	A	ATP
Clear	CL	-	-	CTP
White	-	WLUC	W	W

**IMPRINTING**

Lenses may be hot stamped, engraved, or opaqued and engraved so that the character only is displayed. The chart below designates type size available for hot stamping. Size of lens determines size of type that can be used.

TYPE	ACTUAL SIZE	
	WIDTH	HEIGHT
2 Pt.	.050	.060
6 Pt.	.060	.080
8 Pt.	.080	.110
10 Pt.	.090	.120
12 Pt.	.110	.160

NOTE: For other size type, contact factory

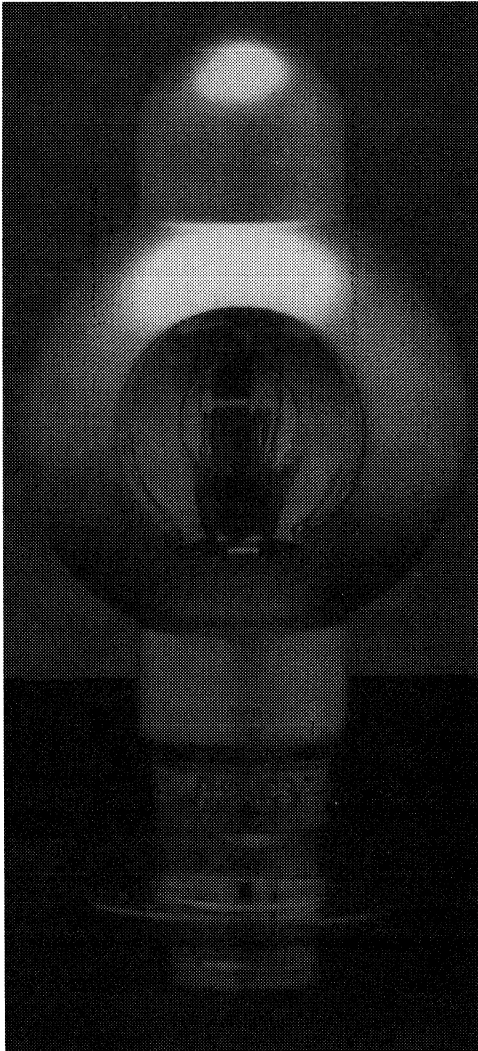
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# STANLEY ELECTRIC CO., LTD.

## SUPER BRIGHT LED LAMP

### HI-SUPER BRIGHT LED LAMP (Ta=25°C)

Shape	Type No.	Emitted Color	Peak Wavelength λp(nm)	Iv(TYP)		Resin Color
				(mcd)	I <sub>f</sub> (mA)	
	H-3000L	Red	660	3,000	20	Clear
	H-2000L		660	2,000	20	
	H-1000L		660	1,000	20	
	ER-700L		660	700	20	
	ER-500L		660	500	20	
	ER-300L		660	300	20	
	HBR5066X	Red	660	300	20	Pastel Red
	HAA5066X	Orange	605	250	20	Pastel Orange
	HAY5066X	Yellow	580	150	20	Pastel Yellow
	HPY5066X		570	300	20	
	HPG5066X	Green	560	200	20	Pastel Green
	HBG5066X	Pure Green	555	150	20	
	KR5005S	Red	660	300	20	Clear
	KR5004X		660	800	20	
	KR3301X		660	140	20	

### LARGE-SIZE LED (Ta=25°C)

Shape	Type No.	Emitted Color	Peak Wavelength λp(nm)	Iv(TYP)		Resin Color
				(mcd)	I <sub>f</sub> (mA)	
	HBR7071X	Red	660	60	20	Pastel Red Diff.
	HPY7071X	Yellow	570	60	20	Pastel Yellow Diff.
	KR7001X	Red	660	1,000	20	Clear
	H-3010-1	Red	660	3,000	20	Clear
	HPY1010-1	Yellow	570	1,000	20	Clear

### BICOLOR LED LAMP (Ta=25°C)

Shape	Type No.	Emitted Color	Peak Wavelength λp(nm)	Iv(TYP)		Resin Color
				(mcd)	I <sub>f</sub> (mA)	
	VRPY5614S	Red	630	30	20	Milky - White Diff
		Yellow	570	50	20	
	VRBG5614S	Red	630	30	20	
	VRPY5614X	Red	630	30	20	Milky - White Diff
		Yellow	570	50	20	
	VRBG5614X	Red	630	30	20	
		Pure Green	555	16	20	
	VRPY5645X	Red	630	4	20	Milky - White Diff
		Yellow	570	6	20	
	VRBG5645X	Red	630	4	20	
		Pure Green	555	2	20	
	VRPY3349S	Red	630	4	20	Milky - White Diff
		Yellow	570	6	20	
	VRBG3349S	Red	630	4	20	
		Pure Green	555	1.6	20	
	VRPY3312X	Red	630	8	20	Milky - White Diff
		Yellow	570	16	20	
	VRBG3312X	Red	630	8	20	
		Pure Green	555	6	20	
	VRPY5641K	Red	630	4	20	Milky - White Diff
		Yellow	570	8	20	
	VRBG5641K	Red	630	4	20	
		Pure Green	555	2	20	

Stanley Electric Sales of America, Inc.

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### PANEL LIGHTING LED LAMP (Ta=25°C)

Shape	Type No.	Emitted Color	Peak Wavelength λp(nm)	Iv(TYP)		Resin Color	
				(mcd)	I <sub>f</sub> (mA)		
	BR5363X/5373X	Red	660	30/12	20	Pastel Red/Diff	
			MPR5363X/5373X	700	4/2		10
			MVR5363X/5373X	630	20/10		20
	MAA5363X/5373X	Orange	605	20/10	20	Pastel Org/Diff	
			MAY5363X/5373X	580	20/10		20
	MPY5363X/5373X	Yellow	570	30/12	20	Pastel Yellow/Diff	
			MPG5363X/5373X	560	20/10		20
	MBG5363X/5373X	Pure Green	555	10/3	20	Pastel Green/Diff	
	BR5362X	Red	660	4	20	Pastel Red - Clear	
			PR5362X	700	0.6		10
			VR5362X	630	4		20
	AA5362X	Orange	605	4	20	Pastel Orange-Clear	
			AY5362X	580	4		20
	PY5362X	Yellow	570	6	20	Pastel Yellow - Clear	
			PG5362X	560	4		20
	BG5362X	Pure Green	555	1.2	20	Pastel Green - Clear	
			BR3365S	660	5		20
	PR3365S	Red	700	0.8	10	Pastel Red - Clear	
VR3365S			630	4	20		
AA3365S			605	4	20		
AY3365S	Orange	580	4	20	Pastel Orange-Clear		
		PY3365S	570	6		20	
PG3365S	Yellow	560	4	20	Pastel Yellow		
		PG3365S	560	4		20	
BG3365S	Green	555	1.6	20	Pastel Green - Clear		
		BG3365S	555	1.6		20	
	BR3361X/3371X	Red	660	12/10	20	Pastel Red/Diff	
			MPR3361X/3371X	700	1.6/1		10
			MVR3361X/3371X	630	8/6		20
	MAA3361X/3371X	Orange	605	12/10	20	Pastel Org Clear/Diff	
			MAY3361X/3371X	580	10/8		20
	MPY3361X/3371X	Yellow	570	20/16	20	Pastel Yellow Clear/Diff	
			MPG3361X/3371X	560	12/10		20
	MBG3361X/3371X	Pure Green	555	6/4	20	Pastel Green/Diff	
	BR3822K	Red	660	4	20	Red Clear	
			PR3822K	700	0.8		10
			VR3822K	630	4		20
	AA3822K	Orange	605	4	20	Orange Clear	
			AY3822K	580	4		20
	PY3822K	Yellow	570	4	20	Yellow Clear	
			PG3822K	560	4		20
BG3822K	Pure Green	555	2	20	Green Clear		
	BR5379K	Red	660	24	20	Pastel Red/Diff	
			MPR5379K	700	3		10
			MVR5379K	630	20		20
	MAA5379K	Orange	605	24	20	Pastel Org/Diff	
			MAY5379K	580	24		20
	MPY5379K	Yellow	570	40	20	Pastel Yellow/Diff	
			MPG5379K	560	24		20
	MBG5379K	Pure Green	555	6	20	Pastel Green/Diff	
	BR4868K	Red	660	10	20	Pastel Red	
			MPR4868K	700	1.5		10
			MVR4868K	630	8		20
	MAA4868K	Orange	605	10	20	Pastel Orange	
			MAY4868K	580	10		20
	MPY4868K	Yellow	570	12	20	Pastel Yellow	
			MPG4868K	560	8		20
	MBG4868K	Pure Green	555	4	20	Pastel Green	

### FLUSH MOUNT LED LAMP (Ta=25°C)

Shape	Type No.	Emitted Color	Peak Wavelength λp(nm)	Iv(TYP)		Resin Color	
				(mcd)	I <sub>f</sub> (mA)		
	BR3864X	Red	660	30	20	Pastel Red	
			MPR3864X	700	3		10
			MVR3864X	630	20		20
	MAA3864X	Orange	605	24	20	Pastel Orange	
			MAY3864X	580	20		20
	MPY3864X	Yellow	570	40	20	Pastel Yellow	
			MPG3864X	560	24		20
	MBG3864X	Pure Green	555	10	20	Pastel Green	

Flush mount lamps

- Are auto insertable
- Can be flushed to PC board

- Can absorb shock



**STANLEY ELECTRIC CO., LTD.**

**SUPER BRIGHT LED LAMP**

**■ SUPER BRIGHT LED LAMP**

Shape	Type No.	Emitted Color	Peak Wavelength (nm)	Iv (Typ) (mcd)	If (mA)	Resin Color
	BR5364X/5374X	Red	660	120/60	20	Pastel Red - Clear/Diff
	MPR5364X/5374X		700	10/6	10	
	MVR5364X/5374X		630	100/60	20	
	MAA5364X/5374X	Orange	605	100/50	20	Pastel Org-Clear/Diff
	MAY5364X/5374X	Yellow	580	80/40	20	Pastel Yellow - Clear/Diff
	MPY5364X/5374X		570	120/60	20	
	MPG5364X/5374X	Green	560	100/40	20	Pastel Green - Clear/Diff
	MBG5364X/5374X	Pure Green	555	40/16	20	Pastel Green - Clear/Diff
	BR5385X	Red	660	6	20	Pastel Red/Diff
	PR5385X		700	0.9	10	
	VR5385X		630	6	20	
	AA5385X	Orange	605	6	20	Pastel Org/Diff
	AY5385X	Yellow	580	5	20	Pastel Yellow /Diff
	PY5385X		570	6	20	
	PG5385X	Green	560	5	20	Pastel Green /Diff
	BG5385X	Pure Green	555	1.6	20	Pastel Green /Diff
	BR5304S/5334S	Red	660	80/20	20	Clear/Red Diff
	PR5304S/5334S		700	12/10	10	
	VR5304S/5334S		630	60/16	20	
	AA5304S/5334S	Orange	605	60/16	20	Clear/Org Diff
	AY5304S/5334S	Yellow	580	60/16	20	Clear/Yellow Diff
	PY5304S/5334S		570	80/30	20	
	PG5304S/5334S	Green	560	60/24	20	Clear/Green Diff
	BG5304S/5334S	Pure Green	555	50/10	20	Clear/Green Diff
	BR4365S/4375S	Red	660	20/12	20	Pastel Red - Clear/Diff
	MPR4365S/4375S		700	3/1.2	10	
	MVR4365S/4375S		630	16/10	20	
	MAA4365S/4375S	Orange	605	20/8	20	Pastel Org/Diff
	MAY4365S/4375S	Yellow	580	20/8	20	Pastel Yellow - Clear/Diff
	MPY4365S/4375S		570	30/16	20	
	MPG4365S/4375S	Green	560	20/12	20	Pastel Green - Clear/Diff
	MBG4365S/4375S	Pure Green	555	10/6	20	Pastel Green - Clear/Diff
	BR4361F/4371F	Red	660	20/10	20	Pastel Red - Clear/Diff
	MPR4361F/4371F		700	1.2/1	10	
	MVR4361F/4371F		630	8/6	20	
	MAA4361F/4371F	Orange	605	10/8	20	Pastel Org-Clear/Diff
	MAY4361F/4371F	Yellow	580	10/8	20	Pastel Yellow - Clear/Diff
	MPY4361F/4371F		570	12/10	20	
	MPG4361F/4371F	Green	560	10/6	20	Pastel Green - Clear/Diff
	MBG4361F/4371F	Pure Green	555	6/3	20	Pastel Green - Clear/Diff
	BR3889S	Red	660	8	20	Pastel Red Diff
	PR3889S		700	0.9	10	
	VR3889S		630	6	20	
	AA3889S	Orange	605	5	20	Pastel Org Diff
	AY3889S	Yellow	580	4	20	Pastel Yellow Diff
	PY3889S		570	5	20	
	PG3889S	Green	560	4	20	Pastel Green Diff
	BG3889S	Pure Green	555	1.6	20	Pastel Green Diff
	BR3368S/3378S	Red	660	80/30	20	Pastel Red - Clear/Diff
	MPR3368S/3378S		700	6/3	10	
	MVR3368S/3378S		630	40/20	20	
	MAA3368S/3378S	Orange	605	40/20	20	Pastel Org/Diff
	MAY3368S/3378S	Yellow	580	40/20	20	Pastel Yellow /Diff
	MPY3368S/3378S		570	60/30	20	
	MPG3368S/3378S	Green	560	40/20	20	Pastel Green /Diff
	MBG3368S/3378S	Pure Green	555	20/10	20	Pastel Green /Diff

Shape	Type No.	Emitted Color	Peak Wavelength (nm)	Iv (Typ) (mcd)	If (mA)	Resin Color
	BR2262S/2272S	Red	660	20/16	20	Pastel Red - Clear/Diff
	MPR2262S/2272S		700	1.6/1.2	10	
	MVR2262S/2272S		630	16/12	20	
	MAA2262S/2272S	Orange	605	16/12	20	Pastel Org-Clear/Diff
	MAY2262S/2272S	Yellow	580	16/10	20	Pastel Yellow - Clear/Diff
	MPY2262S/2272S		570	24/16	20	
	MPG2262S/2272S	Green	560	16/12	20	Pastel Green - Clear/Diff
	MBG2262S/2272S	Pure Green	555	8/4	20	Pastel Green - Clear/Diff
	BR7351K	Red	660	3	20	Red Diff
	PR7351K		700	0.5	10	
	VR7351K		630	2.4	20	
	AA7351K	Orange	605	2.4	20	Orange Diff
	AY7351K	Yellow	580	2.4	20	Yellow Diff
	PY7351K		570	4	20	
	PG7351KY	Green	565	3	20	Green Diff
	BG7351K	Pure Green	555	1	20	Green Diff
	BR5351K	Red	660	3	20	Red Diff
	PR5351K		700	0.5	10	
	VR5351K		630	2.4	20	
	AA5351K	Orange	605	2.4	20	Orange Diff
	AY5351K	Yellow	580	2.4	20	Yellow Diff
	PY5351K		570	4	20	
	PG5351KY	Green	565	3	20	Green Diff
	BG5351K	Pure Green	555	1	20	Green Diff
	BR5352K	Red	660	3	20	Red Diff
	MPR5352K		700	0.5	10	
	MVR5352K		630	2.4	20	
	MAA5352K	Orange	605	2.4	20	Orange Diff
	MAY5352K	Yellow	580	2.4	20	Yellow Diff
	MPY5352K		570	4	20	
	MPG5352K	Green	560	3	20	Green Diff
	MBG5352K	Pure Green	555	1	20	Green Diff
	BR5353K	Red	660	3	20	Red Diff
	MPR5353K		700	0.5	10	
	MVR5353K		630	2.4	20	
	MAA5353K	Orange	605	2.4	20	Orange Diff
	MAY5353K	Yellow	580	2.4	20	Yellow Diff
	MPY5353K		570	4	20	
	MPG5353K	Green	560	3	20	Green Diff
	MBG5353K	Pure Green	555	1	20	Green Diff
	BR5356K	Red	660	2	20	Red Diff
	MPR5356K		700	0.5	10	
	MVR5356K		630	2	20	
	MAA5356K	Orange	605	2	20	Orange Diff
	MAY5356K	Yellow	580	2	20	Yellow Diff
	MPY5356K		570	3	20	
	MPG5356K	Green	560	2.4	20	Green Diff
	MBG5356K	Pure Green	555	0.8	20	Green Diff
	BR4364K	Red	660	6	20	Pastel Red
	MPR4364K		700	1.5	10	
	MVR4364K		630	5	20	
	MAA4364K	Orange	605	6	20	Pastel Orange
	MAY4364K	Yellow	580	6	20	Pastel Yellow
	MPY4364K		570	10	20	
	MPG4364K	Green	560	6	20	Pastel Green - Clear
	MBG4364K	Pure Green	555	3	20	Pastel Green - Clear

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# STANLEY ELECTRIC CO., LTD.

## SUPER BRIGHT CHIP TYPE LED

Surface mount LEDs were developed for low cost, low profile and high density design applications. A wide variety of package styles and colors are available to suit virtually any requirement.

### NOVA BRIGHT AlInGaP SURFACE MOUNT LEDs

The H, C & F series are also available in a higher luminous intensity by using the AlInGaP material technology.

### ULTRA COMPACT TYPE SURFACE MOUNT LEDs

The 1111C (1.6x0.8x0.7)mm and 1112C (1.6x0.8x0.5)mm series are Stanley's ultra compact surface-mount LEDs. Application examples are cellular phones, pagers, and backlighting LCD displays.

### RIGHT ANGLE SURFACE MOUNT LEDs

The 1101F series is Stanley's right angle series. The key benefit for this surface mount is its right angle sidelighting capability. Application examples are status indicators, edgelighting and indicators for printed circuits.

### REVERSE SURFACE MOUNT LEDs

Stanley offers a reverse-mount type designed to be mounted on one side of the PCB with the light going through a hole in the opposite direction. Application examples are cellular phones, backlighting and membrane switch pads.

### BICOLOR ULTRA COMPACT SURFACE MOUNT LEDs

The 1211C series is Stanley's smallest 2 chip (bicolor) surface mount LED with dimensions of 1.6x1.5x0.7mm. Application examples are pagers, backlighting, LCDs, hand held test equipment, radio panels and keyless entry.

### SURFACE MOUNT TYPE LEDs

#### Nova-Bright LEDs (AlInGaP)

(Ta=25°C)

Package	Shape	Type No.	Emitted Color	Peak Wavelength λp(nm)	Iv(TYP) (mcd)	If (mA)	Reels
Thin Chip (H) Series		FR1112H	Red-Orange	630	50	20	†4000pcs
		FA1112H	Orange Red	609	65	20	†4000pcs
		FY1112H	Amber	592	65	20	†4000pcs
Ultra Compact (C) Series		FR1111C	Red-Orange	630	50	20	*4000pcs
		FA1111C	Amber	609	65	20	*4000pcs
		FY1111C	Yellow	592	65	20	*4000pcs
Right Angle (F) Series		FR1101F	Red-Orange	630	50	20	3000pcs
		FA1101F	Orange Red	609	65	20	3000pcs
		FY1101F	Amber	592	65	20	3000pcs

†=2015 inches, 0805 mm \* =1608 inches, 0603 mm

1608 mm (0603) inch (Ta=25°C)

#### Ultra Compact Type (Single Color)

Shape	Type No.	Emitted Color	Peak Wavelength λp(nm)	Iv(TYP) (mcd)	If (mA)
	BR1111C	Red	660	11.7	20
	AA1111C	Orange	605	3.4	20
	AY1111C	Yellow	580	3.4	20
	PY1111C	Yellow	570	11.7	20
	PG1111C	Green	560	6.4	20
	BG1111C	Pure Green	555	2.4	20
1.6Lx0.8Wx0.5H	PY1112C	Yellow	570	14	20

#### Thin Type (Single Color) (1225 mm, 0805 inch, Ta=25°C)

Shape	Type No.	Emitted Color	Peak Wavelength λp(nm)	Iv(TYP) (mcd)	If (mA)
	BR1112H	Red	660	11.7	20
	AA1112H	Orange	605	3.7	20
	AY1112H	Yellow	580	3.7	20
	PY1112H	Yellow	570	11.7	20
	PG1112H	Green	560	6.4	20
	BG1112H	Pure Green	555	2.7	20

#### Right Angle Type (Single Color)

(Ta=25°C)

Shape	Type No.	Emitted Color	Peak Wavelength λp(nm)	Iv(TYP) (mcd)	If (mA)
	BR1101F	Red	660	12.4	20
	AA1101F	Orange	605	3.0	20
	AY1101F	Yellow	580	3.0	20
	PY1101F	Yellow	570	8.8	20
	PG1101F	Green	560	5.2	20
	BG1101F	Pure Green	555	2.4	20
	BR1113F	Red	660	11.7	20
	PY1113F	Yellow	570	11.7	20
	PG1113F	Green	560	6.4	20

Available in reels of 3,000

#### Reverse Type (Single Color)

(Ta=25°C)

Shape	Type No.	Emitted Color	Peak Wavelength λp(nm)	Iv(TYP) (mcd)	If (mA)
	BR1111R	Red	660	12.7	20
	AA1111R	Orange	605	3.7	20
	AY1111R	Yellow	580	3.7	20
	PY1111R	Yellow	570	12.7	20
	PG1111R	Green	560	6.9	20
	BG1111R	Pure Green	555	2.7	20

Available in reels of 3,000

#### Standard Type (Single Color)

3216 mm (1206) inch (Ta=25°C)

Shape	Type No.	Emitted Color	Peak Wavelength λp(nm)	Iv(TYP) (mcd)	If (mA)
	BR1101W	Red	660	4.5	20
	AA1101W	Orange	605	3.6	20
	AY1101W	Yellow	580	3.2	20
	PY1101W	Yellow	570	4	20
	PG1101W	Green	560	3	20
	BG1101W	Pure Green	555	1.4	20
	BR1102W	Red	660	17	20
	AA1102W	Orange	605	9	20
	AY1102W	Yellow	580	6	20
	PY1102W	Yellow	570	12	20
	PG1102W	Green	560	7.5	20
	BG1102W	Pure Green	555	2.3	20

Available in reels of 2,500

#### Standard Type (Bicolor) (3225 mm, 1210 inch) (Ta=25°C)

Shape	Type No.	Emitted Color	Peak Wavelength λp(nm)	Iv(TYP) (mcd)	If (mA)
	BRPY1201W	Red/Yellow	660/570	4.5/4	20
	BRPG1201W	Red/Green	660/560	4.5/3	20
	BRBG1201W	Red/ Pure Green	660/555	4.5/1.4	20
	BRPY1204W	Red/Yellow	660/570	17/12	20
	BRPG1204W	Red/Green	660/560	17/7.5	20
	BRBG1204W	Red/ Pure Green	660/555	17/2.3	20
	AAPY1204W	Orange/Yellow	605/570	9/12	20

Available in reels of 2,500

#### Ultra Compact Type (Bicolor)

(Ta=25°C)

Shape	Type No.	Emitted Color	Peak Wavelength λp(nm)	Iv(TYP) (mcd)	If (mA)
	BRPY1211C	Red/Yellow	660/570	11.7/11.7	20
	BRPG1211C	Red/Green	660/560	11.7/6.4	20
	BRBG1211C	Red/ Pure Green	660/555	11.7/2.4	20

Available in reels of 4,000

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**STANLEY ELECTRIC CO., LTD.**

**SEVEN SEGMENT DISPLAY / ALPHANUMERIC DISPLAY**

■ SEVEN SEGMENT DISPLAY

(Ta=25°C)

Digit Size	Shape	Common	Type No. Package Color		Emitted Color	Iv(mcd/seg) Rank			Peak Wave-length λp(nm)
			Black	Gray		A	B	C	
0.3" 7.6mm		Anode	NAR131S	NAR133S	Red	1.4	2.8	5.6	700
			NAG131SP	NAG133SP	Green	-	2.0	-	565
			NAA131S	NAA133S	Orange	0.6	1.2	-	605
		Cathode	NKR131S	NKR133S	Red	1.4	2.8	5.6	700
			NKG131SP	NKG133SP	Green	1.0	2.0	-	565
			NKA131S	NKA133S	Orange	0.6	1.2	-	605
0.4" 10mm		Anode	NAR141S	NAR143S	Red	1.6	3.2	-	660
			NAG141SP	NAG143SP	Green	-	1.2	-	565
			NAA141S	NAA143S	Orange	0.8	1.6	-	605
		Cathode	NKR141S	NKR143S	Red	1.6	3.2	-	660
			NKG141SP	NKG143SP	Green	0.6	1.2	-	565
			NKA141S	NKA143S	Orange	0.8	1.6	-	605
		Anode	NAR245	NAR247	Red	3.2	6.4	8.8	660
			NAG245P	NAG247P	Green	-	1.6	-	565
			NAA245	NAA247	Orange	2.4	4.8	-	605
		Cathode	NKR245	NKR247	Red	3.2	6.4	8.8	660
			NKG245P	NKG247P	Green	0.8	1.6	-	565
			NKA245	NKA247	Orange	2.4	4.8	-	605
0.6" 15mm		Anode	NAR161	NAR163	Red	6	12	15	660
			NAG161P	NAG163P	Green	-	4	-	565
			NAA161	NAA163	Orange	4	8	-	605
		Cathode	NKR161	NKR163	Red	6	12	15	660
			NKG161P	NKG163P	Green	2	4	-	565
			NKA161	NKA163	Orange	4	8	-	605
		Anode	NAR261	NAR263	Red	6	12	15	660
			NAG261P	NAG263P	Green	-	4	-	565
			NAA261	NAA263	Orange	4	8	-	605
		Cathode	NKR261	NKR263	Red	6	12	15	660
			NKG261P	NKG263P	Green	2	4	-	565
			NKA261	NKA263	Orange	4	8	-	605
1.0" 25mm		Anode	NAR105	NAR107	Red	10	20	25	660
			NAG105P	NAG107P	Green	-	8	-	565
			NAA105	NAA107	Orange	8	16	-	605
		Cathode	NKR105	NKR107	Red	10	20	25	660
			NKG105P	NKG107P	Green	4	8	-	565
			NKA105	NKA107	Orange	8	16	-	605

13□, 14□, 16□, 10□, 24□, 26□: IF=20mA

■ SEVEN SEGMENT DISPLAY BICOLOR TYPE

(Ta=25°C)

Digit Size	Shape	Common	Type No. Package Color		Emitted Color	Iv(mcd/seg) Rank			Peak Wave-length λp(nm)
			Black	Gray		A	B	C	
0.4" 10mm		Anode	NARG141	NARG143	Red	-	2.4	-	660
			NARG141	NARG143	Green	-	2.4	-	570
		Cathode	NKRG141	NKRG143	Red	-	2.4	-	660
			NKRG141	NKRG143	Green	-	2.4	-	570
0.6" 15mm		Anode	NARG161	NARG163	Red	-	2.4	-	660
			NARG161	NARG163	Green	-	2.4	-	565
		Cathode	NKRG161	NKRG163	Red	-	2.4	-	660
			NKRG161	NKRG163	Green	-	2.4	-	570
1.0" 25mm		Anode	NARG105	NARG107	Red	-	4	-	660
			NARG105	NARG107	Green	-	4	-	570

\*IF=10mA

■ +1 SEGMENT DISPLAY

(Ta=25°C)

Digit Size	Shape	Type No. Package Color		Emitted Color	Iv(mcd/seg) Rank			Peak Wave-length λp(nm)
		Black	Gray		A	B	C	
0.4" 10mm		NSR145	NSR147	Red	3.2	6.4	8.8	660
		NSG145P	NSG147P	Green	0.8	1.6	-	565
		NSA145	NSA147	Orange	2.4	4.8	-	605
0.6" 15mm		NSR161	NSR163	Red	6	12	15	660
		NSG161P	NSG163P	Green	2	4	-	565
		NSA161	NSA163	Orange	4	8	-	605
1.0" 25mm		NSR101	NSR103	Red	10	20	25	660
		NSG101P	NSG103P	Green	4	8	-	565
		NSA101	NSA103	Orange	8	16	-	605

\*IF=20mA

■ ALPHANUMERIC DISPLAY

(Ta=25°C)

Digit Size	Shape	Common	Type No. Package Color	Emitted Color	Iv(mcd/seg) Rank			Peak Wave-length λp(nm)
			Black		A	B	C	
1.0" 25mm		Anode	AAR101	Red	6/12	12/24	15/30	660
			AAA101	Orange	2/4	4/8	-	605
1.0" 25mm		Cathode	AKA101	Orange	2/4	4/8	-	605
			AAR121	Red	-	6	-	660
2.0" 50mm		Anode	AAR121	Red	-	6	-	660
			AAA121	Orange	-	3	-	605

\*101: IF=20mA 121: IF=40mA

● Common cathode types have a reverse polarity

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# STANLEY ELECTRIC CO., LTD.

## LED DOT MATRIX DISPLAY/LED GRAPHIC DISPLAY

### LED GRAPHIC DISPLAY UNIT

Stanley LED graphic displays made with super bright LEDs guarantee a bright and clear display. Including □144, □160, and □240. Stanley also provides 2digit type displays such as □64 and □96. Also available are 4 digit type LED mini modules such as □32 and □40.

Size WxH	Shape	Type No.	Emitted Color	Dot Size	Dot Pitch	Dot Formit	Logic Circuit		Display Circuit		Luminosity TYP.	Viewing Angle MIN.	Data Transmission Speed MAX.	Driving Method
							Input Volt Vcc1	Current Consumption Icc1MAX.	Input Volt Vcc2	Current Consumption Icc2MAX.				
□144		LMD09A-LRG4	R	Ø5.0	9	16x16	5±0.25	0.15	5±0.25	3.0	150	90	2.0	1/4 Duty Drive
			G								250			
□160		LMD10A-LRGS	R	Ø7.5	10	16x16	5±0.25	0.30	2.75 ±0.25	±210.5	1800	80	2.0	Static Drive
			G								800			
□240		LMD15A-LRGS	R	12	15	16x16	5±0.25	0.6	5±0.25	10.1	2400	30	10	Static Drive
			G								1500			
		LMD15A-LRGS-W	R	12	15	16x16	5±0.25	0.6	5±0.25	10.1	1800	60	10	Static Drive
			G								1200			
64 x 128		LMD04A-CRG8-2C	R	Ø3	4	16x32	5±0.25	0.1	3.25 ±0.25	±25.0	±2120	80	1.0	1/8 Duty Drive
			G								200			
		LMD04A-CRG16-2L	R	Ø3	4	16x32	5±0.25	0.12	3±0.25	±3.6	±90	120	2.0	1/16 Duty Drive
			G								±135			
		LMD04A-CRG16-2CL *1	R	Ø3	4	16x32	5±0.25	0.12	3±0.25	±3.6	±90	90	2.0	1/16 Duty Drive
			G								±135			
96 x 192		LMD06A-CRG16-2L	R	Ø4.8	6	16x32	5±0.25	0.15	3±0.25	3.6	90	120	2.0	1/16 Duty Drive
			G								100			
32 x 128		MM1216C-RG4-L	R	Ø1.6	2	16x64	5±0.25	0.12	3±0.25	2.4	70	120	10	1/16 Duty Drive
			G								100			
40 x 160		MM1516C-RG4-L	R	Ø1.8	2.5	16x64	5±0.25	0.5	3±0.25	3.7	55	120	7.5	1/16 Duty Drive
			G								65			

\* R (Red), G (Green) \* 1 Surface temp. is less than 70°C. Only MM series \* 2 The lighting ratio is 50% max. \* 1 Clear type

### LOD SERIES

Size WxH	Shape	Type No.	Emitted Color	No. Of LED	Absolute Maximum Ratings							Electro-Optical Characteristics					Luminous Standard		
					Power Dissipation Pb	Forward Current IF	Peak Forward Current	Reverse Voltage Vr	Operating Temperature Topr	Storage Temp. Tstg	Relative Humidity RH	Forward Voltage Vf	Reverse Current Ir	Peak Current Ip	Peak Wavelength λp TYP.	Center Intensity	Mixed Color	Visible Angle MIN.	
Ø24		LOD240RY-P-1	Red	7	0.40	30	100	28	-30	-30	10	12	20	20	28	660	0.7	1.5	Horizontal ±10 Vertical ±10
			Green	8	0.58	30	100	32	~+60	~+85	~90	17	20	20	32	570	0.8		
Ø50		LOD500RY-3L	Red	20	0.95	50	-	40	-30	-30	10	18	40	200	40	660	6.0	8.4	Horizontal ±15 Vertical ±15
			Green	30	1.65	75	-	40	~+60	~+85	~90	21	60	300	40	570	2.4		
□20		LOD220RYW-1LK	Red	4	0.20	25	100	16	-30	-30	10	7.4	20	100	16	660	1.1	1.66	Horizontal ±40 Vertical ±25
			Green	8	0.44	50	200	16	~+60	~+85	~90	8.4	40	200	16	570	0.56		
□30		LOD300RYW-1LK	Red	5	0.26	25	100	20	-30	-30	10	9.3	20	100	20	660	1.0	2.55	Horizontal ±40 Vertical ±25
			Green	20	1.08	100	400	20	~+60	~+85	~90	10.5	80	400	20	570	1.55		
□50		LOD520RYW-1PK	Red	10	0.70	32	-	40	-30	-30	10	18.5	20	100	40	660	3.9	6.7	Horizontal ±40 Vertical ±25
			Green	40	2.20	92	-	40	~+60	~+85	~90	21	80	400	40	570	2.8		
□24		LOD240RYW-2LK	Red	4	0.21	25	100	16	-30	-30	10	7.5	23	100	16	660	0.95	2.05	Horizontal ±60 Vertical ±25
			Green	16	0.87	100	400	16	~+60	~+85	~90	8.5	92	400	16	570	1.1		
□50		LOD500RYW-2PK	Red	22	0.94	42	-	44	-30	-30	10	20.0	34	200	44	660	4.7	7.7	Horizontal ±60 Vertical ±25
			Green	60	2.7	126	-	40	~+60	~+85	~90	20.7	102	600	40	570	3.0		

\* Luminous intensity IV and peak wavelength λp are applicable when forward current IF=20 mA. \* Each lamp requires a current limiting resistor. \* Peak forward current is 100 mA max., where tw ≤ 1 msec. and duty ≤ 1/20. \* When in use, the temperature of case should be below 80°C.

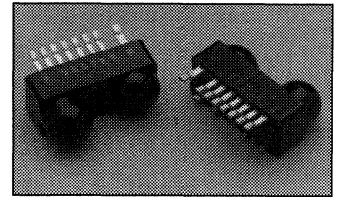
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# STANLEY ELECTRIC CO., LTD.

## IrDA OPTO WIRELESS TRANSCEIVER MODULE

Stanley's IrDA modules include all of the components necessary for wireless transmission such as infrared LED, PIN photodiode, driver, amplifier, and a wave shape rectifier. High performance can be easily obtained by using the high intensity Stanley Infrared LED.



The IrDA SIR ver. 1.0 HRM130S and HRM130ST are Stanley's smallest package while HRM130ST offers a wider range of operating and storage temperatures. The IrDA FIR ver. 1.1 HRM230S has a faster data transmission rate of 9.6k - 4M bps. For applications which require top view mounting, Stanley offers the IrDA SIR ver. 1.0 HRM150V.

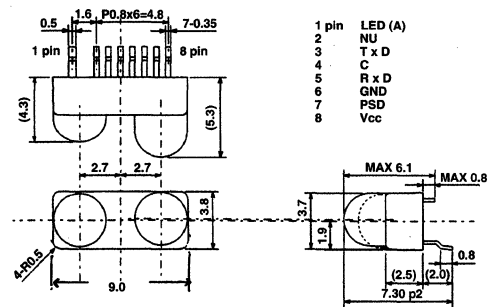
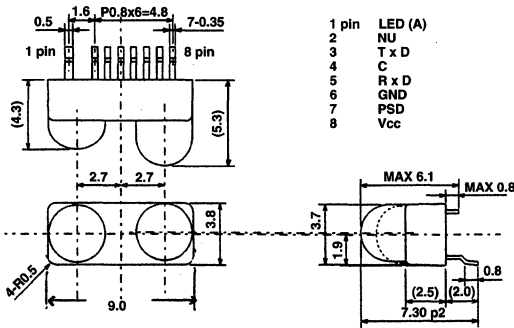
### CHARACTERISTICS

Parameter	HRM130S/130ST	HRM230S	HRM150V	UNIT
Compatible Standard	IrDA ver. 1.0 SIR	IrDA ver. 1.1 FIR	IrDA ver. 1.0 SIR	
Supported Data Rates	2.4k - 115.2k	2.4k - 4M	2.4k - 115.2k	bps
Operating Voltage	2.7 to 5.5	3 to 5.5	2.7 to 5.5	V
Hi Level Output Voltage	Vcc x 0.9 Min.	Vcc x 0.9 Min.	Vcc x 0.9 Min.	V
Lo Level Output Voltage	0.5 Max	0.5 Max	0.5 Max	V
Receiving Current Consumption	0.85 (TYP)	5.3 (MAX)	0.75 (TYP)	mA
Current Consumption in Standby Mode	1 (MAX)	1 (MAX)	1 (MAX)	uA
Light Pulse Rise / Fall Time	200 (MAX)	40 (MAX)	200 (MAX)	ns
Transmission Receiving Half Angle	20 (TYP)	20 (TYP)	20 (TYP)	deg
Transmission Radiant Intensity	40 (MIN:lled=150mA)	100 (MIN:lled=400mA)	40 (MIN:lled=200mA)	mW/sr
Absolute Maximum LED Current (Pulse)	400	500	400	mA
Peak Wavelength	880	850	880	nm
Operating Temperature	-10~70 / -30~85	-10~70	-20~70	°C
Dimension (W x H x D)	9 x 3.8 x 7.3	11.2 x 4 x 7	8.2 x 3.5 x 5	mm
Soldering Method	Reflow	Reflow	Reflow	

### DIMENSIONS AND APPLICATIONS

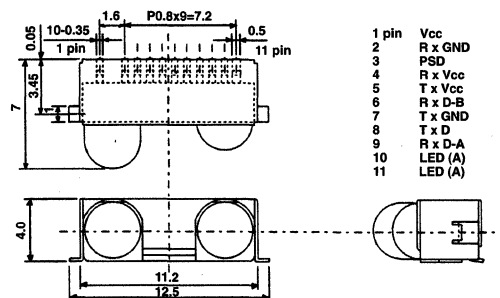
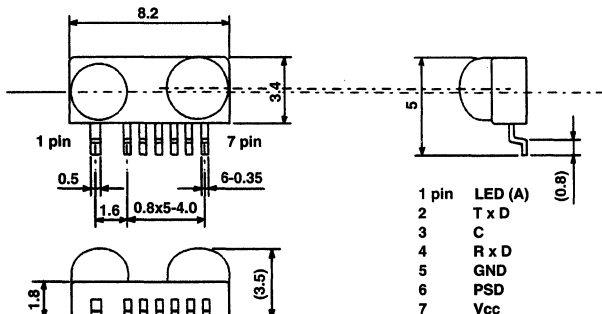
**HRM130S** - PC, Pager, Portable Phone, Printer

**HRM130ST** - Automotive, Digital Camera, Pager, Portable Phone



**HRM150V** - Digital Camera, PDA, Portable Equipment

**HRM230S** - Scanners, Notebook PC, Printer, Digital Camera



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**STANLEY ELECTRIC CO., LTD.**
**INFRARED LED/PHOTO TRANSISTOR/PIN PHOTO DIODE**
**■ INFRARED LED  
AN series (GaAs)**
 $\lambda_p$ : 950nm (Ta=25°C)

Shape	Type No.	Absolute Maximum Rating		Erecto-Optical Characteristics		Application
		Pd(mW)	Ir(mA)	Ie(mW/sr)	$\Delta\theta$ (deg)	
ø5 Epoxy	AN304	150	100	15	50	Wireless
Axial Leads, Epoxy	AN501	75	50	5	50	Headphones
Right Angle, Epoxy	AN504	150	100	3	60	Data
Surface Mount Type	AN1102W	75	50	0.8	60	Transmission

 $V_f=1.3V, I_f=50mA$ 
**■ INFRARED LED FOR OPTICAL COMMUNICATIONS USE  
(GaAlAs)**
 $\lambda_p$ : 660nm (Ta=25°C)

Shape	Type No.	Absolute Maximum Rating		Erecto-Optical Characteristics	
		Pd(mW)	Ir(mA)	Ie(mW/sr)	$\Delta\theta$ (deg)
ø5 Epoxy Flat Lens	FH1011	140	70	1.2*1	90
ø3 Epoxy Flat Lens	KR311	140	70	1.7*3	11x

 $*1 V_f=2.0V, I_f=30mA \quad *2 V_f=1.75V, I_f=30mA \quad *3 V_f=2.1V, I_f=50mA$ 
**■ PHOTO TRANSISTOR**
**PS series**
 $\lambda_p$ : 880nm (930nm) (Ta=25°C)

Type No.	Shape	Characteristics				Application
		I (mA)	ID (µA)	VCEO (V)	$\Delta\theta$ (deg)	
PS3022	ø5 Epoxy	7*1	0.2	30	24	Photo Sensor/Photo Switch
PS3322	ø3 Epoxy	3.6*1	0.2	30	20	Photo Sensor
PS3072	ø3 Epoxy	0.7*1	0.2	30	110	Photo Sensor
PS4032	ø3 Epoxy Flat	5*2	0.2	30	90	Photo Sensor
PS5022	ø1.7 Axial Lead Type	2*1	0.2	30	46	Photo Sensor
PS5132	ø5 Flat Lens	6.3*2	0.2	30	130	Photo Sensor/Fiber
PS5042	ø3.6 Side View	1.4*1	0.2	30	75	Photo Sensor/Interrupter
PS5042-2*	ø3.6 Side View	0.4*1	0.2	30	75	Photo Sensor
PS1101W	Right Angle, Epoxy	3.5*3	0.1	30	140	Photo Sensor

 $*PS 5042-2 (\lambda_p: 930nm)$ 
 $*1 E_e=1mW/cm^2 \quad V_{ce}=5$   
 $*2 E_e=10mW/cm^2 \quad V_{ce}=5$   
 $*3 E_e=5mW/cm^2 \quad V_{ce}=5$ 
**DN series (GaAlAs)**
 $\lambda_p$ : 850nm (Ta=25°C)

Shape	Type No.	Absolute Maximum Rating		Erecto-Optical Characteristics		Application
		Pd(mW)	Ir(mA)	Ie(mW/sr)	$\Delta\theta$ (deg)	
ø3 Epoxy Flat Lens *1	DN311	150	100	3.5	110	Optofiber/autofocus
Axial Leads Epoxy *1	DN501	100	50	10	40	Photo Sensor
Right Angle, Epoxy *1	DN504	150	100	8	80	Photo Sensor
Surface Mount Type *2	DN1102W	75	50	1.6	60	Photo Sensor

 $*1 V_f=1.6V, I_f=50mA$ 
 $*2 V_f=1.45V, I_f=20mA$ 
**DNP series (GaAlAs)**
 $\lambda_p$ : 880nm (Ta=25°C)

Shape	Type No.	Absolute Maximum Rating		Erecto-Optical Characteristics		Application
		Pd(mW)	Ir(mA)	Ie(mW/sr)	$\Delta\theta$ (deg)	
ø5 Epoxy	DNP318U	150	100	70	20	Wireless
ø3 Epoxy	DNP319	150	100	40	18	Headphones
ø5 Epoxy	DNP324U	150	100	35	35	Data
ø5 Epoxy	DNP325	150	100	80	10	Transmission
ø3 Epoxy	DNP331	150	100	21	55	

 $V_f=1.4V, I_f=50mA$ 
**DNF series (GaAlAs)**
 $\lambda_p$ : 850nm fc: 30MHz (Ta=25°C)

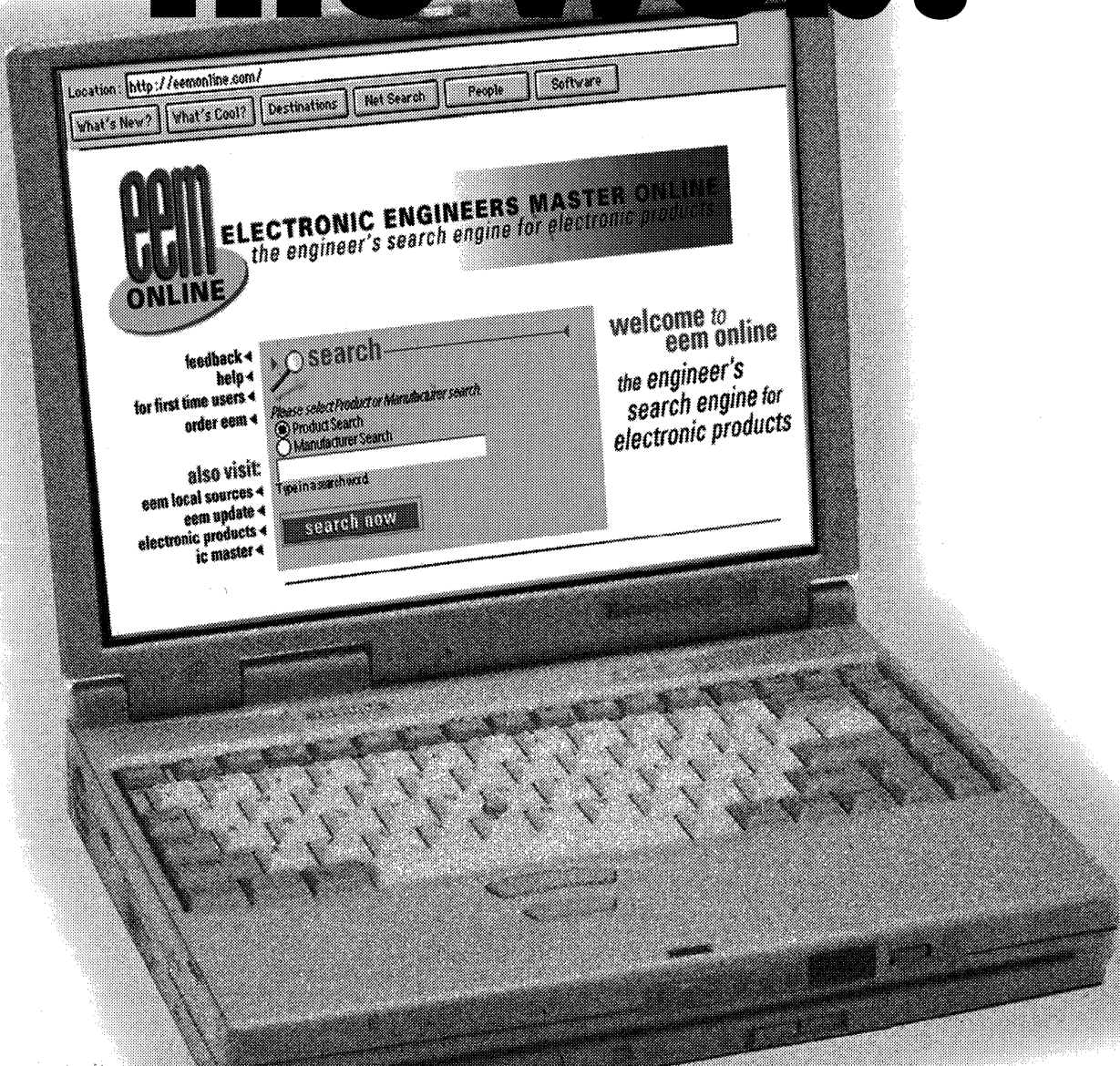
Shape	Type No.	Absolute Maximum Rating		Erecto-Optical Characteristics		Application
		Pd(mW)	Ir(mA)	Ie(mW/sr)	$\Delta\theta$ (deg)	
ø5 Epoxy	DNF318U	150	100	60	20	Bar Code Readers
ø3 Epoxy	DNF324U	150	100	30	35	Sensors

 $V_f=1.4V, I_f=50mA$ 
**■ PIN PHOTO DIODE**
**PS series**
 $\lambda_p$ : 950nm (Ta=25°C)

Shape	Type No.	Characteristics			$\Delta\theta$ (deg)
		Ip(mA)	ID(mA)	Vmax (V)	
ø3 Epoxy Flat Lens	PP403	1.0 *2	10	30	90
Right Angle, Epoxy	PP506	6.5 *2	30	30	130
Right Angle, Epoxy	PP506-1	5.5 *2	30	30	130
Right Angle, Epoxy	PP506-2	3.5 *2	30	30	130
Right Angle, Epoxy	PP508	7.5 *2	20	30	150
Right Angle, Epoxy	PP509	7.5 *2	20	30	90
Right Angle, Epoxy	PP509-1	5.5 *2	20	30	90
Axial Leads, Epoxy	PS601	6.0 *2	30	30	130
Axial Leads, Epoxy	PP601-1	4.8 *2	30	30	130
Axial Leads, Epoxy	PP601-2	3.0 *2	30	30	130
Epoxy Flat Lens	PP602	440 *3	100	30	125
Epoxy Lens	PP701	1100 *3	20	30	70
Epoxy Lens	PP703	1100 *3	10	30	45
Cone Shaped Lens	PP801	190 *3	20	12	156
Surface Mount Type	PP1101W	4 *1	10	15	140

 $*1 V_R=5V \quad E_e=5mW/cm^2 \quad *2 V_R=5V \quad E_e=0.5mW/cm^2 \quad *3 V_R=12V \quad E_e=5mW/cm^2$ 
**Stanley Electric Sales of America, Inc. ■ 2660 Barranca Parkway, Irvine, CA 92606**
**■ Tel: 949-222-0777 ■ Toll Free: 800-LED-LCD1 ■ FAX: 949-222-0555 ■ www.stanleyelec.com**

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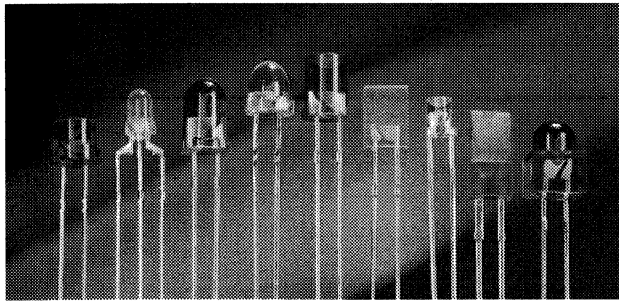
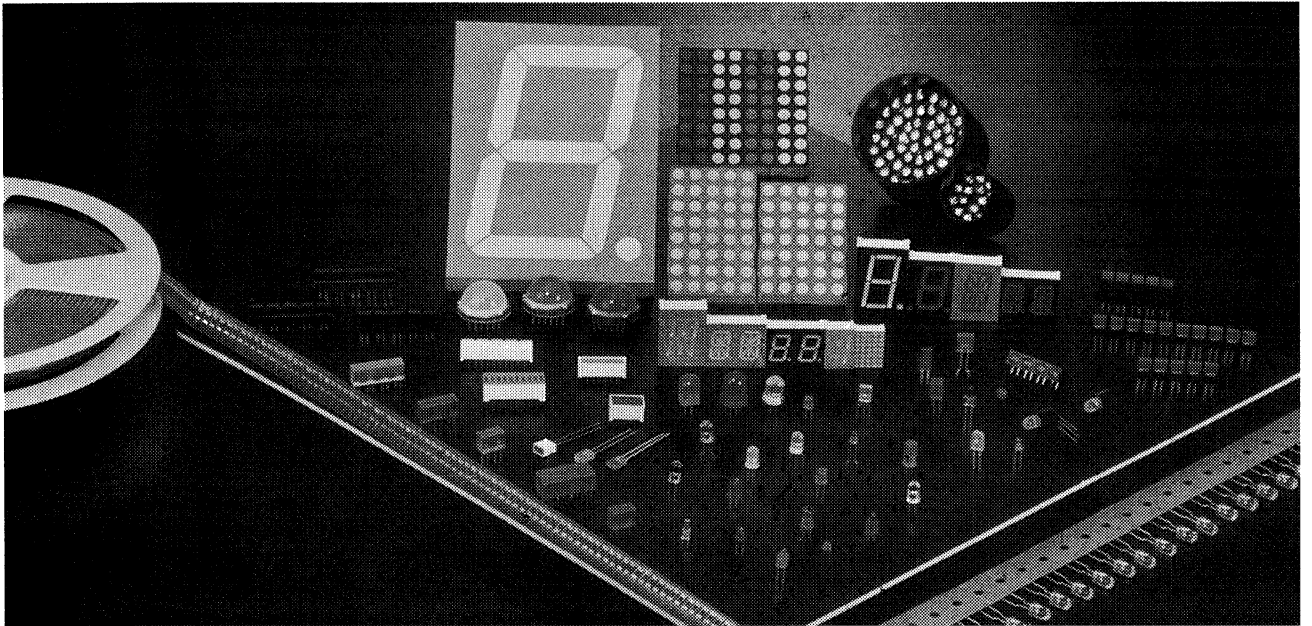
**SUN LED CO.**

20793 E. Valley Blvd. #C, Walnut, CA 91789

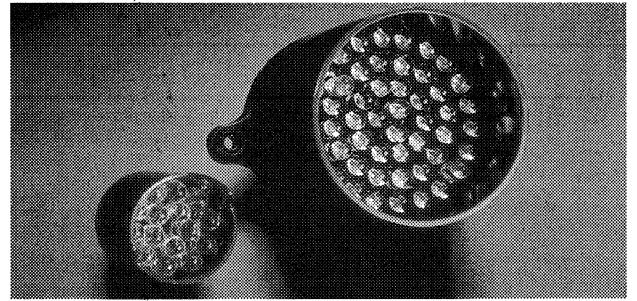
Tel: 909-598-8266 • Fax: 909-598-4966

Website: www.sun-led.com

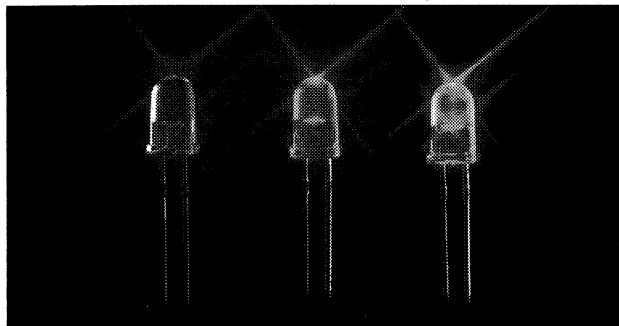
E-mail: sales@sun-led.com

**SUN LED****Standard LED Lamps**

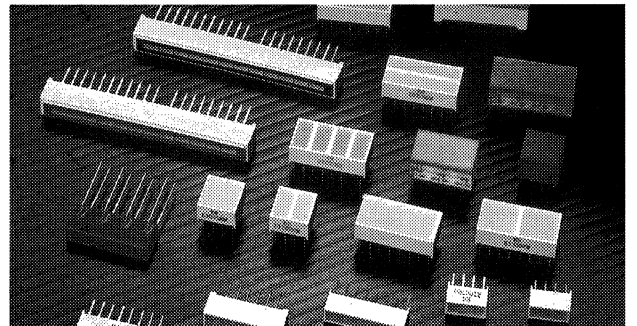
- Over 1000 Standard Types
- Low Current LEDs (2mA)
- Resistor LEDs (5V, 12V)
- Blinking LEDs (3.5V-15V)
- Blue LEDs (20-1000 mcd)
- Pure green and orange LEDs

**Cluster LED Lamps**

- 1"  $\phi$  ~ 2"  $\phi$  w/canopy
- Single or multi-color clusters
- Indoor or outdoor use

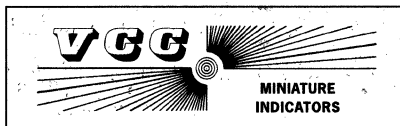
**Super/UltraBright LEDs**

- Broad choices of viewing Angles 12° ~ 60°
- Elliptical 30° vertical and a 60° horizontal viewing angle
- 100% burn-in & bin sorted
- Red (AlGaAs), PureGreen (GaP), Yellow (AlInGaP), Blue (GaN)

**LED Arrays, Bar Graphs & Light Bars**

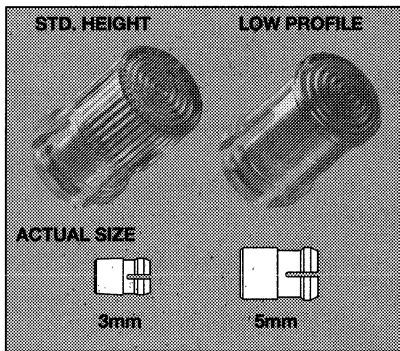
- 1 ~ 12 positions
- Any color compositions
- Custom type available
- Intensity & wavelength sorting available
- Different sizes of light bars

Please contact us for technical information and samples

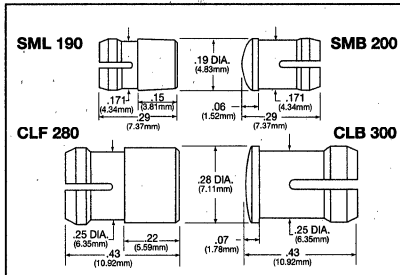


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**RECOMMENDED LEDs**

	A	B	C
3mm	.150	.200	.02 MIN to .04 MAX
5mm	.230	.340	.02 MIN to .05 MAX

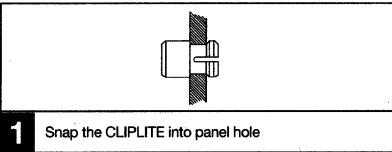
## CLIPLITE® LENS/MOUNTS FOR 3mm & 5mm LEDs

**FEATURES**

- Installs with finger pressure – no tools required – takes only six seconds
- Increases viewing angle up to 180 degrees using either diffused or point source LEDs
- Protects LED from being pushed back through panel – LED backlight

- Moisture seals easily to panel with the application of common sealants
- Intensifies apparent brightness up to 125% by the use of striated lines and fresnel rings
- Guards against IC damage by electrostatic discharge transmitted thru exposed LED

**SIMPLE TWO-STEP INSTALLATION**

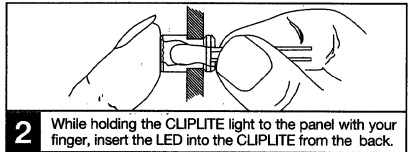


**SPECIFICATIONS**

**MATERIAL** Lens - Polycarbonate; Spacer - Nylon (U.L. Listed).

**DESIGN** Standard and low profile lenses with fresnel rings and striated lines. A low profile lens without rings is available for direct sunlight applications.

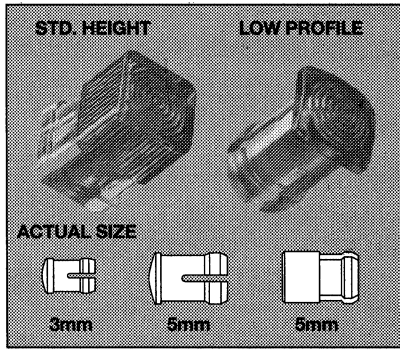
**MOUNTING:** Mounts thru front of panel. Mounting holes should be deburred but not chamfered. 3mm (SML 190, SMB 200) mounts in .171" (4.34mm) hole on 1/4" centers. Panel thickness for SML 190, 1/32" to 1/16" SMB 200, 1/16" to 1/8". 5mm (CLF 280, CLB 300, CLR 301) mounts in .250" (6.35mm) hole on 3/8" centers. Panel thickness for CLF 280, 1/16" to 1/8"; CLB 300 and CLR 301, 1/32" to 1/4"; for panels less than 3/16", use SPC 125 spacer.



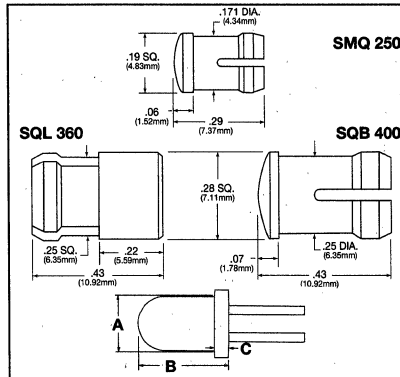
**ORDERING CODES**

	<b>CLF 280</b>	<b>RTP</b>
<b>MODEL</b>	_____	
SML 190 (3mm) Std. Hgt.		
SMB 200 (3mm) L/Profile		
CLF 280 (5mm) Std. Hgt.		
CLB 300 (5mm) L/Profile		
SPC 125 (Spacer for CLB 300)		
<b>COLOR</b>	_____	
RTP	Red Transparent	
ATP	Amber Transparent	
GTP	Green Transparent	
BTP	Blue Transparent	
YTP	Yellow Transparent	
CTP	Clear Transparent	

Price in 10,000 - 10 to 11 cent range



U.S. & For. Pat. Issued & Pend.



**RECOMMENDED LEDs**

	A	B	C
3mm	.150	.200	.02 MIN to .04 MAX
5mm	.230	.340	.02 MIN to .05 MAX

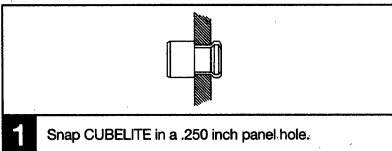
## CUBELITE® SQUARE LENS/MOUNTS FOR LEDs

**FEATURES**

- Enhances aesthetics, square design in both standard and low profile configurations
- Mounts either as a single square lens or stacks in bar configuration
- Increases viewing angle up to 180 degrees using either diffused or point source LEDs

- Intensifies apparent brightness up to 140% by the use of striated lines and fresnel rings
- Installs with finger pressure – no tools required – takes only six seconds
- Guards against IC damage by electrostatic discharge transmitted thru exposed LED

**EASY TWO-STEP INSTALLATION**



**SPECIFICATIONS**

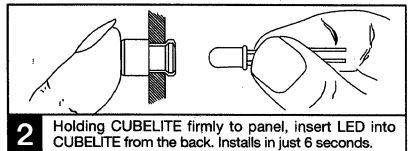
**MATERIAL** LENS - Polycarbonate; Spacer - Nylon (U.L. Listed).

**DESIGN** Square lens, standard and low profile, fresnel rings and striated lines.

**MOUNTING:** Mounts thru front of panel. Mounting holes should be deburred but not chamfered. 3mm (SMQ 250) mounts in .171" (4.34mm) hole on 1/4" centers. Panel thickness from 1/16" to 1/8". 5mm (SQL 360) mounts in .250" (6.35mm) square punched hole on 3/8" centers. Panel thickness from 1/16" to 1/8".

5mm (SQB 400) mounts in .250" (6.35mm) round hole on 3/8" centers. Panel thickness from 1/32" to 1/4"; (for panels less than 3/16", optional SPC 125 is available). Standard metal or plastic washers can also be used to increase panel thickness if necessary.

**PUNCH SOURCES:** Porter Precision, Cincinnati, OH – Stripet, Houdaille Ind., Akron, NY – Unipunch Products, Buffalo, NY – Wiederman Co., King of Prussia, PA.

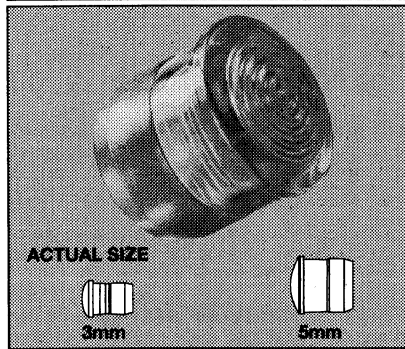


**ORDERING CODES**

	<b>SQL 360</b>	<b>RTP</b>
<b>MODEL</b>	_____	
SMQ 250 (3mm) L/Profile		
SQB 400 (5mm) L/Profile		
SQL 360 (5mm) Std. Hgt.		
SPC 125 (Spacer for SQB 400)		
<b>COLOR</b>	_____	
RTP	Red Transparent	
ATP	Amber Transparent	
GTP	Green Transparent	
BTP	Blue Transparent	
YTP	Yellow Transparent	
CTP	Clear Transparent	

Price in 10,000 - 10 to 12 cent range

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**OUTLINE DRAWINGS**

**RECOMMENDED LEDs**

	A	B	C
3mm	.125	.175	.02 MIN to .04 MAX
5mm	.230	.340	.02 MIN to .05 MAX

# VISUAL COMMUNICATIONS COMPANY, INC.

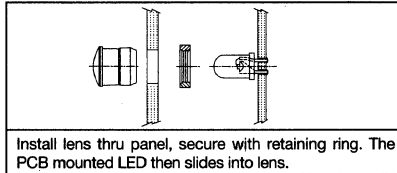
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## CLIPLITE® 3mm & 5mm LOW PROFILE PANEL LENSES

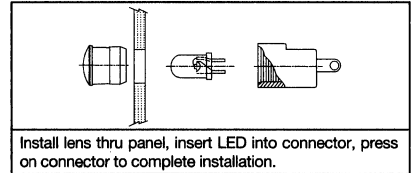
### FEATURES

- Installs in display panels for use with PCB mounted LEDs
- PCB mounted LEDs slide easily into lenses with the closing of panel cover or on the insertion of PCB card into case
- Fresnel rings increase apparent brightness and viewing angle of either diffused or nondiffused LEDs up to 180°
- Use with CONXRITE connector assembly permits easy replacement of LEDs
- Helps prevent IC failure from ESD entry thru exposed panel mounted LEDs
- Affords physical protection to LED, preventing push-back thru panel and possible PCB damage

### PANEL MOUNTED LENSES WITH PCB MOUNTED LED



### PANEL MOUNTED LENS WITH CONXRITE CONNECTOR



### SPECIFICATIONS

**MATERIAL:** Lens - Polycarbonate; Ring - Polypropylene; (U.L. Listed)

**DESIGN:** Low Profile lenses with fresnel rings.

**MOUNTING:** Mounts thru front of panel, retaining ring secures the lens in place.

3mm (SMC 170) mounts in a .173 (4.4mm) hole on 1/4 centers. Panel thickness 1/32" to 1/8".

5mm (CMC 321) mounts in a 9/32" (7.2mm) hole on 3/8" centers. Panel thickness 1/32" to 1/8".

### ORDERING CODES

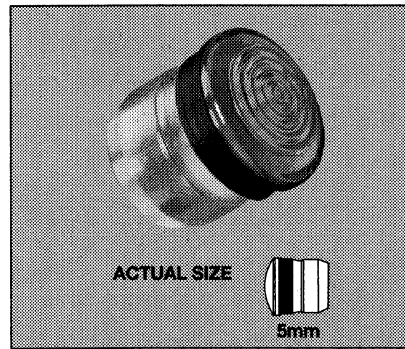
**MODEL** \_\_\_\_\_ **CMC 321** **RTP**

SMC 170 (3mm) L/Profile Lens  
 CMC 321 (5mm) L/Profile Lens  
 RNG 123 (3mm) Retaining Ring  
 RNG 234 (5mm) Retaining Ring

**COLOR**

RTP Red Transparent  
 ATP Amber Transparent  
 GTP Green Transparent  
 BTP Blue Transparent  
 YTP Yellow Transparent  
 CTP Clear Transparent

Price in 10,000 quantity - 10 to 14 cent range



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**OUTLINE DRAWINGS**

**RECOMMENDED LEDs**

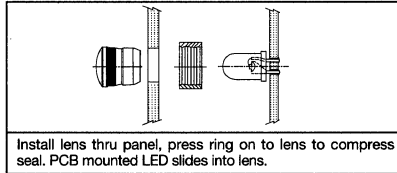
	A	B	C
5mm	.230	.340	.02 MIN to .05 MAX

## CLIPLITE® MOISTURE SEALED LENS FOR LEDs

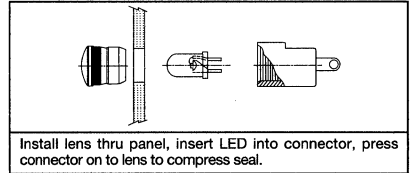
### FEATURES

- Installs in display panels for use with PCB mounted LEDs
- Permits panel mounting of LEDs when use with CONXRITE connectors
- Increases LED viewing angle up to 180° using diffused or nondiffused devices
- Provides effective moisture seal under splash and drip conditions
- Tested for shock up to 6gs and vibration from 0 to 2000hz
- Thermal cycling tested from -40 to +80 degrees C

### SEAL LENS WITH PCB LED



### SEAL LENS W/ CONXRITE CONNECTOR



### SPECIFICATIONS

**MATERIAL:** Lens - Polycarbonate; Ring - Polypropylene, Seal - J-Von (U.L. Listed).

**DESIGN:** Low profile lenses with moisture seal.

**TESTING:** Environmental testing performed by Consolidated Labs. Inc. for moisture sealing, shock, vibration and standard operating temperatures.

**MOUNTING:** Mounts thru front of panel, compression of the seal is accomplished by pressing the retaining ring or CONXRITE connector in place.

5mm (CMS 322), mounts in a 9/32" (7.2mm) hole on 3/8" centers. Panel thickness 1/32" to 1/8". Hole should be deburred but not chamfered.

### ORDERING CODES

**MODEL** \_\_\_\_\_ **CMS 322** **RTP**

CMS 322 (5mm) L/Profile Lens with moisture seal  
 RNG 268 (5mm) Retaining Ring

**COLOR**

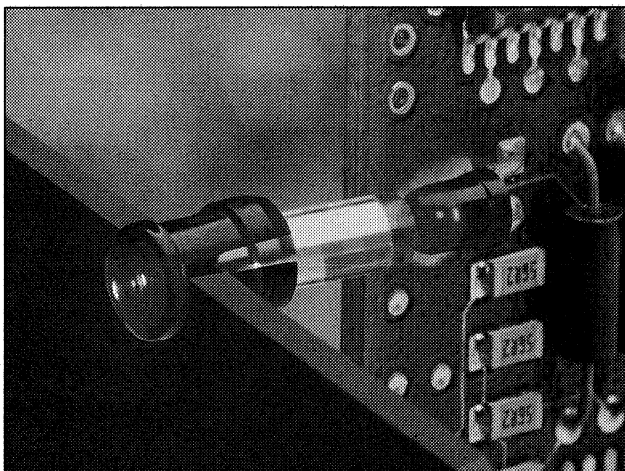
RTP Red Transparent  
 ATP Amber Transparent  
 GTP Green Transparent  
 BTP Blue Transparent  
 YTP Yellow Transparent  
 CTP Clear Transparent

Price in 10,000 - .35 cent range

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**SPECIFICATIONS**

- MATERIAL:** Litepipe - Acrylic (Optical grade)  
 Lens - Polycarbonate; Ring - Polypropylene  
 U.L. Listed Material.
- DESIGN:** LIPEPIPE (3mm and 5mm) with annular ring and locking tab engages into the annular groove of VCC's low profile lens. Lense mounts the litepipe securely to the display panel and provides 180 degrees of viewing angle.
- MOUNTING:** LITEPIPE 3mm - Mates with VCC's lenses model SMB 200 and SMQ 250. Panel mounting hole .171 (4.3mm) on 1/4" centers. Panel thickness 1/32" to 1/8". Litepipe lengths from .200" to 1.200".
- LITEPIPE 5mm - Mates with VCC's lens model CLB 300 and SQB 400. Panel mounting hole .250 (6.35mm) on 3/8" centers. Panel thickness 1/32" to 1/4". Litepipe lengths from .360" to 1.360". For panels less than 3/16" use SPC 125 spacer.
- LENSE RETAINING RING - available for added security (RNG 190, 3mm & RNG 268, 5mm).
- STANDOFF** Use VCC's standoff to adjust the height of a standard LED above the PCB and maintain a maximum .050" clearance between litepipe and LED. See VCC's STD Series data sheet.

**ORDERING CODE: LITEPIPE**

<b>MODEL</b>	<b>LSV 020</b>	<b>CTP</b>	<b>COLOR</b>
LSV (3mm), LCV (5mm)			CTP CLEAR
<b>PRODUCT CODE</b>			
LSV - CODE LENGTH (inches)	020 (.200") 040 (.400") 060 (.600")	LCV - CODE LENGTH (inches)	036 (.360") 056 (.560") 076 (.760")
	080 (.800") 100 (1.00") 120 (1.20")		096 (.960") 116 (1.16") 136 (1.36")

**CLIPLITE®**  
 LITEPIPES & LENSES FOR PCB MOUNTED LEDs

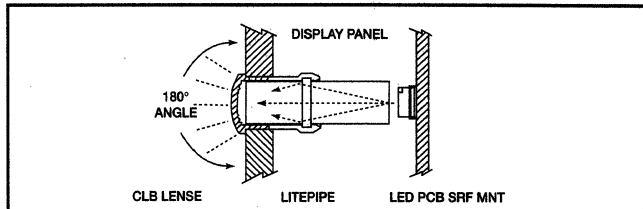
**VERSATILITY** - CLIPLITE litepipe and lense easily provide a means of transmitting the light from PCB mounted LEDs to the front display panel. Both styles of LEDs, surface mount and standard packages, can be displayed in this manner.

**BRIGHTNESS** - CLIPLITE litepipe by itself has a limited angle of view. However, when used with VCC's fresnel lense the light is disbursed over the entire lense surface producing 180 degrees of viewing.

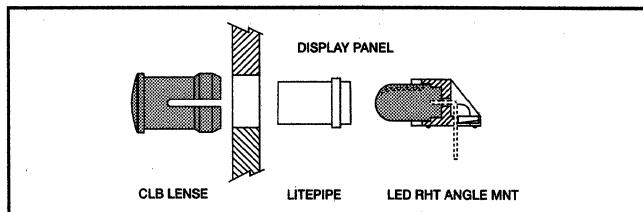
**APPLICATION** - CLIPLITE litepipes and lenses are available for use with both surface mount and standard packaged LEDs in 3mm and 5mm configurations. Because there is no physical connection between the litepipe and the PCB mounted LED, the circuit board can be installed or removed without disturbing the panel display.

**INSTALLATION** - CLIPLITE litepipe and lense are easy to install. Insert the lense thru the panel opening and snap the litepipe into the lense. For added security in harsh environments, a retaining ring is available.

**LITEPIPE & SURFACE MOUNTS LEDs**

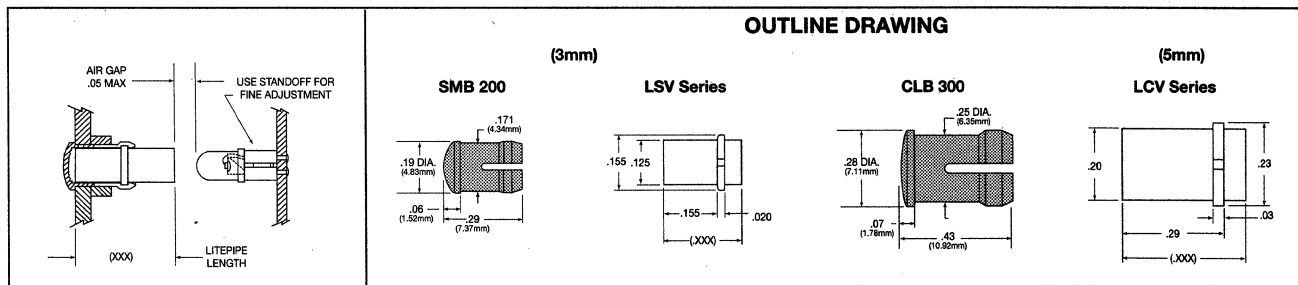


**LITEPIPE & RIGHT ANGLE LEDs**

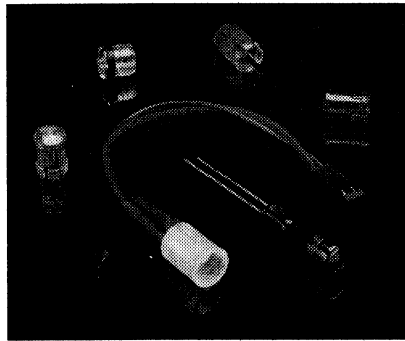
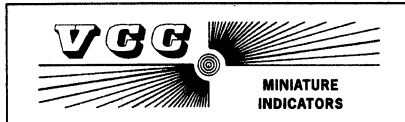


**ORDERING CODE: LENSE**

	<b>CLB 300</b>	<b>RTP</b>	
<b>MODEL</b>			<b>COLOR</b>
SMB 200 (RND 3mm)		RTP	Red Transparent
SMQ 250 (SQ 3mm)		ATP	Amber Transparent
CLB 300 (RND 5mm)		GTP	Green Transparent
SQB 400 (SQ 5mm)		BTP	Blue Transparent
SPC 125 (Spacer for CLB 300 & SQB 400)		YTP	Yellow Transparent
		CTP	Clear Transparent



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**SPECIFICATIONS**

**MATERIAL:** Panel connector, Ring & Header connector - Thermoplastic (black). (U.L. Listed).  
 Terminals - Phosphor bronze, tin plate.  
 Wire - 22 AWG 7 strand copper, PVC insulated.  
**MOUNTING:** Panel mounts - Mates with CMC 321 standard low profile lens, CMS 322 moisture seal lens.  
 Panel Thickness - CMC 321 & CMS 322 .062" with ring .125" without ring.  
 Hole Size - .281" for CMC 321 & CMS 322, .250" for all other Clipline lenses and mounts.  
 Trim LED leads .250" ±.010 for CMC & CMS lens .

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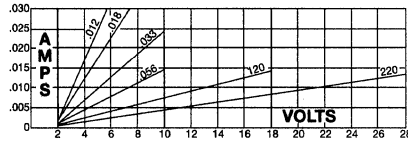
7920-G Arjons Drive San Diego, CA 92126 U.S.A. In CA (619) 549-6900  
 FAX (619) 549-3520 email vccsales@pacbell.com Toll Free (800) 522-5546

**CONXRITE® PRE-WIRED INTERCONNECT WITH RESISTOR**

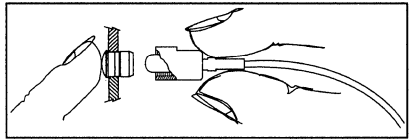
**FEATURES**

- Modular cabling system's plug-in feature simplifies the electrical connection from panel LED to PCB.
- Built in ballast resistor feature allows use on circuits from 3 to 28 volts.
- Power source termination with header terminals for PCB attachment or without terminals for soldering.
- Allows preassembly of wiring harness final eliminating the need for hard-wiring directly to the LEDs.
- Field replacement of defective LEDs made practical and cost effective.
- Various colored lenses, standard or moisture seal types, available for use with the CONXRITE.

**RESISTOR SELECTOR**



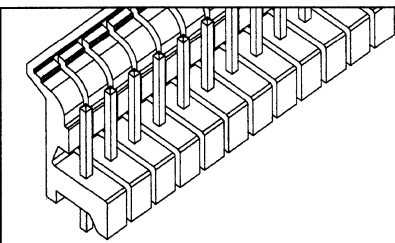
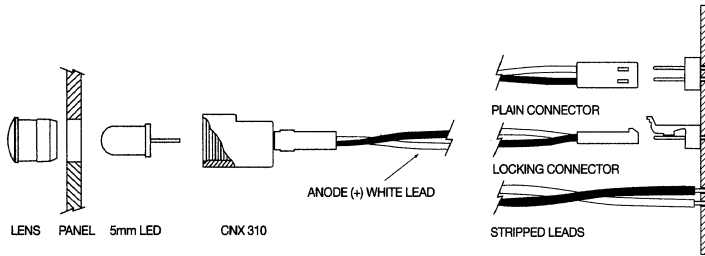
**EASY INSTALLATION**



**ORDERING CODES**

<b>MODEL</b>	CNX 310	056	E	2	1	08	<b>LENGTH IN INCHES</b>
<b>RESISTOR</b>							CODE LENGTH
<b>TERMINATIONS</b>							04 - 4 INCHES
<b>CODE</b>	<b>OHM</b>	<b>CODE</b>	<b>OHM</b>				08 - 8 INCHES
E	120	056	1200				12 - 12 INCHES
X	180	120	2200				18 - 18 INCHES
	033	220	3300				24 - 24 INCHES
				<b>WIRE COLOR</b>			
				CODE DESCRIPTION			
				1 BLK - WHT			
				<b>WIRE GAUGE</b>			
				CODE DESCRIPTION			
				2 22 AWG			

**ASSEMBLY DRAWING**



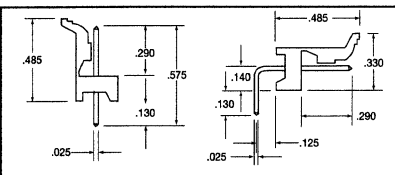
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**CONXRITE® LOCKING HEADER**

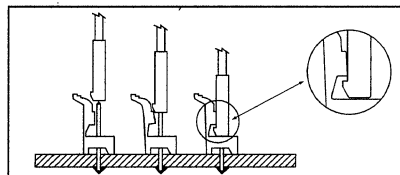
**FEATURES**

- Locking lever prevents header connector from being retracted inadvertently.
- Available in strips in any combination from 2 to 28 pin circuits.
- Designed for both vertical and horizontal applications.
- Brass pins, tin plated, .025" square on .100" centers.
- Device mates with VCC locking header connectors.
- Molded from thermoplastic material U.L. rated 94 VO.

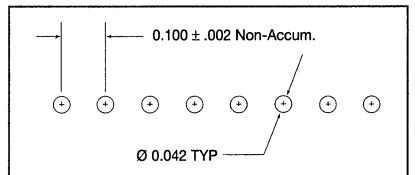
**OUTLINE DRAWINGS**



**HEADER LOCKING FEATURE**



**PCB HOLE PATTERN**



**SPECIFICATIONS**

**MATERIAL** Body - Thermoplastic (black) U.L. 94 VO  
 Pins - Brass .025" square tin plate  
 Pin spacing .100" centers  
 Mates with VCC locking header connectors

**ORDERING CODES**

<b>MODEL</b>	CNX	V06	NTP
		PLATING	NTP - TIN PLATE
		PIN CONFIGURATION	
		V = VERTICAL / # CIRCUITS	
		H = HORIZONTAL / # CIRCUITS	

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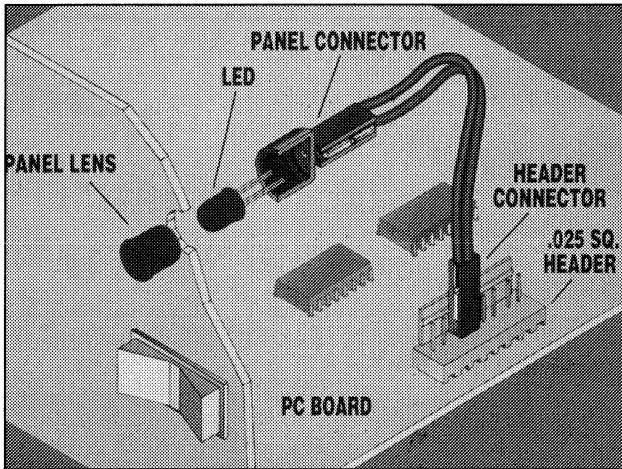


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## CONXRITE®

### PRE-WIRED SOLDERLESS INTERCONNECT

**CONXRITE** - This modular cabling assembly is designed for use in the electrical connection of panel mounted LEDs to printed circuit boards. This plug-in system eliminates many of the problems associated with wiring display panel mounted LEDs.

**APPLICATIONS** - Designed to make quick and easy plug-in connections between panel mounted LEDs and the PCB. The modular concept of panel and header housings along with different wire lengths offer a cost reducing solution to cabling problems.

**VERSATILITY** - Multiple panel mounted LED devices can be connected to PCB mounted headers. A uniquely designed three finger box terminal mates with leads .017" in diameter to .025" square. Cables are available in four, eight, twelve, eighteen and twenty four inch lengths.

**INSTALLATION** - Modular cabling systems simplify the electrical connection from panel to PCB and eliminate the need for assembly tools. Cost savings from the discontinuing of soldering and terminal crimping operations are substantial.

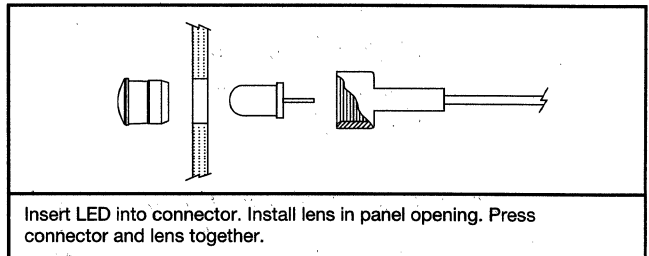
### SPECIFICATIONS

**MATERIAL:** Panel Connector Socket & Ring - Thermoplastic (black).  
 Header Connector - Thermoplastic (black) UL 94-V0.  
 Terminals - Phosphor bronze, tin plated.  
 Wire - 22 AWG, 7 strand copper, insulated.

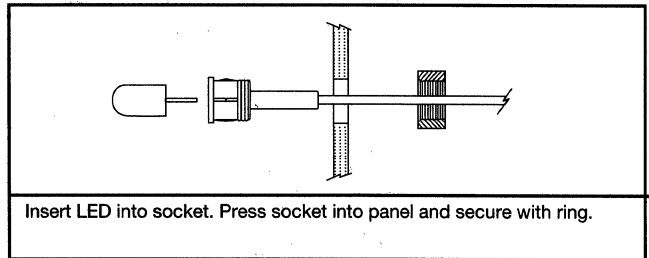
**ELECTRICAL:** Terminal - 3 amp continuous service.  
 Unique three-finger design mates to round, square or rectangular leads .017" to .025".

**MOUNTING:** Panel Connector 3mm - Mate with SMC 170.  
 Panel Connector 5mm - Mate with CMC 321 & CMS 322.  
 Can be mated with CLIPLITE models CLF 280, CLB 300, CLR 301, CLIPLITE clipmount models CLP 125, 127, 129 and CUBELITE SQB 400. See data sheets on lenses and mounts  
 Panel Thickness: - SMC 170, max .100"  
 CMC 321 & CMS 322, max .125 inch. CLF 280, CLP 125, 127 & 129 max .110". CLB 300, CLP 301 & SQB 400 max .250". Use SPC 125 spacer for panels less than 3/16" with CLB, CLP & SQB.  
 Panel Socket 450 470 max .250", use RNG 242 ring for additional security.  
 LED lead trimming - SMC 170, CMC 321, CMS 322 and 450 470 socket .250" +/- .010".  
 Hole Size - SMC 170 .171" (11/64").  
 CMC 321 and CMS 322 .281" (9/32").  
 Use .250" for all other mounts. All holes deburred by not chamfered.  
 Header Connector - Mates with standard headers .025" square on .100" centers. Molex Inc. series 4030, 6373 or equal.

### PANEL MOUNT LENS & CONNECTOR

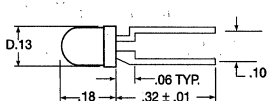


### PANEL SOCKET, FRONT RELAMPABLE

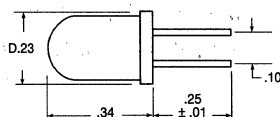


### RECOMMENDED LEDs

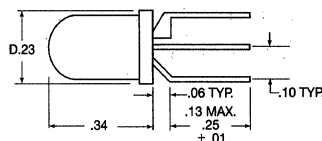
**3mm Bi-Lead**  
 Use "B" Connector



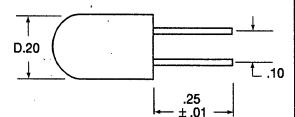
**5mm Bi-Lead**  
 Use "C" Connector



**5mm Tri-Lead**  
 Use "D" Connector



**5mm Flangless**  
 Use "K" Connector



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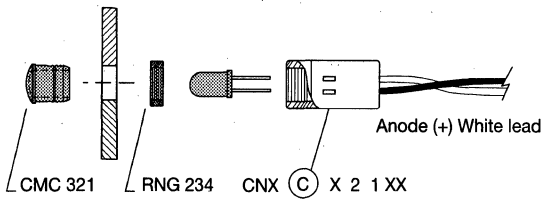
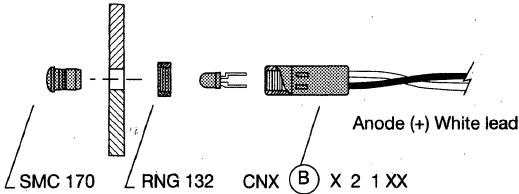
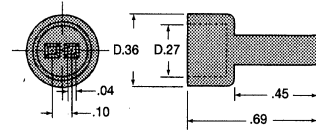
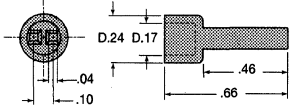
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Toll Free (800) 522-5546

**CONXRITE® PRE-WIRED SOLDERLESS LED INTERCONNECTION**

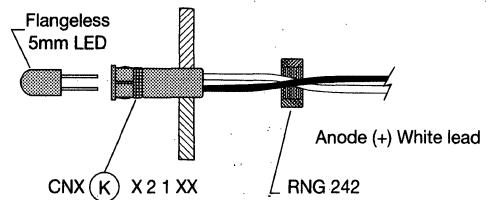
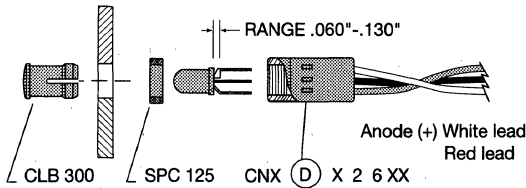
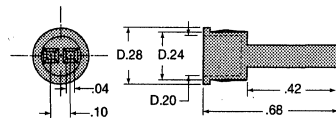
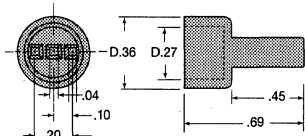
(B) 450 120 Panel Connector for 3mm Bi-Lead LED.

(C) 450 220 Panel Connector for 5mm Bi-Lead LED.

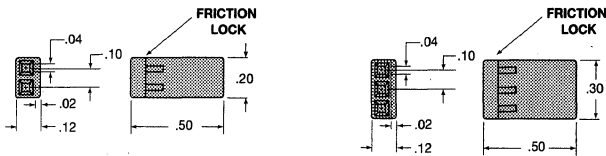


(D) 450 230 Panel Connector for 5mm Tri-Lead LED.

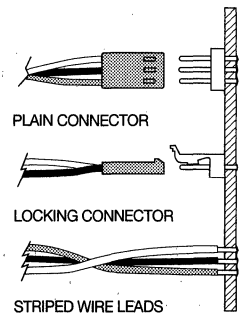
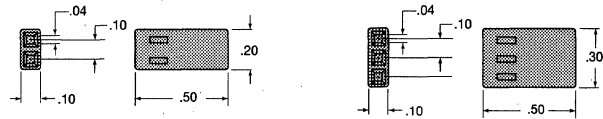
(K) 450 470 Panel Socket, Front Relampable LED. With 5mm Flangeless Bi-lead LED



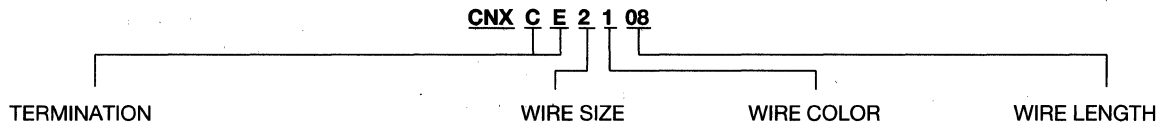
450 320 Friction Lock Bi-Lead, 450 330 Friction Lock Tri-Lead Header Connector For attachment to .025" Square Header Post on .100" Centers.



450 420 Plain Bi-Lead Connector, 450 330 Tri-Lead Connector For attachment to .025" Square Header Post on .100" Centers.



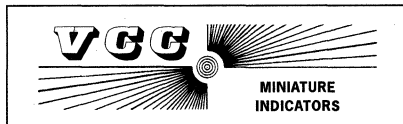
**ORDERING CODE**



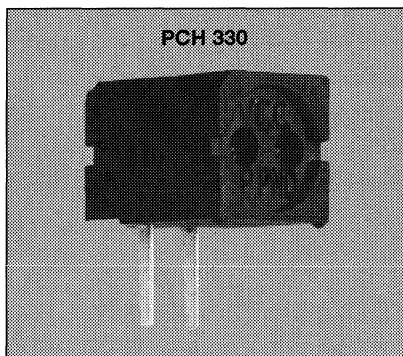
Note: 450 030 wire terminal is standard when a connector is ordered.

A	450 030 - TERMINAL			
B	450 120 - 3mm Panel Connector	2 Lead	22 AWG	04 - 4 INCH
C	450 220 - 5mm Panel Connector	2 Lead		08 - 8 INCH
D	450 230 - 5mm Panel Connector	3 Lead		12 - 12 INCH
E	450 320 - Header Cntr w/lock	2 Lead		18 - 18 INCH
F	450 330 - Header Cntr w/lock	3 Lead		24 - 24 INCH
G	450 420 - Header Cntr plain	2 Lead		
H	450 430 - Header Cntr plain	3 Lead		
K	450 470 - Panel Socket	2 Lead		
X	Wire End - Stripped			

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**SPECIFICATIONS**

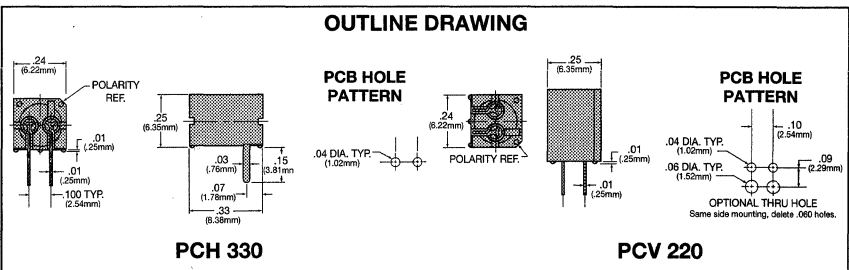
**MATERIALS:** Thermoplastic (black) U.L. 94 VO  
 Contacts Phosphor bronze, 60/40 tin plate.  
**LED:** Type - 3mm or 5mm  
 Lead round or square .017" min .030" max

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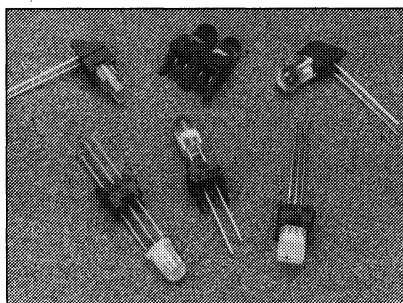
**P-C-LITE<sup>®</sup> PCB SOCKETS FOR LEDs**

**FEATURES**

- Relampable - no direct soldering of LEDs.
- Mount round, square, triangular, odd sizes and various shapes of LEDs.
- Easy installation, replacement of phototransistors, IR emitters, incandescent bi-pin lamps.
- Mounts for PCB status, logic, fault indicator lights.
- Horizontal or vertical mounts. LEDs can be inserted from either end of sockets.
- Designed for lock type security of LEDs used in high shock and vibration environments.



Price in 10,000 quantity - 28 cent range



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**P-C-LITE<sup>®</sup> PCB MOUNT FOR BI/TRI-LEAD LEDs**

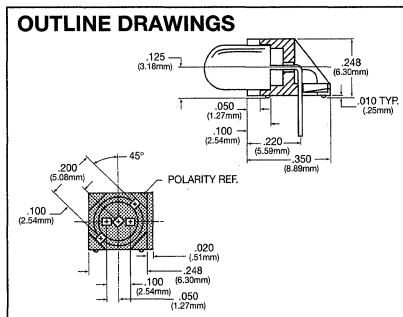
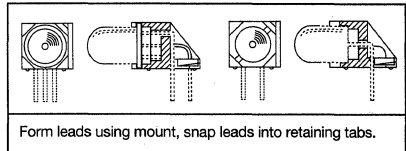
**FEATURES**

- Right angle PCB mount for bi and tri-lead LEDs as logic and diagnostic indicators.
- Accommodate round and rectangular shapes of LEDs with or without flange.
- Dove-tail interlock feature allows mounting of both mono and multi-color LEDs.
- Mount forms LED leads which are locked into position by retaining tabs.
- Formed LED leads are staggered in their length permitting easier PCB insertion.
- Molded standoffs permit the easy cleaning of PCB after wave soldering operation.

**SPECIFICATIONS**

**MATERIALS:** Thermoplastic (black) U.L. 94 VO  
**LED:** 5mm size - round or rectangular shape with or without flange. Bi-lead, standard .100" lead spacing. Tri-lead, either .050" or .100" lead spacing

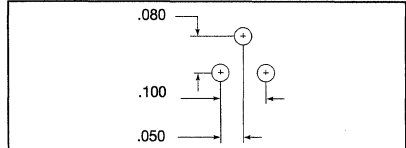
**PCB MOUNTING OF BI & TRI-LEAD LEDs**



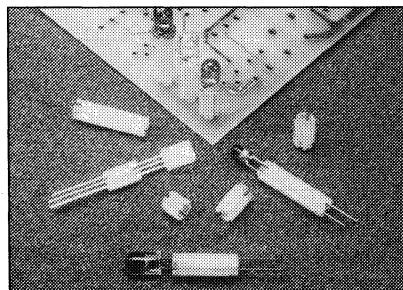
**ORDERING CODE**

MODEL \_\_\_\_\_ **PCH 175**

**PCB HOLE PATTERN**



Price in 10,000 quantity - 4 cent range



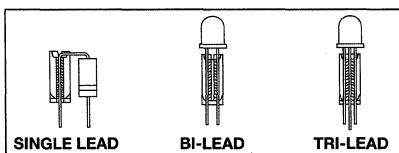
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**P-C-LITE<sup>®</sup> BI/TRI-LEAD LED STANDOFFS**

**FEATURES**

- Mounting of bi-lead, tri-lead LEDs, opto-components on PC boards for industrial, commercial and medical products.
- Accommodate various configurations of both bi and tri-lead LEDs. Lead spacing can vary from .050" to .100" on center. Standoffs will form the leads for easy insertion into the PCB.
- Provide component height control, help eliminate component tilting, lead shorting, while securing LEDs to the PCB.
- Cylindrical plastic body has lead separation channels, clearance pads for PCB cleaning. Lead retention tabs maintain standoff and component as a unit prior to board insertion.

**MOUNTING CONFIGURATIONS**



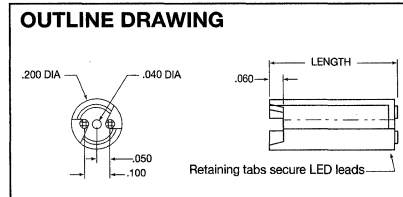
**ORDER CODE**

**STD XXX**  
 \_\_\_\_\_ LENGTH EQUAL INCHES  
 91 lengths available

XXX = Length in inches starting from .110 inch thru 1.0 inch in graduated increments of .010 inches.

Price in 10,000 quantity - 3 to 4 cent range

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W O R L D P R O D U C T S

**NEC ELECTROLUMINESCENT (EL) BACKLIGHTS**

High Brightness (recommended brightness: 150 to 200cd/m<sup>2</sup>; 300cd/m<sup>2</sup>)

Luminous colors		Green	Yellow-green	White	Bluish-White	Yellow
Symbol		G	YGF	W	BW	YF
Type	Features					
LQ	Brightness 300 cd/m <sup>2</sup>	○	○	○ (WF)	—	○
LH	Brightness 200 cd/m <sup>2</sup>	—	—	○	○	—

Medium Brightness (recommended brightness: 90 to 120cd/m<sup>2</sup>)

Luminous colors		Green	Yellowish-green	Yellow-green	White	Yellow
Symbol		G	GF	YGF	W	YF
Type	Features					
LM	Long Life	○	—	○	○	○
LR	High efficiency	○	○	○	○	—

Standard Brightness (recommended brightness: 40 to 60cd/m<sup>2</sup>)

Luminous colors		Bluish-green	White
Symbol		C	W
Type	Features		
L	Non-colored body	—	○ (WM)
LP	High temp. durability	○	—

**Thin Configuration**

Luminous colors		Green	White	Orange
Symbol		G	W	OR
Type	Features			
TA	Thickness t = 0.25 to 0.35 mm	○	○	○

\*Luminous colors may vary slightly depending on type.

**Maximum Ratings**

Item	Test Conditions	Limit Value	Type
Supply voltage	Sine wave, 10 sec., between leads	150 Vrms	L, LP, LM, LR, TA
		200 Vrms	LQ, LH
Insulation voltage	Sine wave, 60 sec., between leads and package film	1000 Vrms	All (except TA)
Supply frequency	Sine wave	1000 Hz	L, LP, LM, LR, TA
		1500 Hz	LQ, LH
Operating temperature	Ambient temperature	-20 to 50°C	All
Storage temperature	Humidity must be kept under 60% RH when stored at temperatures exceeding 40°C	-30 to 60°C	All

**ELECTRICAL CHARACTERISTICS**

Typical properties with area (S) ≤ 300cm<sup>2</sup>, at 20°C, 70%RH

Type & Color	Operating Conditions	Brightness (cd/m <sup>2</sup> )	Current Density (mA/cm <sup>2</sup> )	Power Consumption (mW/cm <sup>2</sup> )	Chromaticity		Half-brightness time (reference)	
					X	Y	With AC Power Supply	With Inverter
L-WM	100 Vac 400Hz	35	0.12	3.0	0.305	0.410	1000 Hrs	1.3 to 2.0 times longer than AC power supply
LP-C		60	0.14	3.1	0.180	0.415	2000 Hrs	
LM-G		90	0.16	4.0	0.180	0.440	3500 Hrs	
LM-YGF		115	0.16	4.0	0.260	0.680	2800 Hrs	
LM-WF		86	0.16	4.0	0.330	0.415	3500 Hrs	
LM-YF		90	0.16	4.0	0.470	0.480	3150 Hrs	
LR-G		135	0.14	3.8	0.175	0.460	2000 Hrs	
LR-GF		135	0.14	3.8	0.200	0.580	2000 Hrs	
LR-YGF		165	0.14	3.8	0.255	0.680	1900 Hrs	
LR-WF		125	0.14	3.8	0.330	0.425	2000 Hrs	
TA-G		65	0.14	2.9	0.175	0.470	1200 Hrs	
TA-G(2)		82	0.17	3.9	0.180	0.475	1000 Hrs	
TA-W		60	0.13	2.6	0.320	0.435	1000 Hrs	
TA-OR		50	0.12	2.0	0.380	0.470		
LQ-G		140 Vac 800 Hz	300	0.44	17.0	0.170	0.430	
LQ-YGF	375		0.44	17.0	0.260	0.690	1100 Hrs	
LQ-WF	295		0.44	17.0	0.320	0.410	1350 Hrs	
LQ-YF	300		0.44	17.0	0.480	0.490	1100 Hrs	
LH-W	200		0.24	6.8	0.350	0.380	540 Hrs	
LH-BW	200		0.24	7.2	0.320	0.380		



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W O R L D P R O D U C T S

# NEC ELECTROLUMINESCENT (EL) BACKLIGHTS

Standard Brightness (recommended brightness: 40 to 60cd/m<sup>2</sup>)

## TA TYPE (Microencapsulated Phosphor)

### Features:

- Ultrathin (0.3mm max.)
- No Seal Area Required
- Uniform Surface Illumination with Flexibility

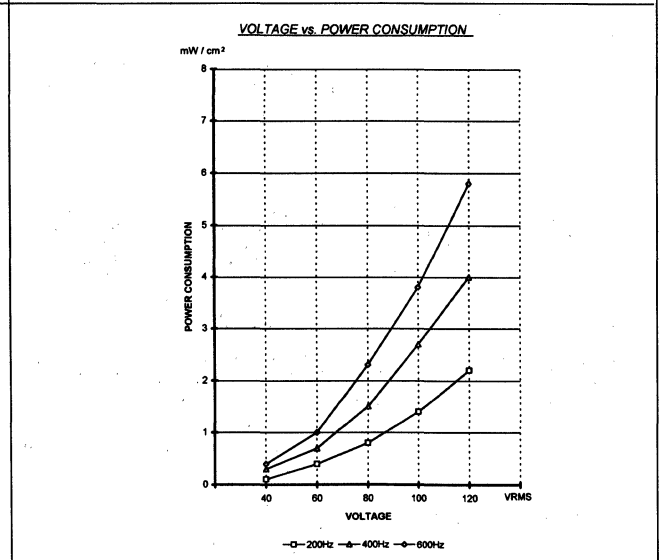
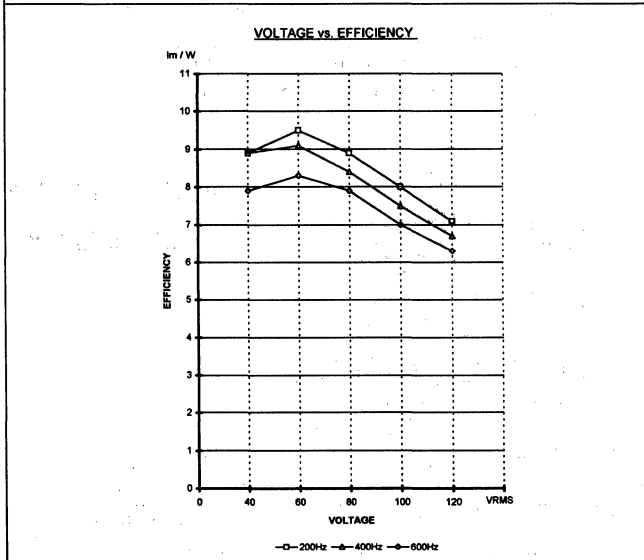
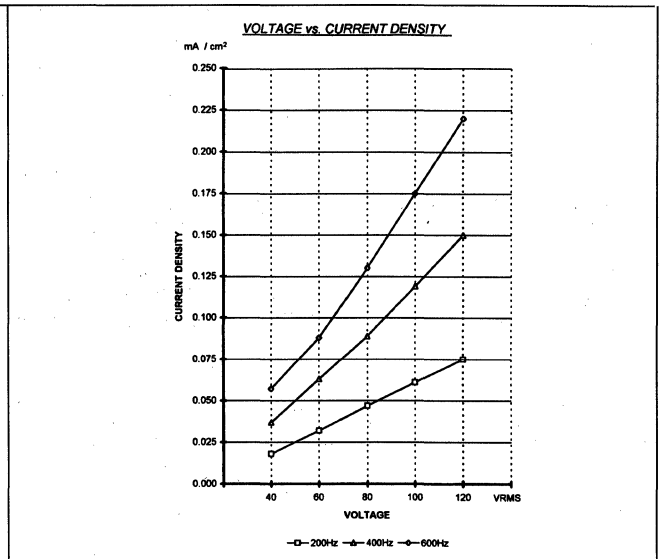
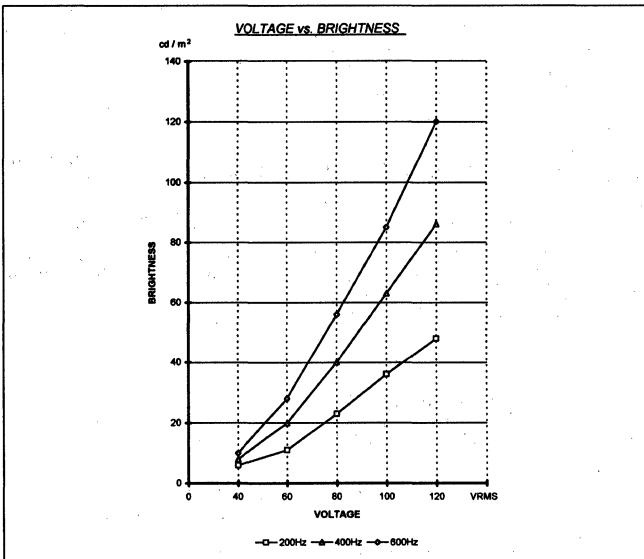
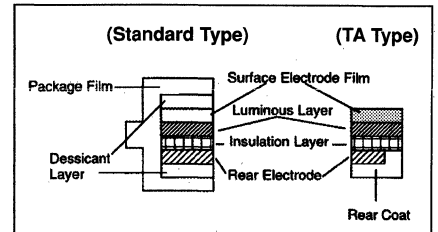
### Characteristics:

- Maximum Ratings  
 Applied Voltage: AC 150Vrms  
 Applied Frequency: 4000 Hz  
 Input Current: 0.6mA/cm<sup>2</sup>

### Electrical Characteristics:

Item	Unit	Operating Conditions	Value (Typ)
Brightness	cd/m <sup>2</sup>	AC 100V 400 Hz (20°C, 60% RH)	65
Current Density	mA/cm <sup>2</sup>		0.14
Power Consumption	mW/cm <sup>2</sup>		2.9
Chromaticity	x y		0.175 0.470

### Construction:



\* Ask About Our New Higher Brightness Types

\* Ask About Our New TB and TC Type



19654 8TH ST. EAST, SONOMA, CA 95476 PHONE (707) 996-5201 FAX (707) 996-3380  
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SEE OUR OTHER DATA PAGES IN SECTIONS 1500, 1850, 4300, 4700, AND 4800

## DATA LINKS RECEIVERS

Manufacturer	Starting EEM Page No.	Unidirectional	Bidirectional	Light Source	Bit Rate (NRZ)	Rise time/Fall time (ns) (typical)	Operating Temperature
Honeywell	B-1164	√			10 MBD		0 to 70°C
Interoptics	B-1165	√			10 MB/S	70	-20°C to 70°C
Litton Systems, Inc.	B-1166	√	√				
Patton Electronics Co.	B-1167		√§		19.2 - 256 KBPS		0 to 50°C

## TRANSMITTERS

Manufacturer	Starting EEM Page No.	Unidirectional	Bidirectional	Light Source	Bit Rate (NRZ)	Rise time/Fall time (ns) (typical)	Operating Temperature
Honeywell	B-1164	√					
Interoptics	B-1165	√		660 - 800nm LED	10 MB/S	70	-20°C to 70°C
Litton Systems, Inc.	B-1166	√	√				
Patton Electronics Co.	B-1167		√§		19.2 - 256 KBPS		0 to 50°C

## FIBER OPTIC CABLE ASSEMBLIES

Manufacturer	Starting EEM Page No.	Type	Connector 1	Connector 2	Cable Type
Interoptics	B-1165	Single mode Multi mode	FC/PC, SC, ST, Diamond FC/PC, SC, ST, SMA	FC/PC, SC, ST, Diamond FC/PC, SC, ST, SMA	LDS, LDD LDS, LDD

## CONNECTORS

Manufacturer	Starting EEM Page No.	Style (Diamond, SMA, DIN47256, NTT, FC, ST, SC, FDDI, etc.)	Single Mode	Multi-mode	Inner diameter range	Connecting Loss (dB)
Interoptics	B-1165	Diamond, DIN47256, FC, SC, ST, SMA	√	√	125μ-1000μ	<0.5 dB

Cable Type Code:

LDS = Light Duty Single

DU = DUALAN (2 fibers in single jacket)

PLDD = Plenum Light Duty Dual (zip style)

LDD = Light Duty Dual (zip style)

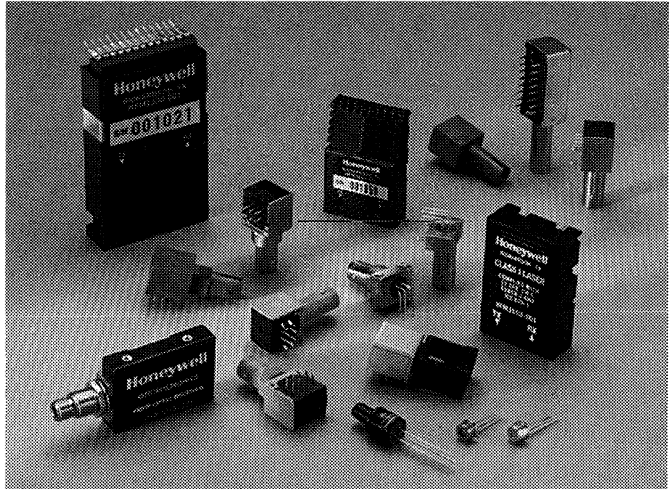
DUP = DUALAN Plenum (2 fibers in single jacket)

# Honeywell

## LAN Products

### FIBER OPTICS

Honeywell is a leader in the field of fiber optics. The Fiber Optics group specializes in the design, development and manufacture of active optoelectronic components and sub-assemblies for the LAN market. Honeywell fiber optic products are compliant with the various standards that govern the LAN industry. Honeywell offers a wide range of standard fiber optic products. As one of the world's leading designers and manufacturers of fiber optic data communications components, Honeywell provides complete, easy to use design solutions. Honeywell fiber optic devices are designed to meet or exceed standards defined by IEEE and other standard bodies.



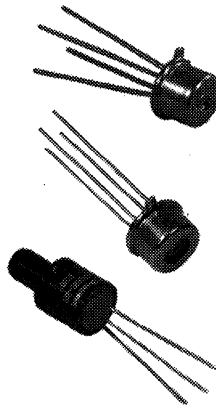
The Fiber Optic Catalog 27 lists the Honeywell standard products now available and includes:

- Connectorized Components
- Fiber Optic Modules
- Fiber Optic LEDs and Integrated Transmitters
- Photo Diodes and Integrated Receivers
- Application Information

## Fiber Optic LAN Components

### High Speed Fiber Optic VCSEL

- Designed for drive currents between 5 and 15 mA
- Lensed-window TO-46 style package
- Flat-window TO-46 style package
- Prealigned SC Connector sleeve
- Optimized for low dependence of electrical properties over temperature
- High speed  $\geq$  GHz
- Two different laser/photodiode polarities
- Attenuating coating
- Packaged with a photodetector



### Fiber Optic VCSEL

HFE4880-321  
HFE4085-321

### Fiber Optic VCSEL

with a custom-designed power monitor diode

HFE4081-321      HFE4083-322  
HFE4082-321      HFE4084-322

### Connectorized High Speed VCSEL

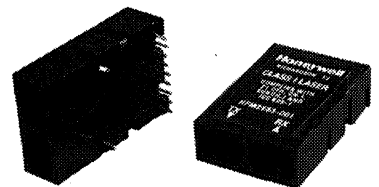
with SC sleeve prealigned and sleeved with a custom designed power monitor diode

HFE4380-321      HFE4383-322  
HFE4381-321      HFE4384-322

## Fiber Optic LAN Modules

### Short Wavelength Transceiver

- Class I eye safe – does not require external circuitry on PCB to ensure eye safety compliance
- Single power supply ( $V_{cc} = 5V$ )
- Received Signal Defect function
- Low cost, high reliability, fiber optic-to-electronic solution
- Complies with 622 Mb/s ATM Standard for short wavelength
- Complies with Fiber Channel (1.0625 Gb/s) Standard
- Comes with IEEE Gigabit Ethernet (1.25 Gb/s) Standard for 850 nm short wavelength
- Industry Standard 1x9 pin package footprint
- Industry Standard duplex SC connector
- Transmit and Receiver functions built into a single package



### MICRO SWITCH

Honeywell Inc.  
Optoelectronics Facility  
830 East Arapaho Road  
Richardson, Texas 75081  
**1-800-367-6786, USA**  
**1-800-737-3360, Canada**

### INTERNET

<http://www.sensing.honeywell.com>  
[opto@micro.honeywell.com](mailto:opto@micro.honeywell.com)

### FAX

1-972-470-4326



# INTEROPTICS®

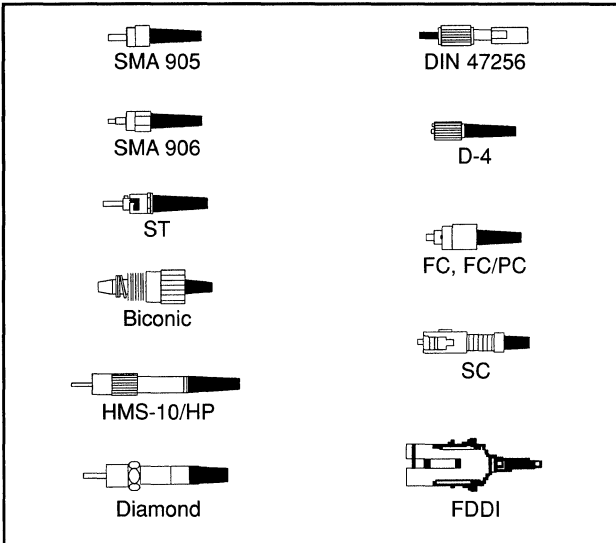
Quality products from Purdy Electronics

## Fiber Optic Components

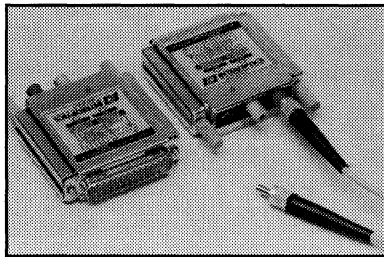
### Glass Fiber Cable Assemblies

Patchcords, Pigtailed, Hybrids & Custom Assemblies

- Fiber Sizes:** Singlemode  
Multimode: 50/125, 62.5/125, 100/140,  
200/230, 400/430, 500/530, 550/570,  
600/630, 100/1035 μm
- Polish Styles:** Standard, Super, Ultra & Angle
- Connector Types:** Simple & Duplex



### OPTO-232C Series • RS-232C Modems 4 Channels



The OPTO-232C series fiber optic modems use optical fibers to transfer up to four channels of RS232 data for point-to-point applications.

#### Specifications

**Data:** RS-232, 4-channel  
Full duplex  
DC to 64 Kb/s

**Data Rate:** 850 nm

**Wavelength:** 2

**No. of Fibers:** 25-pin connector

**Mounting Style:** 2.13"W x 2.21"L x 0.63"H  
54mm x 56mm x 16mm

**Operating Temperature:** -20°C to +70°C

**Connectors:** Optical: SMA or ST  
Data: 25-pin DB  
Power: Host (25 pin)  
External DC jack for OPTO-PS-1

#### Ordering Information

Part Number	Description
OPTO-232C/S	One pair: DTE & DCE four-channel modems, SMA optical port, Male DB 25-pin connector
OPTO-232C/ST	One pair: DTE & DCE four-channel modems, ST optical port, Male DB 25-pin connector
OPTO-232C/X-DCE	One unit: DCE only X=optical connector port
OPTO-232C/X-DTE	One unit: DTE only X=optical connector port
OPTO-PS-1	Power supply, AC/DC plug-in

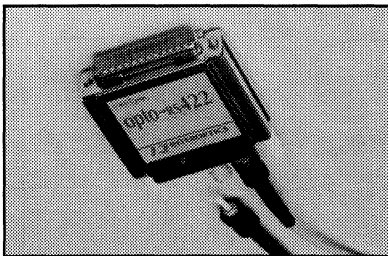
#### Power Budget/Distance

Fiber Size	Power Budget	Distance
50/125	4 dB	1.0 km
62.5/125	8 dB	2.5 km
100/140	13 dB	2.5 km

#### Applications

- Computer networking
- Remote peripherals
- High noise environment
- Factory/office automation

### OPTO-RS422 Series • RS-422 Modems Data Lines Only



The OPTO-RS422 series fiber optic modems use optical fibers to transfer RS422 data for point-to-point applications.

#### Specifications

**Data:** RS-422 (Data Lines Only)  
Full duplex  
DC to 5 MB/s

**Data Rate:** 850 nm

**Wavelength:** 2

**No. of Fibers:** 25-pin connector

**Mounting Style:** 2.13"W x 2.21"L x 0.63"H  
54mm x 56mm x 16mm

**Operating Temperature:** -20°C to +70°C

**Connectors:** Optical: SMA or ST  
Data: 25-pin DB  
Power: Host (25 pin)  
External DC jack for OPTO-PS-1

#### Ordering Information

Part Number	Description
OPTO-RS-422/S	One unit: RS-422 modems, data only SMA optical port, Male DB 25-pin connector
OPTO-RS-422/ST	One unit: RS-422 modems, data only ST optical port, Male DB 25-pin connector
OPTO-PS-1	Power supply, AC/DC plug-in

#### Power Budget/Distance

Fiber Size	Power Budget	Distance
50/125	4 dB	1.0 km
62.5/125	8 dB	2.5 km
100/140	13 dB	2.5 km

#### Applications

- Computer networking
- Remote peripherals
- High noise environment
- Factory/office automation

### TRANSMITTERS/RECEIVERS/TRANSCIEVERS

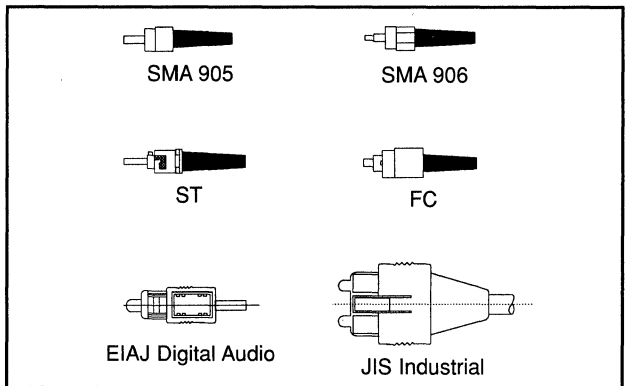
DC to 10 Mb/s  
660 - 800 nm  
PCB Mount  
-20°C to +70°C

### Plastic Fiber Cable Custom Assemblies Patchcords, & Assemblies

**Fiber Sizes:** 980/1000 μm  
Simple & Duplex

**Polish Styles:** Standard

**Connector Types:** SMA, ST, FC, EIAJ Digital Audio, JIS Industrial

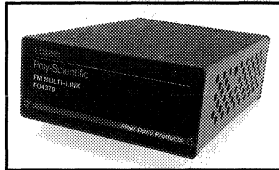


Call for Our Full Line Catalog • See Additional Product Information in Sections 2450-2460-2475-2600-3700-5100

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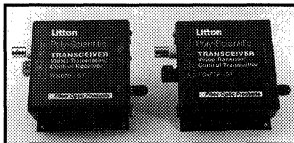
# Fiber Optics

Litton has developed fiber optic transmission systems since 1979. We've taken the same expertise we supply for aircraft LANs, robotics and video systems and adapted it for use in a wide variety of commercial and industrial applications. Our standard products are available for quick delivery. Custom engineering is also available.



## FM Multi-Link FO4370 Frequency Modulated (FM) Fiber Optic Communication System

- Video, audio and data on one fiber
- Up to 3 bidirectional channels and up to 6 unidirectional channels on one fiber
- 10dB optical loss range
- Video Bandwidth = 10 Hz - min 4.2 MHz
- Audio Bandwidth = 10 Hz - 5 KHz
- Data Rate = DC to 1 Mbps NRZ



## Video/Data Link FO4750/51 Tx/Rx

- Video/data (PTZ control signals) on one fiber
- Option of RS-232, RS-422 or TTL
- Video compatibility: NTSC, PAL, RS-170
- Automatic Gain Control (AGC)

## Video/Data Transceivers FO4761/62 Proteus® Compatible FO4728/29 Coaxitron® Compatible

- Up to 13 dB system optical loss range
- 850 nm and 1300 nm wavelengths
- ST® optical connectors standard
- Video Bandwidth 6.5 MHz
- Video compatibility: NTSC, PAL, RS-170

**Power Requirements:**  
12 to 18 VDC, 350 ma

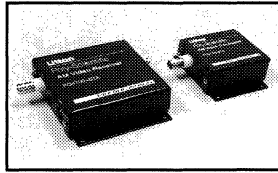
## RS-485 Transceiver (2-wire and 4-wire) FO4765

- 0 to 20 dB system optical loss range
- 850 nm wavelength standard
- ST® optical connectors standard
- Data Rate @ BER 10<sup>-9</sup> DC to 2 Mbps

**Power Requirements:**  
12 to 18 VDC, 330 ma

# Litton

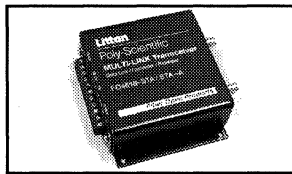
# Poly-Scientific



## AM and FM Video Links FO4710 AM TX / FO4700 AM RX FO4725 FM TX / FO4727 FM RX

- 0 to 16 dB system optical loss range
- 850 nm and 1300 nm wavelengths available
- SNR ≥ 50 dB typical
- ST® optical connectors standard, SMA available
- 3 Hz to 20 MHz bandwidth

	Bandwidth	Power
AM TX	3 Hz to 20 MHz	12 to 18 VDC, 100 ma 16.5 to 24 VAC, 170 ma
AM RX		12 to 18 VDC, 130 ma
FM TX	6.5 MHz	12 to 18 VDC, 150 ma 16.5 to 24 VAC, 250 ma
FM RX		12 to 18 VDC, 200 ma



## Data Transmission Link FO4618

- Data Rate @ BER 10<sup>-9</sup>  
RS-422 - DC to 1Mb/s  
TTL - DC to 1Mb/s  
RS-232 - DC to 100Kb/s
- 0 to 20 dB system optical loss range
- 850 nm and 1300 nm wavelengths available
- ST® optical connectors standard, SMA available

**Power Requirements:**  
12 to 18 VDC, 150 ma

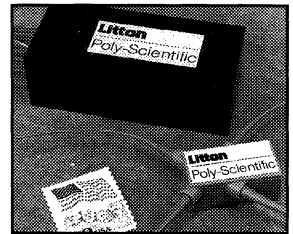


## Hybrid Transmitters/Receivers

AC or edge-coupled with data rates up to 125 Mbps NRZ. Transmitters with high launch power and receivers with superior sensitivity and broad dynamic range.

**Features:**

- Electrical compatibility with PECL, ECL and TTL
- Meet requirements of: ARINC 629, MIL-STD-1773, STANAG 3910



## Multimode Optical Switches

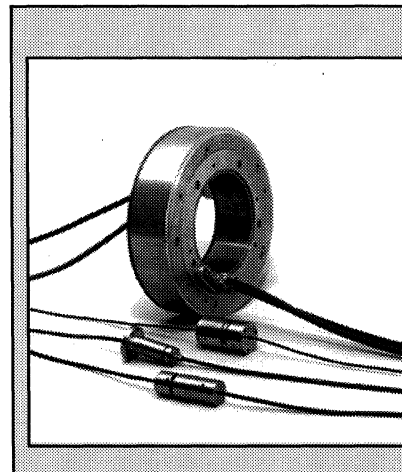
- Miniaturized, commercial
- Ruggedized, military

**Features:**

- Low insertion loss
- High reliability
- Board mountable.

**Applications:**

Test equipment, Local area network (LAN) bypass switching, FDDI compatible



## Fiber Optic Rotary Joints (FORJ)

A FORJ is a device used to pass optical signals from a stationary structure to a rotating mechanism in a fiber optic system. We offer a variety of FORJs: *Off-Axis, Single-Mode, Multi-Mode, Low Cost and Hybrid FORJ/Slip Ring Assemblies*

**Typical Applications:**

Medical Systems, Cable reels, Tethered robotic vehicles, and Aircraft antenna

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- e-mail: [info@litton-ps.com](mailto:info@litton-ps.com)
- FAX (540)953-1841
- International (540)552-3011

In addition to fiber optic products Litton Poly-Scientific designs and manufactures slip rings, resolvers, DC motors and higher order actuator assemblies.

# FIBER OPTIC MODEMS

*Point-to-Point Datacom over Multimode Fiber...*

*Self*  
**POWERED**

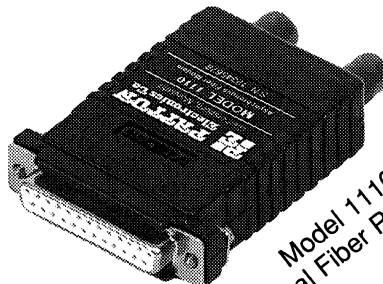
**No External Power Needed**

**SINGLE FIBER**

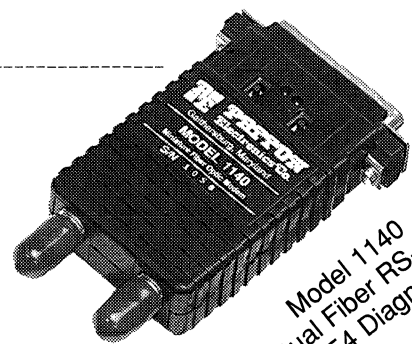
**Full Duplex Communication**

**MODULAR**

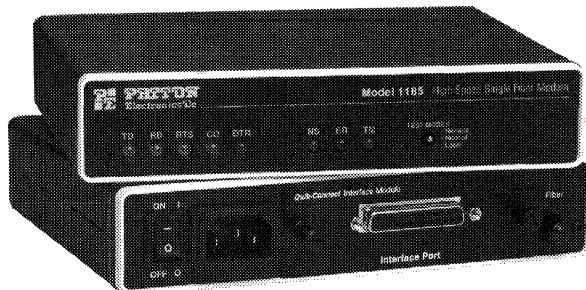
**Swappable Interface Cards**



Model 1110  
Dual Fiber RS-232



Model 1140  
Dual Fiber RS-232  
w/V.54 Diagnostics



Model 1185  
Single Fiber Modem  
Interface Modules for X.21, V.35, G.703, RS-232



Model 1180  
Single Fiber Modem  
Sync./Async., V.24/V.35

Fiber Modems	Max Distance (Miles)		Top Speed (Kbps)		Standalone	Rack Mount	Electrical Interface	Transmission Line	Transmission Format
	2	19.2	Yes	Yes					
1110	2	19.2	Yes	Yes	RS-232	Single Multimode Fiber	Sync/ Async		
1140	2	19.2	Yes	Yes	RS-232	Single Multimode Fiber	Sync/ Async		
1180	1.5/3.0	256	Yes	Yes	RS-232/V.35	Single Multimode Fiber	Sync/ Async		
1185	1.5/3.0	256	Yes	No	Plug Ins **	Single Multimode Fiber	Sync/ Async		

\*\* Plug-In modules available in X.21, V.35, G.703, RS-232

## SPECIAL FEATURES:

- ◆ Single or Dual Multimode Fiber
- ◆ Synchronous or Asynchronous
- ◆ Distances from 2 - 3 Miles
- ◆ Data Rates from 19.2 to 256 kbps
- ◆ Interface Powered or AC Powered
- ◆ Various Hardware Interfaces

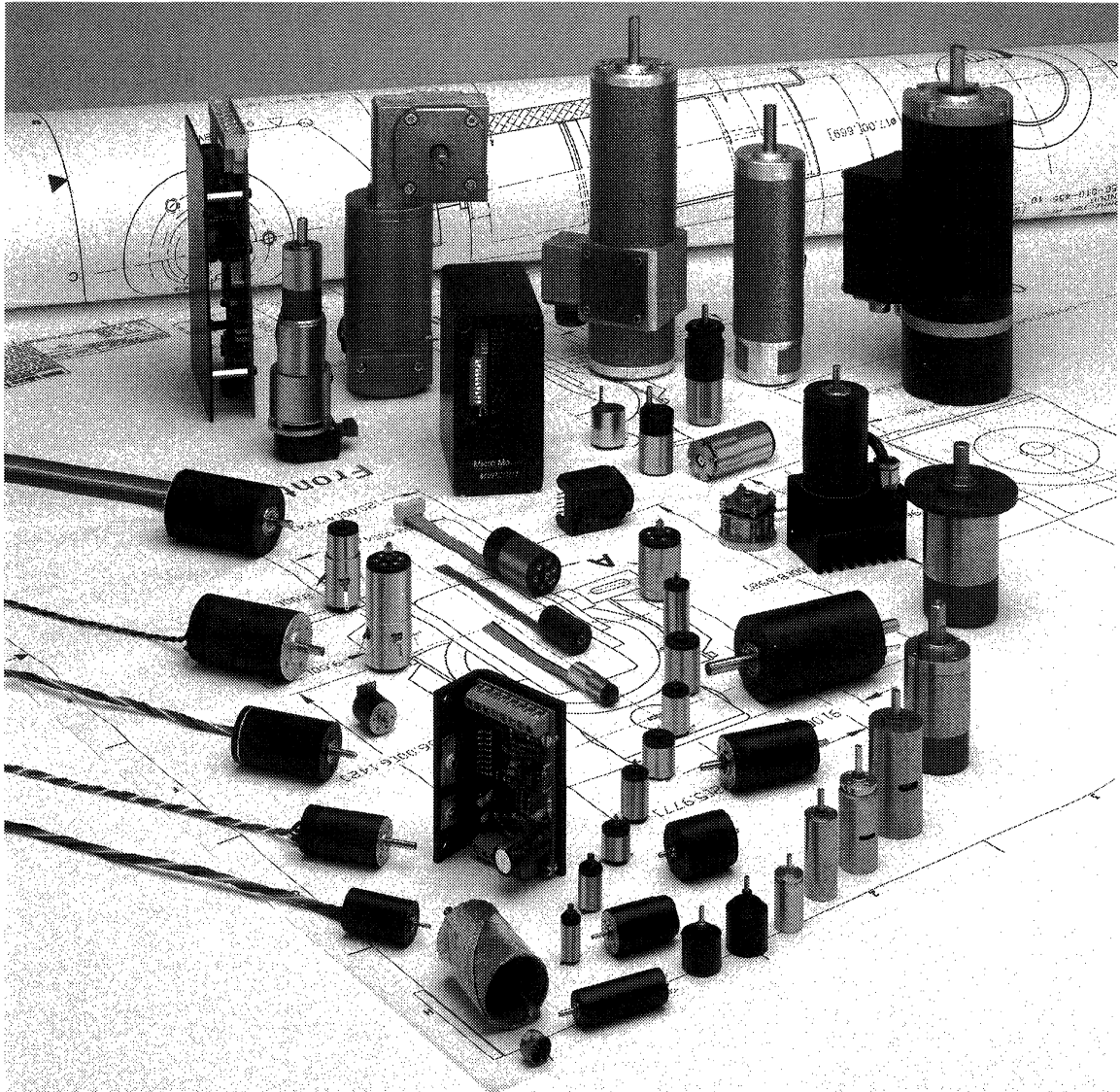


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An ISO-9001  
Certified Company

# Miniature DC Drive Components

Originators of Skew-Wound Coreless Micromotors. Patented and Licensed the World Over.



## Coreless DC Motors

Ø From 8mm (.315 in) - 38mm (1.496 in)  
 .015 - 100 Watts Cont. Output Power  
 .007 - 16 oz-in Max. Cont. Torque  
 Speeds up to 21,000 RPM

## PMDC Motors

Up to 700 Watts Cont. Output Power  
 Up to 315 oz-in Max. Cont. Torque  
 Custom Windings Available up to 180 VDC  
 Speeds up to 7,350 rpm

## Precision Gearheads

Ø From 1.9mm (.075 in) - 120mm (4.724 in)  
 Continuous output Torque up to 250 ft-lbs.  
 Bi-directional operation in ratios up to  
 983,447:1

## Brushless Motors

Ø From 1.9mm (.075 in) - 35mm (1.378 in)  
 Speeds up to 100,000 Rpm  
 2-Wire Drives available  
 Servo Amplifiers

## Also Available:

Tacho-Generators  
 Optical Encoders  
 Magnetic Encoders  
 Precision Gearheads  
 Motor Tachometers  
 Zero Backlash Gearing  
 Brakes  
 Servo Amplifiers  
 Controllers  
 Complete Servo Systems

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FAULHABER GROUP

*The Market Leader in Coreless Motor Technology*

14881 Evergreen Avenue Clearwater, Florida 33762-3008 USA Phone: (813) 572-0131 Fax: (813) 573-5918

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**For full catalog & latest data sheets, call (813) 572-0131 Fax on demand: 800-477-1133**



## MOTORS AND DRIVES

Manufacturer	Starting EEM Page No.	DC Motors						AC Motors			
		Brushless	Brush-Type	Torque	Servo	Step	Permanent Magnet	Induction	Synchronous	Torque	Speed Reducers
Bertsch U.S.	B•1176	√	√		√		√				
Crouzet Corp.	B•1178	√	√			√	√		√		
Denstronics	B•1182					√					
ELTROL Corp.	B•1185	√	√	√	√		√				
Globe Motors	B•1189	√*	√*	√*	√*		√*	√*	√*		√*
Hurst Manufacturing Division	B•1190	√	√		√	√	√	√	√		√
Kollmorgen Motion Technologies Group	B•1194	√			√		√				
Litton Systems, Inc.	B•1195	√	√	√	√		√				
Mabuchi Motor America Corp.	B•1197						√		√		
MFM Technology Inc.	B•1199	√			√		√				
Micro Mo Electronics, Inc.	B•1200	√	√		√	√	√				√
Motor Technology, Inc.	B•1205	√	√	√	√		√				√
M.S. Kennedy Corp.	B•1192	√	√								
Pittman Corp.	B•1208	√	√								
Shinano Kenshi Corp. (SKC)	B•1210	√	√		√	√		√			

## ROTATING COMPONENTS

### SLIP RINGS

Manufacturer	Starting EEM Page No.	Capsule Slip Rings	Power Slip Rings	Pancake Slip Rings	Power Capsule Slip Rings	General Purpose Slip Rings	Flat Slip Ring Assemblies	Vehicle Slip Rings
Airflyte Electronics Company	B•1171	√	√	√	√	√	√	√
Electro-Tec Corp.	B•1183		√		√			
Fabricast Inc.	B•1186	√	√	√	√	√	√	√
Litton Systems, Inc.	B•1195	√	√	√	√	√	√	√

### BRUSHES, ETC.

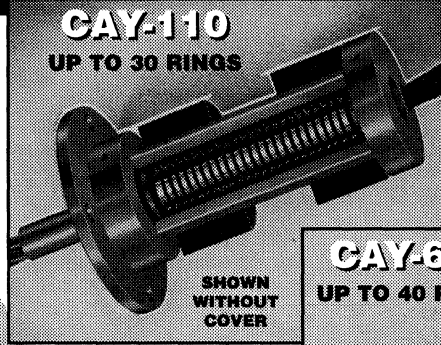
Manufacturer	Starting EEM Page No.	Rotary Switches	Rotors & Brush Blocks	Encoders	Cartridge Type Brushes	Brush Holders	Tachometers	Motorized Potentiometers
Airflyte Electronics Company	B•1171	√	√	√	√	√		
CUI Stack, Inc.	B•1181	√		√				
Fabricast Inc.	B•1186	√	√		√	√		
Globe Motors	B•1189			√			√*	
Litton Systems, Inc.	B•1195		√					
Micro Mo Electronics, Inc.	B•1200			√			√	
Motor Technology, Inc.	B•1205						√	
Pittman	B•1208			√				

# Airflyte ELECTRONICS CO.

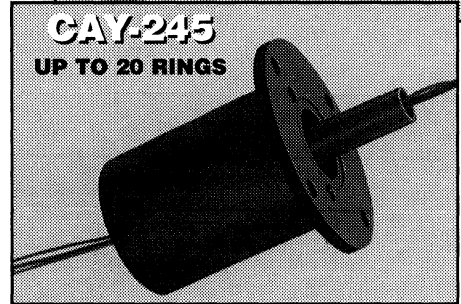
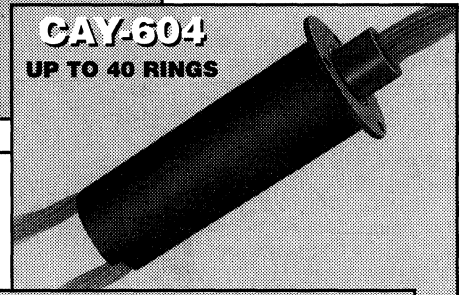
## Capsule Slip Ring Assemblies

These Slip Ring Assemblies have found wide use in gyro gimbal and instrument applications. The fully enclosed and tested assemblies feature fine diameter gold alloy brushes mated to compatible gold alloy rings for excellent noise characteristics at low torque levels. Although miniature in size, the assemblies are surprisingly rugged and are able to withstand most military environmental specifications.

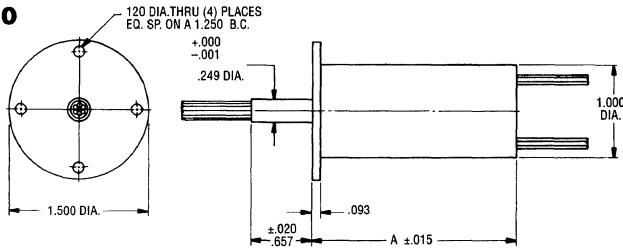
Units have been fully tested to the environmental parameters listed below, proving their ruggedness and reliability. All units are factory tested before shipment and a copy of the test data is available with each unit upon request.



The units shown here are only a sample of those available which include a 50 ring capsule of .685 diameter.

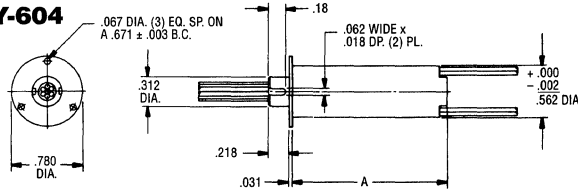


**CAY-110**

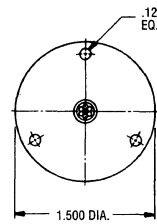


No. of Rings	"A" Inches
4 - 12	1.48
13 - 24	2.20
25 - 30	2.56

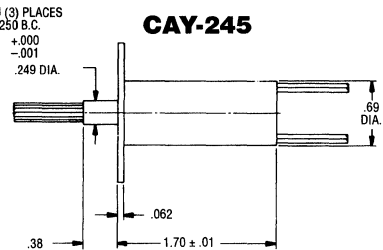
**CAY-604**



No. of Rings	"A" Inches
4 - 12	.741
13 - 24	1.137
25 - 40	1.665



**CAY-245**



**CAY-110**

**CAY-604**

**CAY-245**

**MECHANICAL**

Torque	1.0 in.-oz. max. (24 rings)	1.0 in.-oz. max.	0.5 in.-oz. max. (20 ring assembly)
Speed	500 rpm max.	200 rpm max.	200 rpm max.
Life	10 <sup>6</sup> revs. min.	5 x 10 <sup>6</sup> revs. min.	10 <sup>7</sup> revs. min.

**ELECTRICAL**

Contact Resistance Variation	5 milliohms max. at max. speed	20 milliohms max. at max. speed	5 milliohms max. at max. speed
No. of Rings	30 max.	40 max.	20 max.

**SPECIFICATIONS**

**Mechanical**

- 1 Rings: Gold alloy
- 2 Brushes: Gold alloy wire, spring temper
- 3 Ball Bearings: Stainless steel, shielded
- 4 Shaft: Stainless steel
- 5 Housing: Anodized aluminum
- 6 Rotation: Bi-directional

**Electrical**

- 1 Current: Signal level to 1 amp maximum
- 2 Voltage: Micro-volts to 110 volts rms
- 3 Dielectric Strength: 500 Volts rms (all combinations)
- 4 Leadwire: #30 AWG teflon insulated, 15" long minimum
- 5 Noise: ±5 micro-volts per ma

**Environmental**

- 1 Temperature Shock: +85°C for 1 hour and immediately transferred to -55°C for 1 hour
- 2 Shock: 18 shocks, 20 "g" with duration of 11 ±1 ms (MIL-E-5272c, Procedure V)
- 3 Vibration: MIL-STD-202B Method 204, test condition B
- 4 Altitude: 50,000 ft. and -55°C
- 5 Humidity: MIL-E-5272c, Procedure III (95% R.H. @ 120°F for 360 hours)

**ORDERING INFORMATION**

CAY-□□□ □  
 \_\_\_\_\_ No. of Rings  
 \_\_\_\_\_ Model

NEW HOOK ROAD, BAYONNE, NEW JERSEY 07002 ■ 201-436-2230 ■ FAX 201-436-6024 ■ www.airflyteelectronics.com

# Airflyte ELECTRONICS CO.

## Capsule Slip Ring Assemblies

*These assemblies, specially designed for gyro-rate table and centrifuge applications, have found wide use because of their versatility and compact size. The standard assembly, can be supplied (at slight extra cost) with internally shorted rings for double and triple current ratings, and with single, double and triple shielded wire. Featuring gold alloy wire brushes and compatible gold alloy rings, these assemblies are manufactured from proven production tooling at a very nominal cost. Special assemblies with switching circuits and others with non-standard materials for use in severe environments are available.*

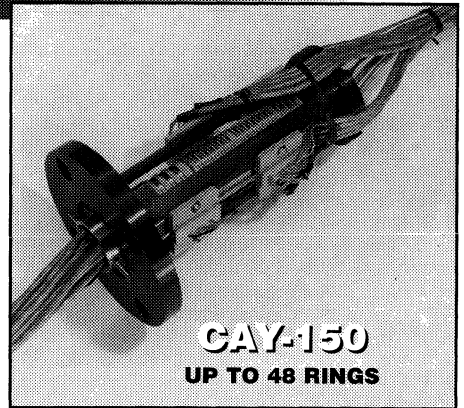
### SPECIFICATIONS

#### Mechanical

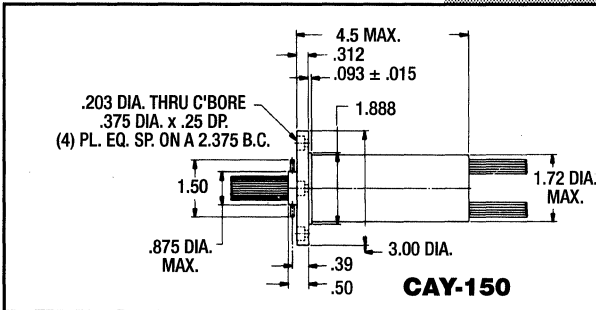
- 1 Rings: Gold alloy
- 2 Brushes: Gold alloy wire, spring temper
- 3 Ball Bearings: Stainless steel
- 4 Shaft: Stainless steel, type 303
- 5 Housing: Anodized aluminum
- 6 Rotation: Bi-directional
- 7 Torque: .125 in.-oz. per ring
- 8 Speed: 600 rpm max-intermittent
- 9 Life: 2000 hrs. @ 100 rpm

#### Electrical

- 1 Current: Signal level to 2.0 amps (Higher levels available)
- 2 Voltage: 400 vdc maximum
- 3 Dielectric Strength: 1000 Volts rms (all combinations)
- 4 Contact Resistance:
  - A. Less than 8 milliohms @ 200 rpm
  - B. Less than 2 milliohms @ 10 rpm
- 5 Leadwire: #28 AWG 18" long (Shielded cables available)



UNIT SHOWN WITHOUT COVER



NOTE: The table below shows similar models that are available.

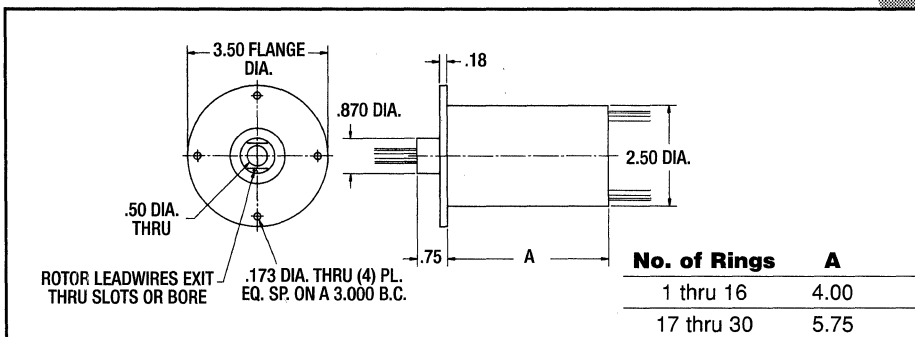
Part No.	Dia.	Rings	Length
CAY-1117	1.72	72	6.0
CAY-1248	1.87	96	8.0
DAY-1481-1	2.75	80	4.92
DAY-1481-2	2.75	170	8.66
DAY-1481-3	2.75	235	11.50
DAY-1481-4	2.75	400	16.25

## Multi-Purpose Capsule Assemblies

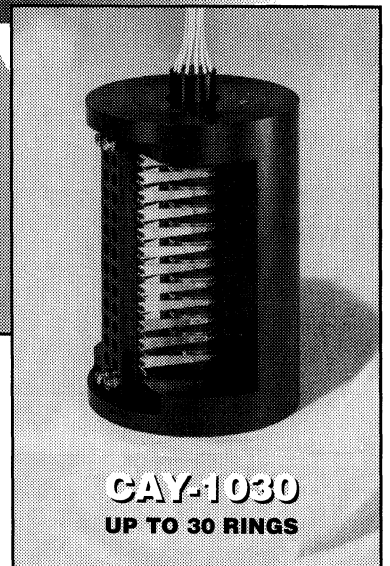
### LONG LIFE ■ HIGH SPEED ■ THROUGH-BORE DESIGN

### SPECIFICATIONS

- 1 Rings: Coin Silver
- 2 Brushes: Silver graphite, two per ring
- 3 Ball Bearings: Stainless steel, shielded
- 4 Shaft: Aluminum
- 5 Housing: Aluminum
- 6 Torque: .03 in.-lb. per ckt. approx.
- 7 Speed: Up to 5000 rpm
- 8 Life: 50 x 10<sup>6</sup> revs. min.
- 9 Rotation: Bi-directional
- 10 Current: 0-5 amps per ring standard (15 amp available)
- 11 Voltage: 250 Volts DC max.
- 12 Dielectric Strength: 500 VRMS (all combinations)
- 13 Noise: 10 milliohms @ max. speed
- 14 No. of Rings: 30 max.
- 15 Leadwire: #22 AWG, 24" long



No. of Rings	A
1 thru 16	4.00
17 thru 30	5.75



CAY-1030  
UP TO 30 RINGS

UNIT SHOWN WITHOUT COVER & MTG FLANGE

# Airflyte ELECTRONICS CO.

## Power Capsule Slip Ring Assemblies

**DAY-705** These slip-rings are built to your order using many standard components which have proven themselves over many years of reliable operation. The "platter-type" design includes one coin silver ring on each side of each molded sub-assembly; and, leaf type silver graphite brushes which are molded in an insulating block and perfectly matched to the face of each ring. Inasmuch as the assemblies are the stack-up type, we are able to custom build them to your specifications - using our standard components - with a very minimum lead time required.

**DAY-710** Similar in construction to our DAY-705, this platter type unit features two coin silver rings on each side of each platter for greater package density, and a "through bore" design which can be used for the passage of fluid or gas lines.

### SPECIFICATIONS

#### Mechanical

- 1 Rings: Coin silver
- 2 Brushes: Silver graphite
- 3 Ball Bearings: Stainless steel, shielded
- 4 Shaft: Anodized aluminum
- 5 Housing: Anodized aluminum

- 6 Speed: 500 rpm maximum
- 7 Rotation: Bi-directional

#### Electrical

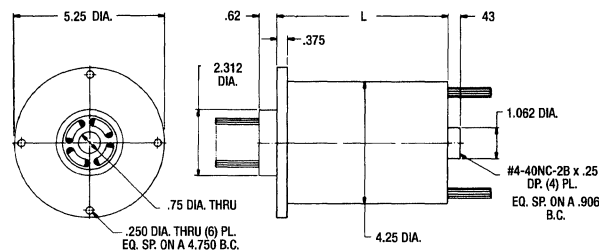
- 1 Voltage: 0 to 150 Volts AC or DC
- 2 Dielectric Strength: 500 Volts rms (all combinations)

### "Through-Bore" Design

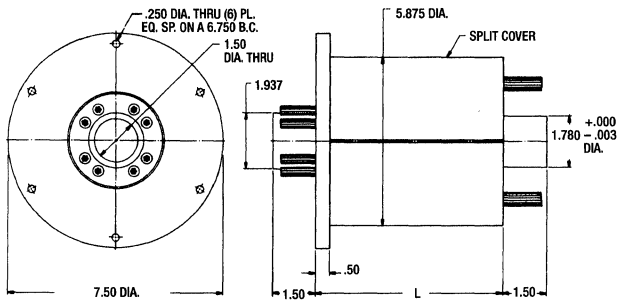


UNIT SHOWN WITHOUT COVER

### DAY-705 UP TO 160 RINGS



### DAY-710 UP TO 120 RINGS

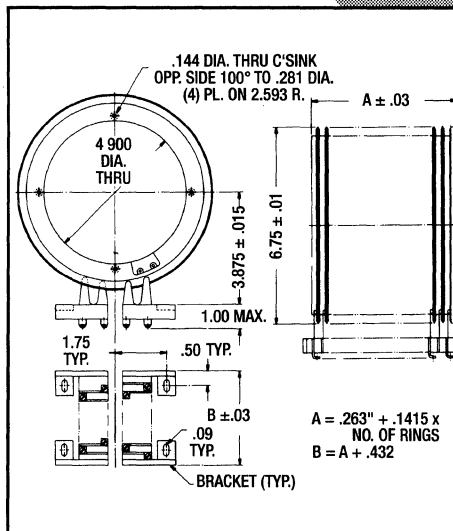


	DAY-705	DAY-710	No. of Rings	DAY-705 "L"	DAY-710 "L"	No. of Rings	DAY-705 "L"	DAY-710 "L"
Torque	1/2 in.-oz. per circuit	3/4 in.-oz. per circuit	10-20	5.375	4.725	81-100	16.625	12.625
Life	3000 hrs. @ 200 rpm	2500 hrs. @ 100 rpm	21-40	8.187	6.700	101-120	19.437	14.600
Current	5 amps max. per circuit	5 amps max. per circuit	41-60	11.000	8.675	121-140	22.250	
Contact Resistance Variation	8 milliohms peak @ max. speed	10 milliohms max.	61-80	13.812	10.650	141-160	25.062	

## Flat Ring Assemblies & Matching Brush Block

### SPECIFICATIONS

- 1 Rings: Coin Silver
- 2 Brushes: Silver graphite (two per ring)
- 3 Ball Bearings: Beryllium copper
- 4 Insulation: Phenolic
- 5 Leadwire: Available upon request
- 6 Speed: 750 rpm max.
- 7 Life: 1000 hours @ 100 rpm
- 8 Current: 5 amps per ring; 10 amps per ring when 4 brushes are used
- 9 Voltage: 350 VRMS
- 10 Dielectric Strength: 500 Volts rms (all combinations)
- 11 Insulation resistance: 10 megohms minimum at 500 VDC
- 12 Noise: The contact resistance change in each circuit shall be less than .005 ohms at maximum speed
- 13 Units with less than 11 rings have one bracket per brush block



### CAY 94

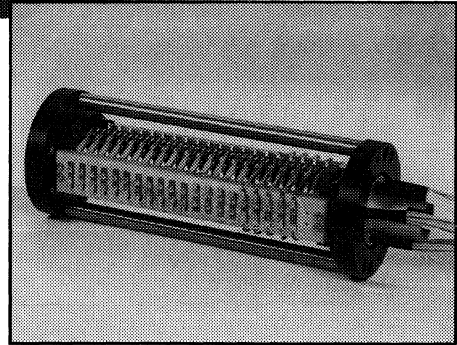


- General purpose
- Stack-up capability (up to 200 rings or more)
- Low noise
- Long life

# Airflyte ELECTRONICS CO.

## Multi-purpose Slip Ring Assemblies

These assemblies, designed for use in commercial equipment, have been used in applications ranging from the thermocouples to the transmission of medium power. They feature coin silver rings, silver graphite brushes, convenient terminals on both the slip ring and brush blocks, and a rotor design which allows the leadwires to be exited through the shaft bore, or under the bearing when a shaft clearance hole is required. The wide variety of sizes and configurations available, including "in-between" shaft diameters, allows the designer to select a standard assembly for this application, eliminating time consuming and costly design charges. The CAY-731/CAY-740 should be specified when bearing mounted assemblies are not practical.



### SPECIFICATIONS

#### Mechanical

- 1 Frame: Aluminum (DAY-490/DAY-499 only)
- 2 Rings: Coin silver
- 3 Brushes: Silver graphite, two per ring
- 4 Leafs: Beryllium copper
- 5 Insulation: Epoxy or laminated plastic

#### Electrical

- 1 Current: 10 amperes per circuit (20 amperes available)
- 2 Voltage: 250 Volts maximum AC or DC
- 3 Dielectric Strength: 750 volts rms (all combinations)
- 4 Insulation Resistance: 50 megohms minimum at 500 VDC

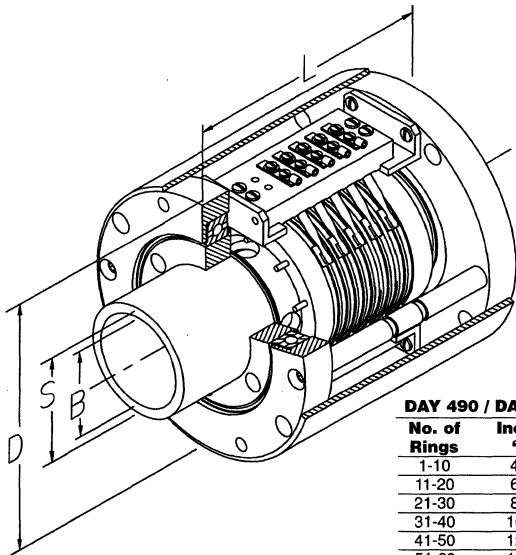
- 5 Contact Resistance Variation: 10 milliohms maximum at maximum speed
- 6 No. of rings: 100 maximum

#### Environmental

- 1 Operating Temperature: 0 to 250°F
- 2 Humidity: 95% maximum

### ...As An Assembly

DAY-490/499 UP TO 100 RINGS



DAY 490 / DAY 499

No. of Rings	Inches "L"
1-10	4.88
11-20	6.75
21-30	8.63
31-40	10.50
41-50	12.38
51-60	16.00
61-70	17.88
71-100	*

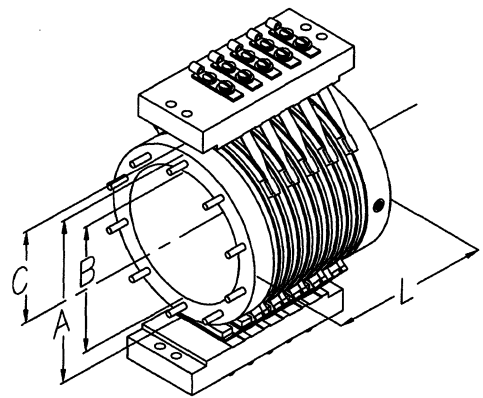
\*Consult Factory

### ASSEMBLY

Part No.	Max. Speed RPM	Min. Life 10 <sup>6</sup> Rev.	Max. Torque Per Ring lb.-in.	"B" I.D.	"D" O.D.	"S"
DAY-490	5000	50	.21	1.00	4.00	1.25
DAY-491	4000	40	.30	1.75	5.00	2.125
DAY-492	3000	30	.40	2.75	6.50	3.125
DAY-493	2500	25	.50	3.75	7.50	4.125
DAY-494	2000	20	.61	4.75	8.50	5.125
DAY-495	1500	15	.71	5.75	9.50	6.125
DAY-496	1500	15	.82	6.75	10.50	7.125
DAY-497	1000	10	.92	7.75	11.50	8.125
DAY-498	1000	10	1.02	8.75	13.00	9.125
DAY-499	750	7.5	1.12	9.75	14.00	10.125

### ...Or As Separates

CAY-731/740 UP TO 100 RINGS



To determine "L" dimensions use the following formula:  
 "L" = .750" + [.1875" (No. of Rings)]

### SEPARATES

Part No.	Max. Speed RPM	Min. Life 10 <sup>6</sup> Rev.	"B" I.D.	"A"	"C"
CAY-731	5000	50	1.25	1.875	1.447
CAY-732	4000	40	2.125	2.750	1.829
CAY-733	3000	30	3.125	3.750	2.281
CAY-734	2500	25	4.125	4.875	2.822
CAY-735	2000	20	5.25	5.875	3.307
CAY-736	1500	15	6.25	7.000	3.857
CAY-737	1500	15	7.25	8.000	4.342
CAY-738	1000	10	8.25	9.000	4.837
CAY-739	1000	10	9.25	10.000	5.332
CAY-740	750	7.5	10.25	11.000	5.827

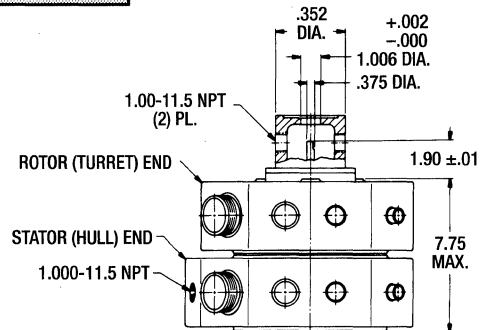
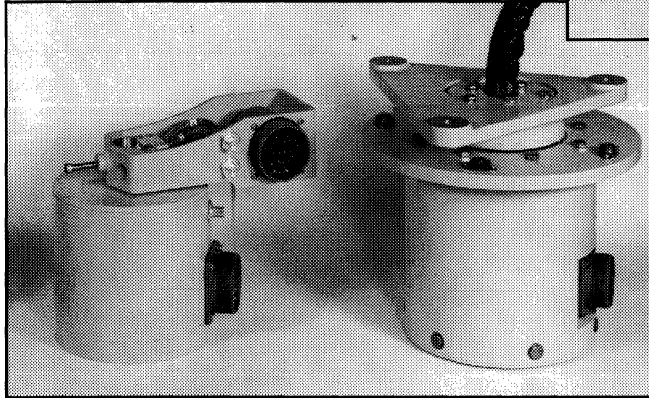
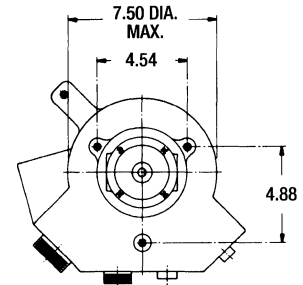
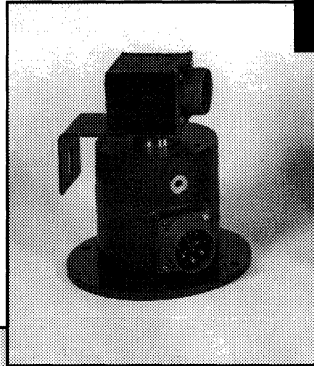
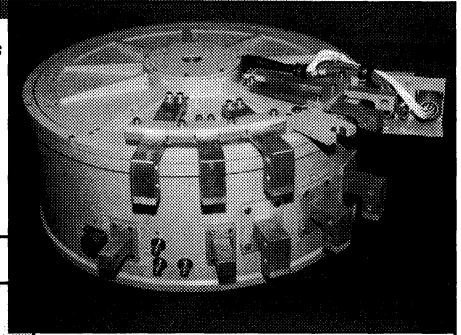
# Airflyte ELECTRONICS CO.

## Vehicle Slip Ring Assemblies

Airflyte Electronics has experience in the design and manufacture of assemblies for personnel carriers, tanks and other military vehicles. We have built slip rings for periscopes, turrets and commander stations. These assemblies range in size from 6" or less in outside diameter to slip rings with clearance holes larger than 28". This type of assembly is characterized by its rugged construction, usually has two high power rings, several low power and up to 50 signal rings. Illustrated are several of the configurations we have built in production quantities.

### SPECIFICATIONS

- 1 Voltage: from 28 VDC to 208 VAC
- 2 Current: from 1 amp to 600 amps
- 3 Frequency: DC to 100 MHz
- 4 Speed: Usually about 20 rpm
- 5 Noise: Less than 10mΩ peak to peak
- 6 Hydraulics: 3000 psi operating
- 7 Pneumatics: 1500 psi operating
- 8 Torque: 15 ft.-lb. max. (no hydraulics)
- 9 Life: 3000 hrs.
- 10 Environmental: Vibration, shock, etc. per MIL SPEC
- 11 Terminations: Connectors & fittings customer compatible



Typical Hull/Turret Tank Unit

## Encoder & Switches

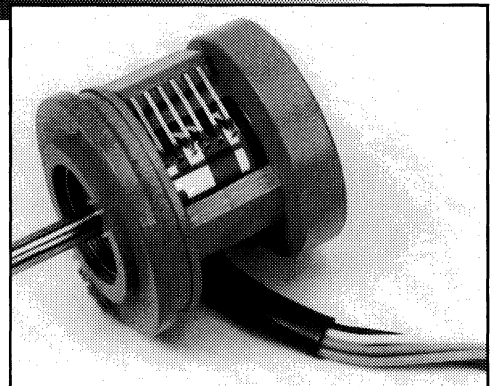
Airflyte encoder and rotary switches feature drum construction with solid gold alloy conducting segments embedded in epoxy and machined flush. Brushes are multi-strand, spring-temper gold-alloy. As small as 1/2" diameter.

### ENCODERS

Special encoders with BCD, Gray, True Binary or non-standard codes are available. Units supplied with or without logic circuitry.

### SWITCHES

When close accuracy, repeatability and size are important, specify Airflyte rotary switches for timing and positioning application switches and cams. Pre-set to eliminate installation time. Zero hysteresis.





**BERTSCH U.S.** 1280 LIBERTY WAY, VISTA, CA 92083  
 PHONE (760) 727-7420 FAX (760) 727-4436

**Series 20-08 • 0.2 Watts • 6000 RPM**

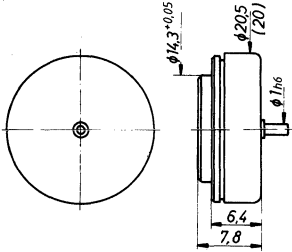
Dimensions — mm 1mm = 0.0394 in  
 7.06 In. Oz.=1mNm

- Rotor 3 Flat Coils
- Magnet SeCo5
- Commutator AgCu3, 6 segments
- Brushes Gold alloy
- Bearings Oilite, Brass

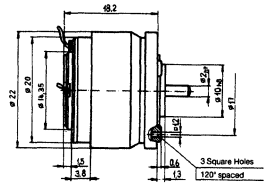
- Efficiency up to 85%
- Rotor Moment of Inertia  $3 \times 10^{-3}$  oz-in<sup>2</sup>
- Mechanical Time Const. appr. 25 ms
- Weight 0.35 oz.

- Recommended Operational Data**
- Speed max. 6000 rpm
  - Torque 0.06 oz-in
  - Temperature -4° +140°F

- M 12-00 Gear Head**
- Max. Torque
  - GBR = 43:1 1.5 oz-in
  - GBR = 139:1 3.0 oz-in
  - GBR = 449:1 5.0 oz-in
  - GBR = 1443:1 7.0 oz-in
  - Max. Motor Speed 7000 rpm
  - Max. Power 0.1 W
  - Max. Radial Load 6 oz
  - Max. Axial Load 2 oz
  - Weight with motor 0.5 oz

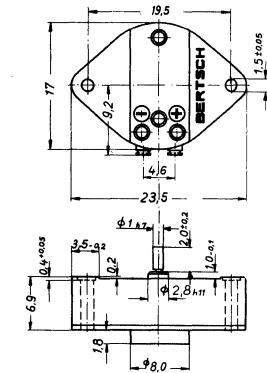


Type	20-08-03	20-08-06	20-08-12	
Voltage	3	6	12	V
No load speed	7000	7500	6800	rpm
Resistance	7.7	28	114	Ohms
Stall torque	.19	.21 oz-in	.19	oz-in
No load current appr.	20	13	6	mA
Recommended current	100	50	30	mA
Torque constant	0.55	1.02	2.25	oz-in/A
Counter-EMF	0.41	0.8	1.7	mV/rpm
Speed/Torque Gradient	36842	35714	35789	rpm/oz-in



**Series 00-30 • 0.05 Watts • 10,000 RPM**

Dimensions — mm 1 mm = 0.0394 in



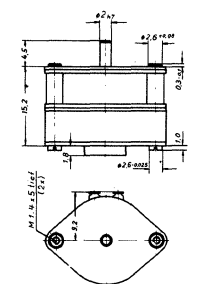
- Rotor 3 Flat Coils
- Magnet Ferrite
- Commutator Flat, 3 Segments
- Brushes AgCu3
- Bearings Brass, Plastic or Sintered Metal
- Weight 0.3 oz.

- Recommended Operational Data**
- Speed 10,000 rpm
  - Torque 0.005 oz-in
  - Temperature -4° to +140°F

- Max. Power 0.04W
- Weight with motor 0.55 oz

- Standard Gear Ratios M 11-00**
- 18.5:1 96.4:1 176:1
  - 249:1 487:1 916:1
  - 4629:1

Type	00-30-02	00-30-03	00-30-04	00-30-06	
Voltage	2	3	4	6	V
No load speed	11,500	13,800 rpm	13,500	13,500	rpm
Resistance	16	26	54	133	Ohms
Stall torque	0.018	0.018	0.018	0.016	oz-in
No load current appr.	28	25	13	10	mA
Recommended current	50	40	30	20	mA
Torque constant	0.18	0.23	0.33	.47	oz-in/A
Counter-EMF	.15	.20	.25	.40	mV/rpm
Speed/Torque Gradient	639,000	767,000	750,000	844,000	rpm/oz-in



**Series 16-24 • 0.4 Watts • 6000 RPM**

Dimensions — mm 1 mm = 0.0394 in

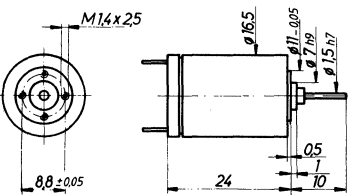
- Magnet AlNiCo
- Commutator AgCu5, 5 segments
- Brushes Gold alloy
- Bearings Oilite, Sintered Metal

- Efficiency up to 75%
- Rotor Moment of Inertia appr.  $3 \times 10^{-3}$  oz-in<sup>2</sup>
- Mechanical Time Const. appr. 25 ms
- Weight 0.7 oz

- Recommended Operational Data**
- Speed max. 6000 rpm
  - Torque 0.07 oz-in
  - Temperature -4° to +148°F

- Gear Head**
- Max. short time torque 12 oz-in
  - Max. Motor Speed 6000 rpm
  - Max. Power 0.4 W
  - Weight with motor 1.3 oz

**Possible Combinations**  
 Gear Head M20.00

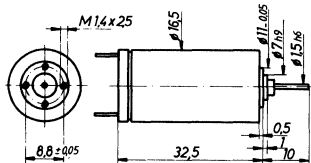


Type	16-24-03	16-24-06	16-24-12	
Voltage	3	6	12	V
No load speed	9,000	7,500	9,000	rpm
Resistance	4	22	60	Ohms
Stall torque	.33	.28	.34	oz-in
No load current appr.	35	20	15	mA
Recommended current	200	90	50	mA
Torque constant	.43	1.0	1.67	oz-in/A
Counter-EMF	.32	.75	1.24	mV/rpm
Speed/Torque Gradient	27,300	26,800	26,500	rpm/oz-in

- Standard Gear Ratios**
- 10.2:1 32.7:1 105:1
  - 20.5:1 65.5:1 210:1
  - 335:1 1073:1
  - 671:1 2147:1

**Series 16-34 and 16-35 • 0.8 Watts • 7000 RPM**

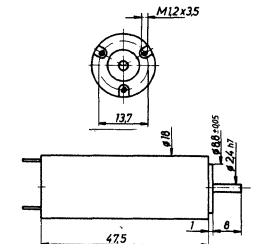
Dimensions — mm 1 mm = 0.0394 in



- Magnet AlNiCo
- Commutator AgCu5, 5 segments
- Brushes Gold alloy
- Bearings Oilite, Sintered Metal
- Efficiency up to 75%
- Rotor Moment of Inertia appr.  $4 \times 10^{-3}$  oz-in<sup>2</sup>
- Mechanical Time Const. appr. 25 ms
- Weight 1 oz.

- Recommended Operational Data**
- Speed max. 7000 rpm
  - Torque 0.15 oz-in
  - Temperature -4° to +175°F

- Possible Combinations**  
 Gear Head M20  
**Gear Head M 20**  
 G Series 16-24, 16-34, 16-35  
 16-34 with Gear Head M 20



Type	16-35-03	16-35-04	16-34-06	16-34-09	16-34-12	16-34-15	Type	16-35-03	16-35-04	16-34-06	16-34-09	16-34-12	16-34-15
Voltage	3	4	6	9	12	15	V	300	250	175	125	100	75
No Load speed	8100	9200	7300	8000	9000	9500	rpm	0.48	0.56	1.1	1.45	1.71	2.0
Resistance	2.5	3.9	11	19.5	31	47	Ohms	.36	.42	.79	1.08	1.27	1.51
Stall torque	0.55	0.52	0.59	.62	.62	.61	oz-in	14,700	17,700	12,400	12,900	14,500	15,600
No load current appr.	50	40	25	22	20	15	mA	16	19	15	17	18	18





**BERTSCH U.S.** 1280 LIBERTY WAY, VISTA, CA 92083  
 PHONE (760) 727-7420 FAX (760) 727-4436

**Series 22-35, 22-45 • 6 Watts • 10,000 RPM**

Dimensions — mm 1 mm = 0.0394 in  
 7.06 In. Oz.=1mNm

Magnet AlNiCo  
 Commutator CuAg 0.1, 5 segments  
 Brushes Graphite  
 Bearings Oilite  
 Brass, Sintered Metal

Efficiency up to 85%  
 Rotor Moment of Inertia 20 x 10<sup>-3</sup> oz-in<sup>2</sup>  
 Mechanical Time Const. appr 20 ms  
 Weight 2.7 oz

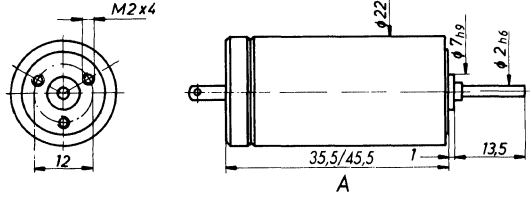
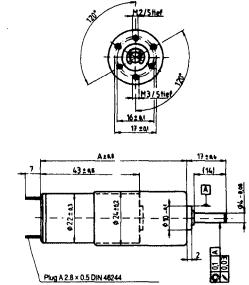
**Possible Combinations**  
 Gear Heads H 30, H 40, P 24  
 Tacho 20-08  
 Encoder HEDS-5500

Axial Play max. 0.012 in  
 Max. Gear Play 3°

**Standard Gear Ratios**

6:1		1-stage
19:1	46:1	2-stages
81:1	199:1	353:1 3-stages

**Planetary Gear Head P 24**  
 Series 22-35, 22-45



Type	22-35-06	22-35-12	22-35-24	22-45-14	22-45-18	22-45-24	22-45-36
Voltage	6 V	12	24	14	18	24	36
No load speed	8000	7,500	7,800	10,000	9,700	9,900	9,700
Resistance	3.2	17	72	6	14	28	65
Stall torque	1.89	1.63	1.39	3.07	2.95	2.63	2.12
No load current appr.	30	20	10	35	25	20	18
Recommended current	500	250	125	450	300	250	150
Counter-EMF	.74	1.56		1.56	2.34	3.15	4.78
Speed/Torque Gradient	4233	4601	5612	3270	3420	3780	4740

A=35.5mm

A=45.5mm

**Series 25-51 • 25 Watts • 25,000 RPM**

Dimensions — mm 1 mm = 0.0394 in

Magnet SeCo5 AlNiCo  
 Commutator CuAg 0.1, 5 segments  
 Brushes Graphite  
 Bearings Ball Bearings  
 Brass, Sintered Metal

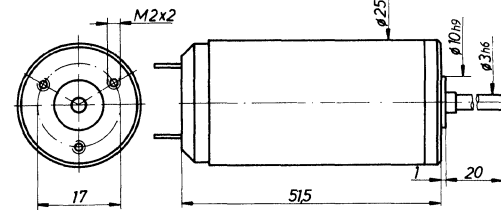
Efficiency up to 85%  
 Rotor Moment of Inertia 20 x 10<sup>-3</sup> oz-in<sup>2</sup>  
 Mechanical Time Const. 8.5 ms  
 Weight 4.4 oz

**Recommended Operational Data**

Speed 25,000 rpm  
 Torque 2 oz-in  
 Temperature -4° to +140°F  
 Max. Rotor Temperature 250°F

**Gear Head H 40.00**

Type	Ratio	No. of gear stages/efficiency	Max. torque continuous temp.
H 40-00	7.5:1	3 0.73	70
	10:1	3 0.73	70
	25:1	3 0.73	70
	50:1	4 0.65	70
	75:1	4 0.65	70
	190:1	5 0.59	70
	250:1	5 0.59	70
	500:1	6 0.53	70
	750:1	6 0.53	70



Type	25-51-24
Voltage	24 V
No load speed	30,000 rpm
Resistance	1.5 Ohms
Stall torque	18.55 oz-in
No load current appr.	200 mA
Recommended current	1.2 mA
Torque constant	1.06 oz-in/A
Counter-EMF	0.8 mV/rpm
Speed/Torque Gradient	1617 rpm/oz-in

**Series 28-52 • 15 Watts • 4000 RPM**

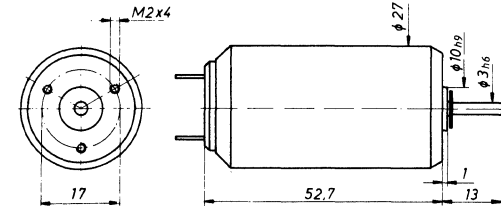
Dimensions — mm 1 mm = 0.0394 in

Magnet SeCo5  
 Commutator CuAg 0.1, 7 segments  
 Brushes Graphite  
 Bearings Oilite, Sintered Metal

Efficiency up to 85%  
 Rotor Moment of Inertia 0.14 oz-in<sup>2</sup>  
 Mechanical Time Const. appr. 20 ms  
 Weight 5.8 oz

**Recommended Operational Data**

Speed 4000 rpm  
 Torque 4.2 oz-in  
 Temperature -4° to +175°F  
 Max. Rotor Temp. 250°F



Type	28-52-12	28-52-24
Voltage	12	24
No load speed	5600	5800
Resistance	2.3	10
Stall torque	16.1	13.9
No load current appr.	100	60
Recommended current	1.2	0.6
Torque constant	2.83	5.45
Counter-EMF	2.0	4.0
Speed/Torque Gradient	347	417

**Planetary Gear Head P 32 for**

Series 22-28  
 Max Motor Speed 5000 rpm  
 Temperature 5°F to 140°F  
 Life at specified torque appr. 3000 hrs

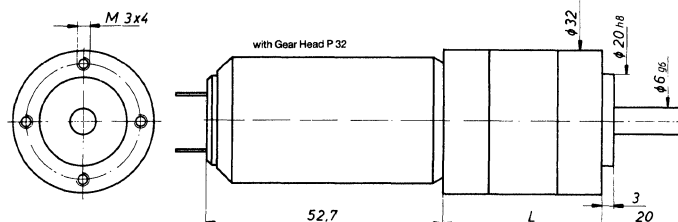
**Possible Combinations:**

Gear Head P 32  
 Encoder HEDS-5500

Max. Torque oz-in	Efficiency	Stages	Length in
100	0.8	1	1.3
300	0.75	2	1.7
600	0.7	3	2.0

**Standard Gear Ratios**

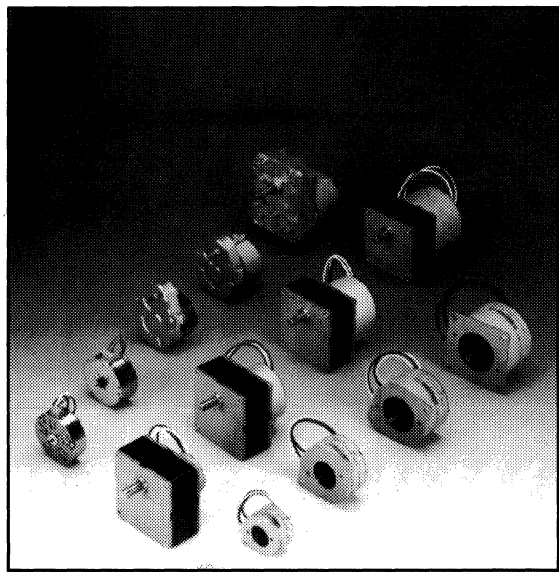
4.5:1	6.25:1	1-stage
20.25:1	50:1	2-stage
91.1:1	162:1	308:1 3-stage





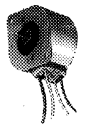



# Sub-Fractional Motors

## SYNCHRONOUS MOTORS AND GEAR MOTORS











- HIGH TORQUE
- PERMANENT MAGNET
- OIL IMPREGNATED BEARINGS
- INTERNATIONAL STANDARDS
- REVERSIBLE OR UNI-DIRECTIONAL
- WIDE RANGE OF SPEED, SHAFT AND VOLTAGE OPTIONS
- TYPICAL APPLICATIONS INCLUDE PUMPS, CHART RECORDERS, DISPLAYS, MEDICAL AND OFFICE EQUIPMENT

### DIRECT DRIVE MOTORS

<p><b>82510</b></p> <ul style="list-style-type: none"> <li>• Synchronous</li> <li>• Reversible</li> <li>• Perm. Magnet</li> </ul> <ul style="list-style-type: none"> <li>• 1.4" Diameter</li> <li>• 300 RPM</li> <li>• 1.9 ozin Starting Torque</li> <li>• 2.1 ozin Running Torque</li> </ul>		<p><b>82550</b></p> <ul style="list-style-type: none"> <li>• Synchronous</li> <li>• Reversible</li> <li>• Perm. Magnet</li> </ul> <ul style="list-style-type: none"> <li>• 1.4" Diameter</li> <li>• 600 RPM</li> <li>• 1.4 ozin Starting Torque</li> <li>• 1.7 ozin Running Torque</li> </ul>		<p><b>82520.4</b></p> <ul style="list-style-type: none"> <li>• Synchronous</li> <li>• Reversible</li> <li>• Perm. Magnet</li> </ul> <ul style="list-style-type: none"> <li>• 2.0" Diameter</li> <li>• 450 RPM</li> <li>• 3.5 ozin Starting Torque</li> <li>• 3.9 ozin Running Torque</li> </ul>		<p><b>82530</b></p> <ul style="list-style-type: none"> <li>• Synchronous</li> <li>• Reversible</li> <li>• Perm. Magnet</li> </ul> <ul style="list-style-type: none"> <li>• 2.3" Diameter</li> <li>• 300 RPM</li> <li>• 7.3 ozin Starting Torque</li> <li>• 8.2 ozin Running Torque</li> </ul>	
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### GEARED MOTORS

<p><b>82344</b></p> <ul style="list-style-type: none"> <li>• Synchronous</li> <li>• Unidirectional</li> <li>• Economical</li> </ul> <ul style="list-style-type: none"> <li>• 300 ozin Static Torque</li> <li>• 75 ozin Dynamic Torque</li> <li>• 155 ozin Running Torque at 1 RPM</li> </ul>		<p><b>82334</b></p> <ul style="list-style-type: none"> <li>• Synchronous</li> <li>• Unidirectional</li> <li>• High Torque</li> </ul> <ul style="list-style-type: none"> <li>• 300 ozin Static Torque</li> <li>• 75 ozin Dynamic Torque</li> <li>• 580 ozin Running Torque at 1 RPM</li> </ul>		<p><b>82305</b></p> <ul style="list-style-type: none"> <li>• Synchronous</li> <li>• Unidirectional</li> <li>• Heavy Duty</li> </ul> <ul style="list-style-type: none"> <li>• 70 inlb Static Torque</li> <li>• 300 inoz Dynamic Torque</li> <li>• 580 ozin Running Torque at 1 RPM</li> </ul>		<p><b>82514</b></p> <ul style="list-style-type: none"> <li>• Synchronous</li> <li>• Reversible</li> <li>• Economical</li> </ul> <ul style="list-style-type: none"> <li>• 300 ozin Static Torque</li> <li>• 75 ozin Dynamic Torque</li> <li>• 460 ozin Running Torque at 1 RPM</li> </ul>	
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<p><b>82524</b></p> <ul style="list-style-type: none"> <li>• Synchronous</li> <li>• Reversible</li> <li>• High Torque</li> </ul> <ul style="list-style-type: none"> <li>• 300 ozin Static Torque</li> <li>• 75 ozin Dynamic Torque</li> <li>• 1200 ozin Running Torque at 1 RPM</li> </ul>		<p><b>82529</b></p> <ul style="list-style-type: none"> <li>• Synchronous</li> <li>• Reversible</li> <li>• Heavy Duty</li> </ul> <ul style="list-style-type: none"> <li>• 70 inlb Static Torque</li> <li>• 300 inoz Dynamic Torque</li> <li>• 1200 inoz Running Torque at 1 RPM</li> </ul>		<p><b>80537</b></p> <ul style="list-style-type: none"> <li>• Synchronous</li> <li>• Reversible</li> </ul> <ul style="list-style-type: none"> <li>• 180 inlb Static Torque</li> <li>• 45 inlb Dynamic Torque</li> <li>• 120 inlb Running Torque at 1 RPM</li> </ul>		<p><b>80547</b></p> <ul style="list-style-type: none"> <li>• Synchronous</li> <li>• Reversible</li> </ul> <ul style="list-style-type: none"> <li>• 180 inlb Static Torque</li> <li>• 45 inlb Dynamic Torque</li> <li>• 234 inlb Running Torque at 1 RPM</li> </ul>	
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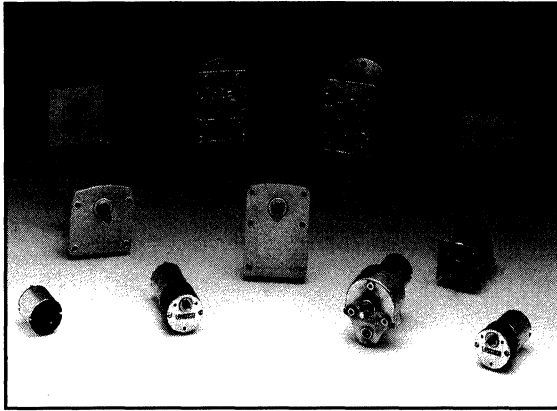
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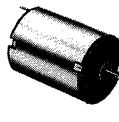
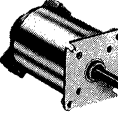
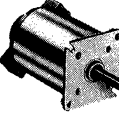
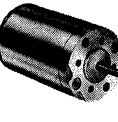
# Sub-Fractional Motors

## DC MOTORS AND GEAR MOTORS



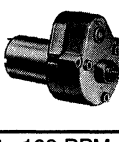
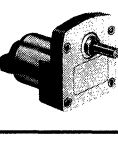


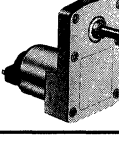
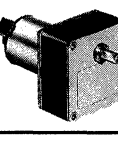
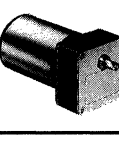
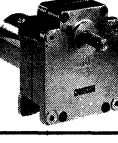
- HIGH TORQUE
- PERMANENT MAGNET
- OUTPUT POWER 1 TO 27W
- OIL IMPREGNATED BEARINGS
- OPTIONS INCLUDE ENCODERS, FILTERS, BALL BEARINGS
- WIDE RANGE OF GEAR RATIOS AND SHAFTS
- TYPICAL APPLICATIONS INCLUDE PUMPS, DISPLAYS, MEDICAL AND OFFICE EQUIPMENT

### DIRECT DRIVE MOTORS

<p><b>82840</b> <b>82860</b></p> <ul style="list-style-type: none"> <li>• 32 MM Diameter</li> <li>• 1-4 Watt</li> <li>• Varistor Filter</li> <li>• QC Terminals</li> </ul>		<p><b>82810</b></p> <ul style="list-style-type: none"> <li>• 42 MM Diameter</li> <li>• 9 Watt</li> <li>• Replaceable Brushes</li> <li>• Encoder Available</li> <li>• QC Terminals</li> </ul>		<p><b>82800</b></p> <ul style="list-style-type: none"> <li>• 42 MM Diameter</li> <li>• 15 Watt</li> <li>• Replaceable Brushes</li> <li>• Encoder Available</li> <li>• QC Terminals</li> </ul>		<p><b>82830</b></p> <ul style="list-style-type: none"> <li>• 62 MM Diameter</li> <li>• 27 Watt</li> <li>• 2 Ball Bearings</li> <li>• QC Terminals</li> </ul>	
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### GEARED MOTORS

<p><b>82862</b></p>  <ul style="list-style-type: none"> <li>• Speed Range 1 to 441 RPM</li> <li>• 75 ozin Dynamic Torque</li> <li>• 300 ozin Static Torque</li> <li>• 82860 Motor</li> </ul>	<p><b>82861</b></p>  <ul style="list-style-type: none"> <li>• Speed Range 1 to 430 RPM</li> <li>• 75 ozin Dynamic Torque</li> <li>• 300 ozin Static Torque</li> <li>• 82860 Motor</li> </ul>	<p><b>82869</b></p>  <ul style="list-style-type: none"> <li>• Speed Range 1 to 108 RPM</li> <li>• 300 ozin Dynamic Torque</li> <li>• 1200 ozin Static Torque</li> <li>• 82860 Motor</li> </ul>	<p><b>80813</b> <b>80803</b></p>  <ul style="list-style-type: none"> <li>• Speed Range 60 to 400 RPM</li> <li>• 18 lbin Dynamic Torque</li> <li>• 70 lbin Static Torque</li> <li>• 82810 or 82800 Motor</li> </ul>
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<p><b>80814</b> <b>80804</b></p>  <ul style="list-style-type: none"> <li>• Speed Range 1 to 40 RPM</li> <li>• 18 lbin Dynamic Torque</li> <li>• 70 lbin Static Torque</li> <li>• 82810 or 82800 Motor</li> </ul>	<p><b>80817</b> <b>80807</b></p>  <ul style="list-style-type: none"> <li>• Speed Range 1 to 208 RPM</li> <li>• 45 lbin Dynamic Torque</li> <li>• 180 lbin Static Torque</li> <li>• 82810 or 82800 Motor</li> </ul>	<p><b>80835</b></p>  <ul style="list-style-type: none"> <li>• Speed Range 4 to 144 RPM</li> <li>• 45 lbin Dynamic Torque</li> <li>• 180 lbin Static Torque</li> <li>• 82830 Motor</li> </ul>	<p><b>80838</b></p>  <ul style="list-style-type: none"> <li>• Speed Range 5 to 375 RPM</li> <li>• 180 lbin Dynamic Torque</li> <li>• 700 lbin Static Torque</li> <li>• Ball Bearings</li> </ul>
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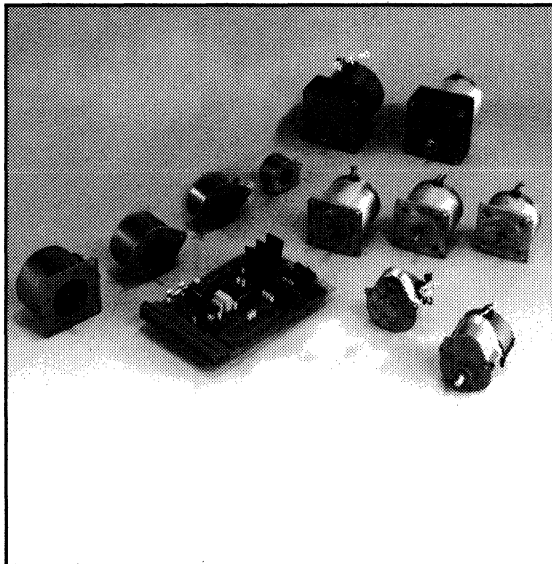
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# Sub-Fractional Motors

## STEPPING MOTORS AND GEAR MOTORS

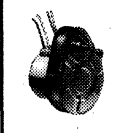
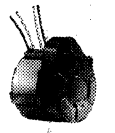

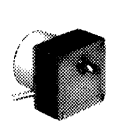


- HIGH TORQUE
- PERMANENT MAGNET
- 7.5° AND 15° BI POLAR AND UNI POLAR
- OIL IMPREGNATED BEARINGS
- WIDE RANGE OF GEAR RATIOS AND SHAFTS
- TYPICAL APPLICATIONS INCLUDE PUMPS, STRIP CHART RECORDERS, IMAGING EQUIPMENT, MEDICAL AND OFFICE EQUIPMENT

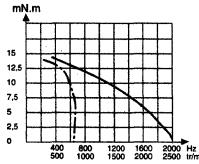
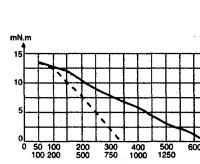
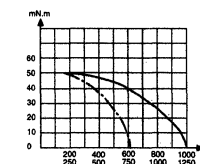
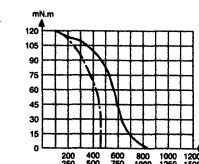
### DIRECT DRIVE MOTORS

<p><b>82910</b></p> <ul style="list-style-type: none"> <li>• 7.5°</li> <li>• Bi Polar</li> <li>• Uni Polar</li> <li>• 5 Watt</li> <li>• 1.4" Diameter</li> <li>• Holding Torque 2ph 3.5 ozin 4 ph 2.8 ozin</li> <li>• Voltages 5-12-24</li> </ul> 	<p><b>82950</b></p> <ul style="list-style-type: none"> <li>• 15°</li> <li>• Bi Polar</li> <li>• Uni Polar</li> <li>• 5 Watt</li> <li>• 1.4" Diameter</li> <li>• Holding Torque 2ph 2.8 ozin 4 ph 2.1 ozin</li> <li>• Voltages 5-12-24</li> </ul> 	<p><b>82920</b></p> <ul style="list-style-type: none"> <li>• 7.5°</li> <li>• Bi Polar</li> <li>• Uni Polar</li> <li>• 7.5 Watt</li> <li>• 2.0" Diameter</li> <li>• Holding Torque 2ph 9.9 ozin 4 ph 8.1 ozin</li> <li>• Voltages 5-12-24</li> </ul> 	<p><b>82930</b></p> <ul style="list-style-type: none"> <li>• 7.5°</li> <li>• Bi Polar</li> <li>• Uni Polar</li> <li>• 10 Watt</li> <li>• 2.25" Diameter</li> <li>• Holding Torque 2 ph 25.5 ozin 4 ph 21.5 ozin</li> <li>• Voltages 5-12-24</li> </ul> 
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### GEARED MOTORS

<p><b>82914</b></p> <ul style="list-style-type: none"> <li>• Bi Polar</li> <li>• Uni Polar</li> </ul>  <ul style="list-style-type: none"> <li>• 300 ozin Static Torque</li> <li>• 75 ozin Dynamic Torque</li> <li>• Various Gear Ratio and Shaft Options</li> </ul>	<p><b>82924</b></p> <ul style="list-style-type: none"> <li>• Bi Polar</li> <li>• Uni Polar</li> </ul>  <ul style="list-style-type: none"> <li>• 300 ozin Static Torque</li> <li>• 75 ozin Dynamic Torque</li> <li>• Various Gear Ratio and Shaft Options</li> </ul>	<p><b>82929</b></p> <ul style="list-style-type: none"> <li>• Bi Polar</li> <li>• Uni Polar</li> </ul>  <ul style="list-style-type: none"> <li>• 70 inlb Static Torque</li> <li>• 300 ozin Dynamic Torque</li> <li>• Various Gear Ratio and Shaft Options</li> </ul>	<p><b>82937</b></p> <ul style="list-style-type: none"> <li>• Bi Polar</li> <li>• Uni Polar</li> </ul>  <ul style="list-style-type: none"> <li>• 180 inlb Static Torque</li> <li>• 45 inlb Dynamic Torque</li> <li>• Various Gear Ratios Available</li> </ul>
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### PERFORMANCE CURVES $mNM \times .1416 = \text{ozin}$

<p><b>82910</b> 2 phases - 12, 9 Ω, 0.3A/ph</p> <p>Constant current with Ericsson PBL 3717</p> 	<p><b>82950</b> 2 phases - 12, 9 Ω, 5.6 V</p> <p>Constant voltage with SGS L297 298 chips inertia 9.53 gcm<sup>2</sup></p> 	<p><b>82920</b> 2 phases - 10.7 Ω, 0.54A/ph</p> <p>Constant current with Ericsson PBL 3717</p> 	<p><b>82930</b> 2 phases - 9 Ω, .53A/ph</p> <p>Constant current with Ericsson PBL 3717</p> 
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## Incremental Optical

MES

NSB

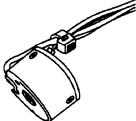
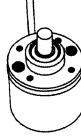
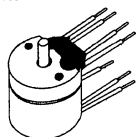
NSC



NSA

NSE

SEH



Body sizes from  $\varnothing 0.472"$

-10° to +85°C typical op. temp

200 kHz frequency response

Resolutions to 10,000 pulses per revolution per channel

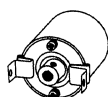
Wide Variety of input & output options

## Hollow Shaft

MEH

NHD

NHG



Body Sizes from  $\varnothing 0.52$

Many input & output formats

-10° to +85°C typical op. temp

200 kHz frequency response

Resolutions to 32,400 pulses per revolution per channel

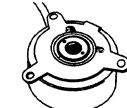
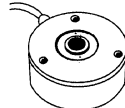
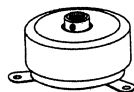
Bore sizes from  $\varnothing 2$  to  $\varnothing 75$ mm

## Magnetoresistive

JR55

JR205

JR305



Ideal for rough, contaminated environments

Differential, quadrature output

Resolutions up to 2048 PPR/channel

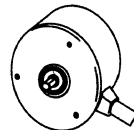
Up to 200 kHz frequency response

$\varnothing 6, 6.35$  & 8mm bore

Economy model to 600 PPR

## Absolute

MA



$2^8$ , (256)

$2^{10}$ , (360)

$2^{12}$ , (4096, 3600, 1000) resolution

Shaft, dual shaft or hollow shaft

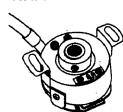
Natural binary, gray or BCD code output

Economy protection per IP65

## Servomotor Feedback

NHA

NHY



Sizes from  $\varnothing 1.11"$

Differential, quadrature output

Commutation channels for 4, 6, & 8 poles

200 kHz frequency response

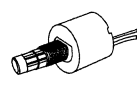
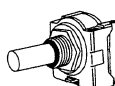
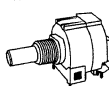
Resolutions to 5,000 PPR/channel

## Manual Optical

EC202A

RE20

NMC



Resolutions to 500 PPR/channel

Quadrature output

Extremely low noise

$10^7$  cycle typical life

Low current models available

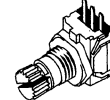
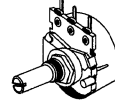
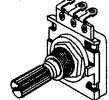
With or without detent

## Mechanical

AEC16

AAB

EC09



Incremental to 75 PPR/channel

Economical

Panel or PCB mount

Various shaft lengths available

**DENSTRONICS**

**DP1103D**

# Two Phase Stepping Motor and Dual Driver

## Features:

- Two drivers in a package
- Unipolar PWM constant current drive
- Small case sizes: 3.00" x 3.00" x .755"
- Wide range of single supply voltage: 15V to 30V
- Output current/coil: 2.5A
- Selectable half step, full step operation

- Automatically standby mode operation-  
Reduces 50% of drive current after 500ms from last step pulse input
- Optical isolated inputs
- Automatically initialized to phase A condition at inhibit mode

## Description

The DP1103D Dual Drive is designed to drive a two-phase stepping motor in the unipolar constant current mode with pulse width modulated operation to minimize power dissipation and maximize load efficiency, the DP1103D constructed in an advanced packaging technique, providing superior performance and versatility with modular size, weight, price and reliability. This driver modular is offered in supply voltages ranged from 15 volts to 30 volts dc with drive current up to 3 A/coil at a maximum operating temperature of 110 degrees celsius at heat spreader. Output current is determined by user selection of a motor and pre-set within 0.2A to 3.0A/coil before shipping to customer. All control logic inputs are optically isolated to eliminate the switching noise from the driver circuit through the ground loop, also protecting the external system from high voltage in case of drive failure.

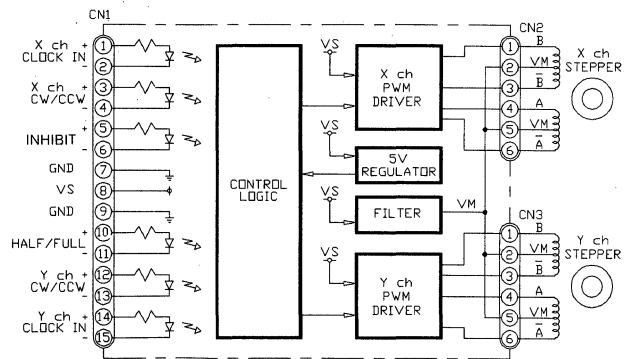
## Function Table

Step In	Direction	Half/Full	Inhibit	Function
	L	H	L	Full Step, CW
	H	H	L	Full Step, CCW
	L	L	L	Half Step, CW
	H	L	L	Half Step, CCW
X	X	X	H	Inhibit, Initialized to Phase A

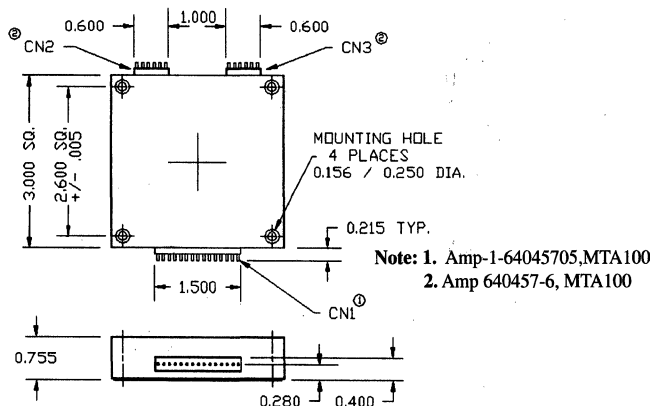
Absolute Maximum Ratings at TA = +25°C	
DC Supply Voltage, Vs	40V
Peak Output Current, Iout p (TW<100µs)	5.0A/coil
Continuous Logic Current, Iout	3.0A/coil
Control Logic Input Forward Current, Iin	±35mA
Control Logic Input Reverse Voltage, Vin	-5V
Operating Temperature Range, Ta	-20°C to -85°C

Recommended Operating Conditions at TA = 25°C			
	Symbol	Min	Max
DC Supply Voltage	VM	+15V	30V
Output Current/Coil	Iout	.5A	2.5A
Control Logic Input	Vin H	3.3V <sub>v</sub>	6.0V
	Vin L	0	1.6V
	Lin H	6mA	16mA
	Lin L	0	2 mA

## Block Diagram



## Physical Dimensions



## Connector Pin Assignment

CN1: Input Connect, MTA100 1-640457-5		CN2: X Axis Output Connector, MTA-100 640457-6	
Pin#	Function	Pin #	Function
1	Xch Step Input +	1	B
2	Xch Step Input -	2	VS
3	Xch Direction +	3	B
4	Xch Direction -	4	A
5	Enable +	5	VS
6	Enable -	6	A
7	Ground	CN3: Y Axis Output Connector, MTA-100 640457-6	
8	VS, Power Supply	Pin #	Function
9	Ground	1	B
10	Half/Full Step Control +	2	VS
11	Half/Full Step Control -	3	B
12	Ych Direction +	4	A
13	Ych Direction -	5	VS
14	Ych Step Input +	6	A
15	Ych Step Input-		

# Endura-Trac™ Plus W-Series

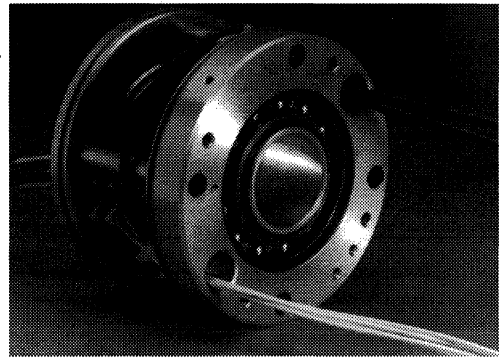
Electro-tec's Pre-engineered solution to your requirements for higher RPMs and greater number of circuits

### Standard Features:

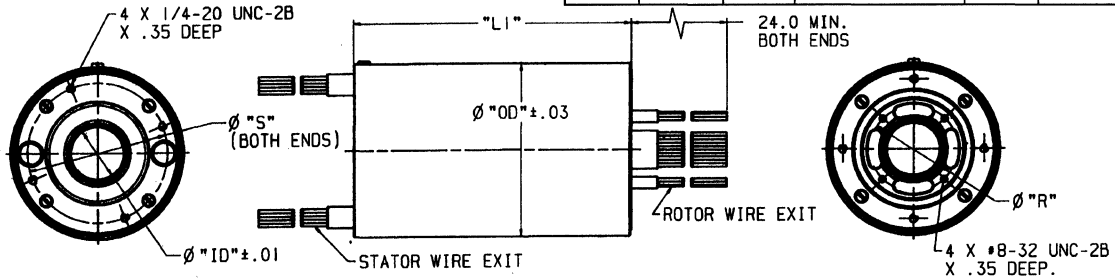
- Unobstructed bore sizes from 1.5" to 9.0"
- Up to 40 signal circuits stocked 100 available  
Up to 20 power circuits stocked 24 available  
See chart below.
- Continuous bi-directional rotation up to 2,000 RPM
- Flying lead wire bundled, 24" lead length
- #20 AWG signal leadwire, #12AWG power leadwire
- All metal cover
- Shaft and flange mounting
- Stator, rotor, or both can rotate
- Composite brushes for greater life

To determine length of overall unit, use the following formulas or contact Electro-Tec for assistance ("L1" and "L2")

XX= Total Number of Signal Rings  
YY=Total Number of Power Rings  
Example: "L1" = .2(XX)+.4(YY)+1.63  
"L1" = .2 (12 Single Rings) + .4 (4 Power Rings)+ 1.63  
"L1" = 2.40 + 1.60 + 1.63  
"L1" = 5.63



Bore Size	"ID" (Actual)	"OD"	"L1"	"S"	"R"
ø1.50	ø1.52	ø5.00	.2(XX)+.4(YY)+1.63	ø4.045	ø2.500
ø3.00	ø3.02	ø6.50	.2(XX)+.4(YY)+1.63	ø5.500	ø3.608
ø6.00	ø6.02	ø9.50	.2(XX)+.4(YY)+1.63	ø8.332	ø6.646
ø9.00	ø9.02	ø12.50	.2(XX)+.4(YY)+1.63	ø11.500	ø9.858



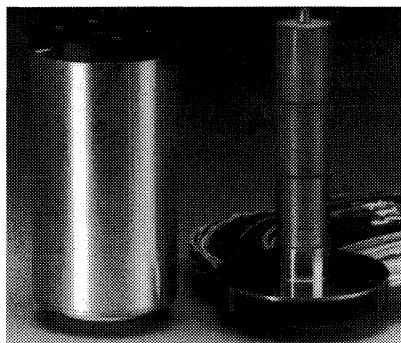
# Endura-Trac™ High Density M-Series

Up to 120 circuits in a small package

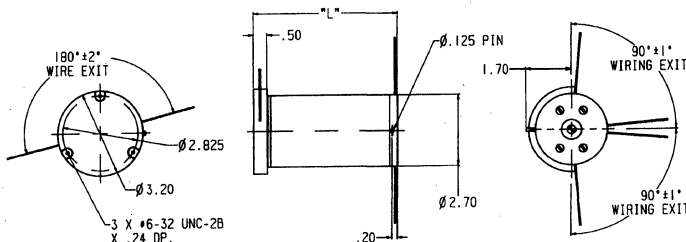
### Standard Features:

- Solves limited space applications
- Modular construction for up to 120 circuits
- All circuits 60V/2amps
- Continuous bi-directional rotation up to 1,000 RPM
- Dust-proof cover standard
- Flange mounting
- Superior Signal Quality
- 24" flying leads. optional wiring and harnessing available
- #26 AWG leadwire

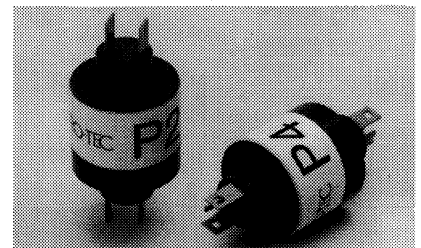
The High Density M-Series slip-ring is an ideal choice for limited space applications. As many as 120 separate circuits are accommodated in a ø2.70" OD envelope and in less than 4.50" in length.



Number of Circuits	"L"
1-40	2.71
41-80	3.97
81-120	4.23



# Endura-Trac P-Series



### Standard Features:

- 2 & 4 Circuit Models Available
- Signal Circuits Rated 2 Amps, 240 Volt
- Power Circuits 7 Amp, 1240 Bolt
- Quality Transmission Of Thermocouple Signals
- 360° Continuous Bi/Directional Rotation, Up to 1,000 RPM
- Compact Size, less than 2" In length
- Spade terminals for easy installation
- Ideal for transferring signal or power from a stationary structure through a rotating barrier

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**ELTROL**  
ELTROL CORPORATION

# DC SERVO SYSTEMS

For applications requiring closed servo loop performance

## MODEL 7-300-030-00 BRUSHLESS D.C. VELOCITY SERVO SYSTEM



The basic system includes the following:

- Brushless DC servo controller
- Brushless DC motor
- Commutation position encoder
- Incremental optical encoder

The system provides precise velocity control in a complete package: Internal D.C. power supplies, crystal reference, controls for bidirectional rotation and variable speed, digital speed readout, operating controls and status indicators.

*Instantaneous speed regulation to  $\pm .001\%$*

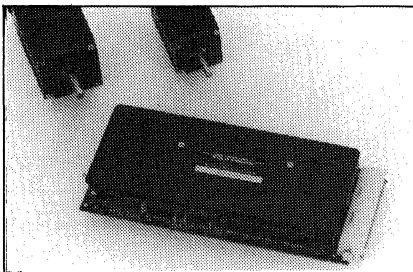
**Fault protection:** Overtemperature, shorts to ground, shorts across motor

**Current loop:** High bandwidth with current limiting

**Input power:** 115/220VAC, 1  $\phi$ , 50-60 Hz

**The Eurocard Phase Lock Servo Controller included in Model 7-300-030-00 is available as a separate item.**

## MODEL 5-156-028-00 BRUSH OR BRUSHLESS D.C. SERVO CONTROLLER

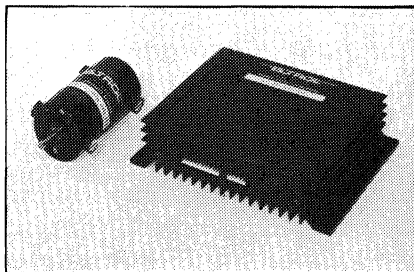


This EUROCARD provides closed loop four quadrant PWM control of motor velocity or torque. It offers maximum flexibility. Many operating features are set by pluggable jumpers. Variable compensation and gain by plug-in component carrier and trim pots simplify set up of closed loop operation.

### FEATURES

- Single 24-60 volt P.S.
- Adjustable current 5-15 amps
- High efficiency 24KHZ PWM drive scheme minimizes EMI in noise sensitive applications
- Fault protection for excess temperature, speed, voltage, current, and motor stall
- Digital inputs command enable/reset, brake, and  $\pm$  travel limits
- Differential amplifier for  $\pm 10V$  input command
- Velocity F/B from commutation sensors, encoder, or DC tachometer

## MODEL 6-120-024-00 BRUSH-TYPE LINEAR D.C. SERVO CONTROLLER



Motion control of position, velocity, or torque.

Simple adjustments for application adaptation

**Peak output current:** 2-10 amps  
**Linear operating mode:** No switching EMI, high servo stiffness, no torque dead zone

**Fault protection:** Shorts across motor, shorts to ground, peak and time dependent continuous foldback current limits, external fault indication and reset.

**The Eltrol motor-tach shown above is ideally suited to take full advantage of the servo's controller's capabilities.**

**Also available are Eurocard Brushless Linear Sine Wave Servo Amplifiers.**

**Eltrol Corporation** is an engineering oriented firm specializing in D.C. servo systems. We provide standard, modified standard or custom designed systems to your electrical and mechanical specifications.

Write or call us today for additional information.

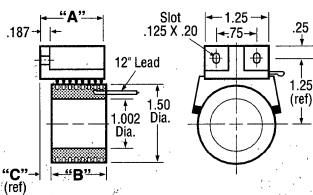
**ELTROL**  
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5661 Palmer Way, Suite E  
Carlsbad, CA 92008-7255  
TEL: (760) 438-4986 FAX: (760) 438-4987

# STANDARD SLIP RING ASSEMBLIES

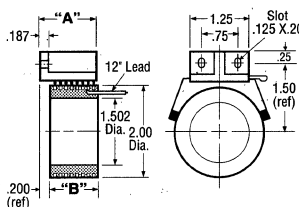
## SEPARATE ROTOR AND BRUSH BLOCK SLIP RING ASSEMBLIES

### BEST COST • 1.002 INCH BORE • STOCK DELIVERY



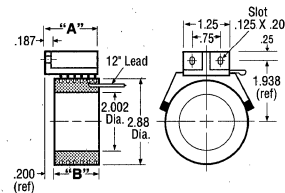
TYPE	No. of Rings	Length "A" Inches	Length "B" Inches	Length "C" Inches
1201	2	.75	.56	.230
1401	4	.75	.56	.230
1905	5	.87	.70	.200
1906	6	.99	.82	.200
1907	7	1.11	.94	.200
1908	8	1.23	1.06	.200
1909	9	1.35	1.18	.200
19010	10	1.47	1.30	.200
19015	15	2.07	1.90	.200

### BEST COST • 1.502 INCH BORE • QUICK DELIVERY

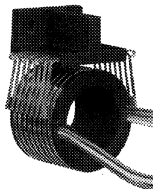


TYPE	No. of Rings	Length "A" Inches	Length "B" Inches
1972	2	.75	.58
1973	3	.75	.58
1914	4	.75	.58
1915	5	.87	.70
1916	6	.99	.82
1917	7	1.11	.94
1918	8	1.23	1.06
1919	9	1.35	1.18
19110	10	1.47	1.30

### BEST COST • 2.002 INCH BORE • QUICK DELIVERY



TYPE	No. of Rings	Length "A" Inches	Length "B" Inches
1924	4	.75	.58
1926	6	.99	.82

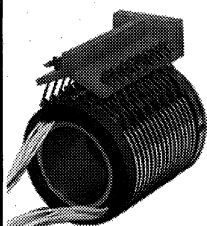


TYPE 1908

### SEPARATE ROTOR AND BRUSH BLOCK SLIP RING CHARACTERISTICS

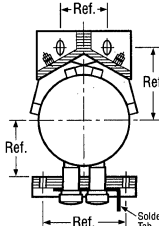
**CURRENT:** 5 amp standard.  
**RINGS:** Coin Silver Rings.  
**BRUSHES:** Silver Graphite. Fabricast Grade FAG 180 (80% Ag - 20% C). Two brushes per ring (5 amp). Four brushes per ring (10 amp). Brush complement molded as unit with diallyl phthalate dielectric.  
**NOISE:** 10 Milliohms dynamic resistance max with 2 brushes per ring. 5 Milliohms dynamic resistance max with 4 brushes per ring.  
**HI-POT:** 1000 VAC 60 CYCLE for 15 seconds.  
**ROTOR:** Ring complement molded as unit with diallyl phthalate dielectric.  
**ROTOR LEADS:** 5 Amp. leads - 20 AWG per MIL-W-16878 Type "E".

### BRUSH BLOCK TYPE "A"



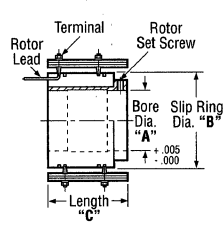
TYPE 2150

### BRUSH BLOCK TYPE "A"



BRUSH BLOCK 50 AMP POWER (OPTIONAL)

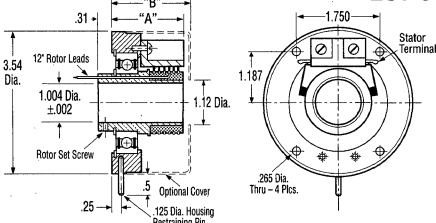
### BRUSH BLOCK 5 AMP STANDARD



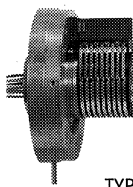
Type	Bore Dia. "A" Inches		No. Rings	Current Amps.	Slip Ring Dia. "B" Inches	Length "C" Inches
	Nominal	Range				
2050	Solid	.000 - 0.127	18	5 Amp. std. 2 brushes per ring	.500	.625 + .125 (no. rings - 1)
2087	Solid	.000 - 0.377	48		.875	.625 + .110 (no. rings - 1)
2112	.375	.000 - 0.627	52		1.125	.625 + .125 (no. rings - 1)
2125	.500	.000 - 0.750	25		1.250	.625 + .150 (no. rings - 1)
2150	.750	.625 - 1.002	52		1.500	.625 + .120 (no. rings - 1)
2187	1.000	.750 - 1.250	48	1.875	.625 + .125 (no. rings - 1)	
2200	1.125	.750 - 1.375	80	OR	2.000	.750 + .125 (no. rings - 1)
2237	1.250	1.000 - 1.502	78		2.375	.750 + .130 (no. rings - 1)
2268	1.500	1.250 - 1.752	107		2.687	1.000 + .150 (no. rings - 1)
2350	2.000	1.750 - 2.502	78		3.500	1.000 + .181 (no. rings - 1)
2375	2.500	2.370 - 2.875	48		3.750	1.000 + .200 (no. rings - 1)
2462	3.000	2.750 - 3.752	100	4.652	1.250 + .160 (no. rings - 1)	
2500	4.000	3.250 - 4.002	40	10 Amp. std. or low noise 4 brushes per ring	5.000	1.250 + .250 (no. rings - 1)
2600	5.000	4.000 - 5.002	80		6.000	1.250 + .186 (no. rings - 1)
2700	6.000	5.000 - 6.002	63		7.000	1.250 + .186 (no. rings - 1)
2800	7.000	6.000 - 7.002	58		8.000	1.250 + .187 (no. rings - 1)
2900	8.000	7.000 - 9.002	58		10.000	1.250 + .187 (no. rings - 1)

## SELF-CONTAINED SLIP RING ASSEMBLIES

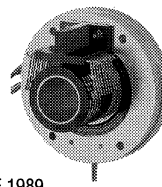
### BEST COST • 1.004 INCH BORE • STOCK DELIVERY



TYPE	No. of Rings	Length "A" Inches	Length "B" Inches
1982	2		
1983	3	1.52	1.87
1984	4		
1985	5	1.76	
1986	6		
1987	7	2.00	
1988	8		2.37
1989	9	2.24	
19810	10		
19815	15	2.84	2.94

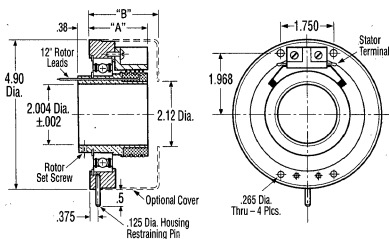


TYPE 1989



TYPE 39812 WITH OPTIONAL COVER

### BEST COST • 2.004 INCH BORE • QUICK DELIVERY



TYPE	No. of Rings	Length "A" Inches	Length "B" Inches
3984	4	1.69	1.81
3988	8	2.17	2.31
39812	12	2.65	2.75

### SELF-CONTAINED SLIP RING CHARACTERISTICS

**CURRENT:** 5 amp standard.  
**RINGS:** Coin Silver Rings.  
**BRUSHES:** Silver Graphite. Fabricast Grade. FAG 180 (80% Ag - 20% C). Two brushes per ring (5 amp). Four brushes per ring (10 amp). Brush complement molded as unit with diallyl phthalate dielectric.  
**NOISE:** 10 Milliohms dynamic resistance max with 2 brushes per ring. 5 Milliohms dynamic resistance max with 4 brushes per ring.  
**HI-POT:** 1000 VAC 60 CYCLE for 15 seconds.  
**ROTOR:** One piece aluminum sleeve. Ring complement molded as unit with diallyl phthalate dielectric.  
**ROTOR LEADS:** 5 Amp. leads - 20 AWG per MIL-W-16878 Type "E".  
**HOUSING:** One piece aluminum structure.  
**OPTIONS:** Overall aluminum cover. 10 Amp.

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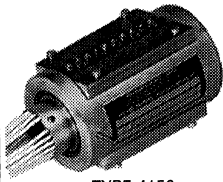
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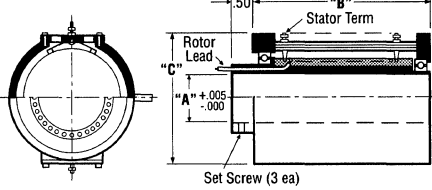
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# STANDARD SLIP RING ASSEMBLIES

## SELF-CONTAINED SLIP RING ASSEMBLIES



TYPE 4150



Type	Bore Dia. "A" Inches		No. Rings	Current Amps.	Length "B" Inches	Housing Dia. "C"
	Nominal	Range				
4100	.500	.250 - .502	48	5 Amp. std. 2 brushes per ring	1.19 + .125 (no. rings - 1)	2.00
4150	1.000	.500 - 1.002	100		1.19 + .120 (no. rings - 1)	2.50
4200	1.312	1.000 - 1.312	100		1.19 + .125 (no. rings - 1)	3.00
4237	1.750	1.312 - 1.752	78		1.19 + .130 (no. rings - 1)	3.37
4268	2.187	1.750 - 2.189	100	OR	1.28 + .150 (no. rings - 1)	3.62
4350	2.750	2.187 - 2.752	100		1.75 + .150 (no. rings - 1)	4.50
4400	3.250	2.750 - 3.252	100		1.75 + .187 (no. rings - 1)	5.00
4462	3.750	3.250 - 3.752	100		1.75 + .160 (no. rings - 1)	5.50
4500	4.250	3.750 - 4.252	100	10 Amp. std. or low noise	1.75 + .187 (no. rings - 1)	6.00
4600	5.250	4.250 - 5.252	48		1.75 + .186 (no. rings - 1)	7.00
4700	6.250	5.250 - 6.252	63		1.75 + .186 (no. rings - 1)	8.00
4800	7.250	6.250 - 7.252	58		1.75 + .187 (no. rings - 1)	9.00
4900	8.750	7.250 - 8.750	58	4 brushes per ring	1.75 + .187 (no. rings - 1)	11.00

## SELF-CONTAINED SLIP RING CHARACTERISTICS

**RINGS:** Coin Silver Rings.

**BRUSHES:** Silver Graphite.  
Fabricast Grade FAG 180 (80% Ag - 20% C).  
Two brushes per ring (standard).  
Brushes individually removable and replaceable.

**ROTOR:** One piece steel sleeve. Ring complement vacuum cast on sleeve as unit with epoxy dielectric.

**NOISE:** 10 Milliohms dynamic resistance max with 2 brushes per ring.  
5 Milliohms dynamic resistance max with 4 brushes per ring.

**CURRENT:** 5 Amp with 2 brushes per ring  
10 Amp with 4 brushes per ring

**HI-POT:** 1000 VAC 60 CYCLE for 15 seconds.

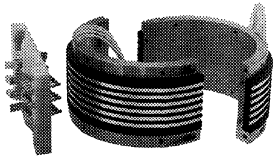
**ROTOR LEADS:** 5 Amp leads - 20 AWG per MIL-W-16878 Type "E".  
Lead exit as shown on most units. Maximum ring complement may require smaller wire or reduced bore diameter.

**HOUSING:** One piece tube construction.  
**OPTIONS:** Current capacities up to 100 Amps per ring.  
Overall covers. Stator wiring.

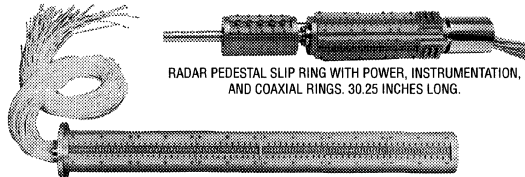
## CUSTOM SLIP RING ASSEMBLIES

Since Fabricast was founded, a significant percentage of our business has always been the design and manufacture of high quality custom slip ring assemblies. The pictures on this page show a selection of the wide variety of custom slip rings we manufacture. Please contact Fabricast with any custom slip ring application.

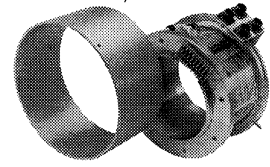
Because many custom slip rings are designed around standard tooling you will find our cost and delivery extremely competitive. We can be contacted by phone, fax, E-mail or by using either of the two forms found on our Website: (Request For More Information Form or Slip Ring Specification Form).



SEPARATE ROTOR & BRUSH BLOCK SLIP RING WITH SPLIT ROTOR. 6.379 INCH THRU BORE.



RADAR PEDESTAL SLIP RING WITH POWER, INSTRUMENTATION, AND COAXIAL RINGS. 30.25 INCHES LONG.

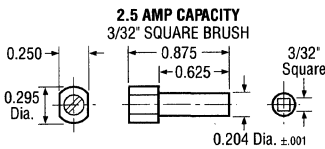


HI-RPM INSTRUMENTATION SLIP RING WITH STATOR CONNECTORS AND ROTOR TERMINAL BOARD. 7.002 INCH THRU BORE.

## BRUSH ASSEMBLIES

### PLUNGER TYPE • Stock Delivery

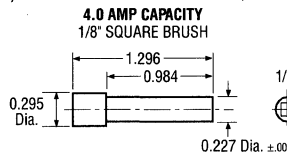
BRUSH MATERIAL - FAG 180 (80% AG - 20% C) HOLDER MATERIAL - BRASS, TIN PLATED



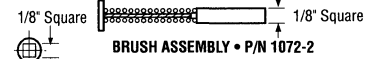
**2.5 AMP CAPACITY**  
3/32" SQUARE BRUSH  
**HOLDER ASSEMBLY • P/N 1070004**  
(CAP ASSEMBLY INCLUDED)



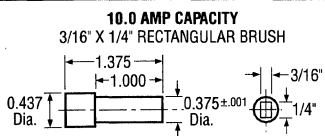
**BRUSH ASSEMBLY • P/N 1072-1**



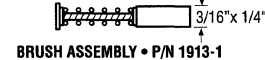
**4.0 AMP CAPACITY**  
1/8" SQUARE BRUSH  
**HOLDER ASSEMBLY • P/N 1051032**  
(CAP ASSEMBLY INCLUDED)



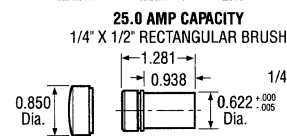
**BRUSH ASSEMBLY • P/N 1072-2**



**10.0 AMP CAPACITY**  
3/16" X 1/4" RECTANGULAR BRUSH  
**HOLDER ASSEMBLY • P/N 1913002**  
(CAP ASSEMBLY INCLUDED)



**BRUSH ASSEMBLY • P/N 1913-1**



**25.0 AMP CAPACITY**  
1/4" X 1/2" RECTANGULAR BRUSH  
**HOLDER ASSEMBLY • P/N 1092006**  
(CAP ASSEMBLY INCLUDED)



**BRUSH ASSEMBLY • P/N 1092003-3**

### BRUSH MATERIAL

- Fabricast grade FAG 180 is the universal low noise level grade used for all standard brush assemblies.
- Fabricast grade FAG 150 is the long life and high surface speed grade, however, noise levels are compromised.
- Fabricast grades FAG 180A and FAG 150A contain additives required for operation in altitude, vacuum, and inert environments.

Grade No.	Composition	Recommended Surface Speed	Carrying Capacity
FAG 180	80% Silver 20% Graphite	Up to 3500 ft. per min.	250 Amps per sq. in.
FAG 180A	80% Silver 20% Graphite plus MoS <sub>2</sub>	Up to 3500 ft. per min.	250 Amps per sq. in.
FAG 150	50% Silver 50% Graphite	Up to 7000 ft. per min.	100 Amps per sq. in.
FAG 150A	50% Silver 50% Graphite plus MoS <sub>2</sub>	Up to 7000 ft. per min.	100 Amps per sq. in.

FOR FURTHER INFORMATION ON OPTIONAL BRUSH CONTACT MATERIALS AND CORRESPONDING PLUNGER BRUSH PART NUMBERS CONTACT FABRICAST

## LEAF TYPE • For information on Leaf Type Brush Assemblies contact FABRICAST

FAX, PHONE, E-MAIL, OR VISIT OUR WEBSITE FOR LATEST FABRICAST CATALOG

Toll Free: 1-800-649-9930

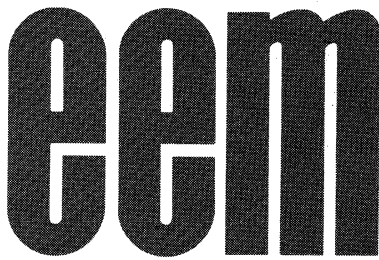
# Fabricast, Inc.®

MANUFACTURERS OF  
STANDARD AND CUSTOM  
SLIP RING ASSEMBLIES

TELEPHONE: (626) 443-3247  
FAX: (626) 443-5594  
E-MAIL: info@fabricast.com  
WEB SITE: www.fabricast.com

P.O. BOX 3176, 2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIFORNIA 91733

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# MINIGLOSSARY

## BASIC CAPACITOR FORMULAS

### I. Capacitance (farads)

English:  $C = \frac{.224 \text{ K A}}{t_D}$

Metric:  $C = \frac{.0884 \text{ K A}}{t_D}$

### II. Energy stored in capacitors (Joules, watt-sec)

$$E = \frac{1}{2} CV^2$$

### III. Linear charge of a capacitor (Amperes)

$$I = C \frac{dV}{dt}$$

### IV. Total Impedance of a capacitor (ohms)

$$Z = \sqrt{R_s^2 + (X_c - X_L)^2}$$

Where  $R_s = \text{ESR}$

### V. Capacitive Reactance (ohms)

$$X_c = \frac{1}{2 \pi fC}$$

### VI. Inductive Reactance (ohms)

$$X_L = 2 \pi fL$$

### VII. Phase Angles:

Ideal Capacitors: Current leads voltage  $90^\circ$

Ideal Inductors: Current lags voltage  $90^\circ$

Ideal Resistors: Current in phase with voltage

### VIII. Dissipation Factor

$$DF = \tan \delta \text{ (loss angle)} = \frac{\text{ESR}}{X_c} = (2 \pi fC) (\text{ESR})$$

### IX. Power Factor

PF = Sine  $\delta$  (loss angle) = Cos  $\phi$  (phase angle)

PF = DF (when less than 10%)

### X. Quality Factor (dimensionless)

$$Q = \text{Cotan } \delta \text{ (loss angle)} = \frac{1}{DF}$$

### XI. Equivalent Series Resistance (ohms)

$$\text{ESR} = (DF) (X_c) = (DF) \left( \frac{1}{2 \pi fC} \right)$$

### XII. Power Loss (watts)

$$\text{Power loss} = (2 \pi fCV^2) (DF)$$

### XIII. KVA (Kilowatts)

$$\text{KVA} = 2 \pi fCV^2 \times 10^{-3}$$

### XIV. Temperature Characteristic (ppm/ $^\circ\text{C}$ )

$$TC = \frac{C_t - C_{25}}{C_{25} (T_t - 25)} \times 10^6$$

### XV. Cap Drift (%)

$$\text{C.D.} = \frac{C_1 - C_2}{C_1} \times 100$$

### XVI. Reliability of Ceramic Capacitors

$$\frac{L_t}{L_o} = \left( \frac{V_t}{V_o} \right)^x \left( \frac{T_t}{T_o} \right)^r$$

### XVII. Capacitors in Series (current the same)

$$\text{Any number: } \frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \dots + \frac{1}{C_N}$$

$$\text{Two: } C_T = \frac{C_1 C_2}{C_1 + C_2}$$

### XVIII. Capacitors in Parallel (voltage the same)

$$C_T = C_1 + C_2 + \dots + C_N$$

### XIX. Aging Rate

A.R. = %  $\Delta C$ /decade of time

### XX. Decibels

$$\text{db} = 20 \log \frac{V_1}{V_2}$$

### Metric prefixes:

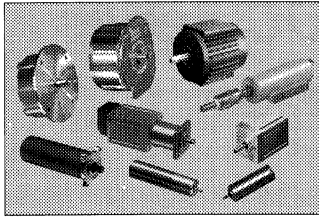
Pico	X $10^{-12}$
Nano	X $10^{-9}$
Micro	X $10^{-6}$
Milli	X $10^{-3}$
Deci	X $10^{-1}$
Deca	X 10
Kilo	X $10^3$
Mega	X $10^6$
Giga	X $10^9$
Tera	X $10^{12}$

### Symbols:

K	= Dielectric Constant
A	= Area of electrode overlap
$t_D$	= Dielectric thickness
V	= Voltage (volts)
t	= time (hours)
$R_S$	= Series Resistance (ohms)
f	= frequency (Hertz)
L	= Inductance (henries)
$\delta$	= Loss angle

$\phi$	= Phase angle
x+y	= Exponent effect of voltage and temperature
$L_O$	= Operating life (hours)
$L_T$	= Test life (hours)
$V_T$	= Test voltage (volts)
$V_O$	= Operating voltage (volts)
$T_T$	= Test temperature ( $^\circ\text{C}$ )
$T_O$	= Operating temperature ( $^\circ\text{C}$ )

### Standard and Custom BLDC

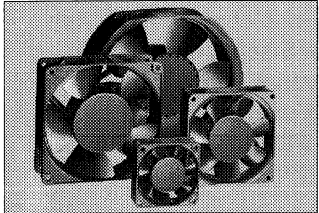


Globe's line of brushless DC motors and gearmotors provides high performance, cost-effective solutions.

- Speeds to 70,000 RPM
- Wide range of permanent magnet choices
- Part sets availability
- Custom design capabilities.

### Globe Motors™

### High-Performance, Precision Cooling Fans

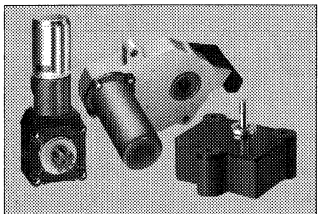


Globe's wide range of reliable, competitively priced, commercial cooling fans provide 10 to 230 CFM; from 60 to 173 mm. Delivered from stock, Globe fans feature:

- AC and BLDC design
- Precision ball bearings
- Low noise; long life
- Multiple accessories.

### Globe Motors™

### Precision Rotary Actuators



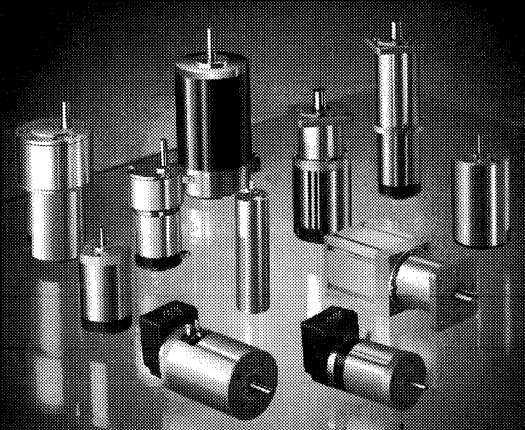
Globe's precision rotary actuators feature:

- Rates of travel to meet your requirements
- Mechanical stops or position feedback systems
- RFI suppression
- Spur or planetary gear systems.

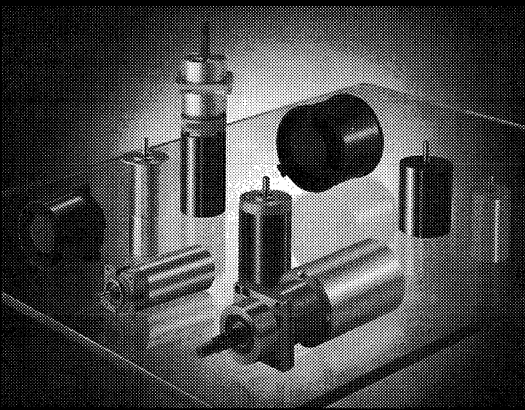
### Globe Motors™

## Globe Motors™

### Subfractional DC Motors, Brushless DC Motors, Gearmotors, and Commercial Cooling Fans



#### Standard Solutions



#### Custom Devices

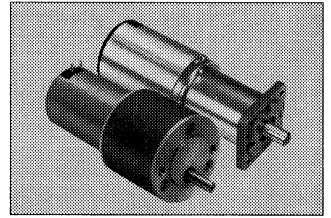
Call Time, Allied, Minarik, or Globe Motors:

**9 3 7 - 2 2 8 - 3 1 7 1**

2275 Stanley Avenue ■ Dayton, Ohio 45404 ■ Fax: 937-229-8531

**9001**  
ISO CERTIFIED

### Spur and Planetary Gearmotors



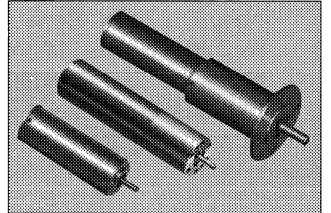
Globe's low cost, high torque spur and planetary geartrains are available with nickel alloy sintered gears on size 13, 15, and 21 motors.

	<b>Spur</b>	<b>Planetary</b>
Ratios to:	4,730:1	46,656:1

Standard windings are 12 and 24 VDC.

### Globe Motors™

### Size .8" Diameter, Brushless DC Motors

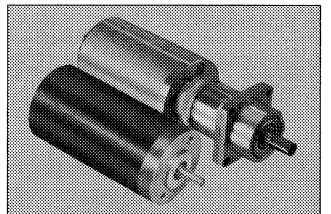


Globe's high speed, brushless DC motors and gearmotors for surgical tool and other high-speed applications feature:

- 18 Watts peak @ 70,000 RPM
- Samarium cobalt magnetics
- Spur and planetary geartrains
- Designed to withstand autoclave temperatures.

### Globe Motors™

### High-Temperature, Precision Motors



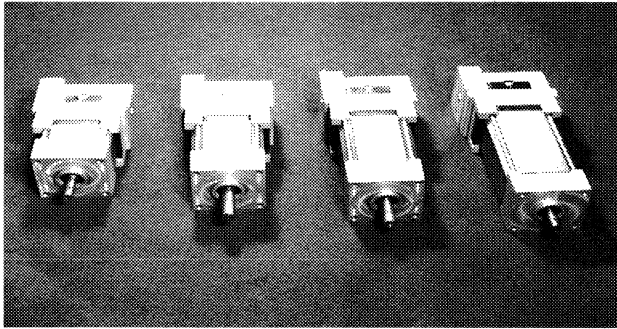
Globe's 1.5" (BL) and 2.25" (GRP) diameter, permanent magnet DC motors are capable of operating at 250° C (480° F). Field proven sustainability and trouble-free operation from specifically developed insulation coatings, bearing lubrication, and commutation systems.

### Globe Motors™



Hurst Manufacturing Div., Emerson Electric Co.  
1551 E. Broadway, Princeton, IN 47670. Telephone (812) 385-2564. Fax (812) 386-7504

## New Compact Size, Low-Priced BLDC Series

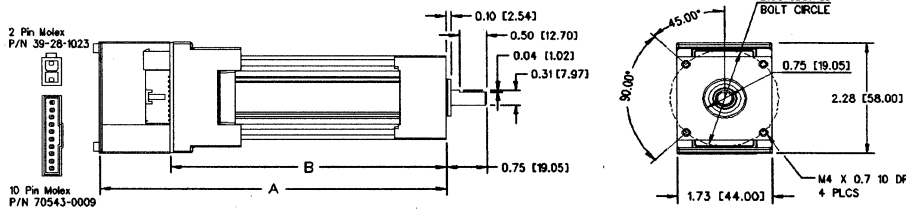


### BLDC Series Provides

- Reliable Brushless Performance
- Neodymium Magnets
- Smooth Precision Motion
- Advantages of Integral Control
- Flexibility in Connectors
- Flexibility in Feedback Options
- High Quality, Economically Priced

### FOUR SIZES OF HIGH PERFORMANCE BRUSHLESS DC MOTORS WITH FLEXIBLE INTEGRATED CONTROL & FEEDBACK OPTIONS

Hurst Manufacturing, a leader in Brushless DC Motor Technology, is pleased to announce the introduction of four new high performance Brushless DC motors with Flexible Integrated Controls & Feedback Options. The BLDC Series motors are powerful brushless DC motors well-suited for any application which demands integrated variable speed control, precision performance with low torque ripple, and high power at minimal size. The BLDC Series is designed for high reliability with such features as class B insulation system, ring magnets instead of arcs, and a bearing system designed with 100 years of Emerson Electric expertise in motor design. A variety of options are available, including level of controllability, variety of connectors, multiple winding and stack length combinations, and a choice of standard feedback devices. Throw away those nasty brushes and step up to the latest in Brushless DC Motors with Integrated Control.



#### MOTOR PERFORMANCE

Performance Characteristic	BP-4410	BP-4420	BP-4430	BP-4440
Voltage (Vdc)	12.0 - 40.0	12.0 - 40.0	12.0 - 40.0	12.0 - 40.0
No-Load Speed (rpm)	1000 - 8000	1000 - 8000	1000 - 8000	1000 - 8000
Torque Constant (oz-in/A)	2.0 - 54.0	2.0 - 54.0	2.0 - 54.0	2.0 - 54.0
Max Continuous Torque (oz-in)	1.5 - 13.5	3.0 - 25.0	4.0 - 36.0	6.0 - 45.0
"A" Length (inches)	3.36-4.11	4.11-4.86	4.86-5.61	5.61-6.36
"B" Length (inches)	2.80	2.80-3.55	3.55-4.30	4.30-5.05

Values shown represent performance range. Actual no-load speed and continuous torque rating will depend on input voltage and torque constant required by customer. Consult Hurst Mfg. for availability.

## Hurst Quality is Treasured by Fortune 500 Companies

When it comes to sub-fractional motors, Hurst quality is unrivaled. Fortune 500 companies have specified them for years. Quality is built-in because we make in-house virtually all the components of our motors-rotors, shafts, pinions, gears, etc. The Hurst line is broad, too. Choose brushless DC motors and controls, permanent magnet stepper and synchronous motors, linear actuators,

switched reluctance motors and more. Stepping motor controls, too. All made to meet the Hurst high standard of quality – the quality your products deserve.

For a catalog, write or call Hurst Mfg. Div., Emerson Electric Co., 1551 E. Broadway, Princeton, IN 47670. Tel. (812) 385-2564. Fax (812) 386-7504. Send E-mail to: [hurst@hurstmfg.com](mailto:hurst@hurstmfg.com)

*Hurst engineers can supply helpful application information and, on request, will recommend economical control systems and position sensors.*



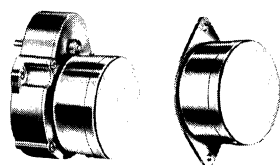
FOR MORE INFORMATION ABOUT THESE EXCITING NEW POWERFUL MOTORS  
Contact Hurst Mfg. at 812-385-2564 or Visit our Webpage at [www.hurstmfg.com](http://www.hurstmfg.com)





Hurst Manufacturing Div., Emerson Electric Co.  
1551 E. Broadway, Princeton, IN 47670. Telephone (812) 385-2564. Fax (812) 386-7504

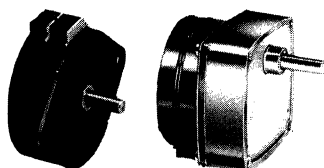
# STEPPING AND SYNCHRONOUS MOTORS



## A SERIES

Designed for long life at rated loads. Geared models have hardened steel gears and pinions running on steel studs. Hi-Torque rotors available; also voltages other than those shown may be specified. Widely used in applications requiring high quality components.

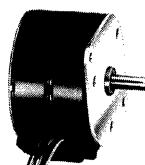
Dim. Geared: 2.81" H x 1.63" D  
Direct Drive: 1.94" H x 1.02" D



## S SERIES

Compact direct drive or geared motors for applications where space is limited and precise performance is required. Geared motors have typical torque ratings to 200 oz-in @ 200 p/s (max. gear train loading). Dual-stack motors featuring greater torque are now available. Call or write for complete specifications.

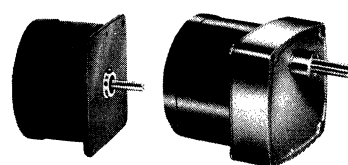
Dim. Geared: 2.45" H x 1.78" D  
Direct Drive: 2.28" H x .97" D



## SC SERIES

SC Series stepping motors have approximately 66% greater torque yet are only 2/3" longer than the popular SAS Series motors. Dual sleeve bearings are standard but ball bearings as well as double ended shafts may be specified.

Dim. Direct Drive: 3.13" H x 1.41" D



## P SERIES

PAS and PBS Series motors provide users with a choice of direct drive or geared models, standard or Hi-Torque rotors and, for direct drive models, a choice of mounting plates. Voltages other than those shown may be specified.

Gearing is scaled to provide a maximum dynamic gear train loading of 200 ounce-inches.

Dim. PAS Geared: 2.38" H x 2.25" D  
PAS Direct Drive: 2.28" H x 1.56" D  
PBS Geared: 2.38" H x 2.13" D  
PBS Direct Drive: 2.28" H x 1.41" D

## DIRECT DRIVE STEPPING MOTORS

	AS and ABS	SAS and SBS	SCS	PAS and PBS
STEP ANGLE (degrees)	7.5 and 15	7.5 and 15	7.5	7.5 and 15
STEPS PER REVOLUTION	48 and 24	48 and 24	48	48 and 24
2-PHASE HOLDING TORQUE (oz-in)	3.8 and 4.3	8.0 and 11.9	18.5 and 20.5	11, 12.3, 14, 16.5
RATED TORQUE @ 4-5 p/s (oz-in)	2.3 and 2.75	7.5 and 9.0	12.5 and 16.5	5.8, 7.3, 8.5, 11.5
INPUT POWER (Watts)	3.5 and 4.5	8	8	8 and 8.5
NOMINAL VOLTAGE (Volts)	12	6, 12, 24	5, 6, 12, 24	12
WINDING RESISTANCE (Ohms)	100 and 53	9, 36 and 144	6.1, 8.8, 35, 140	32 and 35
ROTOR INERTIA (oz-in)	0.07	0.17	.29	0.19 and 0.34
TEMPERATURE RISE (°C)	30 and 48	65	58	50, 52
WEIGHT (oz)	6.8	8	11.5	13

## GEARED STEPPING MOTORS

	AS and ABS	SAS and SBS		PAS and PBS
REDUCTION	300 to 4 1/2	600 to 2		300 to 2
STEP ANGLE (degrees)	0.025 to 3.6	0.025 to 7.50		0.025 to 3.75
NOMINAL VOLTAGE (Volts)	12	12		14, 400 to 96
OUTPUT SPEED @ 200 p/s (rpm)	0.83 to 120	0.42 to 125.0		.83 to 125
TYPICAL TORQUE @ 200 p/s (oz-in)	150* to 5.3	200* to 3		200* to 7.5
INPUT POWER (Watts)	3.5 and 4.5	8		8, 8.5
WINDING RESISTANCE (Ohms)	100 and 53	9, 36, 144		32 and 35
WEIGHT (oz)	11	16		18

\*Maximum gear train loading

- NOTES**
1. Standard lead wire configuration is 6 leads.
  2. All stepping motors shown here can be driven with Hurst Stepping Motor Controls.
  3. (PAS and PBS). Square mounting plate is standard for direct drive motors.

## DIRECT DRIVE SYNCHRONOUS MOTORS

	A and AB	SA and SB	SC	PA and PB
SPEED @ OUTPUT SHAFT (rpm)	300 or 600	300 or 600	300	300 or 600
RATED TORQUE (oz-in)	2.0 to 3.75	6.0 to 9.0	8.75 to 11.5	5.5 to 11
INPUT POWER (Watts)	3 to 6.5	5 to 7	7 to 9	7.5 to 11
CAPACITOR VALUE (mfd)	.25 to .62	.50 to .62	.68 to .85 ± 10%	.68 to 1
FULL LOAD TEMPERATURE RISE (°C)	21 to 43	28 to 37	35 to 40	31 to 45
WEIGHT (oz)	6.8	8	10	13

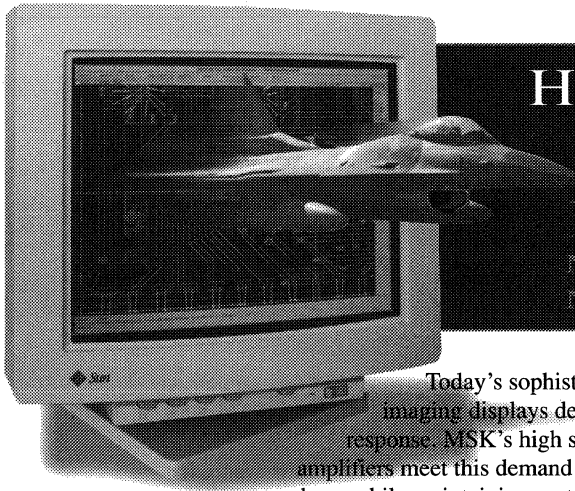
## GEARED SYNCHRONOUS MOTORS

	A and AB	SA and SB	SC	PA and PB
SPEED @ OUTPUT SHAFT (rpm)	1 to 360	1 to 180	15 to 180	1 to 360
RATED TORQUE (oz-in)	150 to 4.0	200* to 7	116* to 13	6 to 200
INPUT POWER (Watts)	3 to 6.5	5 to 7	7 to 9	7.5 to 11
CAPACITOR VALUE (mfd)	.25 to .62	.50 to .62	.68 to .85	.68 to 1
WEIGHT (oz)	11	16	18	18

\*Maximum gear train loading

- NOTES**
1. Capacitors furnished with most standard synchronous motors.
  2. All synchronous motors shown on this page operate on 115 VAC, 60 Hz.

HURST OFFERS A WIDE SELECTION OF SYNCHRONOUS AND STEPPING MOTORS, LINEAR ACTUATORS, AND STEPPING MOTOR CONTROLS. WRITE FOR CATALOG!



## High Speed-High Voltage Amplifiers

ISO 9001 Certified  
MIL-STD 1772 Certified  
MIL-1138534 QML

Today's sophisticated graphic imaging displays demand high speed response. MSK's high speed hybrid video amplifiers meet this demand in a compact package while maintaining system bandwidth and transition times.

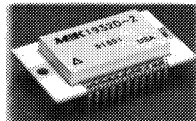
These new amplifiers are designed specifically to drive today's leading edge systems, such as:

- |   |   |
|---|---|
| <input type="checkbox"/> High Resolution RGB Displays         | <input type="checkbox"/> HDTV   |
| <input type="checkbox"/> High Resolution Monochrome Displays  | <input type="checkbox"/> RS-170, RS-343 Interfacing                     |
| <input type="checkbox"/> Airborne and Helmet Mounted Displays | <input type="checkbox"/> Electro Magnetic Deflection Control Amplifiers |
|   | <input type="checkbox"/> Electrostatic Deflection                       |

### Ultra High Speed/Voltage Video Amplifier

#### 1932 Series

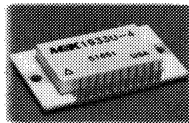
- Low Cost Complete Amplifier System
- 100Vpp Output Signal Into 10pF
- Ultra Fast Transition Times: 1.7nS @ 50Vpp
- User Adjustable Contrast and Brightness
- TTL Compatible Blanking
- On Board DC Reference Output
- Customized Versions Readily Available



### Ultra High Speed/Voltage Negative Output Video Amplifier

#### 1933 Series

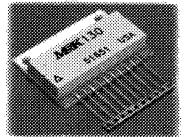
- Low Cost Complete Amplifier System
- 100Vpp Output Signal Into 10pF
- Ultra Fast Transition Times: 2.5nS @ 50Vpp
- User Adjustable Contrast and Brightness
- TTL Compatible Blanking
- On Board DC Reference Output
- Customized Versions Readily Available



### High Voltage, High Speed Differential Op-Amp

#### Model 130

- Wide Supply Voltage Range:  $\pm 15V$  to  $\pm 200V$
- High Output Current:  $\pm 200mA$
- FET Input
- Fast Slew Rate -  $300V/\mu S$  Typ
- Electrically Isolated Case
- Low Cost

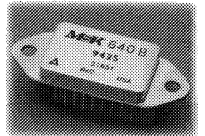


### Wide Bandwidth, High Voltage CRT Video Amplifier

#### 640 Series

#### This series features:

- 175 MHz Bandwidth
- 75 Vpp Output Swing
- 2nS Transition Times
- Positive and Negative Output Voltage Versions Available
- Drives 8.5 pf Load
- Replacement for CR3424R



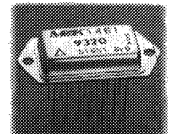
### High Speed Power Op-Amp

#### 1461 Op-Amp

The MSK 1461 high current, high voltage op-amp is designed for yoke drive, deflection, auto test and other applications requiring high speed at high current and high voltage levels.

#### This amplifier features:

- 65 Vpp Output Voltage Swing
- Wide Supply Range  $\pm 15V$  to  $\pm 45V$
- $\pm 750$  mA Output Current
- 1.2 GHz Gain Bandwidth Product
- 500 V/ $\mu S$  Slew Rate
- VMOS Output - No Secondary Breakdown
- User Adjustable Current Limit Capability

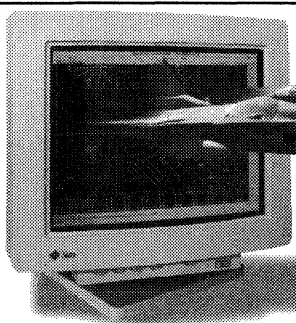


ISO 9001

**MSK**  
M.S. Kennedy Corporation

8170 Thompson Rd. • Cicero, NY 13039  
Phone: (315) 699-9201 • Fax: (315) 699-8023  
[www.mskennedy.com](http://www.mskennedy.com)





# Power

**DSCC Certified to ISO 9001**

MIL-STD 1772 Certified • MIL-PRF-38534 QML

Class K Certified for Space

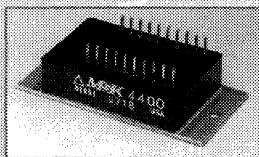
## The New Power In Power Micro Electronics

- Custom Power Hybrids ● Motor Drive ● Motor Control ● 1/2 Bridges, H-Bridges
- 3Φ Bridges ● Regulators ● High Side/Low Side Drives

### 4400

3-Phase MOSFET  
Bridge with  
Intelligent Gate Drive

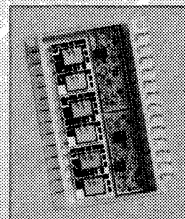
- 60 Volt Motor Supply Voltage
- Programmable Dead-Time Control
- 100% Duty Cycle High Side Conduction Capable
- Undervoltage Lockout Protection
- 10 Amp Output Switch Capability



### 4320

3Φ Bridge with  
Gate Drives

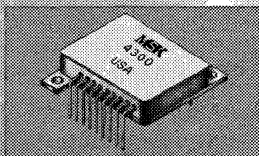
- 200 Volt, 42 Amp Rating
- Rugged MOSFET's with Fast Intrinsic Diodes
- Internal High Side Supplies
- Internal Gate Drive for DC to 50KHz Switching
- Programmable I/O Logic Levels
- Cross Conduction Lockout
- Under Voltage Lockout



### 4300

3-Phase MOSFET  
Bridge with  
Intelligent Gate Drive

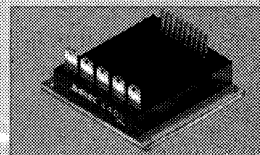
- 80 Volt Motor Supply Voltage
- 10 Amp Output Switch Capability
- Shoot-Through/Cross Conduction Protection
- Suitable for PWM Applications from DC to 100KHz
- Available with Three Lead Bend Options



### 4401

3-Phase MOSFET Bridge  
with Intelligent Gate  
Drive

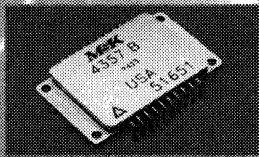
- 80 Volt Motor Supply Voltage
- 29 Amp Output Switch Capability, All N-Channel MOSFET Output Bridge
- Suitable for PWM Applications from DC to 100KHz
- Low Active Enable for Bridge Shutdown Control



### 4327

3Φ Bridge with  
Gate Drives

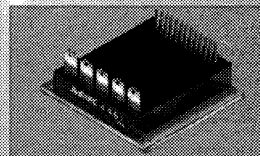
- 500 Volt, 28 Amp Rating
- IGBT/FRED Outputs
- Internal Gate Drive for DC to 25 KHz Switching
- Cross Conduction Lockout and 2μS Dead Time
- Internal High Side Supplies



### 4461

3-Phase MOSFET  
Brushless Motor  
Controller

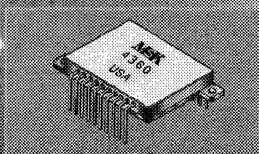
- 80 Volt Motor Supply Voltage
- 29 Amp Output Switch Capability
- 100% Duty Cycle High Side Conduction Capable
- Good Accuracy Around the Null Torque Point
- 60°/120° Phasing Selectable



### 4300

3-Phase MOSFET  
Brushless Motor  
Controller

- 80 Volt Motor Supply Voltage
- 10 Amp Output Switch Capability
- Shoot-Through/Cross Conduction Protection
- 60°/120° Phasing Selectable



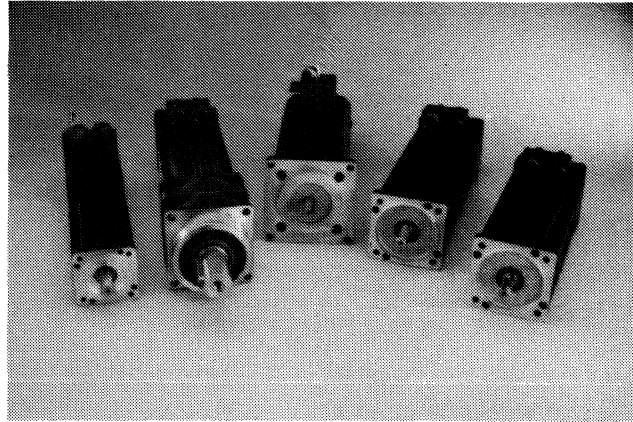
# MSK

M.S. Kennedy Corporation

8170 Thompson Rd.  
Cicero, NY 13039  
Phone: (315) 699-9201  
Fax: (315) 699-8023  
[www.mskennedy.com](http://www.mskennedy.com)

## Kollmorgen GOLDLINE™ Servomotors

Kollmorgen **GOLDLINE** servomotors incorporate highest energy rare earth neodymium-iron-boron magnets and excellent thermal design to provide exceptional continuous torque and peak torque performance available in a compact package. They are UL classified and are available in five frame sizes with three stack lengths per frame size. Combined with multiple winding variations, there is a solution for all motion control needs.



### Brushless Servomotor

**B-Series (Low-Inertia)** provides extremely low inertia rotors allowing for optimum performance in applications requiring rapid acceleration and deceleration.

**M-Series (Medium-Inertia)** is an extension of the B-Series. With seven times higher inertia, this motor series offers the advantage of better performance for systems having complaint loads or larger inertia mismatches.

**EB-Series (Explosion-Proof)** are listed by UL for use in Class 1, Division 1, Groups C and D hazardous locations.

**BE-Series (Low-Inertia) and ME-Series (Medium-Inertia)** provide the same inertia advantages as the B- and M-Series. A commutation encoder is incorporated in place of the resolver.

All models have a built-in thermostat and provide Class H insulation. Options on all models include a fail-safe brake and NEMA mountings.

Kollmorgen **GOLDLINE** Gearheads for B-, BE-, M- and ME-Series Motors mount directly to the motor shaft. Available in multiple ratios, the gearheads multiply the motor's output torque leveraging the high-speed capabilities of Kollmorgen servomotors. Gearhead features include precise positioning, low backlash, high reliability, and long life. They are a cost effective solution for low speed, high-torque applications offering a small package and high-torsional stiffness. Right angle gearheads are also available from Kollmorgen - your one vendor solution.

Series	B-	M-	BE-	ME-	EB-
<b>Features:</b>					
Torque Rating (N/m)	0.84 to 149.8	0.84 to 149.8	0.84 to 149.8	0.84 to 149.8	0.84 to 149.8
Torque Rating (lb/ft)	0.62 to 110.0	0.62 to 110.0	0.62 to 110.0	0.62 to 110.0	0.62 to 110.0
Square Frame (mm)	70.0 to 190.0	70.0 to 190.0	70.0 to 190.0	70.0 to 190.0	70.0 to 190.0
Square Frame (inches)	2.76 to 7.48	2.76 to 7.48	2.76 to 7.48	2.76 to 7.48	2.76 to 7.48
Feedback	Resolver	Resolver	Encoder	Encoder	Resolver
Maximum Speed (RPM)	7500	7500	6000	6000	7500
Extension	Rear Shaft	Rear Shaft	Rear Shaft	Rear Shaft	
<b>Options:</b>					
Sealing	IP65 and IP67	IP65 and IP67	IP65 and IP67	IP65 and IP67	
Connectors	Mating	Mating	Mating	Mating	
Gearheads	Front Mounted	Front Mounted	Front Mounted	Front Mounted	
Commutation			1024 LPR	1024 LPR	
Feedback	Encoder	Encoder			Encoder

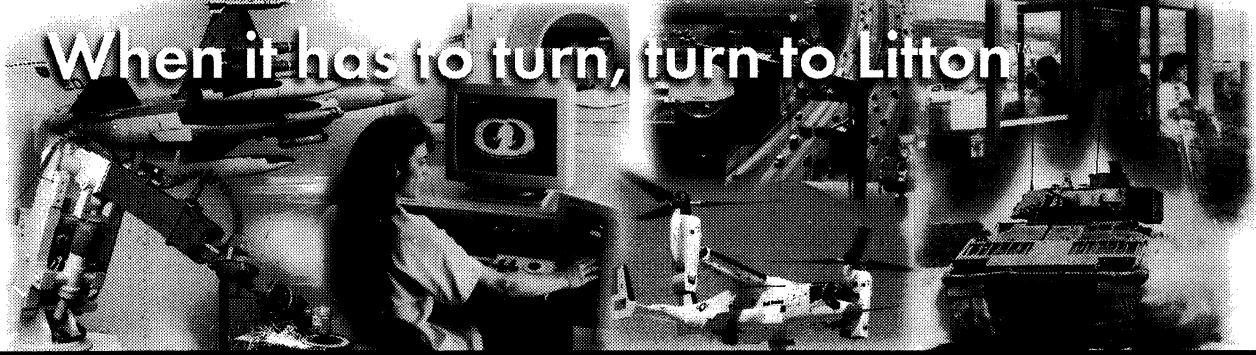
Please see our Ad in the 1100 Amplifier Assemblies, Instrumentation Section

# KOLLMORGEN

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Website: <http://www.kollmorgen.com> • E-mail: [kmtg@kollmorgen.com](mailto:kmtg@kollmorgen.com)

# Slip Rings and DC Motors

## When it has to turn, turn to Litton



### Commercial and Military/Aero-space Slip Rings and DC Motors

Our commercial slip rings are:

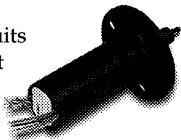
- Aggressively priced
- Available for immediate delivery
- Specially designed for tough applications

#### Slip Ring Capsules

##### *AC4898 Commercial Slip Ring Capsule*

This standard off-the-shelf slip ring uses gold contacts and is available for immediate delivery.

- 2 amp/210 VDC circuits
- 6, 12, 18 and 24 circuit models
- Speeds up to 250 rpm continuous



##### *AC6023 Compact Commercial Slip Ring Capsule*

Similar in design to our popular AC4898 capsule mentioned above, the AC6023 is 25-38% shorter in length (depending on the model chosen), providing increased flexibility when dealing with size restrictions.

- 2 amp/210 VDC circuits
- 6, 12, 18 and 24 circuit models
- Speeds up to 250 rpm continuous
- Lengths from .571 to 1.381
- Precision ball bearings meet or exceed life requirements for most commercial applications
- One week delivery

### Commercial Slip Rings with Through-Bores

The unobstructed bore through the center provides routing space for hydraulics, pneumatics, or for a concentric shaft mount.

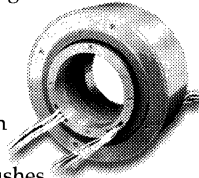
#### *AC4598 with 1-1/2" Through-Bore*

- 6, 12, 18 or 24 amp/210 VDC circuits
- 5A and 10 A circuit models
- Speeds up to 250 rpm
- Standard collar mounting; flange mounting optional
- Rugged, high-impact thermoplastic shaft, frame, standard bearings and cover
- One week delivery



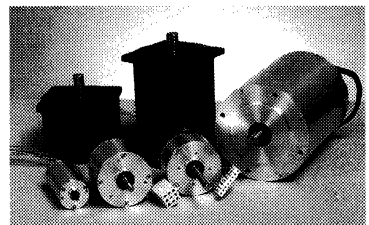
#### *AC6098 with 4" Through-Bore*

- Available in four lengths - from 4.6" to 14.4"
- Compact 8" O.D.
- 3-72 signal circuits
- 1-24 power circuits
- Speeds up to 60 rpm
- Silver plated rings; silver alloy fiber brushes
- Handles controller signals



One for every application:  
We have over 6,000 slip ring designs including many for special applications:  
-Large diameter slip rings - inside diameters up to 50"  
-High speed slip rings - speeds up to 10,000  
-Miniature slip ring separates - rotor diameters less than 0.100"

### *Silencer™ Brushless DC Motors*



- Sizes 12, 23, 34 and 42
- Standard NEMA frames in 1.2 to 4.15" diameter
- Speeds up to 20,000 rpm
- Continuous torques range from 2.4 to 519 oz-in
- Compact size - lengths range from 1.3" to 5.5"
- Standard options include gearheads, resolvers, encoders & electronic drivers

### *Brushless DC Motors - BOF, BON and BI Series*



- Available with either an inside or outside rotor
- Lengths from 1.3" to 2.8"
- Continuous torques from 12.6 to 41 oz-in
- Speeds up to 20,000 rpm
- High torque per dollar ratio
- Standard options include electronic drivers, encoders, and gearheads. Hall effect, resolver and sensorless feedback are also available

## Litton

## Poly-Scientific

### 800-336-2112

[www.litton-ps.com](http://www.litton-ps.com)

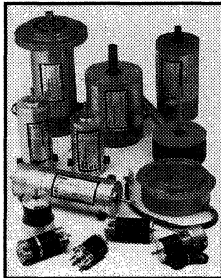
☐ FAX (540)953-1841 ☐ International (540)552-3011 ☐ email: [info@litton-ps.com](mailto:info@litton-ps.com)

Litton Poly-Scientific is an innovative rotary motion and control company with related design and manufacturing capabilities for slip rings, resolvers, DC motors and higher order actuator assemblies.

# Slip Rings and DC Motors

## Permanent Magnet DC Brush Motors - Series C13, C23, C34 and C42

- Complete line from 1.31" to 4.0" diameter
  - Lengths up to 9.0" Standard NEMA frame sizes
  - Long-life, replaceable brushes
  - Gearmotors available in most frame sizes
  - Up to 560 oz-in continuous torque
  - Up to 3,500 oz-in peak starting torque
- Military / Aerospace Slip Rings, Motors and Resolvers



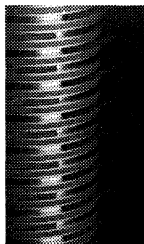
## Miniature Slip Ring Capsules

- In various circuit configurations for military applications
- Center-to-Center adjacent ring spacings as small as 0.015 inch
- Up to 300 rings
- Gold-on-gold and fiber brush sliding contact typical
- Through-bore designs available
- Frequency bandwidth to 1 GHz



## Space/Vacuum Slip Rings

In addition to Litton's traditional aerospace slip rings contact designs, we can provide our patented fiber brush contact design. Our space/vacuum slip rings offer both high and low current capabilities, long life, meet NASA outgassing requirements, very little wear debris, low noise and a wide temperature operating range.



## Poly-Twist or Twist Capsules

The Poly-Twist is a reliable slip ring substitute for limited rotation applications, up to 1-1/2 turns of rotational freedom.



## Vehicular Slip Rings



Electrical slip rings are used in vehicles such as tanks, retrievers, mobile missile launchers, LAVs and armored personnel carriers. A typical vehicle might contain slip rings in the turret, the commander station and the infrared sight.

## Helicopter Slip Rings



Slip Rings are typically used in de-icing and blade-folding systems, and main and tail rotors. Instrumentation and data transfer capabilities are available and standard on many designs.

- We also offer slip ring assemblies for:
- **Pedestal.** Radar, missile and gun fire control systems.
  - **Fiber Optic Rotary Joint (FORJ).** Optically passes signals from a stationary to a rotating structure. We offer on- and off-axis, single and multimode models.
  - **Cable Reel.** For marine/seismic exploration, underwater towed vehicles and other rugged environments.

## Servo Torque Motors



- Torques from 6 oz-in to 14 lb-ft.
- 1.1" to 5.25" O.D. standard
- Gold commutators available
- Tachometer and potentiometer options available
- Housed motors or as separate rotor/stator sets

Our brushless DC torque motors feature:

- Peak torques up to 6,480 oz-in
- 1.25" to 14.20" O.D. standard

- Tachometer and potentiometer options available
- Meet the requirements of MIL-E-5400

## DC Cube Torque Brush Motors

- Available in sizes: 1"x1"x1", 1"x1"x.75", 1"x1"x1.35", and .75"x.75"x.75"
- Up to 24 oz-in peak torque
- Options include gearheads, brakes, resolvers and potentiometers
- Available with rare earth magnets



## Brush and Brushless, Single and Multispeed, Pancake and Housed Resolvers

- Coupled to R/D converters, they provide a digital interface to computerized motion control systems.
  - +7" accuracy standard, +3" available for single speed
  - 400-10,000 Hz frequency range standard
  - Arc second accuracies are standard for multispeed resolvers
- We also offer:
- Custom engineering services
  - Limited Angle Rotation (LAR) (Toroidally Wound) DC Brushless Motors

## Integrated Motion Technology Assemblies

For years, we've been integrating our motors, resolvers and slip rings into sophisticated Integrated Motion Technology (IMT) systems for both military/aerospace and commercial use. By using one source for IMT, our customers realize many benefits:

- Compact systems with optimal performance.
  - Make or buy. With in-house resources often limited, our customers are able to focus their resources on their global mission and concentrate on what they do best.
  - Accountability. Dealing with one IMT source streamlines our customers' purchasing and paperwork efforts, reducing their cost of business.
- The slip rings, motors and resolvers described on these two pages are a sampling of the thousands of designs we have developed for both commercial and military/aerospace use. For more information, call us toll-free or visit our web site.

# Litton

## Poly-Scientific

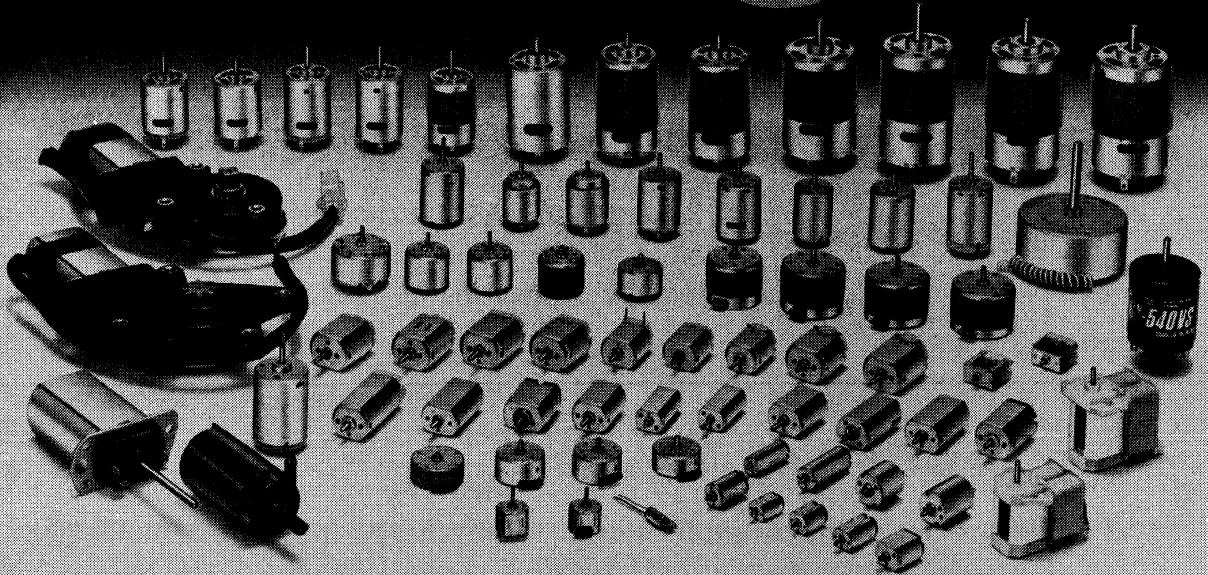
### 800-336-2112

### www.litton-ps.com

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Litton Poly-Scientific is an innovative rotary motion and control company with related design and manufacturing capabilities for slip rings, resolvers, DC motors and higher order actuator assemblies.

# Little motors for Big ideas.



## Mabuchi Subfrac hp pm dc motors are:

- **Big on variety.** 51 models for maximum design freedom.
- **Big on economy.** Competitive prices.
- **Big on service.** On-time delivery from world's largest maker: 5 Million a day.
- **Big on specs.** Advanced specs.
- **Big on efficiency.** Save time, assure certainty: Fax/write for our Motor Requirement Form; our engineers will match your needs.
- **Big on reliability.** 100% final test.

## Literally hundreds of applications:

- in automotive
- in computer related
- in power tools
- in appliances
- in you-name-it.



SINCE 1954

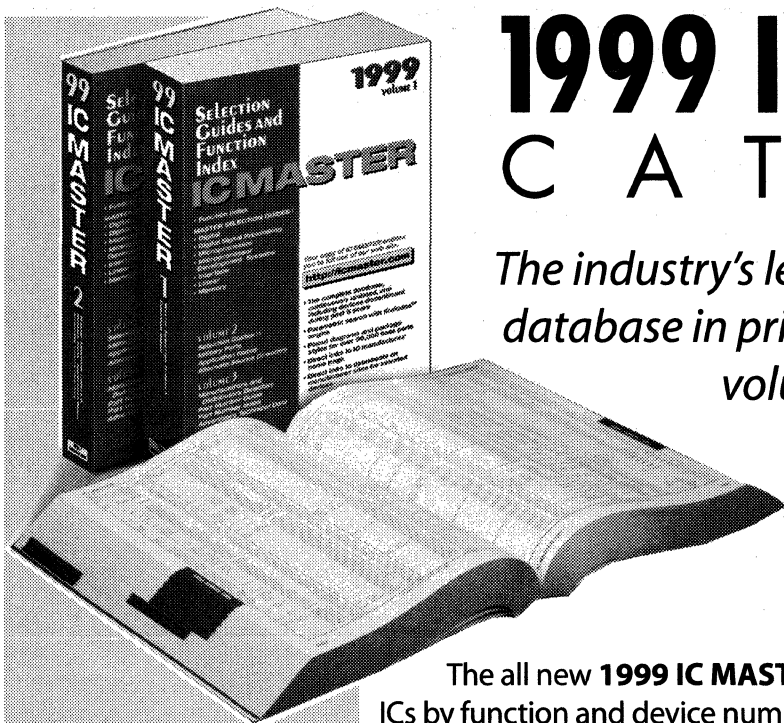
# MABUCHI MOTOR

## MABUCHI MOTOR AMERICA CORP.

3001 West Big Beaver Road, Suite 520, Troy, MI 48084

<http://www.mabuchi-motor.co.jp> • Fax (248) 816-3242 • Tel (248) 816-3100

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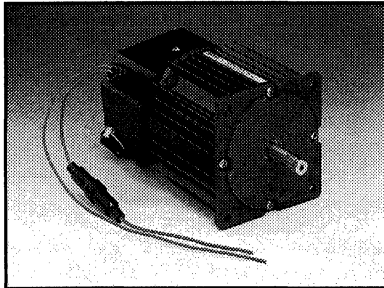
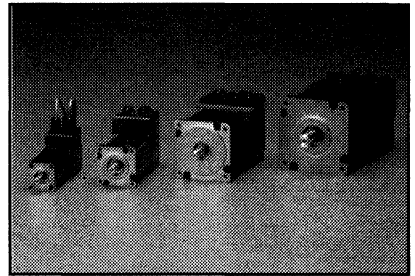
**The IC MASTER catalog is published annually in February.**

See us on the World Wide Web at <http://icmaster.com>

# Brushless DC Motor Systems

## "ULYSSES" Brushless Servo Motors

- Continuous torque up to 90 lb-in. (superior thermal management)
- NEMA 17, 23, 34 & 42 frame sizes
- NEMA & metric mounting
- High torque to inertia ratio
- Sealed for washdown
- Matching amplifiers
- Options are modular & field upgradeable:
  - encoder, resolver, brake & MS connector

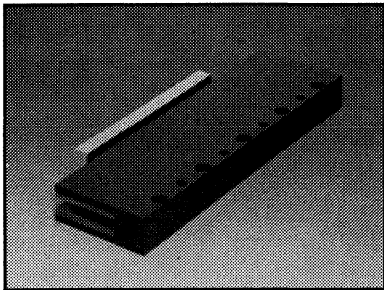
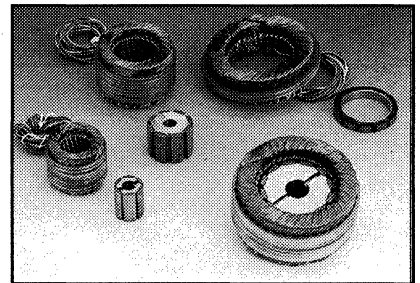


## Two Wire Brushless Replacement for Brush Motors

- Controllable by PWM, "H", or SCR technology
- Torque capability to 613 oz-in. (4.3 Nm)
- Full torque, CW/CCW through ZERO SPEED
- Standard NEMA frame sizes, 23, 34, 42
- Encoder 1000 ppr line driver outputs standard

## Frameless Brushless Solutions for OEM

- Economical Performance. (Lower overall costs)
- Eliminate mechanical transmission and gears costs. (No couplings or gears)
- High performance – higher stiffness and better response, direct drive. (No backlash)
- Space saving – built integral to the load reduces overall size of machine.
- Torque capability .9 lb-in to 457 lbs-in. (52 NM)
- Low cogging. Unique magnetic circuit design
- Hi O.D. 1.25 to 10" (254 mm)

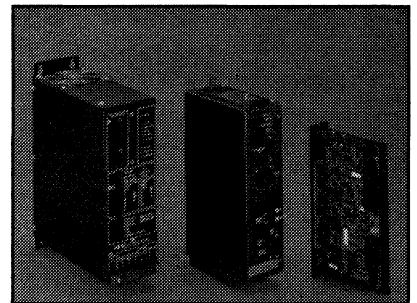


## "HERCULES" Brushless Linear Motors

- Continuous force up to 38 lbs.
- Higher performance (superior thermal management)
- Built in cooling system (no hoses)
- Modular design: stackable "end to end"
- Matched sine wave drive optimum efficiency
- Least number of wires in the industry

## "ODYSSEY" Brushless Servo Amplifiers

- Continuous current ratings up to 10 amps
- Output voltage up to 300VDC; DC or AC input
- Compact
- Accepts +/- 10VDC analog input
- Transconductance or velocity
- Independent current & velocity loops
- Options are modular & field upgradeable:
  - encoder, resolver, sine wave & digital



Enabling the Brushless Age

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## MOTOR STYLE SELECTOR

**•Originators of Skew-Wound Coreless Micromotors**

STYLE	SERIES	CASE DIAMETER (mm)	(in)	OVERALL LENGTH (mm)	(in)	MAX. CONTINUOUS OUTPUT POWER (W)	MAX. CONT. TORQUE (oz.-in)	RECOMMEND MAX SPEED (RPM)
	0816	8	(.315)	16	(.63)	.16	.02	13,000
	FITS GEARHEAD SERIES 08/1							
	1016	10	(.39)	16	(.63)	.35	.07	13,000
	FITS GEARHEAD SERIES 10/1 & 12/3							
	1212	12	(.47)	12	(.48)	.1	.01	15,000
	FITS GEARHEAD SERIES 10/1 & 12/3							
	1219	12	(.47)	19	(.74)	.45	.09	12,000
	FITS GEARHEAD SERIES 10/1 & 12/3							
	1319	13	(.51)	19	(.75)	.1	.17	12,000
	FITS GEARHEAD SERIES 14/1, 15/2, 15/3, 15/5 & 15/8							
	1331	13	(.51)	31	(1.23)	.2	.35	12,000
	FITS GEARHEAD SERIES 14/1, 15/5 & 15/8							
	1336	13	(.51)	36	(1.42)	1.8	.57	9,000
	FITS GEARHEAD SERIES 14/1, 15/2, 15/3, 15/5 & 15/8							
	1516	15	(.59)	16	(.63)	.3	.07	12,000
	FITS GEARHEAD SERIES 15/1, 15/2, 15/3, 15/5, 15/8 & 16A							
	1516R	15	(.59)	16	(.63)	.4	.11	12,000
	FITS GEARHEAD SERIES 15/1, 15/2, 15/3, 15/5, 15/8 & 16A + INTEGRAL ENCODER							
	1524	15	(.59)	24	(.94)	.6	.14	12,000
	FITS GEARHEAD SERIES 15/1, 15/2, 15/3, 15/5, 15/8 & 16A							
	1524R	15	(.59)	24	(.94)	1.4	.35	10,000
	FITS GEARHEAD SERIES 15/1, 15/2, 15/3, 15/5, 15/8, 16/7 & 16A + INTEGRAL ENCODER							
	1616	16	(.63)	16	(.62)	.45	.11	12,000
	FITS GEARHEAD SERIES 16/2, 16/3, 16/5, 16/7, 16/8 & 16A							
	1624	16	(.63)	24	(.94)	.9	.21	12,000
	FITS GEARHEAD SERIES 16/2, 16/3, 16/5, 16/7, 16/8 & 16A							
	1717	17	(.67)	17	(.67)	.1	.20	12,000
	FITS GEARHEAD SERIES 16/7 & 16A							
	1724	17	(.67)	24	(.95)	1.5	.28	8,000
	FITS GEARHEAD SERIES 16/7 & 16A							
	1727	17	(.67)	27	(1.06)	1.7	.71	7,000
	FITS GEARHEAD SERIES 16/7							
	2017	20	(.79)	17	(.68)	.45	.11	12,000
	FITS GEARHEAD SERIES 2020							
	2025	20	(.79)	25	(.98)	.9	.21	8,000
	FITS GEARHEAD SERIES 2034							
	2224R	22	(.87)	24	(.63)	3.8	.71	8,000
	FITS GEARHEAD SERIES 22/2, 22B, 22/5 & 23/1+ INTEGRAL ENCODER							
	2225	22	(.87)	25	(.98)	.1	.28	8,000
	FITS GEARHEAD SERIES 22/2, 22B, 22/5, 23/1 & 38/3							
	2230	22	(.87)	30	(1.18)	.2	.35	8,000
	FITS GEARHEAD SERIES 22/2, 22B, 22/5, 23/1 & 38/3							
	2233	22	(.87)	33	(1.29)	2.8	.43	8,000
	FITS GEARHEAD SERIES 22/2, 22B, 22/5, 23/1 & 38/3							
	2338	23	(.91)	38	(1.48)	2.5	.57	6,000
	FITS GEARHEAD SERIES 23/1, 30/1, 32PG & 38/3							
	2342CR	23	(.906)	42	(1.65)	9.5	2.27	7,000
	FITS GEARHEAD SERIES 23/1, 30/1, 32PG, 38/1, 38/2 & 38/3							



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## MOTOR STYLE SELECTOR

STYLE	SERIES	CASE DIAMETER (mm)	(in)	OVERALL LENGTH (mm)	(in)	MAX. CONTINUOUS OUTPUT POWER (W)	MAX. CONT. TORQUE (oz.-in)	RECOMMEND MAX SPEED (RPM)
	2842	28	(1.10)	42	(1.65)	6	3	5,000
	FITS GEARHEAD SERIES 23/1, 30/1, 32PG, 38/1, 38/2 & 38/3							
	3042	30	(1.18)	42	(1.65)	17	4	5,000
	FITS GEARHEAD SERIES 30/1, 32PG, 38/1 & 38/2							
	3540	35	(1.38)	40	(1.57)	10	4	5,000
	FITS GEARHEAD SERIES 30/1, 32PG, 38/1 & 38/2							
	3557	35	(1.38)	57	(2.24)	20	6	5,000
	FITS GEARHEAD SERIES 30/1, 32PG, 38/1 & 38/2							
	3557CS	35	(1.38)	57	(2.24)	25	7	5,000
	FITS GEARHEAD SERIES 30/1, 32PG, 38/1 & 38/2							
	3557CR	35	(1.38)	57	(2.24)	40	9	5,000
	FITS GEARHEAD SERIES 30/1, 32PG, 38/1 & 38/2							
	3863	38	(1.50)	63	(2.48)	92	16	8,000
	FITS GEARHEAD SERIES 38/1 & 38/2							
	GNM 2130	34	(1.34)	94	(3.70)	8	2	6,000
	FITS GEARHEAD SERIES G4, G4A & G5							
	GNM 2145	34	(1.34)	110	(4.33)	12	3	6,000
	FITS GEARHEAD SERIES G1.1, G4 G4A, & G5							
	GNM 2636	45	(1.77)	107	(4.21)	28	13	4,000
	FITS GEARHEAD SERIES G1.2 & G12.1							
	GNM 2670	45	(1.77)	151	(5.94)	55	18	4,000
	FITS GEARHEAD SERIES G13.1							
	GNM 3125	55	(2.17)	126	(4.98)	30	15	4,000
	FITS GEARHEAD SERIES G24							
	GNM 3150	55	(2.17)	126	(4.98)	55	28	4,000
	FITS GEARHEAD SERIES G2.6							
	GNM 3175	55	(2.17)	126	(4.98)	75	38	4,000
	FITS GEARHEAD SERIES G11.1							
	GNM 4125	70	(2.76)	118	(4.65)	45	33	3,000
	FITS GEARHEAD SERIES G8N							
	GNM 4150	70	(2.76)	143	(5.63)	75	53	3,000
	FITS GEARHEAD SERIES G11.2							
	GNM 4175	70	(2.76)	168	(6.61)	100	79	3,000
	FITS GEARHEAD SERIES G11.2							
	GNM 5440	83	(3.27)	166	(6.56)	125	79	3,000
	FITS GEARHEAD SERIES G3.1 & G6.1							
	GNM 5480	83	(3.27)	206	(8.13)	210	150	3,000
	FITS GEARHEAD SERIES G6.1 & G40.1							
	GNM 62100	100	(3.94)	243	(9.57)	450	225	3,000
	FITS GEARHEAD SERIES G40.1							
	GNM 7045	120	(4.72)	202	(7.95)	175	178	3,000
	FITS GEARHEAD SERIES G40.1							
	GNM 7085	120	(4.72)	256	(10.08)	300	295	3,000
	FITS GEARHEAD SERIES G40.1							
	GNM 70130	120	(4.72)	313	(12.32)	430	415	3,000
	FITS GEARHEAD SERIES G50.1 & GCN							
	GNM 80	110	(4.33)	147	(5.78)	250	200	3,000
























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## GEARHEAD STYLE SELECTOR

STYLE GEARHEADS	SERIES	CASE DIAMETER		SHAFT DIAMETER		RATIOS		MAX. CONT. TORQUE (oz-in)	INTERMITTENT TORQUE (oz-in)
		(mm)	(in)	(mm)	(in)	FROM	TO		
	1.9 PG	1.9	(.075)	.5	(.009)	3.6:1-47:1		.02	.04
	FITS MOTOR SERIES 1.9 BL								
	08/1	8	(.315)	1.5	(.059)	4:1-4096:1		8.5	17
	FITS MOTOR SERIES 0816								
	10/1	10	(.394)	2	(.079)	4:1-4096:1		14.2	28.3
	FITS MOTOR SERIES 1016, 1212 & 1219								
	12/3	12	(.472)	2	(.079)	9.17:1-154,368:1		4.2	14.2
	FITS MOTOR SERIES 1016, 1212 & 1219								
	14/1	14	(.551)	3	(.118)	3.71:1-5647:1		42.5	63.8
	FITS MOTOR SERIES 1319, 1331 & 1336								
	15A	15	.591	3	(.118)	19:1-23,014:1		35.4	56.6
	FITS MOTOR SERIES 1516R, 1524R								
	15/1	17	(.669)	2	(.079)	11.8:1-5752:1		2.8	7.1
	FITS MOTOR SERIES 1516, 1516R, 1524 & 1524R								
	15/2	16	(.630)	2	(.079)	3.45:1-235,067:1		4.2	14.2
	FITS MOTOR SERIES 1319, 1331, 1336, 1516, 1516R, 1524 & 1524R								
	15/3	16	(.630)	2	(.079)	6.3:1-235,067:1		4.2	14.2
	FITS MOTOR SERIES 1319, 1331, 1336, 1516, 1516R, 1524 & 1524R								
	15/5	16	(.630)	3	(.118)	6.3:1-235,067:1		14.2	42.4
	FITS MOTOR SERIES 1319, 1331, 1336, 1516, 1516R, 1524 & 1524R								
	15/8	16	(.630)	3	(.118)	22:1-1670:1		14.2	42.4
	FITS MOTOR SERIES 1319, 1331, 1336, 1516, 1516R, 1524 & 1524R								
	16A	16	(.630)	2	(.079)	11.8:1-5752:1		4.2	14.2
	FITS MOTOR SERIES 1516, 1516R, 1524, 1524R, 1616, 1624, 1717, & 1724								
	16/2	17	(.669)	2	(.079)	3.45:1-235,067:1		4.2	14.2
	FITS MOTOR SERIES 1616 & 1624								
	16/3	17	(.669)	2	(.079)	6.3:1-235,067:1		4.2	14.2
	FITS MOTOR SERIES 1616 & 1624								
	16/5	17	(.669)	3	(.118)	6.3:1-235,067:1		14.2	42.2
	FITS MOTOR SERIES 1616 & 1624								
	16/7	16	(.630)	3	(.118)	3.71:1-5647:1		42.5	64
	FITS MOTOR SERIES 1516R, 1524R, 1616, 1624, 1717, 1724, 1727; BRUSHLESS 1628								
	16/8	17	(.669)	3	(.118)	141:1-1670:1		14.2	42.4
	FITS MOTOR SERIES 1616 & 1624								
	20/1	20	(.787)	4	(.157)	3.71:1-1,526:1		70.8	99.1
	FITS MOTOR SERIES 2025, 2224R, 2225, 2230, 2233								
	22B	24	(.945)	4	(.157)	9:1-2187:1		14.2	56.6
	FITS MOTOR SERIES 2224R, 2225, 2230 & 2233								
	22/2	23.8	(.937)	4	(.157)	3.1:1-983,447:1		14.2	56.6
	FITS MOTOR SERIES 2224R, 2225, 2230 & 2233								
	22/5	23.8	(.937)	4	(.157)	29.6:1-2050:1		14.2	56.6
	FITS MOTOR SERIES 2224R, 2225, 2230 & 2233								



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## GEARHEAD STYLE SELECTOR

- *Zero Backlash Gearing on Selected Models*
- *Bi directional Operation*

STYLE GEARHEADS	SERIES	CASE DIAMETER		SHAFT DIAMETER		RATIOS		MAX. CONT. TORQUE (oz.-in)	INTERMITTENT TORQUE (oz.-in)
		(mm)	(in)	(mm)	(in)	FROM	TO		
	32PG	32	(1.26)	6	(.236)	4:1-2076:1		637	850
	FITS MOTOR SERIES 2338, 2342CR, 2444, 2842, 3540 & 3557								
	38/3	38	(1.50)	6	(.236)	5:42:1-1094:1		170	283
	FITS MOTOR SERIES 2225, 2230, 2233, 2338, 2342CR, 2842, 2444								
	38/1 & 38/2	38	(1.60)	8	(.315)	14:1-1526:1		1416	2,124
	FITS MOTOR SERIES 2842, 3042, 3540, 3557, 3863, BRUSHLESS 3564								
	G1.1	-		6	(.236)	7.3:1-38:1		92	283
	FITS MOTOR SERIES GNM 2145								
	G1.2	-		8	(.315)	7.3:1-38:1		156	283
	FITS MOTOR SERIES GNM 2636								
	G2.6	-		10	(.394)	4.8:1-36:1		425	1,133
	FITS MOTOR SERIES GNM 3150								
	G3.1	-		12	(.472)	5.6:1-35:1		878	1,841
	FITS MOTOR SERIES GNM 5440								
	G4	-		8	(.315)	15:1-43740:1		340	425
	FITS MOTOR SERIES GNM 2130 & 2145								
	G4A	-		8	(.315)	60:1-9720:1		454	566
	FITS MOTOR SERIES GNM 2130 & 2145								
	G5	34	(1.34)	8	(.315)	30:1-54680:1		710	710
	FITS MOTOR SERIES GNM 2130 & 2145								
	G6.1	83	(3.27)	20	(.787)	8:1-185.7:1		7081	18,410
	FITS MOTOR SERIES GNM 5440 & 5480								
	G8N	-		12	(.472)	15:1-405:1		2,982	2,982
	FITS MOTOR SERIES GNM 4125								
	G11.1	56	(2.21)	14	(.551)	8.3:1-242.9:1		3,115	4,248
	FITS MOTOR SERIES GNM 3175								
	G11.2	56	(2.21)	14	(.551)	8.3:1-242.9:1		3,115	4,248
	FITS MOTOR SERIES GNM 4150								
	G12.1	-		10	(.394)	10:1-810:1		708	1,133
	FITS MOTOR SERIES GNM 2636								
	G13.1	45	(1.77)	12	(.472)	5.5:1-220:1		2,195	2,832
	FITS MOTOR SERIES GNM 2670								
	G24	-		10	(.394)	15:1-540:1		1,416	1,699
	FITS MOTOR SERIES GNM 3125								
	G40.1	-		15	(.591)	10:1-56:1		3,965	9,913
	FITS MOTOR SERIES GNM 5480 & 62100								
	G50.1	-		20	(.787)	10:1-40:1		5,310	14,160
	FITS MOTOR SERIES GNM 70130								
	G50.1	120	4.724	30	(1.181)	3.8:1-109.8:1		48,150	89,203
	FITS MOTOR SERIES GNM 70130								
	GCN	120	4.724	30	(1.181)	3.8:1-109.8:1		48,150	89,203
	FITS MOTOR SERIES GNM 70130								

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**BRUSHLESS DC MOTORS**

SERIES	CASE DIAMETER		OVERALL LENGTH		CONT.	MAX. CONT.	RECOMMENDED	
	(mm)	(in)	(mm)	(in)	MAX. POWER OUTPUT (W)	TORQUE (oz.-in)	MAX. SPEED (RPM)	
1.9 BL	1.9	(.075)	5.5	(.217)	.07	.001	100,000	FITS GEARHEAD SERIES 1.9 PG
1525	15	(.591)	25	(.984)	1.4	.17	15,600	
1628	16	(.630)	28	(1.102)	10	.37	65,000	FITS GEARHEAD SERIES 16/7
1928	19	(.748)	28	(1.102)	1.5	.13	10,000	
1935	19	(.748)	35	(1.378)	2	.45	10,000	
2036	20	(.787)	36	(1.417)	20	.74	49,000	FITS GEARHEAD SERIES 20/1
2444	24	(.98)	44	(1.732)	37	1.67	38,000	FITS GEARHEAD SERIES 23/1 & 30/1
3056	30	(1.181)	56	(2.205)	49	3.04	28,000	FITS GEARHEAD SERIES 30/1, 38/1 & 38/2
3153	31	(1.220)	53	(2.087)	5	1.7	6,500	
3564	35	(1.378)	64	(2.520)	109	6.67	27,000	FITS GEARHEAD SERIES 30/1, 38/1 & 38/2

**SERVO AMPLIFIERS**

SERIES	PRODUCT	FEATURES
BLD 453	BRUSHLESS AMPLIFIER	PWM, 3 AMP, 2-QUADRANT
BLD 568	BRUSHLESS AMPLIFIER	PWM, 8 AMP, 2-QUADRANT
BLD 3502	BRUSHLESS AMPLIFIER	PWM, 2.5 AMP, 2-QUADRANT
BLD 5603/5604	BRUSHLESS AMPLIFIER	PWM, 4 AMP, 4-QUADRANT/ 2-QUADRANT
BLD 5606/5608	BRUSHLESS AMPLIFIER	PWM, 8 AMP, 4-QUADRANT/ 2-QUADRANT
LC3002A	BRUSH-TYPE AMPLIFIER	LINEAR, 3 AMP, 4-QUADRANT

**DEVICENET™ COMPLIANT SERVO CONTROLLERS**

MVP® 2001A	DEVICENET™ COMPLIANT MOTION CONTROLLER	PWM; 3A cont., 10A peak
MVP® 2001B	DEVICENET™ COMPLIANT MOTION CONTROLLER	LINEAR; 1A cont., 3.5A peak

**OPTIONS**

If your application demands special considerations as to... **Micro Mo Electronics Can Make Modifications To**

	Motors	Gearheads	Encoders	Motor/Tach	Comments
POWER CONNECTIONS	•	•	•	•	Cable and connector options including PVC, Teflon, high flex cable, radiation hardened leads in user specified lengths and colors; connectors designed to mate with industry standard and special headers.
HARSH ENVIRONMENTS	•	•	•	•	Operating temperatures from -55°C to +155°C (further modifications allow our products to withstand autoclave temperatures to 135°C).
NOISE	•	•	•	•	Extensive experience in solving applications with critical requirements for noise, both electrical and mechanical.
MOUNTING	•	•	•	•	Whether it is a retrofit application or one requiring special shafting, flanges, or housings, chances are we have already done something similar.
MOTOR TOLERANCES	•	•	•	•	In normal production, motor constants have tolerances varying approximately ±8%. If this band is unacceptable, the motors can be calibrated to within approximately ±1%.
BACKLASH	•	•	•	•	"Zero Backlash" gearheads, available for motors 1319, 1331, 1516, 1524, 1616, 1624, 2225, 2230, and 2233. (Note: the backlash contained in our standard gearing is actually quite low... see individual data sheets for details.)
DIRECTION OF ROTATION	•	•	•	•	Most products can be used for operation in either direction.
AXIAL OR RADIAL LOADING	•	•	•	•	A variety of bearing options are available to meet your most demanding requirements, including sleeve, ball, and (for gearheads) ceramic.
SIZE	•	•	•	•	Motors, gearheads, and encoders starting at 1.9mm diameter. Ratios as high as 983,447:1, and torques to 11 ft.-lbs. in a 38mm diameter.
POWER	•	•	•	•	If more power is required, let one of our GNM series gearmotors meet the need. Available in many ratios, for torques through almost 500 ft.-lbs. in a surprisingly small package.



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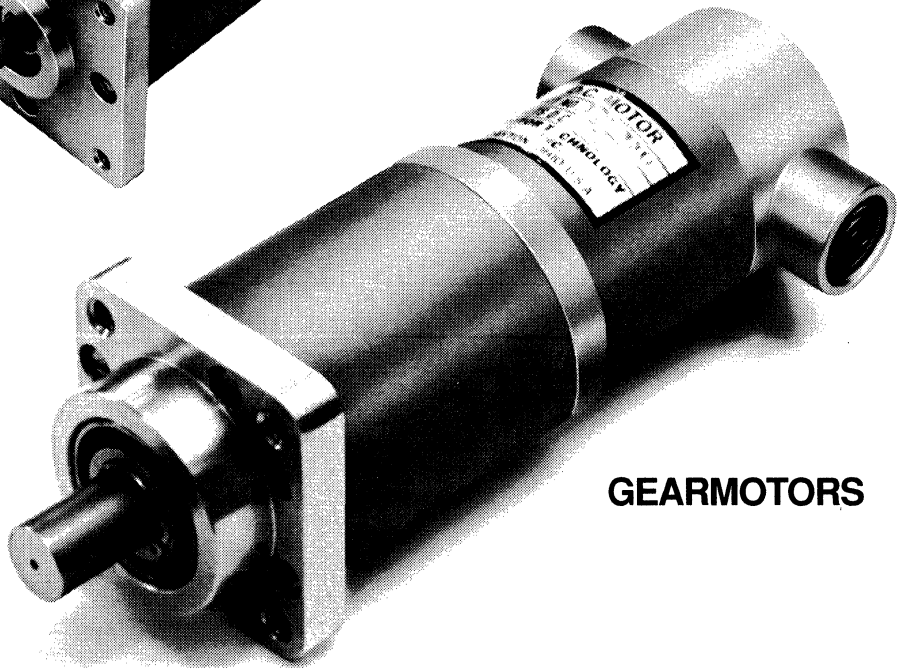
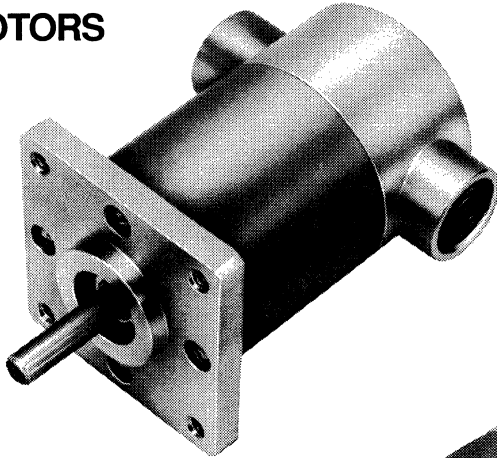
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SERVO DRIVES



### Immediate Solutions by Phone and FAX

At Motor Technology we solve most applications over the phone lines.

Your call to us goes straight to a competent motor application engineer, never to a clerk, correspondent or some other non-technical person. You discuss your project with a highly qualified engineer who is experienced with motors—motor application problem solving, motor design, and motor related hardware.

For a lot of projects, you won't always know the exact torque or speed you need. Or, maybe there's a voltage variation you're not sure how to cope with. The odds are 100:1 we've had experience with a similar application. So, basically, all you need to do is explain the conditions and what you want the motor to do. We help fill in the blanks, then come up with a design that's cost efficient for you.

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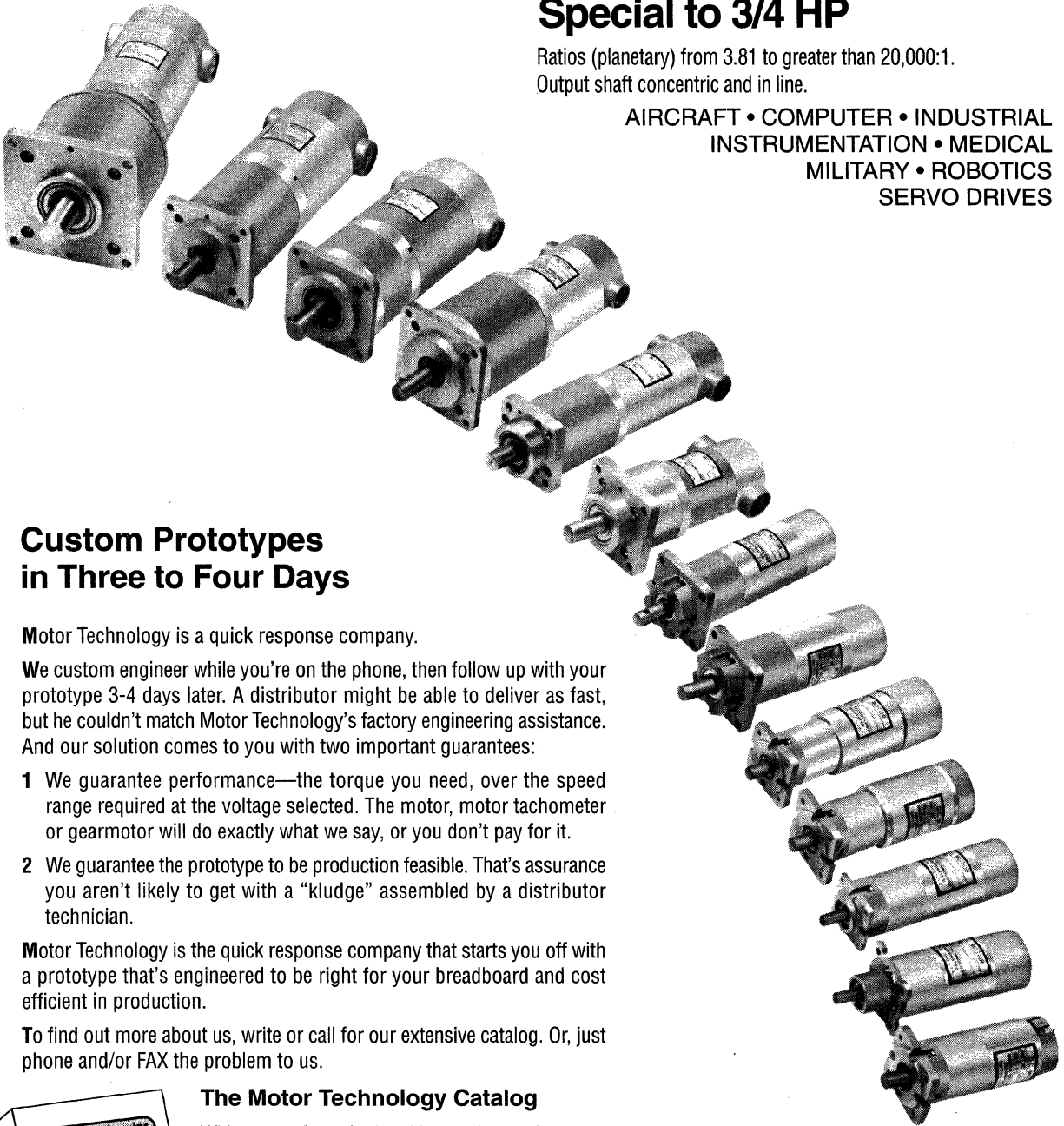
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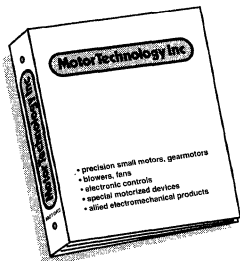
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To find out more about ELCOM II, order a sample from Pittman *Sample Express*<sup>™</sup>, or to order a customized motor, call Pittman at (215) 256-6601, fax us at (215) 256-1338, or e-mail us at [info@pittmanner.com](mailto:info@pittmanner.com).

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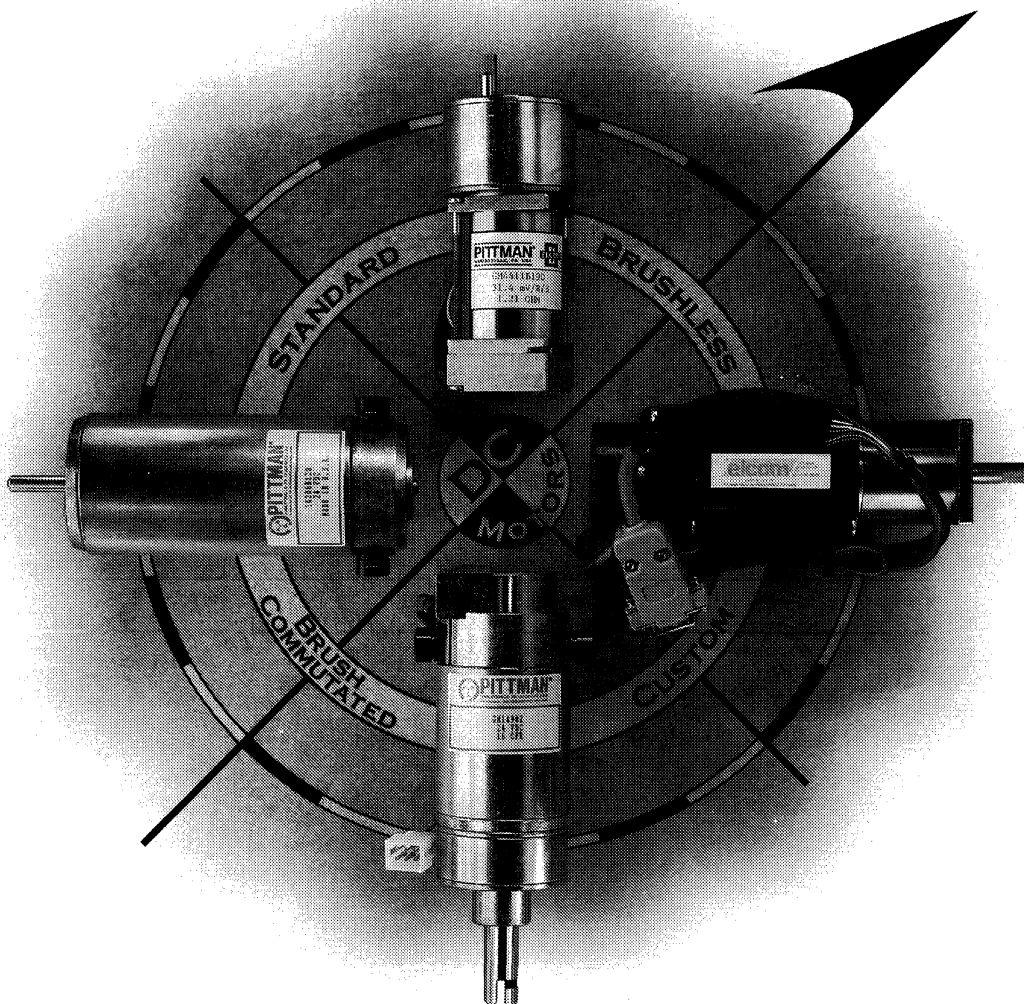
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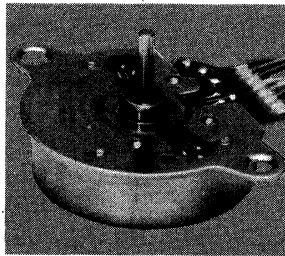
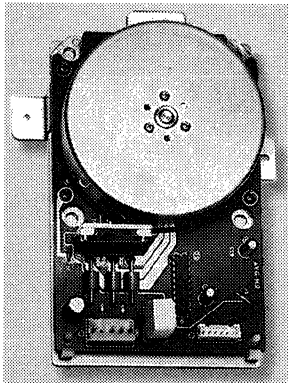
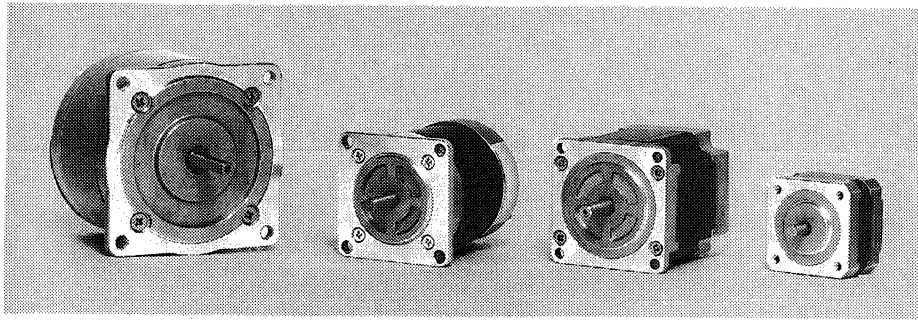
# SKC SHINANO KENSHI CORP.

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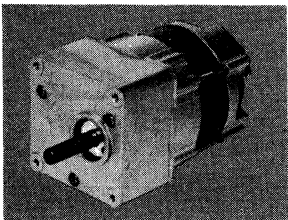
**Sizes:** 15 (35mm), 17 (39 & 42mm), 23 (56mm), 24 (60mm), 34 (83mm).  
**Step Angles:** 0.9°, 1.8°, 3.6° & 3.75°. Hybrid, unipolar and bipolar windings, four (4) phase and five (5) phase models. Some models specifically designed for enhanced microstepping performance. Value engineered 3.75° Size 17 hybrid competitive with P.M. type motors. **Applications:** Tape streamers, printers, medical equipment, office automation equipment.  
\*Size 17 (39mm) only.

### STEPPING MOTORS



### BRUSHLESS DC MOTORS

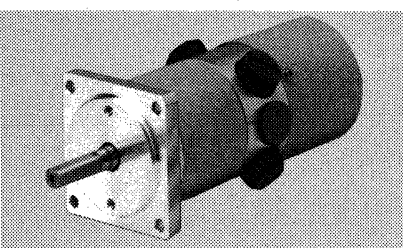
Rare earth magnets, bipolar windings, efficient radial gap, precision ball bearings outer and inner rotor designs from 3 to 300 watts output. With and without integral drivers, some models compatible with gear boxes. **In Stock at SKC!**  
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DC motors, frame sizes of 50 & 70 mm, various voltage ratings, torque ratings up to 40 KG-CM at 82 RPM.



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**Applications:** Robotics, NC machines, office automation, computer peripherals.

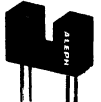





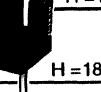



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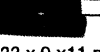
## OPTO SENSORS

### INTERRUPTER TYPE



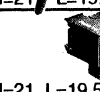



Technical information is subject to revision without notice. For critical applications, please call to verify specifications.

FEATURES	SENSING SLOT WIDTH	OUTPUT TYPE	PART NUMBER	FEATURES	SENSING SLOT WIDTH	OUTPUT TYPE	PART NUMBER
 <ul style="list-style-type: none"> <li>• PCB mount</li> <li>• Miniature</li> <li>• High sensitivity</li> </ul> H = 10 L = 15 W = 6	5.0mm	Tr	OJ-1202	 <ul style="list-style-type: none"> <li>• Screw Mount</li> <li>• Open collector, Photo IC output</li> </ul> H = 21 L = 41 W = 11	5.0mm	IC-OC	OJ-3705
		DTr	OJ-1206			IC-OC (reversed output)	OJ-3703
		IC	OJ-1201				
		IC-OC	OJ-1205				
 <ul style="list-style-type: none"> <li>• PCB mount</li> <li>• Wide sensing slot</li> <li>• Low input-high output</li> </ul> H = 17 L = 34 W = 6	13.2mm	DTr	OJ-2306	 <ul style="list-style-type: none"> <li>• Screw mount</li> <li>• Logic output</li> <li>• Wire leads</li> </ul> H = 10.8 L = 24.6 W =	3.2mm	IC	OJ-3001
						IC-OC	OJ-3005
 <ul style="list-style-type: none"> <li>• Screw mount</li> <li>• Dust proof</li> <li>• Wire Leads</li> </ul> H = 15.5 L = 23.3 W = 6.2	5.1mm	Tr	OJ-3202	 <ul style="list-style-type: none"> <li>• Snap action mount</li> <li>• Wide sensing slot</li> </ul> H = 30 L = 30 W = 10	10.0mm	Tr	OJ-5402
		DTr	OJ-3206			DTr	OJ-5406
		Tr	OJ-3102				
		DTr	OJ-3106				
 <ul style="list-style-type: none"> <li>• Screw mount</li> <li>• Wire Leads</li> </ul> H = 18.5 L = 15.2 W = 20.5	5.2mm	Tr	OJ-3302	 <ul style="list-style-type: none"> <li>• Snap action mount</li> <li>• High sensitivity</li> </ul> H = 18 L = 18.5 W = 12.6	5.0mm	IC	OJ-5101
		DTr	OJ-3306			IC-OC	OJ-5105
 <ul style="list-style-type: none"> <li>• Screw mount</li> <li>• High Sensitivity</li> <li>• Industry Standard Package</li> </ul> H = 10 L = 25 W = 6	3.0mm	Tr	OJ-1402	 <ul style="list-style-type: none"> <li>• Screw mount</li> <li>• 5 sensors in one package</li> </ul> H = 18 L = 53 W = 25.5	8.0mm	IC-OC	OJ-4005
		DTr	OJ-1406				
		IC	OJ-1401				
		IC-OC	OJ-1405				

### REFLECTIVE TYPE

FEATURES	SENSING DISTANCE	OUTPUT TYPE	PART NUMBER	FEATURES	SENSING DISTANCE	OUTPUT TYPE	PART NUMBER
 <ul style="list-style-type: none"> <li>• PCB mount</li> <li>• Dust proof</li> </ul> H = 8 L = 13 W = 5.4	5.0mm	Tr	OM-2414	 <ul style="list-style-type: none"> <li>• Snap action mount</li> <li>• Dust proof</li> <li>• Zero distance sensing</li> </ul> H = 9 L = 12 W = 11	0-2.0mm	Tr	OM-5013
 <ul style="list-style-type: none"> <li>• PCB mount</li> <li>• High sensitivity</li> <li>• Dust proof</li> </ul> H = 7.1 L = 8 W = 5.4	3.0mm	Tr	OM-2514		 <ul style="list-style-type: none"> <li>• Snap action mount</li> <li>• Narrow package</li> <li>• Dust proof</li> </ul> H = 5.9 L = 22.4 W = 11.2	1.0-4.0mm	Tr
 <ul style="list-style-type: none"> <li>• PCB mount</li> <li>• Side sensing</li> </ul> H = 5.7 L = 14.4 W = 5.3	2.0mm	Tr	OM-2607	 <ul style="list-style-type: none"> <li>• Screw Mount</li> <li>• Logic Output</li> <li>• High sensing precision</li> </ul> H = 11 L = 43 W = 10		3.0-7.0mm	IC
 <ul style="list-style-type: none"> <li>• Screw mount</li> <li>• Modulated/</li> <li>• Long range</li> </ul> 33 x 9 x 11 mm	10 - 41 mm	IC-OC	OH-1021-X				

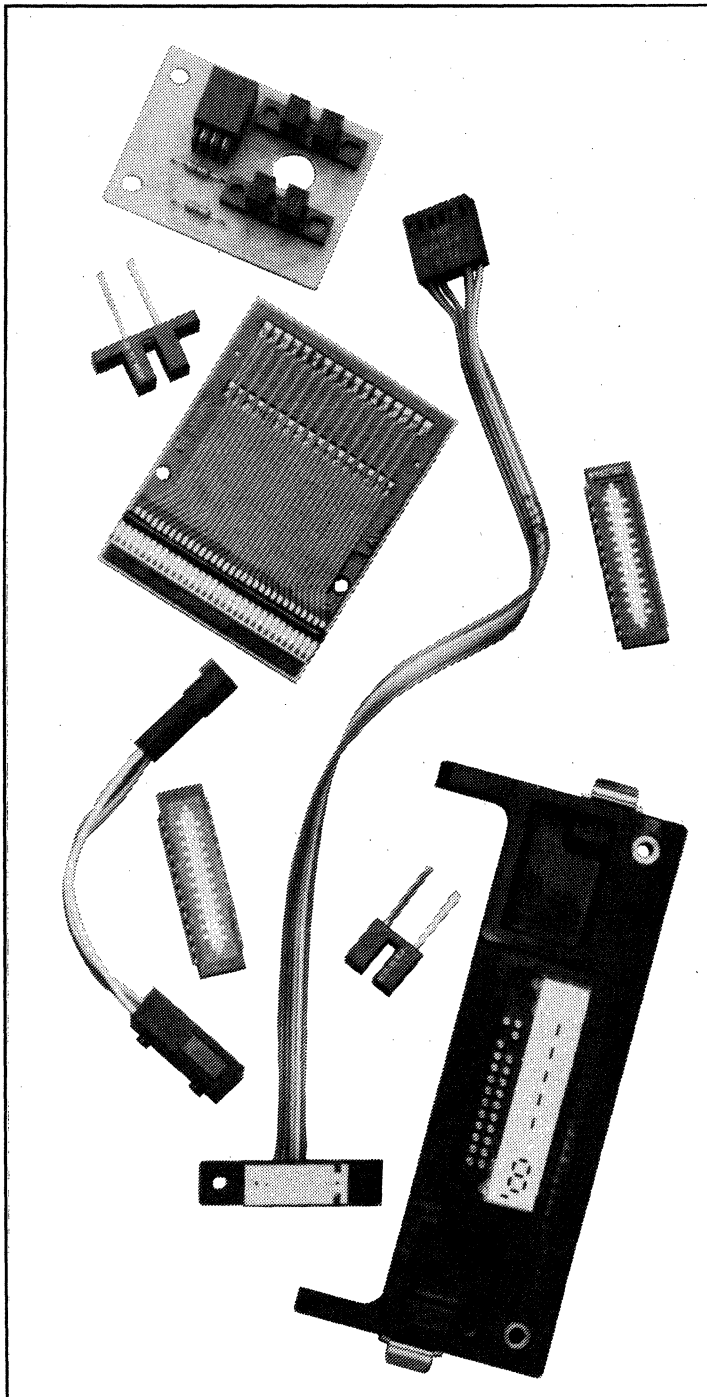
### ACTUATOR TYPE

FEATURES	OPERATING FORCE	OUTPUT TYPE	PART NUMBER	FEATURES	OPERATING FORCE	OUTPUT TYPE	PART NUMBER		
 <ul style="list-style-type: none"> <li>• Selectable actuator style</li> <li>• 5 different termination styles</li> <li>• Snap action mount</li> </ul> H = 21 L = 19.5 W = 11.5	1±0.5g	Tr	OS-5302	 <ul style="list-style-type: none"> <li>• Snap action mount</li> <li>• Top side actuator</li> <li>• Low actuating force</li> <li>• Counterweight</li> </ul> H = 22.5 L = 19.5 W = 23.3	0.4g MAX	Tr	OS-5002		
		IC	OS-5301			Tr-R	OS-5002-2		
		Tr-R	OS-5302-2			IC	OS-5001		
		 <ul style="list-style-type: none"> <li>• Spring loaded</li> </ul> H = 21 L = 19.5 W = 11.5	1g MAX	Tr	OS-5202	 <ul style="list-style-type: none"> <li>• PCB mount only</li> <li>• Ultra miniature</li> <li>• Spring loaded</li> </ul> H = 19.5 L = 11 W = 14	1g MAX	Tr	OS-1009
				IC	OS-5201				
 <ul style="list-style-type: none"> <li>• Snap action mount</li> <li>• Space saver</li> <li>• Spring loaded</li> </ul> H = 8 L = 21 W = 16	1g MAX	Tr	OS-5602	 <ul style="list-style-type: none"> <li>• PCB mount only</li> <li>• Ultra miniature</li> <li>• Low actuating force</li> <li>• Counterweight</li> </ul> H = 23 L = 12 W = 8	0.4g MAX	Tr	OS-1102		
						IC	OS-1101		



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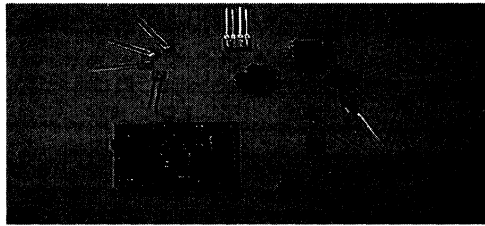
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### ELEKON INDUSTRIES PRODUCTS

#### PHOTO DIODE

Model	Description	Package
EPA 4408	8 Element Array	
4416	16 Element Array	
4432	32 Element Array	
EPB 4410	Position Sensing Bicell	
EPC 4428	Position Sensing Die	Wafer
EPD 4412	.16mm2 SMD Photodiode	Surface Mount
4415	.32mm2 SMD Photodiode	Surface Mount
4416	.65mm2 SMD Photodiode	Surface Mount
EPL 4420	Position Sensing Lateral	
EPM 2001	Detector Assembly	Ceramic
4001	Detector Assembly	Lead Frame
EPS 4430	Sidelooker Detector	
4431	Sidelooker Detector	
4432	Sidelooker Detector	
4440	Sidelooker Photodiode	Sidelooker
4450	Sidelooker Photodiode	Sidelooker

#### IRDA

Model	Description	Package
SIR 115.2	Receiver	8 Pin Dip
IRD 3000	3mm IR LED	3mm
5000	5mm IR LED	5mm
EPS 4430	Sidelooker Detector	
4431	Sidelooker Detector	
4432	Sidelooker Detector	
4440	Sidelooker Photodiode	Sidelooker
4450	Sidelooker Photodiode	Sidelooker

#### PHOTO IC

Model	Description	Package
EIC 3200	Photo IC	Sidelooker
3201	Photo IC	Sidelooker

#### PHOTO INTERRUPTERS

Model	Description	Package
EIN 3230	3.0mm Gap Horizontal Tabs	
3231	3.1mm Gap Elongated Tabs	
3232	3.1mm Gap No Tabs	
3233	3.2mm Gap Vertical Tab	
3234	5mm Gap No Tab	Black Plastic Housing
3235	5mm Gap No Tab	Black Plastic Housing
3236	5mm Gap No Tab	Black Plastic Housing
3237	5mm Gap No Tab w/connector	Black Plastic Housing
3240	2mm Gap PCB Mounting	
3250	4mm Gap PCB Mounting	
3251	2mm Gap No Tab Miniature	Black Plastic Housing
3252	0.9mm Gap No Tab Miniature	Black Plastic Housing
3253	0.5mm Gap with 3 terminals	Black Plastic Housing

#### MEDICAL APPLICATION

Model	Description	Package
EPM 2001	Detector Assembly Photo Diode	Ceramic
4001	Detector Assembly Photo Diode	Lead Frame
ELM 3001	Emitter Assembly	Ceramic
3002	Emitter Assembly	Ceramic
3003	Emitter Assembly	Ceramic
3004	Emitter Assembly	Ceramic
4001	Emitter Assembly	Lead Frame
4002	Emitter Assembly	Lead Frame
5001	Emitter Assembly	4 Pin Plastic
5002	Emitter Assembly	4 Pin Plastic



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 Internet: www.elekon.com  
 E-Mail: Sales@elekon.com

#### EMITTERS (LED)

Model	Description	Package
EEA 3015R	105mm LED Array Red	
3015H	105mm LED Array Red	
3015G	105mm LED Array Green	
3015L	105mm LED Array Red	
3015Y	105mm Dual Color LED Array	
3025G	205mm LED Array Green	
EIR 3020	IR LED Ceramic Epoxy Resin	
3023	IR LED 3mm	
3027Y	IR LED Sidelooker 940nm	
3025F	IR LED 5mm	
3028	IR LED TO-18	
3025A	IR LED 5mm	
3025L	IR LED 5mm	
ELC 31600	600nm LED Chip Yellow	Wafer
31660	660nm LED Chip Red	Wafer
31730	730nm LED Chip IR	Wafer
31770	770nm LED Chip IR	Wafer
31910	910nm LED Chip IR	Wafer
31940	940nm LED Chip IR	Wafer
ELD 8600	Red Single Digit LED Display	10 Pin
8800	Green Single Digit LED Display	10 Pin
ELL 513S	LED Lamp (5mm)	5mm
519EGW	LED Lamp (5mm)	5mm
2010S	LED Lamp (3mm)	3mm
5010S	LED Lamp (5mm)	5mm
ELM 3001	Emitter Assembly	Ceramic
3002	Emitter Assembly	Ceramic
3003	Emitter Assembly	Ceramic
3004	Emitter Assembly	Ceramic
4001	Emitter Assembly	Lead Frame
4002	Emitter Assembly	Lead Frame
5001	Emitter Assembly	4 Pin Plastic
5002	Emitter Assembly	4 Pin Plastic
ELS 3020	IR LED Sidelooker	Sidelooker
3030	IR LED Sidelooker	Sidelooker
3040	IR LED Sidelooker	Sidelooker
3050	IR LED Sidelooker 880nm	Sidelooker
ESM 565GC	Green SMD LED	Surface Mount
585YC	Yellow SMD LED	Surface Mount
635EC	Red SMD LED	Surface Mount
660S	Red SMD LED	Surface Mount
700HC	Bright Red SMD LED	Surface Mount
IR880A	IR SMD LED	
IR880B	IR SMD LED	
IR950A	IR SMD LED	
IR950B	IR SMD LED	

#### PHOTO TRANSISTORS

Model	Description	Package
EPH 3230	Photo Transistor	Sidelooker
3233	Photo Transistor	TO-18
3240	Photo Transistor	Sidelooker
3250	Photo Transistor	
3251	Photo Transistor	
3252	Photo Transistor	
3253	Photo Transistor	
3254	Photo Transistor	
3255	Photo Transistor	
3256	Photo Transistor	
3257	Photo Transistor	
3258	Photo Transistor	
3259PDT	Photo Transistor	
3259PT	Photo Transistor	
3259ST	Photo Transistor	

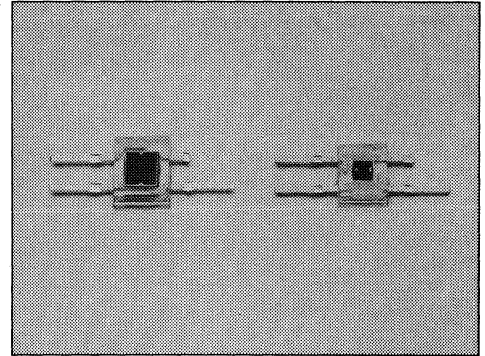
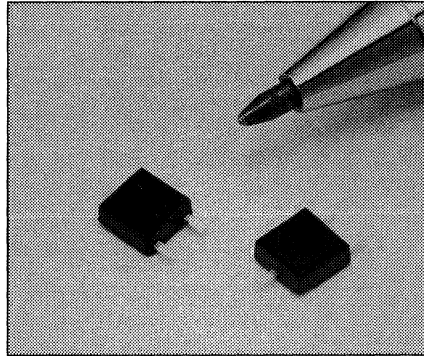
#### REFLECTIVE SENSOR

Model	Description	Package
ERT 3270	Miniature Reflective Sensor	
3280	Miniature Reflective Sensor Flat	
3281	Miniature Reflective Sensor PCB Mount	

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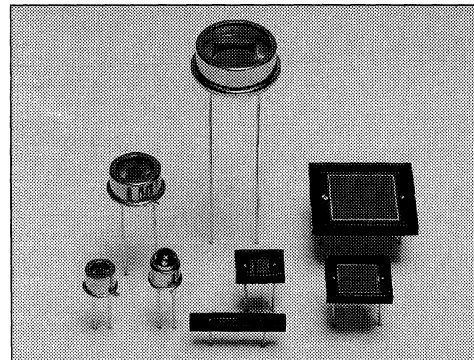
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Part Number	Spectral Range	Rise Time	Active Area	Package	Notes
S5493	320-840 nm	10 $\mu$ s	2.4 x 2.8 mm	4.5 x 5.5 mm	Silicon
S2833	320-730 nm	2.5 $\mu$ s	2.4 x 2.8 mm	4.5 x 5.5 mm	Silicon w/ filter
S5627	320-840 nm	2 $\mu$ s	1.3 x 1.3 mm	4 x 4.8 mm	Silicon
S4011	320-730 nm	0.5 $\mu$ s	1.3 x 1.3 mm	4 x 4.8 mm	Silicon w/ filter
G1115	300-680 nm	1 $\mu$ s	1.3 x 1.3 mm	TO-18	Ga-As-P
G1735	400-760 nm	0.5 $\mu$ s	1.3 x 1.3 mm	TO-18	Ga-As-P
G1126-02	190-680 nm	3.5 $\mu$ s	2.3 x 2.3 mm	TO-5	Ga-As-P
G1746	190-760 nm	3 $\mu$ s	2.3 x 2.3 mm	TO-5	Ga-As-P
G1961	190-550 nm	5 $\mu$ s	1.1 x 1.1 mm	TO-18	Ga-P
G5842	260-400 nm	1 $\mu$ s	0.8 x 0.8 mm	4 x 4 mm	Ga-As-P

**SILICON  
 PHOTODIODES  
 (for Precision Photometry)**



Part Number	Spectral Range	Rise Time	Active Area	Package	Notes
S1336-18BQ	190-1100 nm	0.1 $\mu$ s	1.1 x 1.1 mm	TO-18	
S1336-18BK	320-1100 nm	0.1 $\mu$ s	1.1 x 1.1 mm	TO-18	
S1337-33BQ	190-1100 nm	0.2 $\mu$ s	2.4 x 2.4 mm	6 x 7.6 mm	
S1337-33BR	320-1100 nm	0.2 $\mu$ s	2.4 x 2.4 mm	6 x 7.6 mm	
S1336-44BQ	190-1100 nm	0.5 $\mu$ s	3.6 x 3.6 mm	TO-5	
S1336-44BK	320-1100 nm	0.5 $\mu$ s	3.6 x 3.6 mm	TO-5	
S1337-1010BQ	190-1100 nm	3 $\mu$ s	10 x 10 mm	15 x 16.5 mm	
S1337-1010BR	320-1100 nm	3 $\mu$ s	10 x 10 mm	15 x 16.5 mm	
S5227-1010BQ	190-1100 nm	1 $\mu$ s	10 x 10 mm	15 x 16.5 mm	UV Hardened

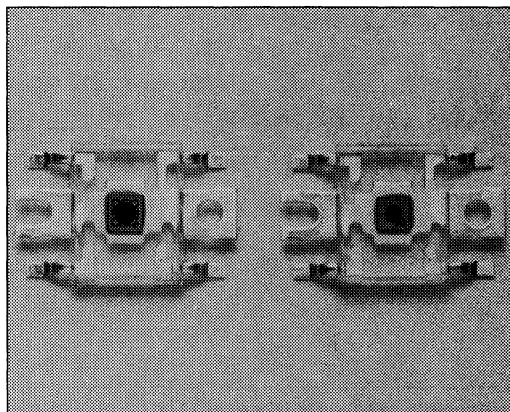
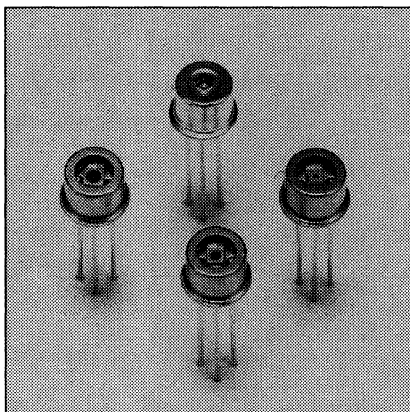
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# HAMAMATSU 1-800-430-0404

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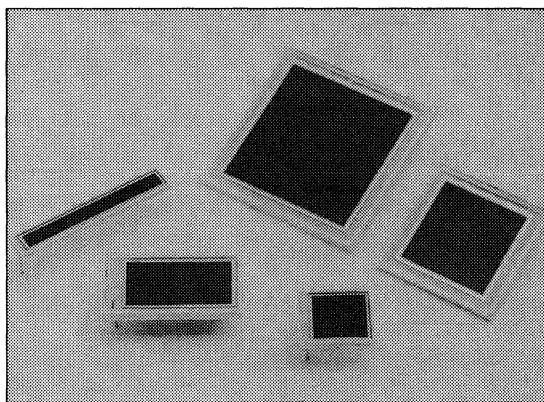
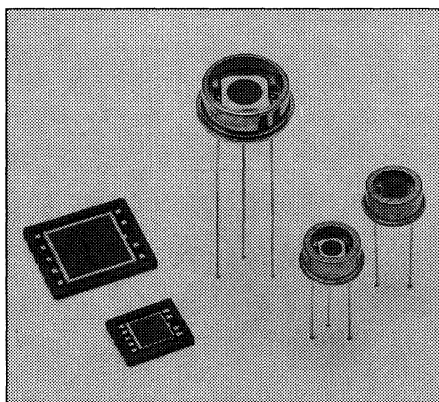
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## SILICON P-I-N PHOTODIODES (High Speed)



Part Number	Spectral Range	Cut-off Frequency	Active Area	Package	Notes
S5973	320-1000 nm	1.5 GHz	0.4 mm dia.	3-pin TO-18	
S5973-01	320-1000 nm	1.5 GHz	0.4 mm dia.	3-pin TO-18	with lens
S6432	320-1000 nm	600 MHz	0.6 mm dia.	4.8 x 4 mm	surface mount
S6431	320-1000 nm	500 MHz	0.8 mm dia.	4.8 x 4 mm	surface mount
S5972	320-1000 nm	500 MHz	0.8 mm dia.	3-pin TO-18	
S5971	320-1060 nm	100 MHz	1.2 mm dia.	3-pin TO-18	
S2506-02	320-1100 nm	25 MHz	2.77 x 2.77 mm	7.8 x 7 mm	
S2506-04	800-1100 nm	25 MHz	2.77 x 2.77 mm	7.8 x 7 mm	

## SILICON P-I-N PHOTODIODES (Large Area)



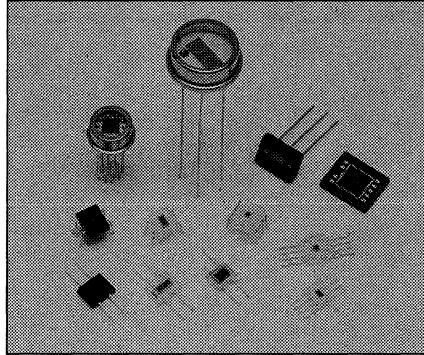
Part Number	Spectral Range	Cut-off Frequency	Active Area	Package	Notes
S3584-08	320-1100 nm	10 MHz	28 x 28 mm	35.6 x 35.6 mm	
S3204-08	320-1100 nm	20 MHz	18 x 18 mm	25.5 x 25.5 mm	
S2744-08	320-1100 nm	25 MHz	10 x 20 mm	14.2 x 27 mm	
S3590-08	320-1100 nm	40 MHz	10 x 10 mm	14.5 x 12.7 mm	
S3588-08	320-1100 nm	40 MHz	3 x 30 mm	34 x 5.8 mm	
S5107	320-1100 nm	10 MHz	10 x 10 mm	16.5 x 14.5 mm	Surface Mount
S5106	320-1100 nm	20 MHz	5 x 5 mm	10.6 x 8.8 mm	Surface Mount

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## MULTI-ELEMENT PHOTODIODES (for Position Sensing)

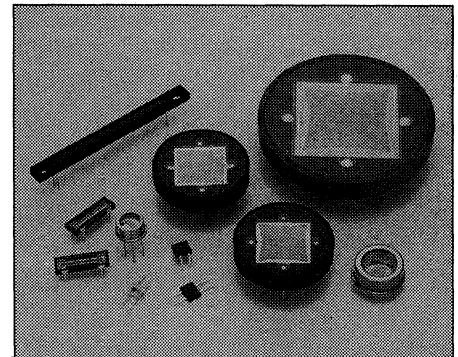
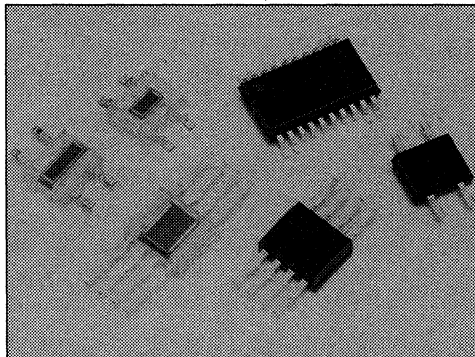


Part Number	Spectral Range	Cut-off Frequency	Active Area	Package	Notes
S5981	320-1100 nm	20 MHz	10 x 10 mm	14.5 x 16.5 mm	2 x 2 Array, Surface Mount
S5980	320-1100 nm	30 MHz	5 x 5 mm	8.8 x 10.6 mm	2 x 2 Array, Surface Mount
S4349	190-1000 nm	20 MHz	3 x 3 mm	TO-5	2 x 2 Array
S6058	320-1000 nm	150 MHz	0.6 x 1.2 mm	4.0 x 4.8 mm	2 x 2 Array
S6242	320-1060 nm	40 MHz	1.5 x 2.0 mm	4.0 x 4.8 mm	2 x 2 Array
S6241	320-1060 nm	40 MHz	0.6 x 1.2 mm	4.0 x 4.8 mm	1 x 2 Array

## PHOTODIODE ARRAYS

Part Number	Spectral Range	Rise Time	Active Area	Package	Notes
S5668-01	320-1100 nm	0.7 $\mu$ s	2.0 x 25 mm	20 x 25.4 mm	1 x 16 Array
S4111-35Q	190-1100 nm	1.2 $\mu$ s	4.4 x 34.9 mm	15.5 x 50.8 mm	1 x 35 Array, D.I.P.
S4111-46Q	190-1100 nm	1.2 $\mu$ s	4.4 x 45.9 mm	15.5 x 65.0 mm	1 x 46 Array, D.I.P.

## LATERAL-EFFECT PHOTODIODES (for Position Sensing)



Part Number	Spectral Range	Rise Time	Active Area	Package	Notes
S5991	320-1100 nm	2.0 $\mu$ s	10 x 10 mm	16.5 x 14.5 mm	2-Dimensional, Surface Mount
S5990	320-1100 nm	1.0 $\mu$ s	5 x 5 mm	10.6 x 8.8mm	2-Dimensional, Surface Mount
S1743	320-1100 nm	0.3 $\mu$ s	4.1 x 4.1 mm	TO-8	2-Dimensional
S4744	760-1100 nm	25 $\mu$ s	2 x 3 mm	5.5 x 4.5 mm	2-Dimensional
S5730	320-1100 nm	20 $\mu$ s	0.7 x 24 mm	4 x 36.7 mm	1-Dimensional, Surface Mount
S3932	320-1100 nm	3 $\mu$ s	1 x 12 mm	4.8 x 15.2 mm	1-Dimensional
S6560	760-1100 nm	0.014 $\mu$ s	1.2 x 3 mm	6.0 x 6.4 mm	Angle Sensor

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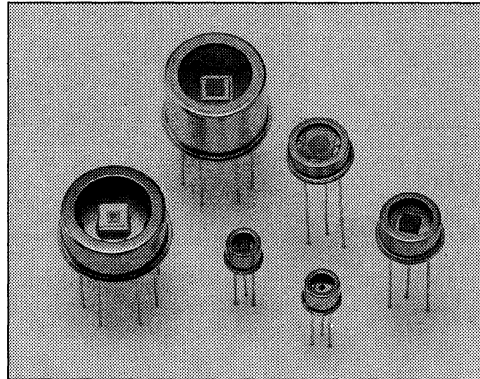


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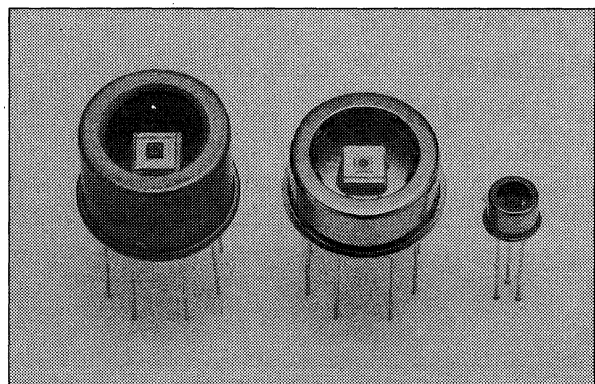
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## In-Ga-As P-I-N PHOTODIODES



Part Number	Spectral Range	Cut-off Frequency	Active Area	Package	Notes
G3476-01	0.9-1.7 $\mu\text{m}$	2 GHz	0.08 mm dia.	3-pin TO-18	
G3476-03	0.9-1.7 $\mu\text{m}$	400 MHz	0.3 mm dia.	3-pin TO-18	
G3476-05	0.9-1.7 $\mu\text{m}$	200 MHz	0.5 mm dia.	3-pin TO-18	
G5832-01	0.9-1.7 $\mu\text{m}$	35 MHz	1.0 mm dia.	3-pin TO-18	
G5832-11	0.9-1.67 $\mu\text{m}$	18 MHz	1.0 mm dia.	6-pin TO-8	w/ 1-stage TE cooler
G5832-21	0.9-1.65 $\mu\text{m}$	18 MHz	1.0 mm dia.	6-pin TO-8	w/ 2-stage TE cooler
G5832-05	0.9-1.7 $\mu\text{m}$	600 kHz	5.0 mm dia.	3-pin TO-8	
G5832-15	0.9-1.67 $\mu\text{m}$	600 kHz	5.0 mm dia.	6-pin TO-8	w/ 1-stage TE cooler
G5832-25	0.9-1.65 $\mu\text{m}$	600 kHz	5.0 mm dia.	6-pin TO-8	w/ 2-stage TE cooler

## In-Ga-As P-I-N PHOTODIODES (Long Wavelength Enhanced)



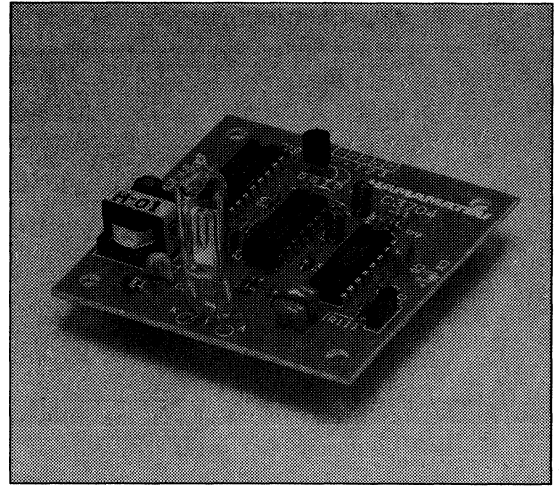
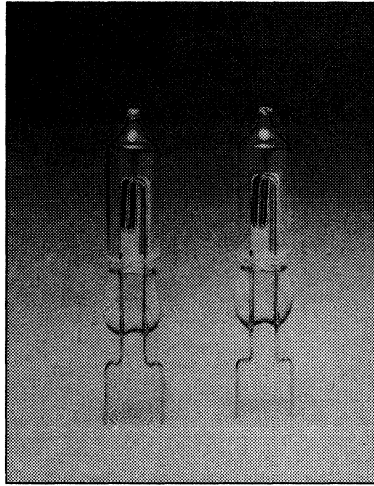
Part Number	Spectral Range	Cut-off Frequency	Active Area	Package	Notes
G5853-01	1.2-2.6 $\mu\text{m}$	15 MHz	1.0 mm dia.	3-pin TO-18	
G5853-11	1.2-2.57 $\mu\text{m}$	15 MHz	1.0 mm dia.	6-pin TO-8	w/ 1-stage TE cooler
G5853-21	1.2-2.55 $\mu\text{m}$	15 MHz	1.0 mm dia.	6-pin TO-8	w/ 2-stage TE cooler
G5852-01	0.9-2.1 $\mu\text{m}$	40 MHz	1.0 mm dia.	3-pin TO-18	
G5852-11	0.9-2.07 $\mu\text{m}$	40 MHz	1.0 mm dia.	6-pin TO-8	w/ 1-stage TE cooler
G5852-21	0.9-2.05 $\mu\text{m}$	40 MHz	1.0 mm dia.	6-pin TO-8	w/ 2-stage TE cooler
G5851-01	0.9-1.9 $\mu\text{m}$	40 MHz	1.0 mm dia.	3-pin TO-18	
G5851-11	0.9-1.87 $\mu\text{m}$	40 MHz	1.0 mm dia.	6-pin TO-8	w/ 1-stage TE cooler
G5851-21	0.9-1.85 $\mu\text{m}$	40 MHz	1.0 mm dia.	6-pin TO-8	w/ 2-stage TE cooler

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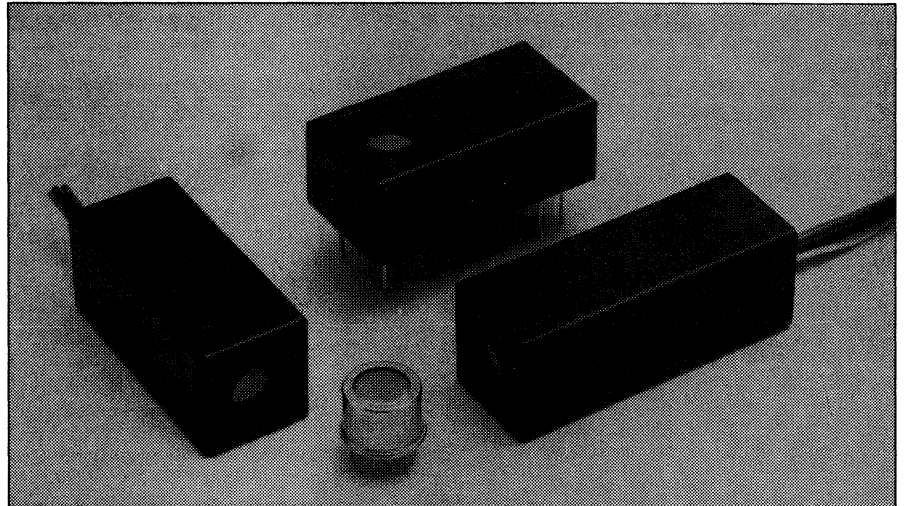
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## UV-TRON (for Fire Detection and Flame Monitoring)



Part Number	Spectral Range	Active Area	Package	Notes
R2868	185-260 nm	5 x 12 mm	12 mm dia.	Driver #C3704 Available

## PHOTOSENSOR MODULES (for Low Light Levels)



Part Number	Spectral Range	Rise Time	Active Area	Package	Notes
H6780	300-650 nm	0.65 ns	8 mm dia.	22 x 22 x 50 mm	Operable from 12 v DC Supply
H6780-01	300-820 nm	0.65 ns	8 mm dia.	22 x 22 x 50 mm	Operable from 12 v DC Supply
H6780-03	185-650 nm	0.65 ns	8 mm dia.	22 x 22 x 50 mm	Operable from 12 v DC Supply
H6780-04	185-820 nm	0.65 ns	8 mm dia.	22 x 22 x 50 mm	Operable from 12 v DC Supply

PC Board type H6779 series is available

## MULTI-ELEMENT PHOTOMULTIPLIER TUBE

Part Number	Spectral Range	Rise Time	Pixel Size	Package	Notes
H6568	300-650 nm	0.83 ns	4 mm x 4 mm	30 x 30 x 45 mm	4 x 4 Array

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# Honeywell

## MICRO SWITCH Solid State and Optoelectronic Sensor Capabilities

Honeywell's MICRO SWITCH division provides a full line of electronic and electromechanical sensing and control solutions. Electronic sensing capabilities include: infrared, Hall effect, pressure, temperature, air flow, and fiber optic local area network (LAN) components. Our worldwide field specialists can recommend the best sensing solution for all your application needs.

LAN products are in section 2475, Fiber Optic Equipment & Accessories. Hall effect, pressure, temperature, and air-flow sensors are in the Switches section 5100.

All of the Honeywell infrared products are manufactured in ISO 9000 certified facilities. Certification provides a solid foundation for our total quality effort, and demonstrates our commitment to providing customers with excellence. Among the ISO 9000 certified facilities involved in the manufacture of these products are:

- Aldermaston, UK - value-added center
- Juarez, Mexico - component/product assembly
- Freeport, Illinois, USA - plastic molding operations
- Richardson, Texas, USA - Class 10 sensor/IC fabrication

These facilities manufacture products in conjunction with our marketing centers in Brussels, Singapore, and Richardson, our applications laboratory in Munich, and our local sales offices throughout the world.

## Optoelectronic Infrared Sensors

Optoelectronics, the integration of optical principles and semiconductor electronics, has become the technology of choice for many sensing applications. In electronic systems where feedback and control systems are common, infrared sensors function as reliable cost-effective solutions.

Products include:

- IREDS
- Sensors
- Transmissive switches
- Reflective Switches

General application areas include:

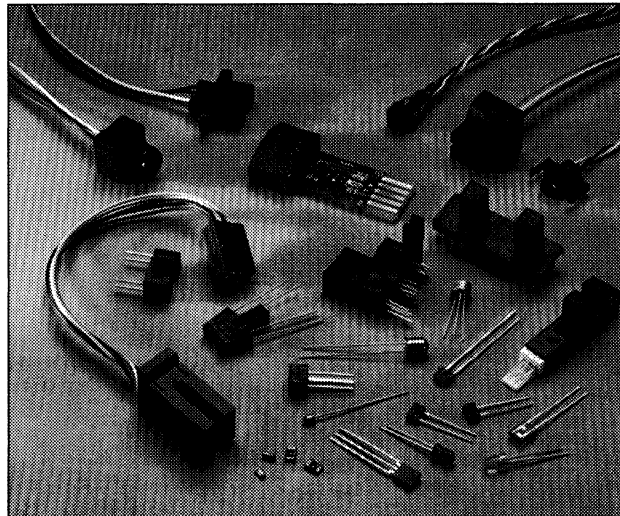
- Object presence sensing
- Motion sensing
- Position encoding
- Limit sensing
- Movement counting

Specific applications include:

- Printers and copiers
- Data storage systems
- Motion control systems
- Drop sensors and other non-invasive medical equipment applications
- Scanning
- Automated Transaction Systems
- Metering Systems

We offer a broad selection of cost-effective, off-the-shelf solutions for many applications. In addition to the products described here, Honeywell provides a broad array of custom solutions ranging from special electrical selections, special markings, wiring and connectors, to completely unique housings or integrated circuits.

Honeywell has an experienced staff of application engineers who are available to provide assistance at all stages of product development. Contact one of Honeywell's field sales engineers for further information.



### MICRO SWITCH

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 In Canada: (604) 946-1271, Fax: (604) 946-0368  
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## Precise Solutions for Sensing Applications

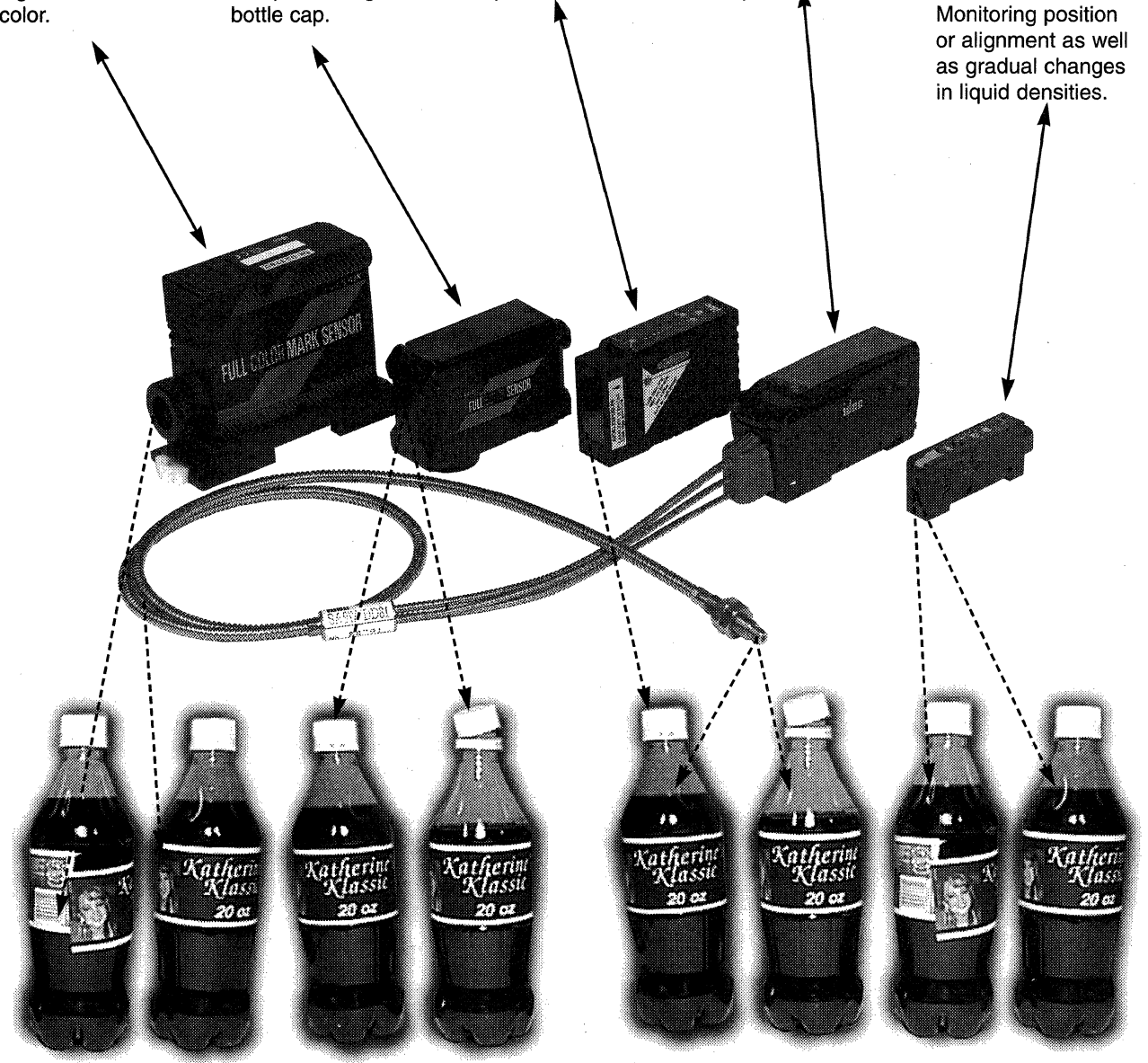
**SA1K Full Color recognition sensor.**  
*Applications include:* Checking labels for the correct positioning, content, and color.

**SA1J Full Color recognition sensor.**  
*Applications include:* Checking for the presence of a logo and positioning of bottle cap.

**SA1M Analog Laser color mark sensors.**  
*Applications include:* Checking for information or logo on the cap.

**SA1W Water detection sensors.**  
*Applications include:* Checking for the proper level and presence of liquid.

**SA1C-FK3 High speed miniature photoelectric sensors with fiber optics.**  
*Applications include:* Monitoring position or alignment as well as gradual changes in liquid densities.



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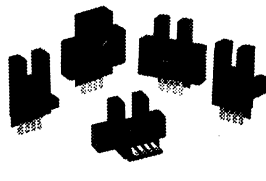
## Photomicrosensors

### Pulse-Modulated Amplified



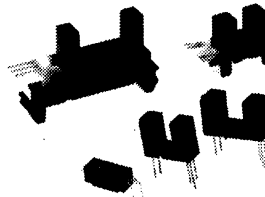
Clockwise from top left:  
EE-SPW321, EE-SPX303, EE-SPX301,  
EE-SPX305-W2A, EE-SPY311

### Non-Pulse Modulated Amplified



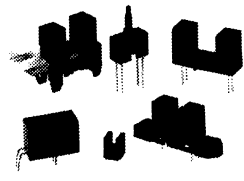
Clockwise from top left:  
EE-SX672, EE-SY671, EE-SX670,  
EE-SX673, EE-SX671

### Photo IC Non-Amplified



Clockwise from top left:  
EE-SX461-P11, EE-SX4235A-P2,  
EE-SX3070, EE-SX3081, EE-SY313

### Phototransistor Non-Amplified



Clockwise from top left:  
EE-SX1235A-P2, EE-SA105,  
EE-SX1070, EE-SX1088, EE-SX1109,  
EE-SY169A

### Pulse-Modulated Amplified

Part number	Slot width/ sensing distance	Output logic	Supply voltage	Max. load current output	Response frequency	Operating ambient temperature	Package dimensions H x W x L	Connecting method
Unit	mm (in)	—	VDC	mA	Hz	°C	mm	—

### Fiber optics

EE-SPZ301W-01	30 (1.181)	Dark-ON	5 ~ 24	80	100	-10 ~ +55	28.1 x 26 x 7.4	A
EE-SPZ401W-01	30 (1.181)	Light-ON	5 ~ 24	80	100	-10 ~ +55	28.1 x 26 x 7.4	A

### Separated, transmissive

EE-SPW311 <sup>2</sup>	1000 (39.370)	Dark-ON	5 ~ 24	100	100	-10 ~ +55	27 x 25.4 x 8.6	B
EE-SPW321 <sup>1</sup>	300 (11.811)	Dark-ON	12 ~ 24	100	—	-20 ~ +55	10.7 x 12 x 5.8	—
EE-SPW321-A <sup>1</sup>	300 (11.811)	Dark-ON	12 ~ 24	100	—	-20 ~ +55	10.7 x 14 x 5.8	—
EE-SPW411 <sup>2</sup>	1000 (39.370)	Light-ON	5 ~ 24	100	100	-10 ~ +55	27 x 25.4 x 8.6	B
EE-SPW421 <sup>1</sup>	300 (11.811)	Light-ON	12 ~ 24	100	—	-20 ~ +55	10.7 x 14 x 5.8	—
EE-SPW421-A <sup>1</sup>	300 (11.811)	Light-ON	12 ~ 24	100	—	-20 ~ +55	10.7 x 14 x 5.8	—

### Reflective

EE-SPY311	6 (.236)	Dark-ON	5 ~ 24	80	100	-10 ~ +55	22.8 x 26 x 7.6	C
EE-SPY312	5 (.197)	Dark-ON	5 ~ 24	80	100	-10 ~ +55	22.8 x 26 x 7.6	C
EE-SPY411	6 (.236)	Light-ON	5 ~ 24	80	100	-10 ~ +55	22.8 x 26 x 7.6	C
EE-SPY412	5 (.197)	Light-ON	5 ~ 24	80	100	-10 ~ +55	22.8 x 26 x 7.6	C
EE-SB5V-E	19 (.75)	Light-ON	5 ~ 15	80	50	-25 ~ +55	22.2 x 25.4 x 7.0	C
EE-SPZ301-A <sup>3</sup>	200 (7.874) <sup>4</sup>	Dark-ON	5 ~ 24	80	100	-10 ~ +55	29 x 26 x 7.4	D
EE-SPZ401-A <sup>3</sup>	200 (7.874) <sup>4</sup>	Light-ON	5 ~ 24	80	100	-10 ~ +55	29 x 26 x 7.4	D

### Slotted, transmissive

EE-SPX301	3.6 (.142)	Dark-ON	5 ~ 24	80	500	-10 ~ +55	24 x 26 x 7	D
EE-SPX302-W2A	3.6 (.142)	Dark-ON	5 ~ 24	80	500	-10 ~ +55	21.2 x 13 x 13	E
EE-SPX303	13 (.512)	Dark-ON	12 ~ 24	80	500	-10 ~ +55	26 x 26 x 7.4	C
EE-SPX305-W2A	5 (.197)	Dark-ON	5 ~ 24	80	500	-10 ~ +55	15.5 x 27.2 x 14.5	E
EE-SPX401	3.6 (.142)	Light-ON	5 ~ 24	80	500	-10 ~ +55	24 x 26 x 7	D
EE-SPX402-W2A	3.6 (.142)	Light-ON	5 ~ 24	80	500	-10 ~ +55	21.2 x 13 x 13	E
EE-SPX403	13 (.512)	Light-ON	12 ~ 24	80	500	-10 ~ +55	26 x 26 x 7.4	C
EE-SPX405-W2A	5 (.197)	Light-ON	5 ~ 24	80	500	-10 ~ +55	15.5 x 27.2 x 14.5	E
EE-SPX613	6-13 (.24 ~.51)	Light-ON/ Dark-ON	12 ~ 24	100	—	-10 ~ +55	17.2 x 26 x 16	E

Notes: 1. Sensing distance with aperture (Two pair are provided with sensor unit):

Size of aperture	Sensing distance	Sensing object
0.5 x 3 mm (.020 x .118 in)	10 cm (3.94 in)	Opaque: 0.5 mm (.020 in) dia. min.
1 x 3 mm (.039 x .118 in)	20 cm (7.87 in)	Opaque: 1 mm (.039 in) dia. min.

- Wire harness/connector included with EE-SPW311 and EE-SPW411.
- Retroreflective
- When used with a E39-R1 reflector.
- Except the terminal section.

Connecting Methods:

- A=EE-1002, EE-1003 (with/1-m cable attached)
- B=Dedicated connectors: EE-1001, EE-1006, EE-1006L and EE-1006D
- C=Applicable connectors: EE-1001, EE-1006
- D=Applicable connectors: EE-1002, EE-1003
- E=Cable length: 1-m long cable (attached)

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**Photomicrosensors**

**Non-Pulse Modulated Amplified**

Part number	Slot width/ sensing distance	Output logic	Supply voltage	Max. load current output	Response frequency	Operating ambient temperature	Package dimensions H x W x L	Connecting method
Unit	mm (in)	—	VDC	mA	Hz	°C	mm	—
<b>Reflective</b>								
EE-SY671	5 (.197) <sup>2</sup>	Light-ON/ Dark-ON <sup>3</sup>	5 ~ 24	100	500	-10 ~ +55	25.2 x 25.4 x 7	A/B
EE-SY672	5 (.197) <sup>2</sup>	Light-ON/ Dark-ON <sup>3</sup>	5 ~ 24	100	500	-10 ~ +55	25 x 25.4 x 7	A/B
<b>Slotted, Transmissive</b>								
EE-SX670/A <sup>1</sup>	5 (.197)	Light-ON/ Dark-ON <sup>3</sup>	5 ~ 24	100	3,000	-10 ~ +55	22.2 x 25.4 x 7	A/B
EE-SX671/A <sup>1</sup>	5 (.197)	Light-ON/ Dark-ON <sup>3</sup>	5 ~ 24	100	3,000	-10 ~ +55	15.5 x 26.2 x 18.3	A/B
EE-SX672/A <sup>1</sup>	5 (.197)	Light-ON/ Dark-ON <sup>3</sup>	5 ~ 24	100	3,000	-10 ~ +55	26 x 13.7 x 26	A/B
EE-SX673/A <sup>1</sup>	5 (.197)	Light-ON/ Dark-ON <sup>3</sup>	5 ~ 24	100	3,000	-10 ~ +55	26 x 13.4 x 12.8	A/B
EE-SX674/A <sup>1</sup>	5 (.197)	Light-ON/ Dark-ON <sup>3</sup>	5 ~ 24	100	3,000	-10 ~ +55	15.5 x 13.6 x 25.3	A/B

Notes: 1. Indicates two different models, EE-SX67□ and EE-SX67□A.  
2. White paper with reflection factor of 90%.  
3. The Light-ON/Dark-ON models can be used as Light-ON models when the L terminal and positive (+) terminal are connected. To use them as Dark-ON models, do not connect these terminals.

Connecting methods:  
A=EE-1001/1006 connectors  
B=Soldering terminals

**Photo IC Non-Amplified**

Electrical characteristics

Part number	Slot width/ sensing distance	Output logic	Absolute maximum ratings			V <sub>OL</sub> (max.)	V <sub>OH</sub> (min.)	Response frequency (min.)	P <sub>OUT</sub>	V <sub>F</sub> (max.) @ I <sub>F</sub> = 20 mA	I <sub>CC</sub> (max.)	Package dimensions H x W x L
			I <sub>F</sub>	V <sub>CC</sub>	T <sub>OPR</sub>							
Unit	mm (in.)	—	mA	VDC	°C	V	V	P.P.S.	mW	V	mA	mm
<b>Actuator adaptable</b>												
EE-SA407-P2 <sup>a</sup>	—	Light-ON	—	7	-20 ~ +75	0.35	V <sub>CC</sub> x 0.9	3,000	250	—	30	21.9 x 27 x 8
<b>Reflective (PCB mount)</b>												
EE-SY310	5 (.197)	Dark-ON	50	16	-40 ~ +65	0.4	15	50	250	1.5	—	4.8 x 18 x 4.6
EE-SY313	4.4 (.173)	Dark-ON	50	16	-40 ~ +65	0.4	15	50	250	1.5	—	6 x 18 x 6.2
EE-SY410	5 (.197)	Light-ON	50	16	-40 ~ +65	0.4	15	50	250	1.5	—	4.8 x 18 x 4.6
EE-SY413	4.4 (.173)	Light-ON	50	16	-40 ~ +65	0.4	15	50	250	1.5	—	6 x 18 x 6.2
<b>Transmissive (with connector)</b>												
EE-SX4009-P1 <sup>b,c</sup>	5 (.197)	Light-ON	—	10	-20 ~ +75	0.3	V <sub>CC</sub> x 0.9	3,000	250	—	30	18 x 44.5 x 11
EE-SX4009-P10 <sup>c</sup>	5 (.197)	Light-ON	—	10	-20 ~ +75	0.3	V <sub>CC</sub> x 0.9	3,000	250	—	30	18 x 45.8 x 11
EE-SX4235A-P2 <sup>a</sup>	5 (.197)	Light-ON	—	7	-20 ~ +75	0.35	V <sub>CC</sub> x 0.9	3,000	250	—	16.5	12.6 x 27 x 8
EE-SX460-P1 <sup>d</sup>	5 (.197)	Light-ON	—	10	-20 ~ +75	0.3	V <sub>CC</sub> x 0.9	3,000	250	—	30	18 x 30 x 11
EE-SX461-P11 <sup>b,c</sup>	15 (.591)	Light-ON	—	7	-20 ~ +75	0.3	V <sub>CC</sub> x 0.9	3,000	250	—	35	18 x 32.5 x 12
<b>Transmissive (PCB mount)</b>												
EE-SX3070	8 (.315)	Dark-ON	50	16	-40 ~ +75	0.4	15	3,000	250	1.5	10	10 x 17.7 x 6
EE-SX3081	5 (.197)	Dark-ON	50	16	-40 ~ +75	0.4	15	3,000	250	1.5	10	10 x 13.7 x 5
EE-SX3088	3.4 (.134)	Dark-ON	50	16	-40 ~ +75	0.4	15	3,000	250	1.5	10	10 x 25 x 6
EE-SX398	3 (.118)	Dark-ON	50	16	-40 ~ +75	0.4	15	3,000	250	1.5	10	10 x 12.2 x 5
EE-SX4070	8 (.315)	Light-ON	50	16	-40 ~ +75	0.4	15	3,000	250	1.5	10	10 x 17.7 x 6
EE-SX4081	5 (.197)	Light-ON	50	16	-40 ~ +75	0.4	15	3,000	250	1.5	10	10 x 13.7 x 5
EE-SX4088-W1 <sup>1</sup>	3.4 (.134)	Light-ON	50	16	-40 ~ +75	0.4	15	3,000	250	1.5	10	10 x 25 x 6
EE-SX493	2 (.079)	Light-ON	50	16	-40 ~ +60	0.4	15	3,000	250	1.5	10	9.7 x 11 x 8
EE-SX498	3 (.118)	Light-ON	50	16	-40 ~ +75	0.4	15	3,000	250	1.5	10	10 x 12.2 x 5

Notes: 1. Hysteresis denotes the difference in forward LED current value, expressed in percentage, calculated from the respective forward LED currents when the photo IC is turned ON from OFF and when the photo IC is turned OFF from ON.  
2. [ ] denotes response delay time for Light-ON type sensors.  
3. Wire harness with 1-m wire.

Applicable mating connectors:  
A=AMP 175778-3, 173977-3  
B=AMP 171822-3, 171880-3  
C=Molex 50-57-9403, 15-47-4033  
D=EE-1005 connector

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## Photomicrosensors

### Phototransistor Non-Amplified

Part number	Absolute maximum ratings				Electrical characteristics					Package dimensions H x W x L
	Slot width/ sensing distance	I <sub>F</sub>	P <sub>C</sub>	T <sub>OPR</sub>	V <sub>F</sub> (typ.)	I <sub>L</sub> (min.)	V <sub>CE (SAT.)</sub> (max.)	t <sub>r1</sub> (typ.)	t <sub>r1</sub> (typ.)	
Unit	mm (in.)	mA	mW	°C	V	mA	V	μS	μS	mm
<b>Transmissive (snap-in with connector)</b>										
EE-SX1235A-P2 <sup>1</sup>	5 (.197)	50	100	-25 ~ +95	1.2	0.6	0.4	8	8	12.6 x 28 x 7.6
<b>Transmissive (solder terminals)</b>										
EE-SG3	3.6 (.142)	50	100	-25 ~ +85	1.2	2.0	0.4	4	4	11.7 x 25.4 x 6.4
EE-SH3	3.4 (.134)	50	100	-25 ~ +85	1.2	0.5	0.4	4	4	10.4 x 25.4 x 6.2
<b>Transmissive (PCB mount)</b>										
EE-SX198	3 (.118)	50	100	-25 ~ +85	1.2	0.5	0.4	4	4	10 x 12.2 x 5
EE-SX1018	2 (.079)	50	100	-25 ~ +85	1.2	0.5	0.4	4	4	6 x 8 x 4
EE-SX1025	2.8 (.110)	50	100	-25 ~ +85	1.2	0.5	0.4	4	4	5.4 x 9.3 x 4
EE-SX1035	5.2 (.205)	50	100	-25 ~ +85	1.2	0.5	0.4	4	4	6.9 x 12.6 x 6.3
EE-SX1041	5 (.197)	50	100	-25 ~ +95	1.2	0.5	0.4	4	4	10.2 x 14.4 x 6
EE-SX1042	5 (.197)	50	100	-25 ~ +85	1.2	0.5	0.4	4	4	14.7 x 14 x 5
EE-SX1046	3 (.118)	50	100	-25 ~ +85	1.2	1.2	0.4	4	4	5 x 10 x 6.5
EE-SX1061	4.6 (.181)	50	100	-40 ~ +60	1.2	1.3	0.8	1000 max.	1000 max.	13.2 x 12.8 x 6.4
EE-SX1070	8 (.315)	50	100	-25 ~ +95	1.2	0.5	0.4	4	4	10 x 17.7 x 6
EE-SX1071	3.4 (.134)	50	100	-25 ~ +85	1.2	0.5	0.4	4	4	10.4 x 13.6 x 6.2
EE-SX1081	5 (.197)	50	100	-25 ~ +85	1.2	0.5	0.4	4	4	10 x 13.7 x 5
EE-SX1088	3.4 (.134)	50	100	-25 ~ +85	1.2	0.5	0.4	4	4	10 x 25 x 6
EE-SX1096	3.4 (.134)	50	100	-25 ~ +85	1.2	0.5	0.4	4	4	10 x 25 x 6
EE-SX1103	2 (.080)	50	80	-25 ~ +85	1.3	0.5	0.4	10	10	5.2 x 5 x 4.2
EE-SX1105	2 (.080)	50	80	-25 ~ +85	1.3	0.5	0.4	10	10	3.3 x 4.9 x 2.6
EE-SX1106	3 (.120)	50	80	-25 ~ +85	1.3	0.5	0.4	10	10	5.4 x 6.4 x 4.2
<b>Transmissive (dual channel, PCB mount)</b>										
EE-SX1031	3.4 (.134)	50	100	-25 ~ +85	1.2	0.5	0.4	4	4	10.2 x 13.6 x 13.6
<b>Transmissive (surface-mount)</b>										
EE-SX1107	1 (.040)	25	75	-30 ~ +85	1.1	50 μA	0.4	10	10	3 x 3.4 x 3
EE-SX1108	2 (.080)	25	75	-30 ~ +85	1.1	50 μA	0.4	10	10	4 x 5 x 4
EE-SX1109	3 (.120)	25	75	-30 ~ +85	1.1	50 μA	0.4	10	10	5 x 6 x 4
<b>Transmissive (dual channel, surface-mount)</b>										
EE-SX1131	2 (.080)	25	75	-30 ~ +85	1.1	50 μA	0.4	10	10	4 x 6 x 4
<b>Reflective (surface-mount)</b>										
EE-SY125	1 (.039)	50	75	-25 ~ +85	1.2	50 μA	—	35	25	1.7 x 4 x 3
<b>Actuator (PCB mount)</b>										
EE-SA105 <sup>2</sup>	—	50	100	-25 ~ +70	1.2	0.5	0.4	—	—	14.2 x 9.4 x 4.4
<b>Actuator adaptable (PCB mount)</b>										
EE-SA107-P2 <sup>1</sup>	3.6 (.142)	50	100	-25 ~ +85	1.2	0.5	0.4	8	8	18.6 x 27 x 8
<b>Reflective (PCB mount)</b>										
EE-SB5-B	5 (.197)	50	100	-25 ~ +80	1.2	0.2	—	30	30	11.5 x 25.4 x 6.4
EE-SF5-B	5 (.197)	50	100	-25 ~ +80	1.2	0.2	—	30	30	8 x 13 x 5.4
EE-SMR1-1	1 (.039)	40	150	0 ~ +60	1.2	80 μA	—	4	4	5.8 dia.
EE-SY110	5 (.197)	50	100	-40 ~ +85	1.2	0.2	—	30	30	4.8 x 15.2 x 4.6
EE-SY113	4.4 (.173)	50	100	-40 ~ +85	1.2	0.16	—	30	30	6 x 15.2 x 6.2
EE-SY124	1 (.039)	50	75	-25 ~ +85	1.2	50 μA	—	35	25	1.7 x 4 x 3
EE-SY169A	4 (.157)	50	100	0 ~ +70	1.5 max.	0.16	—	30	30	8 x 14.1 x 6
EE-SY171	3.5 (.138)	50	100	-25 ~ +80	1.2	50 μA	—	30	30	3 x 15 x 4.2
<b>Reflective (solder terminals)</b>										
EE-SB5	5 (.197)	50	100	-25 ~ +80	1.2	0.2	—	30	30	11.5 x 25.4 x 6.4
EE-SF5	5 (.197)	50	100	-25 ~ +80	1.2	0.2	—	30	30	8 x 13 x 5.7

Notes: 1. Applicable mating connectors: AMP 175778-3 and AMP 173977-3.

2. Actuator operation: Free position (FP): 14.2 ± 0.3 mm (.559 ± .012 in.); Operating position (OP): 13.0 mm (.512 in.) min.; Total travel position (TTP): 12.1 mm (.476 in.) max. Operating force: 15 gf (0.15 N) max.; Life expectancy: 500,000 operations min.

For more information, call 1-800-55-OMRON.

# Infrared Opto Electronic Components

TO-46 Package IRLED's					
P/N	Power Output (mW) @ 100mA	Beam Angle (°)	Wavelength (nm)	Response Time (μs)	Operating Temp Range (°C)
OD-880W	20	80	880	0.5	-55 to 100
OD-880L	20	35	880	0.5	-55 to 100
OD-880F	17	8	880	0.5	-55 to 100
OD-148W	10	95	880	0.5	-55 to 100
OD-880E	30	90	880	0.5	-55 to 100
OD-880	30	80	880	0.5	-55 to 100
OD-24F	15	8	880	0.7	-55 to 100
OD-880WHT	9	80	880	0.5	-65 to 150
OD-880LHT	8.5	35	880	0.5	-65 to 150
OD-880FHT	8	8	880	0.5	-65 to 150
OD-870W	5.5	80	870	0.015	-55 to 100
OD-870L	5	35	870	0.015	-55 to 100
OD-870F	4.5	8	870	0.015	-55 to 100
TO-39 Package IRLED's					
P/N	Power Output (mW) @ 500mA	Beam Angle (°)	Wavelength (nm)	Response Time (μs)	Operating Temp Range (°C)
OD-50L	50	7	880	0.7	-55 to 100
OD-50W	75	110	880	0.7	-55 to 100
OD-100	100	110	880	0.7	-55 to 100
TO-66 Package IRLED's					
P/N	Power Output (mW) @ 300mA	Beam Angle (°)	Wavelength (nm)	Response Time (μs)	Operating Temp Range (°C)
OD-663	170	120	880	1	-55 to 100
OD-666	330	120	880	2	-55 to 100
OD-669	500	120	880	3	-55 to 100
"Monochromatic" GaAlAs Detectors					
P/N	Active Area (mm <sup>2</sup> )	Responsivity @ 880nm (A/W)	Responsivity @ 750nm (A/W)	I <sub>D</sub> @ -5V (nA)	Response Time (μs)
ODD-45W	1.0	0.6	0.01	0.4	1
ODD-95W	5.0	0.6	0.01	1.0	1

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NAME OF DEVICE	CIRCUIT SYMBOL	ELECTRICAL CHARACTERISTICS	MAJOR APPLICATIONS	NOTES
CT-201AD MOSFET DRIVER WITH ACTIVE DISCHARGE		Absolute Maximum Ratings Led Forward Current Steady State 50 ma Led Forward Current Peak 10% Duty Cycle 75 ma Led Reverse Voltage Reverse Current, -10 ua 5 V Output Voltage Open Circuit 16 V Output Current 1 Led = 50ma 75 ua Operating Temperature 0 C to +85 C Storage Temperature -50 C to +125 C Isolation Voltage 2500 V DC	High side switching Solid state relays Process Controls Robotics Automatic Test Equipment Automotive Applications Programmable Controls	Active gate discharge circuitry, Optical isolation, High isolation voltage, Fast turn off speed, Low off state output impedance
CT-202D MOSFET DRIVER		Absolute Maximum Ratings Led Forward Current Steady State 50 ma Led Forward Current Peak 10% Duty Cycle 75 ma Led Reverse Voltage Reverse Current, -10 ua 5 V Output Voltage Open Circuit 16 V Output Current 1 Led = 50ma 75 ua Operating Temperature 0 C to +70 C Storage Temperature -50 C to +125 C Isolation Voltage 2500 V DC	High side switching Solid state relays Process Controls Robotics Automatic Test Equipment Automotive Applications Programmable Controls	Dielectric Isolation, Optical Isolation, High Isolation Voltage, High Efficiency, Logic Compatible
Opto Coupler 1) Transistor (H11A, H15A) 2) Darlington (H11B, H15B) Outputs		 Output characteristics are identical to a normal transistor/ Darlington except that the LED current (IF) replaces the base drive (IB).	Isolated interfacing of logic systems with other logic systems, power semiconductors and electro-mechanical devices. Solid state relays.	Optical Isolation, High BVceo types available, Ceramic units for hybrid applications available.
Opto Coupler SCR Output (H11C)		 With Anode voltage (+) the SCR can be triggered with a forward LED current. (Characteristics identical to a normal SCR except that LED current (IF) replaces gate trigger current - IGT).	Isolated interfacing of logic systems with AC power switching functions. Replacement of relays: microswitches.	Optical Isolation, Low holding current, High efficiency.
AC Input Opto Coupler (H11AA)		 Identical to a "standard" transistor coupler except that LED current can be of either polarity.	Telecommunications - ring signal detection, monitoring line usage. Polarity insensitive solid state relay. Zero voltage detector.	Optical Isolation, High LED surge current.

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PART NO	Active Area		Breakdown Voltage		C <sub>T</sub>	I <sub>d</sub>	Responsivity	Gain	Risetime(µs)	N.E.P.	PACKAGE
	Dia(mm)	Area (mm <sup>2</sup> )	V	dv/dI(1/°C)	pF	nA	850nm(A/W)	Min		W/Hz <sup>1/2</sup>	
SSO-AD230	0.23	0.042	160	0.4	2	0.6	0.45	200	180	1 X 10 <sup>-14</sup>	TO52i
SSO-AD500	0.50	0.196	160	0.4	3	2	0.45	200	280	3 X 10 <sup>-14</sup>	TO52i
SSO-AD500NF	0.50	0.196	160	0.4	2.5	2	0.45	200	280	2 X 10 <sup>-14</sup>	TO18
SSO-AD800	0.80	0.500	160	0.4	5	4	0.45	100	700	4 X 10 <sup>-14</sup>	TO5i
SSO-AD1100	1.13	1.00	160	0.4	10	6	0.45	100	1ns	8 X 10 <sup>-14</sup>	TO5i
SSO-AD1900	1.95	3.00	160	0.4	20	10	0.45	100	1.3ns	1.5 X 10 <sup>-13</sup>	TO5i
SSO-ADS2500	2.52	5.00	150	0.4	40	20	0.45	100	2ns	3 X 10 <sup>-13</sup>	TO5i

**SERIES -2****UV ENHANCED PHOTODIODES**

PART NO	Active Area		Responsivity (A/W)		Shunt Resistance	Capacitance(pF)	Dark Current(nA)	Risetime(µs)	N.E.P.	PACKAGE
	Dia(mm)	Area (mm <sup>2</sup> )	200nm	340nm	10mV(MOhms)	5V	5V	0V	W/Hz <sup>1/2</sup>	
SSO-BL1-2	1.13	1	-	0.4	2000	30	0.2	0.5	8 X 10 <sup>-15</sup>	TO5
SSO-BL2-2	1.60	2	-	0.4	2000	45	0.4	0.8	9 X 10 <sup>-15</sup>	TO5
SSO-BL5-2	2.52	5	-	0.4	1000	90	1	1.5	1 X 10 <sup>-14</sup>	TO5
SSO-BL10-2	3.57	10	-	0.4	500	120	1	2.5	1.2 X 10 <sup>-14</sup>	TO5
SSO-BL20-2	5.05	20	-	0.4	100	170	2	3.5	1.4 X 10 <sup>-14</sup>	TO8
SSO-BLS33-2	5.5x6.1	33	0.1	0.4	100	270	2	2	1.6 X 10 <sup>-14</sup>	Ceramic Flat Pack
SSO-BL50-2	7.98	50	0.1	0.4	70	300	5	6	1.8 X 10 <sup>-14</sup>	Plastic Flat Pack, BNC
SSO-BL100-2	11.28	100	0.1	0.4	40	450	10	10	2.2 X 10 <sup>-14</sup>	Plastic Flat Pack, BNC

**SERIES -4****LOW SERIES RESISTANCE PHOTODIODES**

PART NO	Active Area		Responsivity (A/W)	Series Resistance	Capacitance(nF)	Dark Current(nA)	Risetime(µs)	N.E.P.	PACKAGE
	Dia(mm)	Area (mm <sup>2</sup> )	850m	Ohms	0V	5V	10V	W/Hz <sup>1/2</sup>	
SSO-PDQ30-4	5.4x5.4	30	0.6	<10	30	0.2	0.25	5 X 10 <sup>-14</sup>	TO8
SSO-PD100-4	11.30	100	0.6	<10	45	0.4	0.5	2 X 10 <sup>-13</sup>	BNC

**SERIES -5****HIGH SPEED EPITAXIAL PIN PHOTODIODES**

PART NO	Active Area		Responsivity (A/W)	Shunt Resistance	Capacitance(pF)		Dark Current(nA)	Risetime(nS)	N.E.P.	PACKAGE
	Dia(mm)	Area (mm <sup>2</sup> )	850m	MOhms @ 10mV	0V	20V	20V	20V	20V	
SSO-PDQ .25-5	5x5	0.25	0.5	200	6	1.8	0.5	0.4	6 x 10 <sup>-15</sup>	TO18
SSO-PDQ 3.6-5	1.9x1.9	3.60	0.5	200	9	20	2	3	5 x 10 <sup>-15</sup>	TO5
SSO-PDQ 11.9-5	3.45x3.45	11.90	0.5	200	180	40	3	5	1 x 10 <sup>-13</sup>	TO5

**SERIES -6****LOW DARK CURRENT PIN DIODES**

PART NO	Active Area		Responsivity (A/W)	Shunt Resistance	Capacitance(pF)		Dark Current(nA)	Risetime(nS)	N.E.P.	PACKAGE
	Dia(mm)	Area (mm <sup>2</sup> )	900nm	10mV(MOhms)	0V	10V	10V	10V	850nm	
SSO-PD1-6	1.13	1	0.62	>2000	40	3	0.05	10	6.5 x 10 <sup>-15</sup>	TO18
SSO-PD2-6	1.60	2	0.62	>2000	50	5	0.1	12	1 x 10 <sup>-14</sup>	TO5
SSO-PD5-6	2.52	5	0.62	>2000	90	10	0.25	13	1.5 x 10 <sup>-14</sup>	TO5
SSO-PD10-6	3.57	10	0.62	1500	150	18	1	20	2.9 x 10 <sup>-14</sup>	TO5
SSO-PD20-6	5.05	20	0.62	750	220	35	2	25	4 x 10 <sup>-14</sup>	TO8
SSO-PD50-6	7.98	50	0.62	300	480	100	5	30	6.5 x 10 <sup>-14</sup>	Plastic Flat Pack, TO8S
SSO-PD70-6	9.44	70	0.62	250	650	130			8 x 10 <sup>-14</sup>	Plastic Flat Pack, BNC
SSO-PD100-6	11.28	100	0.62	150	900	170	10	40	1 x 10 <sup>-13</sup>	Plastic Flat pack, BNC

**SERIES -7****LOW CAPACITANCE PIN PHOTODIODES**

PART NO	Active Area		Responsivity (A/W)		Capacitance(pF)		Dark Current(nA)		Risetime (nS)		N.E.P.	PACKAGE
	Dia(mm)	Area (mm <sup>2</sup> )	@ 900nm	1100nm	12V	80V	12V	80V	12V	80V	850nm	
SSO-PD1-7	1.13	1	0.62	0.2	2		1		40		1 x 10 <sup>-14</sup>	TO52i
SSO-PD5-7	2.52	5	0.62	0.2	5		1		80		2 x 10 <sup>-14</sup>	TO5
SSO-PD10-7	3.57	10	0.62	0.2	10		1		90		3 x 10 <sup>-14</sup>	TO5
SSO-PD20-7	5.05	20	0.62	0.2	20		2		100		4 x 10 <sup>-14</sup>	TO8
SSO-PD50-7	7.98	50	0.62	0.2	35		0.5		60		3 x 10 <sup>-14</sup>	TO8S
SSO-PDH50-7	7.98	50	0.62	0.2	35	20	0.5	2	20		3 x 10 <sup>-14</sup>	TO8S
SSO-PDS80-7	8x10	80	0.62	0.2	45		5		45		5 x 10 <sup>-14</sup>	Ceramic Flat Pack
SSO-PD100-7	11.28	100	0.62	0.2	80		10		200		6 x 10 <sup>-14</sup>	Plastic Flat Pack
SSO-PDS200-7	10x20	200	0.62	0.2	140		2		60		6 x 10 <sup>-14</sup>	Ceramic Flat pack
SSO-PDHS200-7	10x20	200	0.62	0.2	140	65		4	60		6 x 10 <sup>-14</sup>	Ceramic Flat Pack

**SERIES -WS****WAVELENGTH SELECTIVE**

PART NO	Active Area		Responsivity (A/W)		Capacitance(nF)		Dark Current(nA)		Risetime(nS)		N.E.P.	PACKAGE
	Size(mm)	Area (mm <sup>2</sup> )	550nm	890nm	0V	0V	5V	D1 @ 0V	D2 @ 0V	850nm		
WS 7.56	2.75 x 2.7	7.56	0.2	0.45	1	0.1	100	10	1	N/A	TO5	
WS 7.56i	2.75 x 2.7	7.56	0.2	0.45	1	0.1	20	10	1	N/A	TO5i	

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## CUSTOM SILICON PHOTODIODES AND OPTICAL ASSEMBLIES



*Harnessing The Power Of Light*

Silicon Sensors is your premier source for *engineered solutions* to your requirements for photodiodes, assemblies, and photodiode arrays. From photodiode chips to packaged and tested optical assemblies, our engineering team will work with you to develop a cost-effective solution that maximizes your product's performance.

### Custom Photodiodes:

- Spectral range from 250 - 1100nm
- Ultra low dark current (<5 pA)
- Large area, low capacitance cells
- Multichannel devices with low crosstalk
- Position Sensitive Diodes with customizable resolution
- Solderable or bondable versions

### Custom Engineering Services:

- Application and design knowledge to support you
- Custom circuit design
- CAD design of custom chips and PCB; electronic file exchange
- Rigorous testing of photodiodes and assemblies to your specifications:
  - output and leakage current
  - capacitance measurements
  - burn-in, temperature cycling and testing
  - quantum efficiency (A/W)

### Custom Packaging:

- Die attach and wire bond on PCB, flex circuit, and ceramic
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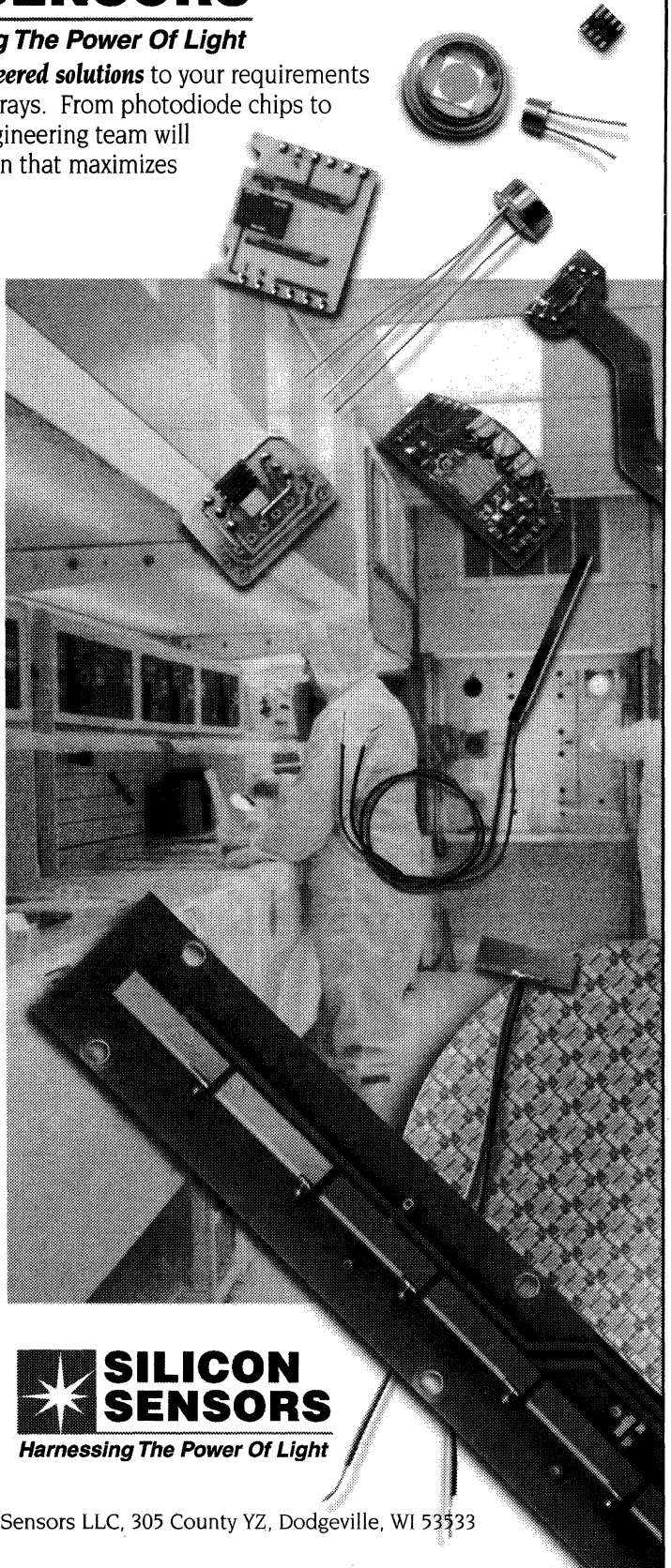
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**CdS/CdSe PHOTOCONDUCTIVE CELLS**

Hermetically Sealed Package

Type No.	Package Type	Spectral Response Peak (nm)	Resistance at 2 ftc (Ω)	Min. Dark after 5 sec. 2 ftc (Ω)	Max. Voltage Rating
NSL-4950	TO-8	515 CdS	40K (1 ftc)	2.4M	320V
NSL-4960	TO-8	515 CdS	1.7K (1 ftc)	1M	320V
NSL-4970	TO-8	515 CdS	7.25K (1 ftc)	400K	320V
NSL-4510	TO-5	515 CdS	43K (1 ftc)	2.5M	120V
NSL-4540	TO-5	515 CdS	3.5K (1 ftc)	100K	120V
NSL-3530	TO-5	725 CdSe	66K	440M	320V
NSL-5150	TO-18	550 CdS	15K	10M	60V
NSL-5160	TO-18	550 CdS	100K	67M	100V
NSL-6110	TO-18	690 CdSe	2K	1.3M	100V
NSL-7140	TO-18	615 CdS	4.5K	3M	60V

**Plastic Encapsulated Ceramic Package**

NSL-4962	TO-8	515 CdS	17K (1 ftc)	1M	320V
NSL-5912	TO-8	550 CdS	1.5K	100K	170V
NSL-4512	TO-5	515 CdS	43K (1 ftc)	2.5M	120V
NSL-5542	TO-5	550 CdS	30K	20M	120V
NSL-4532	TO-5	515 CdS	8K (1 ftc)	400K	120V
NSL-19M51	TO-18	550 CdS	60K (1 ftc)	5M	100V
NSL-5152	TO-18	550 CdS	15K	10M	60V
NSL-6112	TO-18	690 CdSe	2K	1.3M	100V
NSL-4452	1"	515 CdS	26K (1 ftc)	500K	1000V
NSL-4462	1"	515 CdS	11.4K (1 ftc)	165K	1000V
NSL-4472	1"	515 CdS	5.5K (1 ftc)	65K	1000V

Cells light adapted at 30-50 ftc for 16 hours minimum prior to test. All measurements conducted at 25°C ambient, 2854°K.

**LED/PHOTOCELL OPTOISOLATORS**

Axial LED/CdSe photoresistive cell modules for use as audio limiters, AGC, noiseless potentiometers and analog output circuits. Digital to analog isolation. NSL-32 series also available with radial conversion platform for PCB mounting.

Type No.	Resistance			Maximum Ratings			AC or DC Isolation, (V)
	LED Current (mA)	Max. on (Ω)	Min. Dark <sup>(1)</sup> (Ω)	Current (mA)	Power Dissipation <sup>(2)</sup> (mW)	Temp. (°C)	
NSL-26	16	2000	10M	120	40	200	2000
NSL-26AA	16	2000	10M	500	40	125	2000
NSL-28	20	400	10M	100	40	50	2000
NSL-28AA	20	2500	1M	100	40	50	2000
NSL-32	16	500	500K	60	40	50	2000
NSL-32AA	10	10000	10M	60	40	50	2000
NSL-32H-101	1	750	500K	60	40	50	2000
NSL-32H-102	1	960	500K	60	40	50	2000
NSL-32H-103	1	1650	500K	60	40	50	2000
NSL-32H-104	1	2800	500K	60	40	50	2000
NSL-37V51	40	2000	10M	100	40	175	2500
NSL-37V52	16	2000	10M	100	40	175	2500
NSL-37V53	40	500	1M	100	40	175	2500
NSL-37V54	40	3500	100M	100	40	175	2500
NSL-37V62	40	200	400K	100	40	175	2500
NSL-37V71	2	1500	1M	100	40	175	2500
Dual Element <sup>(3)</sup>							
NSL-39V51	40	3000	10M	100	40	175	2500
NSL-39V62	10	500	400K	100	40	175	2500

<sup>(1)</sup> 10 seconds after removal of LED Current. <sup>(2)</sup> Power rating at 25°C linearly derated to 75°C. <sup>(3)</sup> Matched to ±25%

**PHOTOTRANSISTORS**

Silicon planar epitaxial phototransistors are available with flat or high profile lens cap in TO-18 hermetically sealed packages.

Type No.	Light Current	Dark Current	Collector Breakdown	Emitter Breakdown	Saturation Voltage	Rise/Fall Time	Ang. Resp. Half Power
	<sup>(1)</sup> $I_{L(E=5mW/cm^2)}$ V <sub>CE</sub> =5V 2870°K	$I_{D(E=10V)}$ V <sub>CE</sub> =10V	I <sub>C</sub> =100μA Ee=0	I <sub>C</sub> =100μA Ee=0	I <sub>B</sub> =0.5mA I <sub>C</sub> =1mA Ee=0	<sup>(3)</sup> R <sub>L</sub> =100Ω	Typ. Power
SLT-50HF1	0.2	50	40	7.5	0.4	3	40°
SLT-50HF2	0.4	50	40	7.5	0.4	3	40°
SLT-50HF3	1.0	50	40	7.5	0.4	3	40°
SLT-50HF4	2.5	50	40	7.5	0.4	3	40°
SLT-50HL1	0.6	50	40	7.5	0.4	3	15°
SLT-50HL2	1.2	50	40	7.5	0.4	3	15°
SLT-50HL3	2.4	50	40	7.5	0.4	3	15°
SLT-50HL4	4.0	50	40	7.5	0.4	3	15°
SLT-50HL5	6.0	50	40	7.5	0.4	3	15°
SLT-50HL6	12.0	50	40	7.5	0.4	3	15°

<sup>(1)</sup> The light source is a frosted Tungsten Incandescent Lamp @ 2854°K.

<sup>(2)</sup> The light source is a gallium arsenide IRED with a rise time less than 300ns.



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**SOLDERABLE PLANAR PHOTODIODES**

Silicon solderable planar photodiodes are available with flexible leads, in chip form or custom configurations as single or multi-element arrays.

Type No.	Short Circuit Current		Open Circuit Voltage	Dark Current	Breakdown Voltage	Junction Capacitance	Active Area
	Min.	Typ.					
	<sup>(1)</sup> Ee=500 fc 2854°K			Max.	Min.	Typ.	(mm <sup>2</sup> )
SLSD-71N1	0.4	0.5	0.4	1.7	20	0.4	10.4
SLSD-71N2	0.7	1.2	0.4	3.3	20	0.7	21.4
SLSD-71N3	1.3	2.1	0.4	1.7	20	1.0	45.9
SLSD-71N4	1.4	2.3	0.4	5.0	20	1.5	45.2
SLSD-71N5	2.5	4.0	0.4	3.3	20	2.0	93.6
SLSD-71N7	5.0	8.0	0.4	5.0	20	2.5	162.5

**ARRAYS**

Multielement arrays available in chip form or DIP package.

Type No.	Short Circuit Current	Dark Current	Breakdown Voltage	Junction Capacitance	Area per element	Package Type		
							Min.	Typ.
SLCA-61S1004	60	80	3.0	1.0	20	1.17	4 element chip	
SLCA-61S1006	60	80	3.0	1.0	20	1.17	6 element chip	
SLCA-61S1021	60	80	3.0	1.0	20	1.17	12 element chip	
SLD-74A1/16	100	125	0.1	0.1	50	40	2.3	18 Pin DIP
SLD-74D1/4	360	500	0.1	0.1	50	180	9.8	Quad 8 Pin DIP

<sup>(1)</sup> The light source is a Frosted Tungsten incandescent Lamp @ 2854°K

**PLANAR PHOTODIODES**

Planar, passivated silicon photodetectors designed to operate either in photovoltaic mode or in a reverse-bias mode.

Type No.	Short Circuit Current	Spectral Response	Dark Current	Breakdown Voltage	Junction Capacitance	Rise/Fall Time	Area	Package Type	
									Min.
SLE-68E1A	150	225	400-1100	100	50	40	1.0 1.5	2.0	TO-46
SLE-68EBG1A	7.5	11	400-700	100	50	40	1.0 1.5	2.0	TO-46
SLE-68HF1A	110	130	400-1100	100	50	40	1.0 1.5	2.0	TO-46
SLE-68HFBG1A	6	10	400-700	100	50	40	1.0 1.5	2.0	TO-46
SLE-68HL1A	300	450	400-1100	100	50	40	1.0 1.5	2.0	TO-46
SLE-68HLBG1A	18	30	400-700	100	50	40	1.0 1.5	2.0	TO-46
SLE-68HLR1A	120	160	700-1100	100	50	40	1.0 1.5	2.0	TO-46
series available in 5 std. Id sorts									
SLE-67HF1A	600	850	400-1100	100	50	350	8.0 10.0	18.3	TO-5
SLE-67HF2A	450	650	400-1100	100	50	180	8.0 10.0	9.8	TO-5
SLE-67HFBG1A	70	125	400-700	100	50	350	8.0 10.0	18.3	TO-5
series available with isolated case (-J) series available in 5 std. Id sorts									
SLE-65HF1A	1100	1300	400-1100	100	50	380	10.0 12.0	20.3	TO-8
SLE-65HFBG1A	60	100	400-700	100	50	380	10.0 12.0	20.3	TO-8
series available with isolated case (-J) series available in 5 std. Id sorts									

<sup>(1)</sup> The light source is a frosted Tungsten Incandescent Lamp @ 2854°K.

<sup>(2)</sup> The light source is a gallium arsenide IRED with a rise time less than 300ns.

**PLANAR PHOTODIODES, CERAMIC**

Featuring high linearity, low dark current and fast response in low cost ceramic package. Available with visible blocking filter or BG filter.

Type No.	Short Circuit Current	Spectral Response	Dark Current	Breakdown Voltage	Junction Capacitance	Rise/Fall Time	Area	Ceramic Package Type	
									Min.
SLE-52C1A	250	290	400-1100	100	50	120	3.0 3.0	6.9	8mm
SLE-52R1A	100	175	700-1100	100	50	120	3.0 3.0	6.9	8mm
SLE-52BG1A	12.5	14.5	400-700	100	50	120	3.0 3.0	6.9	8mm
SLE-53C1A	50	85	400-1100	100	50	50	1.0 1.5	2.0	6mm
SLE-53BG1A	2.5	4.2	400-700	100	50	50	1.0 1.5	2.0	6mm
SLE-69C1A	600	900	400-1100	100	50	350	8.0 10.0	18.3	9mm
SLE-69R1A	700	1000	700-1100	100	50	350	8.0 10.0	18.3	9mm
SLE-70C1A	120	180	400-1100	100	50	50	1.0 1.5	2.0	TO-5
SLE-70R1A	60	100	700-1100	100	50	50	1.0 1.5	2.0	TO-5
SLE-70BG2A	40	55	400-700	100	50	180	4.0 6.0	9.8	TO-5
SLE-70C2A	450	700	400-1100	100	50	180	4.0 6.0	9.8	TO-5
SLE-70R2A	500	880	700-1100	100	50	180	4.0 6.0	9.8	TO-5

<sup>(1)</sup> Light source is a frosted Incandescent Lamp @ 2854°K.

<sup>(2)</sup> Measured in an unsaturated condition with an IR source and a load resistor of 1KΩ.

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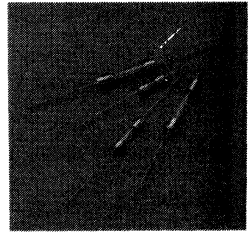
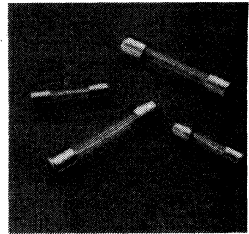
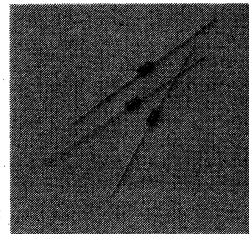
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## CIRCUIT BREAKERS/ CIRCUIT PROTECTORS

Manufacturer	Starting EEM Page No.	Circuit Breakers		Surge Limiters/ Protectors	Transient Voltage Suppressors	Data Line Protectors	Conformance						
		Thermal	Magnetic				UL	CSA	DEMKO	SEMKO	SEV	VDE	MIL
Altech Corp.	B-1232	√	√				√	√	√	√	√	√	
Amber Industries, Inc.	B-1235			√	√	√	√	√					
Bourns, Inc.	B-1239					√§	√	√					
Citel Inc.	B-1246			√	√	√	√		√			√	
Eaton Corporation	B-1248	√	√				√	√				√	√
ETA Circuit Breakers	B-1250	√	√				√	√	√	√		√	√
Joslyn Electronic Systems Corp.	B-1255			√	√	√	√	√					
MCG Surge Protection	B-1258			√	√		√	√					√
Mechanical Products, Inc.	B-1259	√					√	√				√	√
Philips Technologies	B-1264		√*				√	√		√	√	√	√
Raychem Corporation	B-1265						√	√					
Schurter, Inc.	B-1270	√	√	√	√	√	√	√	√	√	√	√	
Siemens Electromechanical Components, Inc.	B-1273	√	√				√	√	√			√	√
Therm-O-Disc, Inc.	B-1275	√					√	√					√
Wickmann	B-1276					√	√	√					
World Products Inc.	B-1282			√	√	√	√	√					

\* MIL Spec.      § Surface Mount.

## FUSES

Manufacturer	Starting EEM Page No.	Normal Action	Slow Blowing	Fast Action	Failure Indicating	Rectifier	Miniature Submin.	Clips & Holders	Conformance						
									UL	CSA	DEMKO	SEMKO	SEV	VDE	MIL
Bel Fuse	B-1236	√	√§	√§			√§	√	√	√		√		√	
FIC Corp.	B-1254				√*			√*	√	√					√
Keystone Electronics Corp.	B-1257							√							
Panel Components Corp.	B-1262		√	√				√	√	√		√		√	
Raychem Corporation	B-1265	√	√	√			√	√	√						
Schurter Inc.	B-1270	√§	√§	√§	√		√§	√§	√	√	√	√	√	√	
Wickmann U.S.A., Inc.	B-1276	√	√	√	√		√	√	√	√		√	√	√	√

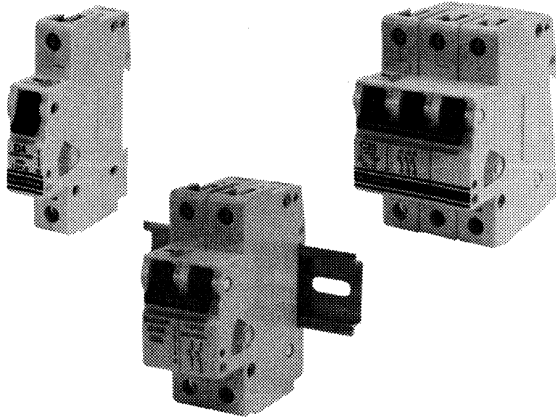
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DIN Rail Mount, Thermag®, UL & CSA to 480 V AC,  
 CE Marked, Euro Approval



UL® Recognized for group applications and motor starting in addition to general purpose applications. Altech/ABL SURSUM V-EA miniature circuit breakers provide OEMs an opportunity for major cost savings and superior circuit protection in equipment to be listed.

Five trip characteristics are recognized. All trip characteristics and all rated currents (RC) have the same housing dimensions and terminal sizes. They can be loaded with full rated currents (100% breaker). Recognized with Line/Load reversibility, i.e., power feed can be to the top 18 AWG to 3 AWG screw-cage clamp terminals or to the 18 AWG to 2 AWG bottom terminals. Terminals are rated for field and factory wiring.

The trip characteristics are internationally defined and accepted "B," "C," "D," "G," and "Z."

"B," Thermal 1 hr. trip zone 1.13 to 1.45 times RC; RC Magnetic 100ms trip zone 3 to 5 times RC CENLEC Household and similar applications.

"C," Thermal 1 hr. trip zone 1.13 to 1.45 times RC; RC Magnetic 100ms trip zone 5 to 10 times RC CENLEC Household and similar applications

"D," Thermal 1 hr. trip zone 1.13 to 1.45 times RC; RC Magnetic 100ms trip zone 10 to 16 times RC CENLEC High-Inrush Industrial.

"G," Thermal 1 hr. trip zone 1.05 to 1.35 times RC; Magnetic 100ms trip zone 8 to 10 times RC CEE 19 General Industrial, USA trip norms.

"Z," Thermal 1 hr. trip zone 1.05 to 1.35 times RC; Magnetic 100ms trip zone 2 to 3 times RC - Semiconductor Protection.

**One Pole and One-Pole-Plus-Neutral - Standard and Group Short-Circuit Rating 35kA with any listed RK5 for V-EA rated currents 0.3A through 4.0A, 10kA with 350A RK5 for V-EA rated currents 5.0A through 50A, to 277V AC.**

Rated Current (RC)	"B" Type	"C" Type	"D" Type	"G" Type	"Z" Type
0.30A	—	1C0.3U	1D0.3U	1G0.3U	1Z0.3U
0.5	—	1C0.5U	1D0.5U	1G0.5U	1Z0.5U
0.75	—	1C0.75U	1D0.7U	1G0.7U	1Z0.7U
0.8A*	—	—	—	1G0.8U	—
1.0A	—	1C1.0U	1D1.0U	1G1.0U	1Z1.0U
1.6A	—	1C1.6U	1D1.6U	1G1.6U	1Z1.6U
2.0A	—	1C2.0U	1D2.0U	1G2.0U	1Z2.0U
2.5A	—	1C2.5U	1D2.5U	1G2.5U	1Z2.5U
3.0A	—	1C3.0U	1D3.0U	1G3.0U	1Z3.0U
3.5A	—	1C3.5U	1D3.5U	1G3.5U	1Z3.5U
4.0A	—	1C4.0U	1D4.0U	1G4.0U	1Z4.0U
5.0A	—	1C5.0U	1D5.0U	1G5.0U	1Z5.0U
6.0A	1B6.0U	1C6.0U	1D6.0U	1G6.0U	1Z6.0U
8.0 A	—	1C8.0U	1D8.0U	1G8.0U	1Z8.0U
10A	1B10U	1C10U	1D10U	1G10U	1Z10U
12A*	—	—	—	1G12U	—
12.5A	—	—	—	1G12.5U	—
13A	1B13U	1C13U	1D13U	—	1Z12.5U
15A*	—	—	1D15U	1G15U	1Z15U
16A	1B16U	1C16U	1D16U	1G16U	1Z16U
20A	1B20U	1C20U	1D20U	1G20U	1Z20U
25A	1B25U	1C25U	1D25U	1G25U	1Z25U
30A*	—	—	1D30U	1G30U	1Z30U
32A	1B32U	1C32U	1D32U	1G32U	1Z32U
40A	1B40U	1C40U	1D40U	1G40U	—
50A	1B50U	1C50U	1D50U	1G50U	—

### Ampere Ratings & Horsepower Rating 1 Ø

Max. FLA = Rated Current	Horsepower at Nominal Line Voltage, 1 Ø					
	110-120V	200V	208V	220-240V	265V	277V
0.3A	2.0A*	2.0A*	2.0A*	2.0A*	2.0A*	2.0A*
0.5A	3.3A*	3.3A*	3.3A*	3.3A*	3.3A*	3.3A*
0.75/0.8A	5.3A*	5.3A*	5.3A*	5.3A*	5.3A*	5.3A*
1.0A	6.6A*	6.6A*	6.6A*	6.6A*	6.6A*	6.6A*
1.6A	10.6A*	10.6A*	10.6A*	10.6A*	10.6A*	10.6A*
2.0A	13.2A*	13.2A*	13.2A*	13.2A	13.2A	13.2A
2.5A	16.5A*	1/6	1/6	1/6	1/6	1/6
3.0A	1/10	1/4	1/4	1/4	1/3	1/3
3.5A	1/6	1/4	1/4	1/3	1/3	1/3
4.0A	1/6	1/3	1/3	1/3	1/2	1/2
5.0A	1/6	1/2	1/2	1/2	3/4	1/2
6.0A	1/4	1/2	1/2	3/4	3/4	1
8.0A	1/3	3/4	1	1	1 1/2	1 1/2
10.0A	1/2	1 1/2	1 1/2	1 1/2	2	2
12.5/13.0A	3/4	1 1/2	2	2	3	3
15.0/16.0A	1	2	2	3	3	3
20.0A	1 1/2	3	3	3	3	5
25.0A	2	3	3	5	5	5
30.0/32.0A	3	5	5	5	5	7 1/2
40.0A	3	7 1/2	7 1/2	7 1/2	10	10
50.0A	5	7 1/2	10	10	10	15

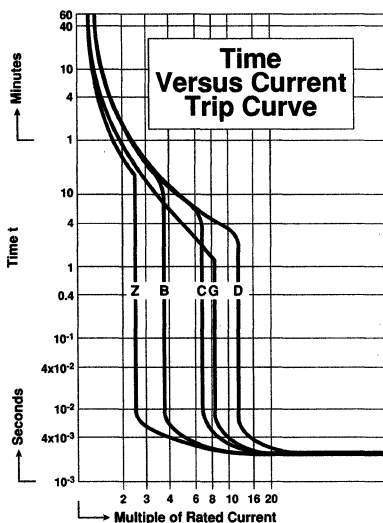
\* Locked Rotor Current Rating in lieu of Horsepower Rating

### Two and Three Pole Multi Phase

Standard short-circuit withstand 10kA, group short-circuit AIC 8.7kA at 480 AC with 350A RK5 upstream. Recognized rated currents through 25 Amp.

### Ampere Ratings & Horsepower Rating 3 Ø

Max. FLA = Rated Current	Horsepower at Nominal Line Voltage, 3 Ø				
	110-120V	200V	208V	240V	440-480V
0.30A	2.0A*	2.0A*	2.0A*	2.0A*	2.0A*
0.50A	3.3A*	3.3A*	3.3A*	3.3A*	3.3A*
0.75/0.80A	5.3A*	5.3A*	5.3A*	5.3A*	5.3A*
1.0A	6.6A*	6.6A*	6.6A*	6.6A*	1/2
1.6A	10.6A*	10.6A*	10.6A*	10.6A*	3/4
2.0A	13.2A*	13.2A*	1/2	1/2	1
2.5A	16.5A*	1/2	1/2	3/4	1 1/2
3.0A	19.8A*	3/4	3/4	3/4	2
3.5A	23.1A*	3/4	3/4	1	2
4.0A	1/2	1	1	1	2
5.0A	3/4	1	1 1/2	1 1/2	3
6.0A	3/4	1 1/2	1 1/2	2	3
8.0A	1	2	2	2	5
10.0A	1 1/2	3	3	3	7 1/2
12.5/13.0A	2	3	3	3	10
15.0/16.0A	2	5	5	5	10
20.0A	3	5	5	7 1/2	15
25.0A	5	7 1/2	7 1/2	10	20





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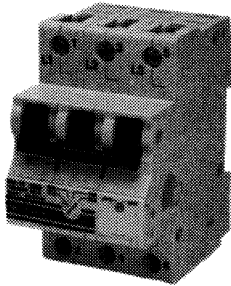
## MA THREE PHASE ADJUSTABLE CIRCUIT BREAKERS

Altech ABL Sursum MA holds starting and inrush currents of three phase transformers, lighting, power supplies and motors yet provides tight overload protection, fast short-circuit protection, and current/energy let-through protection. The MA is UL Listed to UL508 and CSA C22.2 No. 14 as a manual motor controller with group ratings, and functions as a 3 phase disconnect, overload protector and controller in one compact DIN rail mounted package. It is a thermal/ magnetic circuit breaker in the IEC style with thermal overload trip curves calibrated for USA norms. With the adjustment dial set at the full-load amperes (FLA) of the load, the MA/U cold-start trips in about one hour at an overload of 115% FLA and in less than

10 seconds at 600% FLA, and hot-start trips in less than 2 minutes at 150% FLA (i.e., Class 10A overload device).

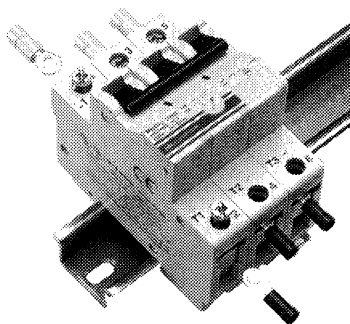
The MA/U is therefore suitable overload protection for all motor applications covered under NFPA70-Nation Electrical Code® 430-32(a) (1), including those with service factors less than 1.15 or temperature rise over 40°C. With screw-cage clamp terminals which accept 18AWG to 3AWG wire, the MA is particularly well suited for group applications and single motor taps under NEC® 430-53(c) and (d).

Request our Terminal Blocks, Circuit Breakers, Interface Modules Catalog No. 310 for application data.

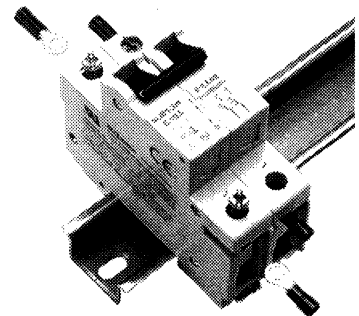


Type and Rated Current	FLA Dial Adjustment Markings	3 ∅ Horsepower Ratings at Nominal Line Voltage					Group SRT. CKT. Ratings
		110-120V	200V	208V	220-240V	440-480V	
MAO.16U	0.10/0.12/0.14/0.16						42kArms symmetrical (max. 1200A MCCB or RK5)
MAO.25U	0.16/0.19/0.22/0.25						
MAO.40U	0.25/0.30/0.35/0.40						
MAO.63U	0.40/0.48/0.56/0.63						
MA1.0U	0.63/0.75/0.87/1.0						
MA1.6U	1.0/1.2/1.4/1.6						
MA2.5U	1.6/1.9/2.2/2.5						
MA4.0U	2.5/3.0/3.5/4.0	1/2	3/4	3/4	1	2	
MA6.3U	4.0/4.8/5.6/6.3	3/4	1 1/2	1 1/2	1 1/2	3	
MA10U	6.3/7.5/8.7/10	1	2	2	3	5	
MA16U	10/12/14/16	2	3	3	5	10	14kArms symmetrical (max. 350A MCCB or RK5)
MA20U	16/17/18.5/20	3	5	5	5	10	
MA25U	20/21.5/23/25	3	5	7 1/2	7 1/2	15	
MA32U	25/27/30/32	5	7 1/2	7 1/2	10	20	
MA40U	32/34/37/40	5	10	10	10	25	10kArms symmetrical (max. 350A MCCB or RK5)

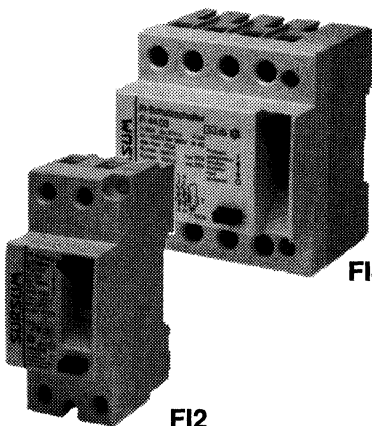
## “URT” RING-TONGUE COMPATIBLE V-EA & MA



Terminal screws in the V-EA/URT and MA/URT are not captive in their housings, allowing the option of either wiring with ring-tongue lugs or wiring directly into the cage-clamp. The URT option is available on all V-EA and MA devices; just add the RT suffix to the type and catalog number. The V-EA/URT, one-pole 0.3A through 50A and two and three-pole 0.3A through 25A (higher currents pending), is UL recognized for motor and general use circuits at the same ratings as the V-EA/U and CSA certified for general use circuits. The MA/URT, three-pole 0.1A through 40A, is UL 508 Listed and CUL certified to CSA 14 for motor and general use circuits at the same ratings as the MA/U.



## FI EARTH LEAKAGE CIRCUIT BREAKERS



Compact DIN rail mount Earth Leakage Circuit Breakers detect and interrupt ground faults. They are VDE approved for the European system of protecting people, animals, equipment and property from dangerous line-to-ground and shock hazard currents. Trip-capable on decayed line voltage, marked approval of DIN/VDE, marked “Snowflake” temperature range, marked trip sensitivity to pulsed as well as sinusoidal fault currents, integral test circuit, insensitive to vibration, etc.

US applications include ground fault protection of equipment (GFPE) using the 10mA and 30mA fault current ratings, especially when high distributed capacitance or other leakages cause excessive nuisance trips at lower fault currents. Applications for the 300mA rating are equipment protection and fire prevention by limiting the energy of a fault to less than the minimum ignition energy for many materials.

FI2				FI4			
Two Pole Single Phase		Four Pole Two/Three Phase		Two/Three Phase			
Rated	Max.	Rated	Max.	Rated	Max.	Rated	Max.
Current	Voltage	Current	Voltage	Current	Voltage	Current	Voltage
16A	240V AC	25A	415V AC	25A	415V AC	25A	415V AC
25A	240V AC	40A	415V AC	40A	415V AC	40A	415V AC
40A	240V AC	63A	415V AC	63A	415V AC	63A	415V AC
Fuse1		Fuse1		Fuse1		Fuse1	
63A		80A		80A		100A	
Rated Current Line	Fault Trip Current	Type	Rated Current Line	Fault Trip Current	Type	Rated Current Line	Fault Trip Current
16A	10mA	FI21.01	25A	30mA	FI42.03	25A	30mA*
25A	30mA	FI22.03	25A	30mA*	FI42.03Y	25A	300mA
25A	30mA*	FI22.03Y	25A	300mA	FI42.30	25A	300mA
25A	300mA	FI22.30	25A	30mA	FI43.03	25A	30mA*
40A	30mA	FI23.03	25A	30mA*	FI43.03Y	25A	300mA
40A	30mA*	FI23.03Y	25A	300mA	FI43.30	25A	300mA
40A	300mA	FI23.30	63A	30mA	FI44.03	63A	30mA*
			63A	300mA*	FI44.03Y	63A	300mA*

\* with mounted Auxiliary Switch.

1 10kA withstand rating based on series fuses.

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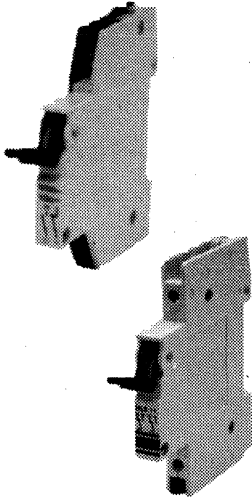
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## ACCESSORIES FOR V-EA & MA DEVICES

Type "H" auxiliary switches and Type "FA" shunt relay trip modules readily field mount, with two screws, to the right hand side of V-EA miniature circuit breakers and MA adjustable circuit breakers (manual motor controllers). Both the Type "H" auxiliary and Type "FA" shunt are directly linked to the internal trip-latch mechanism of the V-EA and MA. Handle ties are provided only to allow easy manual reset. When mounted together, the H, FA, V-EA and MA are "trip free" and will trip even if the handle(s) is held in the "ON" position.

The P25U power feed jumper system has pole configurations that will feed the V-EA 1,2 or 3 pole and the MA with or without mounted Type "H" switches (half-pole width) or Type "FA" shunts (one-pole width).

### Type "H" Auxiliary & Trip Alarm Switches



Two housing and contact configurations are available. The H1 auxiliary contact switch features direct screw pressure terminals suitable for ring-tongue or fork lug wiring as well as direct wiring (max. 12AWG) and heavy duty double-make and double-break contacts.

The family of the H11, HLS02, HLS10 and HLS11 feature cage-clamp terminals suitable for direct wiring with or without ferrules (max. 14AWG), and a choice of auxiliary contacts or overcurrent-trip alarm contacts.

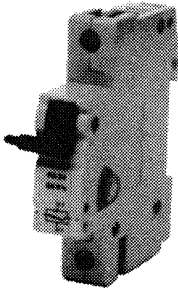
"Auxiliary" contacts switch whenever the main V-EA or MA contacts switch, whether due to an automatic thermal or magnetic trip, or a manual trip by hand (handle to "OFF") or a manual reset.

"Overcurrent" contacts only switch due to an automatic thermal or magnetic trip due to an overcurrent condition, and when subsequently reset following an automatic trip. They do not switch on a manual trip, even though the main V-EA or MA contacts do switch.

The nomenclature used to describe the forms of the auxiliary and overcurrent contacts (see table) is consistent with a SPST-NO designation for the main V-EA and MA contacts (single-pole-single-throw normally open, or Form A, or Euro "making" or "closing" contacts).

Type	Cat. No.	Contact Form(s)	Contact Ratings
H1	15.941	1 Aux. SPST-DNO (Form X) 1 Aux. SPST-DNC (Form Y)	10A at 220V AC 3A at 110V DC or pulsed 1A at 220V DC or pulsed
H11	15.941A	1 Aux. SPST-NO (Form A) 1 Aux. SPST-NC (Form B)	AC-15 9.6A at 120V AC 4.8A at 230V AC
HLS02	15.966	1 Aux. DPDT (2 Form C or 2 EURO "changeover")	
HLS10	15.968	1 Overcurrent alarm SPDT (Form C)	DC-13 3.5A at 125V DC 1.8A at 250V DC
HLS11	15.967	1 Aux. SPDT (Form C) 1 Overcurrent alarm SPDT (Form C)	

### FA Shunt Trip

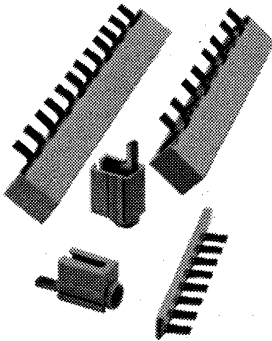


Coil actuated, the FA Shunt Trip allows electrical remote tripping of a breaker. It is trip-free and the housing and terminal specifications are the same as for V-EA miniature circuit breakers. The Shunt Trip contains its own contacts which break the tripping control circuit power when tripped. It is available with trip-coils in most standard control voltages.

Type	Trip-Coil Voltage AC/DC	Max. Coil Current	Cat.No.
FA12	12V	1.3A	15.944
FA24	24V	0.6A	15.945
FA48	48-72V	0.2A	15.946
FA110b	110V	0.25A	15.947
FA110b	220V	0.5A	15.947
FA110b	380V AC	0.8A	15.947

\* One device with wide voltage range

### P25U Power Jumpers for V-EA & MA

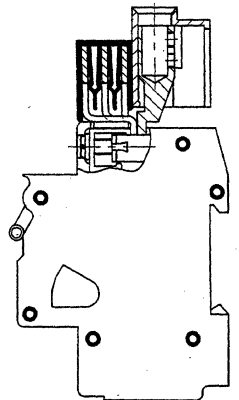


Type P25U power feed pin-lug jumpers are designed to feed the top terminals of the V-EA and MA circuit breakers, in accordance with USA convention of top feed. The top terminals of all V-EA and MA are identically dimensioned, so the P25U can bus power between a mix of all rated currents and pole configurations when they are mounted side-by-side.

Feed incoming power to the P25U with up to 6AWG wire, clamped together with the pin lug of the P25U in the cage of the V-EA or MA terminal. For incoming feed of 6AWG-2AWG, clamp the feed wire into power-feed-lug RP35UM1, then clamp the pin lug of the RP35UM1, together with the pin lug of the P25U jumper, in the cage of the V-EA or MA terminal.

The P25U is constructed of pure copper strips of 25mm<sup>2</sup> cross-section inserted in insulating track of GE Cycloloy 3600 or equal. Creepage and clearance distances meet stringent UL and CSA requirements for wiring terminals.

The RP35UM1 power feed lug (Cat. No. 17.300) is rated 140A at 600V AC. The single-track IP25U is rated 140A at 347V AC. Pin-lug spacings in stock are one-pole (IP25U1); one-pole plus space of a half-pole, for one-pole V-EA's with a Type H auxiliary switch mounted on each (IP25USH); and one-pole plus space of one-pole, for one-pole V-EA's with a Type FA shunt trip mounted on each (IP25U1S1). The three track 3P25U is rated 200A at 600V AC with either one copper jumper strip (3P25U1 single phase feed), or two copper jumper strips (3P25U2 two hot poles or one hot pole and one neutral pole), or three copper jumper strips (3P25U3 three phase feed). Stocked in 8 basic pin configurations.



# AII

## AMBER INDUSTRIES, INC.

### AC POWER LINE AND DATA LINE TRANSIENT SUPPRESSION

#### AC TRACKING SUPPRESSORS

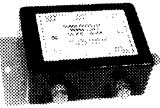


NORMAL MODE			
120 VAC		240 VAC	
MODEL	AMP	MODEL	AMP
AI-101	1.0	AI-201	1.0
AI-102	2.5	AI-202	2.5
AI-105	5.0	AI-205	5.0
AI-107	7.5	AI-207	7.5
AI-115	15.0	AI-215	15.0



NORMAL AND COMMON MODE			
120 VAC		240 VAC	
MODEL	AMP	MODEL	AMP
AI-101-CM	1.0	AI-201-CM	1.0
AI-102-CM	2.5	AI-202-CM	2.5
AI-105-CM	5.0	AI-205-CM	5.0
AI-107-CM	7.5	AI-207-CM	7.5
AI-115-CM	15.0	AI-215-CM	15.0

#### AC TRACKING AND PARALLEL SUPPRESSORS



MODEL	VOLTAGE	AMP	ATTN @ 100KHZ
1116	120VAC	10A	18 dB
1119	120VAC	15A	18 dB
1119-1	120VAC	15A	48 dB
1119-2	240VAC	15A	48 dB
1312	120VAC	25A	48 dB



MODEL	VOLTAGE	AMP	ATTN @ 100KHZ
1332	120VAC	15A	18 dB
1332-1	120VAC	15A	48 dB
1332-2	240VAC	15A	48 dB
1332-3	50VAC	15A	48 dB

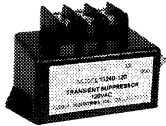
#### AC PARALLEL SUPPRESSORS



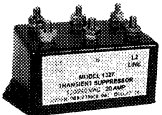
1330-1	130VAC	34J	
1330-2	150VAC	40J	
1330-3	250VAC	65J	
1330-4	270VAC	71J	
1330-6	130VAC	68J	
1330-7	150VAC	79J	
1330-8	250VAC	130J	
1330-9	270VAC	140J	



1335-1	130VAC	SINGLE	68J/L
1335-2	150VAC	SINGLE	79J/L
1335-3	250VAC	SINGLE	120J/L
1335-4	270VAC	SINGLE	140J/L
1335-5	130VAC	DUAL	68J/L
1335-6	150VAC	DUAL	79J/L
1335-7	250VAC	DUAL	120J/L
1335-8	270VAC	DUAL	140J/L
1335-9	130VAC	TRIPPLE WYE	68J/L
1335-10	150VAC	TRIPPLE WYE	79J/L
1335-11	250VAC	TRIPPLE WYE	120J/L
1335-12	270VAC	TRIPPLE WYE	140J/L
1335-13	130VAC	TRIPPLE DELTA	68J/L
1335-14	150VAC	TRIPPLE DELTA	79J/L
1335-15	250VAC	TRIPPLE DELTA	120J/L
1335-16	270VAC	TRIPPLE DELTA	140J/L
1335-17	270VAC	CE DESIGN	



1324A-120	120VAC	2 LINE	135J/L	13K A/L
1324B-120	120VAC	3 LINE	200J/L	19K A/L
1324C-120	120VAC	4 LINE	270J/L	26K A/L
1324D-120	120VAC	5 LINE	340J/L	32K A/L
1324A-240	240VAC	2 LINE	260J/L	13K A/L
1324B-240	240VAC	3 LINE	390J/L	19K A/L
1324C-240	240VAC	4 LINE	520J/L	26K A/L
1324D-240	240VAC	5 LINE	650J/L	32K A/L



1327	120/240VAC	20A	1 PHASE DUAL	230J/L	19KA/L	LINES TO NEUTRAL
1318	120/240VAC	50A	1 PHASE DUAL	230J/L	19KA/L	LINES TO NEUTRAL



1343-1	120/240VAC	LINES TO NEUTRAL	150J/L	13KA/L	QUICK DISCONNECT CONNECTION	LEDS WITH LOGIC OUTPUT
1343-2	120VAC	LINES TO GROUND	150J/L	13KA/L	QUICK DISCONNECT CONNECTION	LEDS WITH LOGIC OUTPUT

#### THREE PHASE SUPPRESSORS



1136-120Y	120/208 V	3 PHASE WYE
1136-120S	120 V	1 PHASE SINGLE
1136-120C	120/240 V	1 PHASE DUAL
1136-220Y	220/380 V	3 PHASE WYE
1136-240S	240 V	1 PHASE SINGLE
1136-240Y	240/415 V	3 PHASE WYE
1136-240D	240 V	3 PHASE DELTA
1136-277Y	277/480 V	3 PHASE WYE
1136-480D	440-480 V	3 PHASE DELTA



1333-5	120/240VAC	LINES TO NEUTRAL	360J/L	40KA/L	SINGLE LINE REDUNDANT	ALUMINUM CASE WITH LEADS
1333-6	120/240VAC	LINES TO NEUTRAL	360J/L	40KA/L	DUAL LINE REDUNDANT	ALUMINUM CASE WITH LEADS

#### DC SUPPRESSORS



AI-025-DC	.25A	PCB MOUNT
AI-050-DC	.5A	PCB MOUNT
AI-100-DC	1.0A	PCB MOUNT
AI-101-DC	1.0A	BARRIER STRIP
AI-102-DC	2.5A	BARRIER STRIP
AI-105-DC	5.0A	BARRIER STRIP
AI-107-DC	7.5A	BARRIER STRIP
AI-115-DC	15.0A	BARRIER STRIP

#### RJ-11/RJ-45 SUPPRESSORS



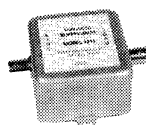
1315A-XXX	RJ-45	4 WIRE	GASTUBE
1315B-XXX	RJ-11	2 WIRE	GASTUBE
1315C-XXX	RJ-11	4 WIRE	GASTUBE
1315D-XXX	RJ-45	4 WIRE	MOV
1315E-XXX	RJ-11	2 WIRE	MOV
1315F-XXX	RJ-11	4 WIRE	MOV

#### DATA LINE SUPPRESSORS



1147-12	2 WIRE	12VDC	20KA/L
1147-25	2 WIRE	25VDC	20KA/L
1147-50	2 WIRE	50VDC	20KA/L
1148-12	4 WIRE	12VDC	20KA/L
1148-25	4 WIRE	25VDC	20KA/L
1148-50	4 WIRE	50VDC	20KA/L

#### COAXIAL SUPPRESSORS



1211	10VDC	20KA
	-1dB TO 50MHz (TYP)	HIGH SPEED VIDEO & DATA LINES
		BNC COAXIAL CONNECTORS

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**bel****FUSES**

Description	Bel Series	Available Amp Range	Volt	Safety Approvals	Data Sheet Number	Pack Type	Min Pack	Std. Box
<b>1/4 X 1-1/4 INCH</b>								
<b>GLASS-QUICK CARTRIDGE</b>	3AG	0.1 - 10A 12 - 15A	250 125	UL, CSA UL, CSA	3AGD0897	BULK	100/BAG	1000/BOX
PIGTAIL	3AP	0.1 - 10A 12 - 15A	250 125	UL, CSA UL, CSA	3AGD0897	BULK T&R	500/BAG CLASS 3	500/BOX 1000/REEL
<b>GLASS-SLOW BLOW CARTRIDGE</b>	3SB	0.062 - 8A 10 - 15A	250 125	UL, CSA UL, CSA	3SBD0897	BULK	100/BAG	1000/BOX
PIGTAIL	3SBP	0.062 - 8A 10 - 15A	250 125	UL, CSA UL, CSA	3SBD0897	BULK T&R	500/BAG CLASS 3	500/BOX 1000/REEL
<b>CERAMIC-NORMAL CARTRIDGE</b>	3AB	0.5 - 10A	250	UL, CSA	3ABD0897	BULK	100/BAG	1000/BOX
PIGTAIL	3ABP	0.5 - 10A	250	UL, CSA	3ABD0897	BULK T&R	500/BAG CLASS 3	500/BOX 1000/REEL
<b>CERAMIC-SLOW BLOW CARTRIDGE</b>	GSA	0.062 - 8A 10 - 15A	250 250	UL, CSA UR, CSA*	GSAD0897	BULK	100/BAG	1000/BOX
PIGTAIL	GSAP	0.062 - 8A 10 - 15A	250	UL, CSA UR, CSA*	GSAD0897	BULK T&R	500/BAG CLASS 3	500/BOX 1000/REEL
<b>1/4 X 1 INCH</b>								
<b>GLASS-NORMAL CARTRIDGE</b>	8AG	0.1 - 2A 2.5 - 7A	250 125	UL, CSA UL, CSA	8AGD0897	BULK	100/BAG	1000/BOX
PIGTAIL	8AP	0.1 - 2A 2.5 - 7A	250 125	UL, CSA UL, CSA	8AGD0897	BULK T&R	500/BAG CLASS 3	500/BOX 1000/REEL
<b>5 X 20MM</b>								
<b>GLASS-UL/CSA STYLE QUICK-CARTRIDGE</b>	5MF	0.1 - 3A 3.2 - 8A	250 125	UL, CSA UL, CSA	5MFD0897	BULK	100/BAG	1000/BOX
QUICK-PIGTAIL	5MFP	0.1 - 3A 3.2 - 8A	250 125	UL, CSA UL, CSA	5MFD0897	BULK T&R	500/BAG CLASS 2	500/BOX 1500/REEL
MEDIUM-CARTRIDGE	5MT	0.1 - 0.8A 1 - 5A	250 125	UL, CSA UL, CSA	5MTD0897	BULK	100/BAG	1000/BOX
MEDIUM-PIGTAIL	5MTP	0.1 - 0.8A 1 - 5A	250 125	UL, CSA UL, CSA	5MTD0897	BULK T&R	500/BAG CLASS 2	500/BOX 1500/REEL

UR = UL recognized component

CSA\* = CSA component acceptance

Specifications subject to change without notice.

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**bel**

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**FUSES**

Description	Bel Series	Available Amp Range	Volt	Safety Approvals	Data Sheet Number	Pack Type	Min Pack	Std. Box
<b>5 X 20MM</b>								
<b>GLASS-UL/CSA STYLE SLOW-BLOW</b>								
CARTRIDGE	5TT	0.080 - 3A 3.1 - 5A (CERAMIC) 6, 7, 8A	250 125 125	UL, CSA UL, CSA UL, CSA	5TTD0897	BULK	100/BAG	1000/BOX
PIGTAIL	5TTP	(CERAMIC) 10A 0.080 - 3A 3.1 - 5A (CERAMIC) 6, 7, 8A (CERAMIC) 10A	125 250 125 125	UR, CSA* UL, CSA UL, CSA UL, CSA UR, CSA*	5TTD0897	BULK T&R	500/BAG CLASS 2	500/BOX 1500/REEL
<b>GLASS-IEC/SEMKO/VDE QUICK-ACT (LBC)</b>								
CARTRIDGE	5SF	0.080 - 6.3A 8 - 10A	250 250	UR, CSA*, S, VDE UR, CSA*	5SFD0897	BULK	100/BAG	1000/BOX
PIGTAIL	5SFP	0.080 - 10A	250	UR, CSA*	5SFD0897	BULK T&R	500/BAG CLASS 2	500/BOX 1500/REEL
<b>GLASS-IEC/SEMKO/VDE TIME-LAG (LBC)</b>								
CARTRIDGE	5ST	0.080 - 6.3A 8 - 10A	250 250	UR, CSA*, S, VDE UR, CSA*	5STD0897	BULK	100/BAG	1000/BOX
PIGTAIL	5STP	0.1 - 10A	250	UR, CSA*	5STD0897	BULK T&R	500/BAG CLASS 2	500/BOX 1500/REEL
<b>GLASS-IEC/SEMKO/VDE TIME-LAG (LBC) HIGH 12T</b>								
CARTRIDGE	5VT	1 - 6.3A	250	UR, CSA*		BULK	100/BAG	1000/BOX
PIGTAIL	5VTP	1 - 6.3A	250	UR, CSA*		BULK T&R	500/BAG CLASS 2	500/BOX 1500/REEL
<b>GLASS-IEC/SEMKO/VDE TIME-LAG (EBC)</b>								
CARTRIDGE	5ET	1 - 6.3A	250	UR, CSA*		BULK	100/BAG	1000/BOX
PIGTAIL	5ETP	1 - 6.3A	250	UR, CSA*				
<b>CERAMIC - IEC/SEMKO/VDE QUICK-ACT (HBC)</b>								
CARTRIDGE	5HF	1 - 6.3A 0.1 - 10A	250	UR, CSA*, S, VDE UR, CSA*	5HFD0897	BULK	100/BAG	1000/BOX
PIGTAIL	5HFP	1 - 6.3A 0.1 - 10A	250	UR, CSA*, S, VDE UR, CSA*	5HFD0897	BULK T&R	500/BAG CLASS 2	500/BOX 1500/REEL
<b>CERAMIC-IEC/SEMKO/VDE TIME-LAG (HBC)</b>								
CARTRIDGE	5HT	1 - 6.3A 0.25 - 10A	250 250	UR, CSA*, S, VDE UR, CSA*	5HTD0897	BULK	100/BAG	1000/BOX
PIGTAIL	5HTP	0.25 - 10A	250	UR, CSA*	5HTD0897	BULK T&R	500/BAG CLASS 2	500/BOX 1500/REEL

UR = UL recognized component  
 CSA\* = CSA component acceptance

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**bel****FUSES**

Description	Bel Series	Available Amp Range	Volt	Safety Approvals	Data Sheet Number	Pack Type	Min Pack	Std. Box
<b>5 X 15MM PIGTAIL</b>								
<b>TELECOM FUSE SLOW BLOW</b> (2AG EQUIV.)	MJS	0.1 - 7A	250	UL, CSA	MJSD0897	BULK T&R	500/BAG CLASS 1	500/BOX 1500/REEL
<b>BALLAST FUSE 350V-QUICK-ACT</b> (2AG EQUIV.)	3JQ	0.1 - 7A	350	UR, CSA*	3JQD0897	BULK T&R	500/BAG CLASS 1	500/BOX 1500/REEL
<b>BALLAST FUSE 300V-SLOW BLOW</b> (2AG EQUIV.)	3JS	0.1 - 7A	350	UR, CSA*	3JSD0897	BULK T&R	500/BAG CLASS 1	500/BOX 1500/REEL
<b>MICRO FUSE</b>								
<b>AXIAL LEAD QUICK-ACT</b>	MQ	0.125 - 15A	125	UR, CSA*	MQD0897	BULK T&R	250/BAG CLASS 1	1000/BOX 2500/REEL
<b>SLOW BLOW</b>	MS	0.375 - 7A	125	UR, CSA*	MSD0897	BULK T&R	250/BAG CLASS 1	1000/BOX 2500/REEL
<b>RADIAL-IEC 127-3 STYLE TIME-LAG (SS 4)</b>								
<b>SHORT LEAD</b>	MRT	0.080 - 4A 0.080 - 6.3A	250 250	UR, CSA*, S, VDE UR, CSA*	MRTD0897	BULK	100/BAG	1000/BOX
<b>LONG LEAD</b>						TAPE	AMMO	1000/BOX
<b>RADIAL-IEC 127-3 STYLE QUICK-ACT (SS 3)</b>								
<b>SHORT LEAD</b>	MRF	0.050 - 5A 0.050 - 6.3A	250 250	UR, CSA*, S, VDE UR, CSA*	MRFD0897	BULK	100/BAG	1000/BOX
<b>LONG LEAD</b>						TAPE	AMMO	1000/BOX
<b>SURFACE MOUNT</b>								
<b>QUICK-ACT</b>	SSQ	0.10 - 7A	125	UL, CSA	SSQD0897	T&R	12MM	1000/REEL 5000/REEL
<b>TIME-LAG</b>	SST	0.50 - 7A	125	UL, CSA	SSTD0897	T&R	12MM	1000/REEL 5000/REEL
<b>1206 CHIP-QUICK ACT</b>	C1Q	1 - 3A	125	UL, CSA	C1QD0897	T&R	8MM	3000/REEL
<b>0603 CHIP-QUICK ACT</b>	C2Q	0.25 - 4A	32	UR, CSA*		T&R	8MM	3000/REEL
<b>FLAT PACK FUSE</b>								
<b>LEADED</b>	DJB	0.25 - 10A	125	UR	DJBD0897	BULK	100/BAG	1000/BOX
<b>SCREW MOUNT</b>	BER	0.25 - 10A	125	UR	DJBD0897	BULK	100/BAG	1000/BOX
<b>FUSE CLIPS</b>								
<b>FOR 1/4" DIA. FUSES</b>	FC-101	WITH EAR STOPS			FCD0897	BULK	2000/BAG	10,000/BOX
	FC-102	W/OUT EAR STOPS			FCD0897	BULK	2000/BAG	10,000/BOX
<b>FOR 5MM DIA. FUSES</b>	FC-201	PCB MOUNT			FCD0897	BULK	2000/BAG	10,000/BOX
	FC-211	PCB MOUNT, LOCKING TYPE			FCD0897	BULK	2000/BAG	10,000/BOX

UR = UL recognized component

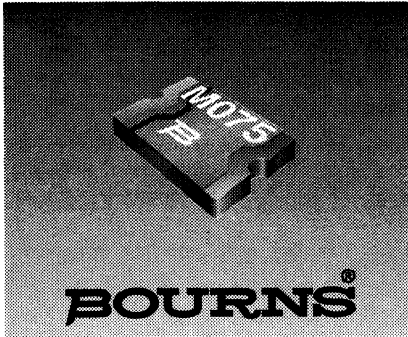
CSA\* = CSA component acceptance

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**Features**

- 4.5mm SMD
- Fast tripping resettable circuit protection
- Surface mount packaging for automated assembly
- Reduced component size and resistance
- Agency recognition:   

**Applications**

High Density Circuit Board Applications:

- Hard disk drives
- PC motherboards
- PC peripherals
- Point-of-sale (POS) equipment
- PCMCIA cards

**MF-MSMC Series - PTC Resetttable Fuses**

**Electrical Characteristics**

Model	V max. Volts	I max. Amps	I <sub>hold</sub>	I <sub>trip</sub>	Initial Resistance		Max. Time To Trip at 8.0 Amps	Tripped Power Dissipation
			Amperes at 23°C		Ohms at 23°C		Seconds at 23°C	Watts at 23°C
			Hold	Trip	Min.	Max.*		
MF-MSMC020	30.00	10	0.20	0.40	0.40	5.00	0.02	0.8
MF-MSMC035	6.0	40	0.35	0.70	0.32	1.3	0.10	0.6
MF-MSMC050	15.0	40	0.50	1.00	0.15	1.0	0.15	0.8
MF-MSMC075	13.2	40	0.75	1.50	0.11	0.45	0.20	0.8
MF-MSMC110	6.00	40	1.10	2.20	0.04	0.21	0.30	0.8

\*Rmax = 1 hour post-reflow conditions.

**Product Dimensions**

Model	A		B		C		D	E	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Min.	Max.
MF-MSMC020	4.37	4.73	3.07	3.41	0.56	0.81	0.30	0.25	0.50
MF-MSMC035	3.00	3.43	2.35	2.80	0.38	0.62	0.35	0.25	0.50
MF-MSMC050	4.37	4.73	3.07	3.41	0.38	0.62	0.30	0.25	0.50
MF-MSMC075	4.37	4.73	3.07	3.41	0.38	0.62	0.30	0.25	0.50
MF-MSMC110	4.37	4.73	3.07	3.41	0.38	0.62	0.30	0.25	0.50

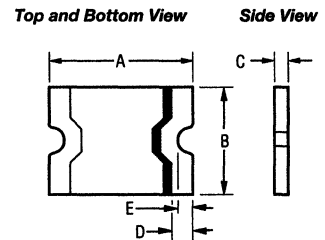
Packaging: All models = 1500 pcs. per reel.

DIMENSIONS = MM

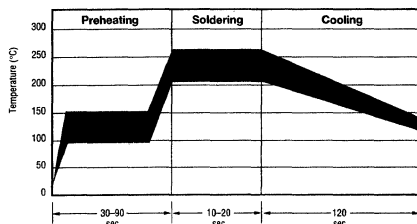
**Thermal Derating Chart - I<sub>hold</sub> (Amps)**

Part No.	Ambient Operating Temperature								
	-40°C	-20°C	0°C	23°C	40°C	50°C	60°C	70°C	85°C
MF-MSMC020	0.29	0.26	0.23	0.20	0.17	0.15	0.14	0.12	0.10
MF-MSMC035	0.47	0.45	0.40	0.35	0.30	0.28	0.24	0.21	0.18
MF-MSMC050	0.77	0.68	0.59	0.50	0.44	0.40	0.37	0.33	0.29
MF-MSMC075	1.15	1.01	0.88	0.75	0.65	0.60	0.55	0.49	0.43
MF-MSMC110	1.59	1.43	1.26	1.10	0.95	0.87	0.80	0.71	0.60

**Product Dimensions**

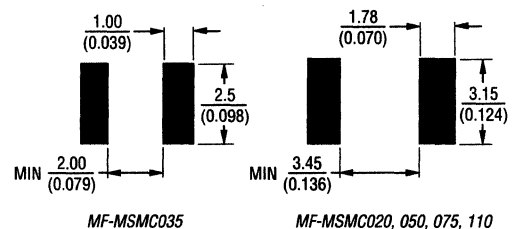


**Soldering Profile**



Note: MF-MSMC models can be wave soldered and reworked.

**Recommended Pad Layout**

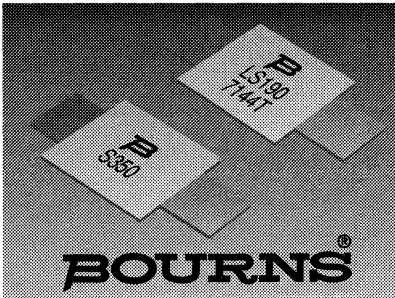





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**Features**

- Axial/radial leaded
- Fully compatible with current industry standards
- Weldable nickel terminals
- Very low internal resistance
- Agency recognition:   

**Applications**

- Rechargeable battery pack protection
  - Cellular phones
  - Laptop computers
- MF-LS: Any application that requires extra protection at elevated ambient temperatures, which the 100°C trip temperature provides.

**MF-S & MF-LS Series - PTC Resettable Fuses**

**Electrical Characteristics**

Model	V max. Volts	I max. Amps	I <sub>hold</sub>	I <sub>trip</sub>	Initial Resistance		1 Hour (R <sub>i</sub> ) Post-Trip Resistance	Max. Time To Trip		Tripped Power Dissipation
			Amperes at 23°C		Ohms at 23°C		Ohms at 23°C	Amperes at 23°C	Seconds at 23°C	Watts at 23°C
			Hold	Trip	Min.	Max.	Max.			
MF-S120	15	100	1.20	2.7	0.085	0.160	0.22	6	5.0	1.2
MF-S120S	15	100	1.20	2.7	0.085	0.160	0.22	6	5.0	1.2
MF-S150	15	100	1.50	3.00	0.05	0.09	0.11	7.5	5.0	1.30
MF-S175	15	100	1.75	3.8	0.05	0.09	0.120	8.75	4.0	1.5
MF-S175S	15	100	1.75	3.8	0.05	0.09	0.120	8.75	4.0	1.5
MF-S200	30	100	2.00	4.4	0.03	0.06	0.080	10	4.0	1.90
MF-S350	30	100	3.50	6.3	0.017	0.031	0.040	20	3.0	2.50
MF-S420	30	100	4.20	7.6	0.012	0.024	0.040	20	6.0	2.90
MF-LS100S	24	100	1.0	2.5	0.070	0.130	0.260	5	7.0	1.5
MF-LS180	24	100	1.8	3.8	0.040	0.068	0.120	9	2.9	2.0
MF-LS180S	24	100	1.8	3.8	0.040	0.068	0.120	9	2.9	2.0
MF-LS190	24	100	1.9	4.2	0.030	0.057	0.100	10	3.0	1.9
MF-LS190RU	15	100	1.9	4.2	0.030	0.057	0.100	10	3.0	1.9
MF-LS260	24	100	2.6	5.2	0.025	0.042	0.076	13	5.0	2.3
MF-LS300	24	100	3.0	6.3	0.015	0.031	0.055	15	4.0	2.0
MF-LS340	24	100	3.4	6.8	0.016	0.027	0.050	17	5.0	2.7

Note: Slotted option available on all models.

**Product Dimensions**

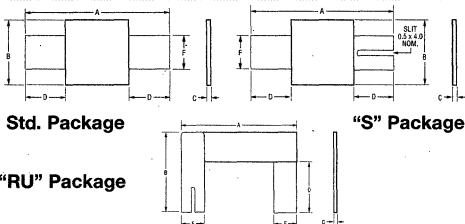
Model	A		B		C		D		F		Package Style
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
MF-S120	19.9	22.1	4.9	5.2	0.6	1.0	5.5	7.5	3.9	4.1	Std.
MF-S120S	19.9	22.1	4.9	5.2	0.6	1.0	5.5	7.5	3.9	4.1	S
MF-S150	21.3	23.4	10.2	11.0	0.5	1.1	4.1	5.5	4.8	5.4	Std.
MF-S175	20.9	23.1	4.9	5.2	0.6	1.0	4.1	5.5	3.9	4.1	Std.
MF-S175S	20.9	23.1	4.9	5.2	0.6	1.0	4.1	5.5	3.9	4.1	S
MF-S200	21.3	23.4	10.2	11.0	0.5	1.1	5.0	7.6	4.8	5.4	Std.
MF-S350	28.4	31.8	13.0	13.5	0.5	1.1	6.3	8.9	6.0	6.6	Std.
MF-S420	30.6	32.4	12.9	13.6	0.5	1.1	5.0	7.5	6.0	6.7	Std.
MF-LS100S	20.9	23.1	4.9	5.2	0.6	1.0	4.1	5.5	3.9	4.1	S
MF-LS180	24.0	26.0	4.9	5.2	0.6	1.0	4.1	5.5	3.9	4.1	Std.
MF-LS180S	24.0	26.0	4.9	5.2	0.6	1.0	4.1	5.5	3.9	4.1	S
MF-LS190	21.3	23.4	10.2	11.0	0.5	1.1	5.0	7.6	4.8	5.4	Std.
MF-LS190RU	19.8	20.8	13.3	14.3	0.4	0.76	8.1	9.5	3.8	4.2	RU
MF-LS260	24.0	26.0	10.8	11.9	0.6	1.0	5.0	7.0	5.9	6.1	Std.
MF-LS300	28.4	31.8	13.0	13.5	0.5	1.1	6.3	8.9	6.0	6.6	Std.
MF-LS340	24.0	26.0	14.8	15.9	0.6	1.0	4.0	5.0	5.9	6.1	Std.

All models packaged in bulk, 500 pieces each.

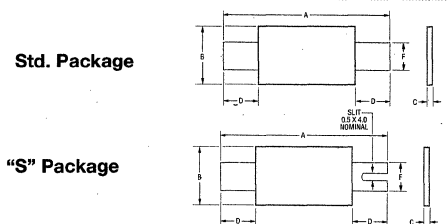
NOTE: Longer lead option available. Consult factory.

DIMENSIONS = MM

**Product Dimensions - MF-S Series**



**Product Dimensions - MF-LS Series**







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## MULTIFUSE® MF-R & MF-RX Series PTC Resettable Fuses

*Reset Your Current Thinking™*

### Features

- Radial Leaded Devices
- Cured, flame retardant epoxy polymer insulating material meets UL 94V-0 requirements
- Bulk packaging, tape and reel and Ammo-Pak available on most models
- Agency recognition: UL, TÜV & CSA
- Resettable circuit protection

### Applications

Almost anywhere there is a low voltage power supply and a load to be protected, including:

- Computers & peripherals
- General electronics
- Automotive applications

### Electrical Characteristics-MF-R Series

Model	V max. Volts	I max. Amps	I <sub>hold</sub>	I <sub>trip</sub>	Initial Resistance		1 Hour (R <sub>1</sub> ) Post-Trip Resistance	Max. Time To Trip at 5 <sup>th</sup> h	Tripped Power Dissipation
			Amperes at 23°C		Ohms at 23°C		Ohms at 23°C	Seconds at 23°C	Watts at 23°C
			Hold	Trip	Min.	Max.	Max.		
MF-R010	60	40	0.10	0.20	2.50	4.50	7.50	4.0	0.38
MF-R017	60	40	0.17	0.34	3.30	5.21	8.00	3.0	0.48
MF-R020	60	40	0.20	0.40	1.50	2.84	4.40	2.2	0.40
MF-R025	60	40	0.25	0.50	1.00	1.95	3.00	2.5	0.45
MF-R030	60	40	0.30	0.60	0.76	1.36	2.10	3.0	0.50
MF-R040	60	40	0.40	0.80	0.52	0.86	1.29	3.8	0.55
MF-R050	60	40	0.50	1.00	0.41	0.77	1.17	4.0	0.75
MF-R065	60	40	0.65	1.30	0.27	0.48	0.72	5.3	0.90
MF-R075	60	40	0.75	1.50	0.18	0.40	0.60	6.3	0.90
MF-R090	60	40	0.90	1.80	0.14	0.31	0.47	7.2	1.00
MF-R110	30	40	1.10	2.20	0.10	0.18	0.27	6.6	0.70
MF-R135	30	40	1.35	2.70	0.065	0.115	0.17	7.3	0.80
MF-R160	30	40	1.60	3.20	0.055	0.105	0.15	8.0	0.90
MF-R185	30	40	1.85	3.70	0.04	0.07	0.11	8.7	1.00
MF-R250	30	40	2.50	5.00	0.025	0.048	0.07	10.3	1.20
MF-R300	30	40	3.00	6.00	0.02	0.05	0.08	10.8	2.00
MF-R400	30	40	4.00	8.00	0.01	0.03	0.05	12.7	2.50
MF-R500	30	40	5.00	10.00	0.01	0.03	0.05	14.5	3.00
MF-R600	30	40	6.00	12.00	0.005	0.02	0.04	16.0	3.50
MF-R700	30	40	7.00	14.00	0.005	0.02	0.03	17.5	3.80
MF-R800	30	40	8.00	16.00	0.005	0.02	0.03	18.8	4.00
MF-R900	30	40	9.00	18.00	0.005	0.01	0.02	*20.0	4.20

\* Tested to 40 amps.

### Product Dimensions-MF-R Series-Refer to drawings next page. Dimensions in mm

Model	A	B	C		D	E	Physical Characteristics		
	Max.	Max.	Nom.	Tol. ±	Min.	Max.	Style	Lead	Material
MF-R010	7.4	12.7	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/NiCu
MF-R017	7.4	12.7	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/NiCu
MF-R020	7.4	12.7	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/CuFe
MF-R025	7.4	12.7	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/CuFe
MF-R030	7.4	13.4	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/CuFe
MF-R040	7.4	13.7	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/CuFe
MF-R050	7.9	13.7	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/Cu
MF-R065	9.7	15.2	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/Cu
MF-R075	10.4	16.0	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/Cu
MF-R090	11.7	16.7	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/Cu
MF-R110	8.9	14.0	5.1	0.7	7.6	3.0	1	0.51 dia.	Sn/Cu
MF-R135	8.9	18.9	5.1	0.7	7.6	3.0	1	0.51 dia.	Sn/Cu
MF-R160	10.2	16.8	5.1	0.7	7.6	3.0	1	0.51 dia.	Sn/Cu
MF-R185	12.0	18.4	5.1	0.7	7.6	3.0	1	0.51 dia.	Sn/Cu
MF-R250	12.0	18.3	5.1	0.7	7.6	3.0	2	0.81 dia.	Sn/Cu
MF-R300	12.0	18.3	5.1	0.7	7.6	3.0	2	0.81 dia.	Sn/Cu
MF-R400	14.4	24.8	5.1	0.7	7.6	3.0	2	0.81 dia.	Sn/Cu
MF-R500	17.4	24.9	10.2	0.7	7.6	3.0	2	0.81 dia.	Sn/Cu
MF-R600	19.3	31.9	10.2	0.7	7.6	3.0	2	0.81 dia.	Sn/Cu
MF-R700	22.1	29.8	10.2	0.7	7.6	3.0	2	0.81 dia.	Sn/Cu
MF-R800	24.2	32.9	10.2	0.7	7.6	3.0	2	0.81 dia.	Sn/Cu
MF-R900	24.2	32.9	10.2	0.7	7.6	3.0	2	0.81 dia.	Sn/Cu

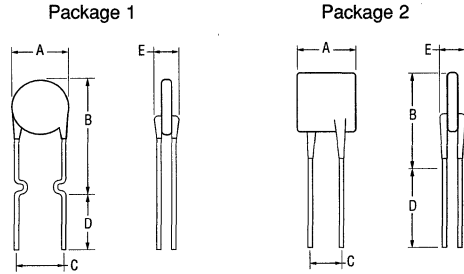


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# MULTIFUSE® MF-R & MF-RX Series PTC Resettable Fuses

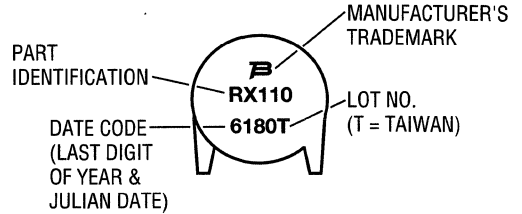
## Product Dimensions-MF-R Series

See previous page & below.



## Typical Part Marking

Represents total content. Layout may vary.



Specifications are subject to change without notice.

## Electrical Characteristics-MF-RX Series

Model	V max. Volts	I max. Amps	I <sub>hold</sub>	I <sub>trip</sub>	Initial Resistance		1 Hour (R <sub>i</sub> ) Post-Trip Resistance	Max. Time To Trip at 5*I <sub>h</sub>	Tripped Power Dissipation
			Amperes at 23°C		Ohms at 23°C		Ohms at 23°C	Seconds at 23°C	Watts at 23°C
			Hold	Trip	Min.	Max.	Max.		
MF-RX110	60	40	1.10	2.20	0.15	0.25	0.38	8.2	1.50
MF-RX135	60	40	1.35	2.70	0.12	0.19	0.30	9.6	1.70
MF-RX160	60	40	1.60	3.20	0.09	0.14	0.22	11.4	1.90
MF-RX185	60	40	1.85	3.70	0.08	0.12	0.19	12.6	2.10
MF-RX250	60	40	2.50	5.00	0.05	0.08	0.13	15.6	2.50
MF-RX300	60	40	3.00	6.00	0.04	0.06	0.10	19.8	2.80
MF-RX375	60	40	3.75	7.50	0.03	0.05	0.08	24.0	3.20

## Product Dimensions-MF-RX Series

Model	A	B	C		D	E	Physical Characteristics		
	Max.	Max.	Nom.	Tol. ±	Min.	Max.	Style	Lead	Material
MF-RX110	13.0	18.0	5.1	0.7	7.6	3.1	1	0.81 dia.	Sn/Cu
MF-RX135	14.5	19.6	5.1	0.7	7.6	3.1	1	0.81 dia.	Sn/Cu
MF-RX160	16.3	21.3	5.1	0.7	7.6	3.1	1	0.81 dia.	Sn/Cu
MF-RX185	17.8	22.9	5.1	0.7	7.6	3.1	1	0.81 dia.	Sn/Cu
MF-RX250	21.3	26.4	10.2	0.7	7.6	3.1	1	0.81 dia.	Sn/Cu
MF-RX300	24.9	30.0	10.2	0.7	7.6	3.1	1	0.81 dia.	Sn/Cu
MF-RX375	28.4	33.5	10.2	0.7	7.6	3.1	1	0.81 dia.	Sn/Cu

DIMENSIONS = MM.  
 0.51 (24AWG)  
 0.81 (20AWG)

## Test Procedures And Requirements For Model MF-R Series

Test.....Test Conditions .....Accept/Reject Criteria  
 Visual/Mech.....Verify dimensions and materials .....Per MF physical description  
 Resistance.....In still air @ 23°C.....R<sub>min</sub> ≤ R ≤ R<sub>max</sub>  
 Time to Trip.....5 times I<sub>hold</sub>, V<sub>max</sub>, 23°C.....T ≤ max. time to trip (seconds)  
 Hold Current.....30 min. at I<sub>hold</sub>.....No trip  
 Trip Cycle Life.....V<sub>max</sub>, I<sub>max</sub>, 100 cycles.....No arcing or burning  
 Trip Endurance ....V<sub>max</sub>, 48 hours .....No arcing or burning

UL File Number ... ( E 174545S)  
 CSA File Number . ( CA 110338)  
 TÜV File Number . ( E9772255.01)

## Environmental Characteristics

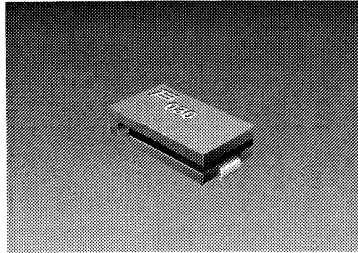
Operating/Storage Temperature.....-40°C to +85°C  
 Maximum Device Surface Temperature  
 in Tripped State .....125°C  
 Passive Aging.....+85°C, 1000 hours.....±5% typical resistance change  
 Humidity Aging.....+85°C, 85% R.H. 1000 hours .....±5% typical resistance change  
 Thermal Shock.....+85°C/-40°C 10 times .....±10% typical resistance change  
 Mechanical Shock .....MIL-STD-202, Method 213, .....No resistance change  
 .....Condition 1 (100g, 6 seconds)  
 Solvent Resistance.....MIL-STD-202, Method 215 .....No change  
 Vibration.....MIL-STD-883C, Method 2007.1, No change  
 .....Condition A



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# MULTIFUSE® MF-SM Series PTC Resettable Fuses

*Reset Your Current Thinking™*



## Features

- Surface Mount Devices
- Fully compatible with current industry standards
- Packaged per EIA 481-2 standard
- Agency recognition: UL, TÜV & CSA

## Applications

Almost anywhere there is a low voltage power supply and a load to be protected, including:

- Computers & peripherals
- General electronics
- Automotive applications

### Electrical Characteristics-MF-SM Series

Model	I max. Amps	V max. Volts	I <sub>hold</sub>	I <sub>trip</sub>	Initial Resistance		1 Hour (R1) Post-Reflow Resistance	Max. Time To Trip at 23°C		Tripped Power Dissipation
			Amperes at 23°C		Ohms at 23°C		Ohms at 23°C	Amps	Seconds	Watts at 23°C
			Hold	Trip	Min.	Max.	Max.	Max.	Max.	Nom.
MF-SM030	10	60	0.30	0.60	1.20	2.40	4.80	1.5	3.0	1.7
MF-SM050	10	60	0.50	1.00	0.35	0.70	1.40	2.5	4.0	1.7
MF-SM075	40	30	0.75	1.50	0.35	0.70	1.00	8.0	0.30	1.7
MF-SM100	40	30	1.10	2.20	0.12	0.24	0.48	8.0	0.50	1.7
MF-SM125	40	15	1.25	2.50	0.07	0.14	0.25	8.0	2.0	1.7
MF-SM150	40	15	1.50	3.00	0.06	0.12	0.25	8.0	5.0	1.9
MF-SM200	40	15	2.00	4.00	0.05	0.10	0.125	8.0	12.0	1.9
MF-SM250	40	15	2.50	5.00	0.04	0.08	0.085	8.0	25.0	1.9

### Product Dimensions-MF-SM Series (mm)

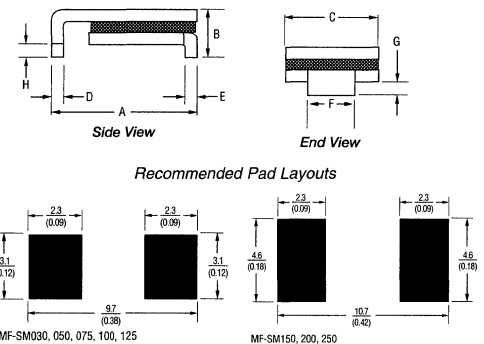
Model	A		B	C	D		E		F		G		H
	Min.	Max.	Max.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
MF-SM030	6.73	7.98	3.18	5.44	0.56	0.71	0.56	0.71	2.16	2.41	0.66	1.37	0.43
MF-SM050	6.73	7.98	3.18	5.44	0.56	0.71	0.20	0.30	2.16	2.41	0.66	1.37	0.43
MF-SM075	6.73	7.98	3.18	5.44	0.56	0.71	0.56	0.71	2.16	2.41	0.66	1.37	0.43
MF-SM100	6.73	7.98	3.00	5.44	0.56	0.71	0.56	0.71	2.16	2.41	0.66	1.37	0.43
MF-SM125	6.73	7.98	3.00	5.44	0.56	0.71	0.56	0.71	2.16	2.41	0.66	1.37	0.43
MF-SM150	8.00	9.50	3.00	6.71	0.56	0.71	0.56	0.71	3.68	3.94	0.66	1.37	0.43
MF-SM200	8.00	9.50	3.00	6.71	0.56	0.71	0.56	0.71	3.68	3.94	0.66	1.37	0.43
MF-SM250	8.00	9.50	3.00	6.71	0.56	0.71	0.56	0.71	3.68	3.94	0.66	1.37	0.43

Packaging options:

TAPE & REEL: MF-SM030-MF-SM125 = 2000 pcs. per reel;

MF-SM150-MF-SM250 = 1500 pcs. per reel.

### Product Dimensions-MF-SM Series



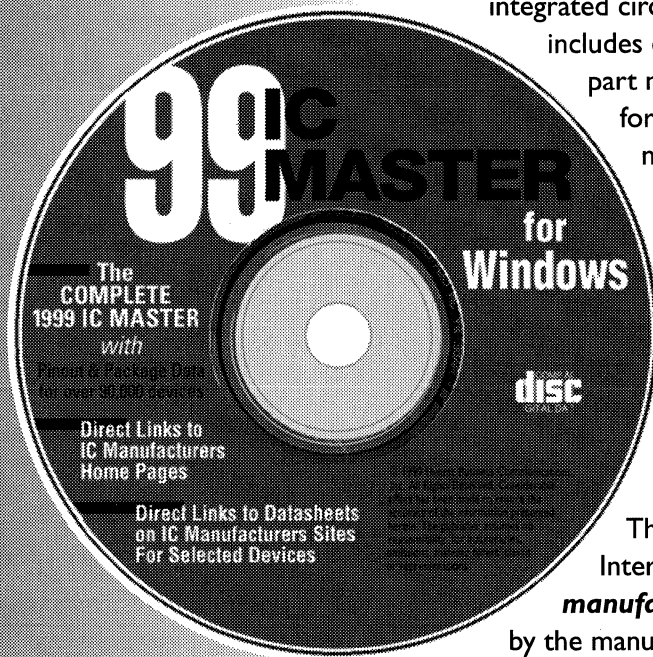
### Thermal Derating Chart - I<sub>hold</sub> (Amps)-MF-SM Series

Part Number	Ambient Operating Temperature								
	-40°C	-20°C	0°C	23°C	40°C	50°C	60°C	70°C	85°C
MF-SM030	0.45	0.40	0.35	0.30	0.25	0.23	0.20	0.17	0.14
MF-SM050	0.76	0.67	0.59	0.50	0.42	0.38	0.33	0.29	0.23
MF-SM075	1.13	1.01	0.88	0.75	0.62	0.56	0.50	0.44	0.34
MF-SM100	1.66	1.47	1.29	1.10	0.91	0.83	0.73	0.64	0.50
MF-SM125	1.89	1.68	1.46	1.25	1.04	0.94	0.83	0.73	0.56
MF-SM150	2.27	2.01	1.76	1.50	1.25	1.13	0.99	0.87	0.68
MF-SM200	3.02	2.68	2.34	2.00	1.66	1.50	1.32	1.16	0.90
MF-SM250	3.78	3.35	2.93	2.50	2.08	1.88	1.65	1.45	1.13

DIMENSION =  $\frac{MM}{INCHES}$

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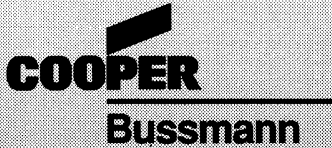
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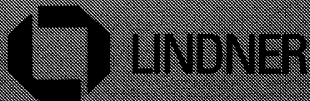
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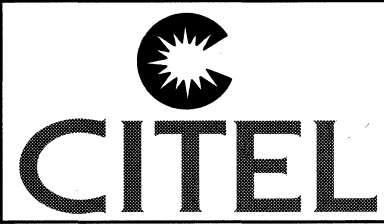
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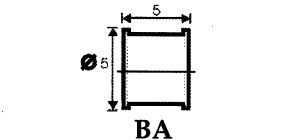




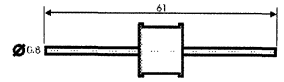
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 Tel: (305) 621-0022 • Fax: 1 (305) 621-0766  
 Internet: <http://www.CitelProtection.com>  
 E-mail: [citel4u@ix.netcom.com](mailto:citel4u@ix.netcom.com)

# Surge Arrester Gas Tubes

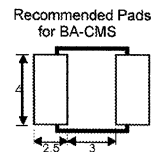
Part Number	Breakdown Voltage		100 Vdc Isolation resistance	1 MHz (pF) Capacitance	Holdover voltage (V)	Arc voltage (V)	8/20µs: 10 times impulse discharge current	10 times: 1s: 50 Hz AC discharge current	Options						
	Static								Axial	Radial	C	FS	SMD		
	Nominal (V)	Tolerance (%)												Leaded	Fail Safe
<b>NEW BA</b> Miniature Gas Tube Available in Surface Mount	230	±20	<700 V	>1GΩ	<1 pF	>100 V	<25V	2,5 kA	2,5 A	•				•	
	350	±20	<900 V	>1GΩ	<1 pF	>100 V	<25V	2,5 kA	2,5 A	•				•	
	400	±20	<1100 V	>1GΩ	<1 pF	>100 V	<25 V	2,5 kA	2,5 A	•				•	
<b>BB</b>	75	±20	<650 V	>1GΩ	<1 pF	>60V	<25 V	20 kA	20 A	•					
	90	±20	<700 V	>1GΩ	<1 pF	>60V	<25 V	20 kA	20 A	•					
	150	±20	<700 V	>1GΩ	<1 pF	>75V	<25 V	5 kA	5 A	•					
	230	±20	<750 V	>1GΩ	<1 pF	>100V	<25 V	8 kA	5 A	•					
	350	±20	<900 V	>1GΩ	<1 pF	>100V	<25 V	5 kA	5 A	•					
	470	±20	<1200 V	>1GΩ	<1 pF	>100V	<25 V	5 kA	5 A	•					
	1500	±20	<2000 V	>1GΩ	<1 pF	>100V	<20 V	10 kA	10 A	•					
<b>BH</b>	230	±20	<750 V	>1GΩ	<1 pF	>90V	<20 V	10 kA	10 A	•					
	350	±20	<900 V	>1GΩ	<1 pF	>100V	<20 V	10 kA	10 A	•					
	500	±20	<1000 V	>1GΩ	<1 pF	>100V	<20 V	10 kA	10 A	•					
	600	±20	<1000 V	>1GΩ	<1 pF	>100V	<20 V	10 kA	10 A	•					
	800	±20	<1400 V	>1GΩ	<1 pF	>100V	<20 V	10 kA	10 A	•					
	1000	±20	<1600 V	>1GΩ	<1 pF	>100V	<20 V	10 kA	10 A	•					
	1200	±20	<1800 V	>1GΩ	<1 pF	>100V	<20 V	10 kA	10 A	•					
	1500	±20	<2000 V	>1GΩ	<1 pF	>100V	<20 V	10 kA	10 A	•					
<b>NEW BM</b> Miniature Gas Tube Available in Surface Mount	90	±20	<700 V	>1GΩ	<1 pF	>70V	<25 V	5 kA	5 A	•				•	
	230	±20	<800 V	>1GΩ	<1 pF	>80V	<25 V	5 kA	5 A	•				•	
	350	±20	<1100 V	>1GΩ	<1 pF	>90V	<25 V	5 kA	5 A	•				•	
	500	±20	<1200 V	>1GΩ	<1 pF	>100V	<25 V	5 kA	5 A	•				•	
	1500	±20	<2000 V	>1GΩ	<1 pF	>100V	<20 V	10 kA	10 A	•					
<b>BT</b>	90	±20	<700 V	>1GΩ	<1 pF	>72V	<20 V	10 kA	10 A	•	•	•			
	150	±20	<700 V	>1GΩ	<1 pF	>80V	<20 V	10 kA	10 A	•	•	•			
	230	±20	<800 V	>1GΩ	<1 pF	>80V	<20 V	10 kA	10 A	•	•	•			
	350	±20	<900 V	>1GΩ	<1 pF	>90V	<20 V	10 kA	10 A	•	•	•			
	500	±20	<1200 V	>1GΩ	<1 pF	>110V	<20 V	10 kA	10A	•	•	•			
<b>CA8T11</b>	150	±20	<800 V	>1GΩ	<5 pF	>100V	<20 V	20kA	20A				•	•	
	230	±20	<800 V	>1GΩ	<5 pF	>100V	<20 V	20kA	20A				•	•	
	300	±20	<800 V	>1GΩ	<5 pF	>100V	<20 V	20kA	20A				•	•	
	420	±20	<1200 V	>1GΩ	<5 pF	>100V	<20 V	20kA	20A				•	•	



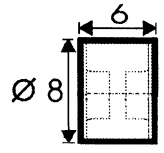
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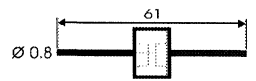
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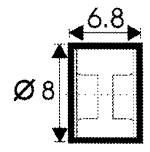
Recommended Pads for BA-CMS



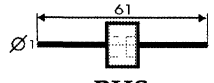
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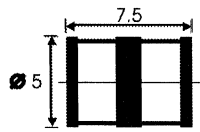
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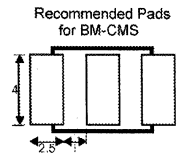
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BHS



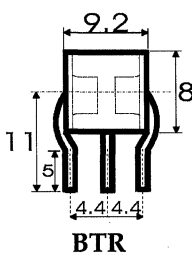
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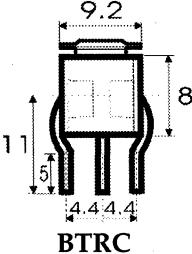
Recommended Pads for BM-CMS

Note 1: All characteristics are at 25°C  
 Note 2: Operating temperature range: -65°C to 125°C  
 Note 3: Call us for other voltages and/or specifications  
 Note 4: All Citel Gas-Tubes are guaranteed Non-Radio Active

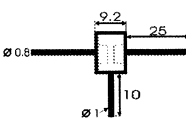
Note 5: Citel Gas-Tubes are UL approved  
 Note 6: Citel is ISO 9002  
 Note 7: Cage Code: OC8T6



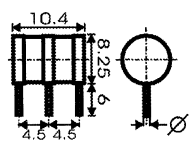
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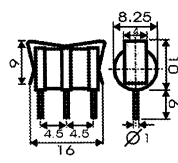
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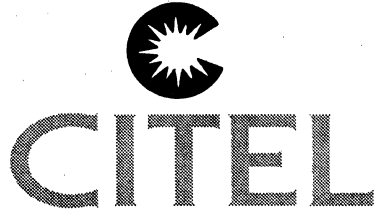
BTS



CA8T11R



CA8T11RFS



1111 Parkcentre Blvd , Suite 474  
Miami, FL 33169-USA  
Tel: (305) 621-0022 • Fax: 1 (305) 621-0766  
Internet: <http://www.CitelProtection.com>

**Coaxial Surge Protectors • Data line Surge Protectors  
AC Power Surge Protectors**

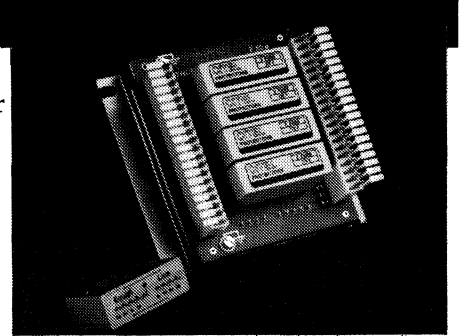
## Coaxial Surge Protectors

Citel coaxial surge protectors have been designed to protect, GPS, PCS transmitters, receivers, 2 way radios, and microwaves against lightning surges and electrical transients. They mount directly behind your equipment. (Bulkhead versions are also available.) Citel P8AX series is bidirectional. Available with N, BNC, UHF, TNC, SMA and 7/16 connectors.

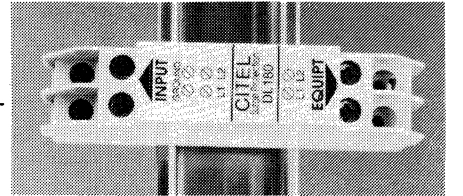


## Telephone and Data Line Surge Protectors

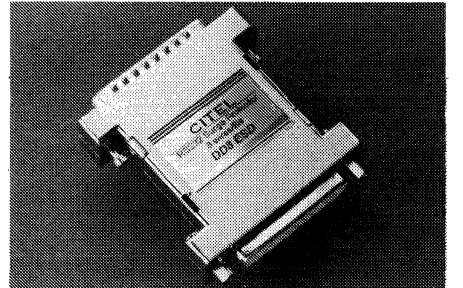
**Modular, Multi-Pair Base-** These modular bases can be used in cascade and are designed to be mounted easily on a wall, backboard, or distributing frame at the demarc point. They terminate and protect outside plant cable pairs. They have been designed to receive two pair plug-in modules, reference E280. Their presentation allows you to mix and match telephone and data lines at different clamping voltages. They are ideal to protect RS232, RS422, RS485, T1/E1 lines, 4-20mA loops, ISDN, LANs, PLCs, etc. Various I/O connections are offered: QC66, AT&T 110, screw terminals, RJ21, etc.



**DIN Rail Surge Protectors-** The Citel DL180 uses a heavy duty multi-stage circuitry to protect (2 wires) against lightning surges and electrical transients. It mounts on standard DIN rail 50022. I/O connections are with screw terminals. It is ideal for industrial control interfaces and any instrumentation. They come in various voltages for 4-20mA loops, analog circuits, and LANs.

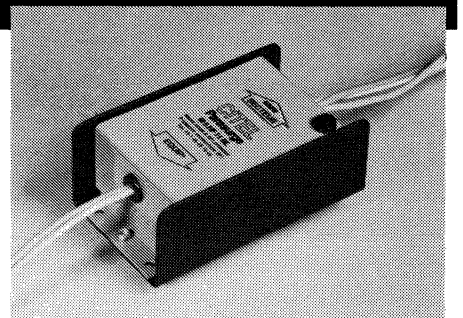
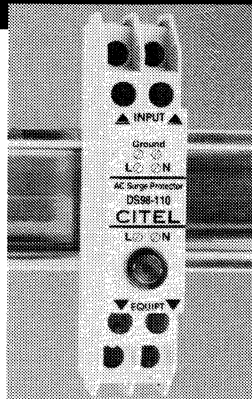


**DB25, DB9, & RJ45 Protectors-** These Citel surge protectors have been designed to be plugged in directly behind your equipment. I/O connection is made with DB25, DB9, DB15 connectors and RJ11 or RJ45 jacks. They are compatible with most major computers, programmable controllers and printers.



## AC Power Surge Protection



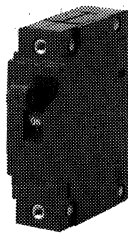
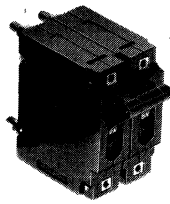
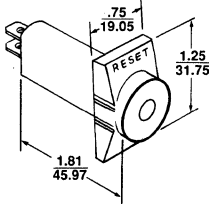
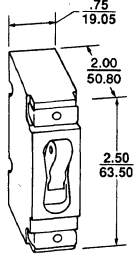
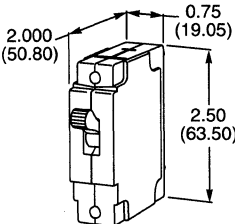
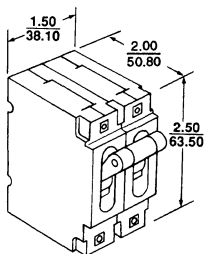
Citel features various AC surge protectors for 110VAC, 220VAC, 480VAC, single phase and three phase applications. They come hardwired for Panel mounting and DIN rail installations. Different levels of protection are offered from a single stage MOV based heavy duty unit to a three stage with EMI/RFI filter unit.



Operating Temperatures: -40°C to 85°C  
Cage Code: OC8T6

# Heinemann® Circuit Breakers

## First in Features, First in Quality

	RE-CIRK-IT® SERIES KD1	SERIES AM	SERIES AM/S	SERIES AM-MIL
				
<b>APPLICATIONS</b>	A low-cost, pushbutton supplementary protector for electrical equipment, designed to fit in a standard 5/8-inch round or "D" fuseholder panel cutout. Resettable at up to 1000% of its rated current from 2.5A through 15A, 500% from 0.25A through 2A. Slide-on retaining ring included.	A low-cost, lightweight breaker available in single or multi-pole configurations, the Series AM features rear-connection studs, a high level of moisture resistance, and a current range up to 100A dc or 60A ac. Qualified under MIL-C-55629 to 50A dc and ac.	Series AM/S "world class" circuit breakers meet International Standard IEC 380 and German Standard VDE 0730. The 8-mm spacing requirement and dielectric-withstand specification are incorporated into the standard AM breaker housing without changes in size, thereby eliminating mounting procedure modifications or the need for adapter plates.	Heinemann Series AM-MIL breakers are specifically built and tested in accordance with the requirements of MIL-C-55629. Fungus- and moisture-resistance is provided by treating all ferrous parts with a special finish, and by using special springs and inherently fungus-resistant phenolic cases, covers and handles.
<b>NO. OF POLES</b>	1	1 to 4	1 to 6	1 to 4
<b>CURRENT RATINGS</b>	0.25-15A	0.020-60A (ac) 0.020-100A (dc)	.1 to 100A (ac) .1 to 100A (dc)	0.020-50A (ac and dc)
<b>MAX. VOLTAGE</b>	250 Vac, 50/60 Hz 50 Vdc up to 10A 32 Vdc @ 15A 50 Vdc @ 10A	250 V, 50/60 or 400 Hz 277 V, 50/60 Hz, 1-phase 480 V, 50/60 Hz, 3-phase "Y", 65 Vdc AC/DC	250 V 50/60 Hz or 400 Hz 277 V 50/60 Hz 1-phase 65 Vdc 480 V 50/60 Hz 3-phase "Y"	240 V 50/60 Hz 240 V 400 Hz 50 Vdc
<b>INTERRUPTING CAPACITY</b>	1000A @ 250 Vac, 50/60 Hz 200A @ 32 Vdc and 50 Vdc per UL Std 1077 testing procedures	1000A 5000A with backup fusing	1000A 5000A with backup fusing 10,000A @ 120 vac	2000A @ 50 Vdc and 120 Vac 60 Hz 1500A @ 120 Vac, 400 Hz 1000A @ 240 Vac, 60 and 400 Hz
<b>AGENCY RECOGNITION OR APPROVAL</b>	UL recognized (Std 1077) CSA certified VDE approved SEV approved	UL recognized CSA certified	UL recognized (std 1077) CSA Certified SEV approved IEC approved VDE pending UL listed TUV approved	Not required for QPL items
<b>DIMENSIONS</b>				

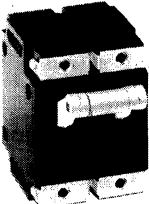




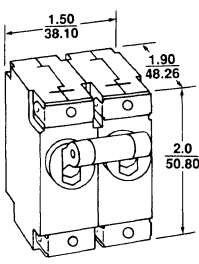
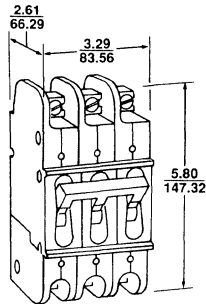
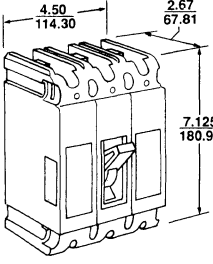
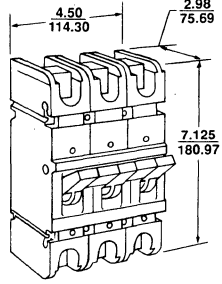
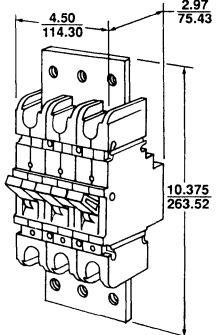
Eaton Corporation  
**Heinemann Products**  
 4201 N. 27th Street, Milwaukee, WI 53216  
 Phone: (800) 962-0820, Fax (414) 449-6118






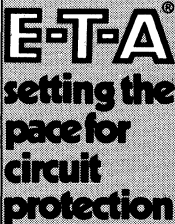











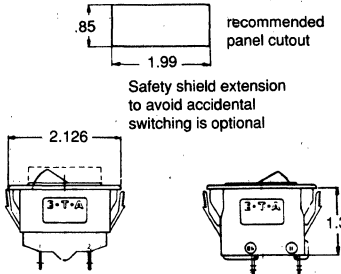
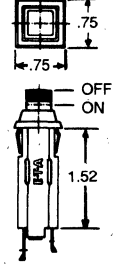
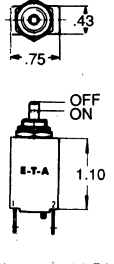
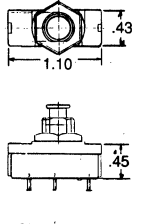
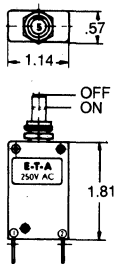
# Heinemann® Circuit Breakers

## First in Features, First in Quality

<p><b>SERIES J/S</b></p> 	<p><b>SERIES CF E-FRAME</b></p> 	<p><b>SERIES GH EH-FRAME</b></p> 	<p><b>SERIES GJ</b></p> 	<p><b>SERIES GJ1P</b></p> 
<p>Compact, lightweight, moderately-priced circuit breaker for single or multi-pole OEM applications. Also available with snap-in mounting or rocker handles. Sealed mount models are also available, single pole only. Series J/S breakers are suitable for domestic or world-market applications. Models also available for marine applications.</p>	<p>Priced considerably lower than competitive E-frame breakers, the Series CF is the most compact and versatile circuit breaker available for equipment and branch-circuit protection. Single- and multi-pole models are stocked in a wide range of standard ratings for fast, off-the-shelf delivery.</p>	<p>This rugged new EH-frame breaker offers all the advantages of a completely magnetic, three-pole breaker with 14,000A interrupting capacity for less than most thermal units. Compact, environmentally stable and to 100A at 480 Vac and 250 Vdc.</p>	<p>Where space is at a premium and current capacity up to 250A is called for, the Series GJ is the answer. Available in one-, two-, or three-pole models, it is especially suitable for panelboards, service entrances, and electric vehicles.</p>	<p>GJ1P parallel-pole breakers incorporate Precision Current Equalization (PCE) to automatically distribute current equally through the current-sensing elements. PCE thereby minimizes nuisance tripping which can occur with conventional parallel-pole breakers. An optional shunt permits metering of current. Since shunt output is only 25 mv, light-gauge wiring can be used between shunt and meter.</p>
<p>OEM (power supplies, medical-electronic equipment, control systems, office and EDP equipment), control panels, marine equipment, field instrumentation.</p>	<p>Panelboards, switchboards, branch circuits, EDP equipment, machine tools, environmental systems, single- and three-phase applications.</p>	<p>Motor controls, air conditioning, electric heating, computer main frames, transportation, indoor or outdoor installations.</p>	<p>Commercial, industrial, and residential service — entrance or panelboard applications; lighting, appliance, transformer, electric vehicles, EDP power supplies, heating, air conditioning, and electronic circuit protection.</p>	<p>Telecommunications, transportation, air conditioning, other outdoor "heat-loaded" equipment.</p>
<p>1 to 6</p>	<p>1 to 6</p>	<p>1 to 3</p>	<p>1 to 3</p>	<p>1</p>
<p>0.02-50A</p>	<p>0.01-100A (ac) 1.0-100A (dc)</p>	<p>.5-100A (ac) .5-100A (dc)</p>	<p>100-250A</p>	<p>100-700A (dc)</p>
<p>250 Vac (30A max.) 65 Vdc (50A max.) 80 Vdc (15A max.)</p>	<p>240 V, 50/60 or 400 Hz 480 V, 1- and 3-phase 125 Vdc 600 V, 3-phase 125 Vdc</p>	<p>480 V, 50/60 Hz 250 Vdc</p>	<p>240 V, 50/60 Hz 125/250 Vdc</p>	<p>160 Vdc</p>
<p>1000A 5000A with backup fusing</p>	<p>10,000 @ 120 Vac 7500A @ 120/240 Vac 50/60 Hz; 240 Vac 50/60 Hz 5000A @ 120/240 Vac 400 Hz; 240 Vac 400 Hz 125 Vdc</p>	<p>10,000A (ac) 10,000A (dc)</p>	<p>18,000A @ 240 V, 50/60 Hz 10,000A @ 125/250 Vdc 14,000A @ 160 Vdc 25,000A @ 65 Vdc</p>	<p>10,000A @ 160 Vdc 25,000A @ 65 Vdc</p>
<p>UL Recognized (Std 1077) CSA certified SEV approved IEC approved VDE approved</p>	<p>240 V, 50/60 Hz and 125 Vdc: UL listed Others: Recognized CSA certified</p>	<p><b>UL Recognized (ac)</b> <b>(3-pole)</b> <b>480 Vac</b> <b>15-100A</b></p>	<p>240 V, 50/60 Hz and 125/250 Vdc: UL listed</p>	<p>160 Vdc: UL listed</p>
				

Eaton Corporation  
**Heinemann Products**  
 4201 N. 27th Street, Milwaukee, WI 53216  
 Phone: (800) 962-0820, Fax (414) 449-6118



	ON-OFF Switch Circuit Breakers			Single Pole Overcurrent		
 <p>setting the pace for circuit protection</p>	 <p>-G10</p>	 <p>3120-F621 fits panel cutout Heinemann TX2 and AIRPAX 203-11 2 pole.</p>		 <p>41-04</p>		
	 <p>41-05</p>	 <p>41-06</p>				
Series	41-10-P10/41-11-P10	3120-F321	1110-F	41-04-PR 41-05-P30 41-06-P30	1410-G1 1410-L1	45-700-IG1-P10 45-700-IG1-P10-DD
Description	Single pole, series trip Rocker, Toggle or Baton handles in many colors. (Illumination Optional)	Double pole, identical Snap-in mounting of single pole 41-10/41-11 series (Illumination Optional)	Single pole, series trip B/W button trip indicator Push ON/Push OFF Switching	Series trip, miniature. 41-04-PR: PC Board Mount 41-05-P30: Snap-in Mount 41-06-P30: Panel Mount	Series trip	Series trip -DD has push ON, push OFF switching, B & W reset button for trip indication.
Current ratings	0.1 thru 20A	0.1 thru 16A	0.10 thru 16A	0.05 thru 10A	0.63 thru 6.3	0.05 thru 25A
Maximum voltage ratings	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc	250V ac or 48V dc	250V ac or 28V dc	250V ac or 28V DC
Maximum interrupting capacity depending on current rating. UL 1077 approved breakers have been tested to 2000A.	10 times rated current normal use. UL up to 2000A.	10 times rated current 0.1-2A. 300A for ratings 2.5-16A. UL tested to 2000A.	10 times rated current normal use. UL up to 1000A.	6 times rated current. UL up to 1000A. 5 times for ratings 3.5 thru 5A, 4 times for ratings 6 thru 10A.	8 times rated current of circuit breaker, normal use. UL up to 200A.	10 times rated current of circuit breaker, normal use. UL up to 2000A.
Current capacity of auxiliary contacts, NO, NC.	NA	5A resistive 3 .110" quick connect NO-NC-COM	NA	NA	NA	NA
Life	6000 cycles (UL 1077) 25,000 mechanical	6000 cycles (UL 1077) 25,000 mechanical	6000 cycles (UL 1077) 10,000 mechanical	2000 cycles at rated current	300 cycles at rated current	6,000 cycles (UL 1077) 10,000 mechanical
Terminals	.250 quick connect	.250 quick connect	.250 quick connect	.110 quick connect	PCB, solder	.250 quick connect
Shunt circuit—A3, optional	Optional; specify—A3	Optional	NA	Optional; specify—A3	NA	Optional; specify—A3
Approvals  E-T-A also has European approvals, such as VDE etc. Additional info upon request.	UL 1077; E67320 CSA: 16186 VDE	UL 1077; E67320 CSA: 16186 VDE	UL 1077; E67320 CSA: 16186 up to 15A VDE	UL 1077; E67320 CSA: 16186 VDE	UL 1077; E67320 CSA: 16186 up to 3.5A VDE	UL 1077; E67320 up to 16A CSA: 16186 up to 15A VDE
Design notes See technical data sheets for data	41-10 is unlighted 41-11 is illuminated	Options: • handle colors • handle marking • illumination • Amp ratings • Dust/water seal	Snap in mounting. Fully trip free. Color trip indicator band upon request.	Smallest full feature circuit breaker. .250 quick-connect avail, non-standard (-P10)	.110 quick-connect available, -G1 only.	Screw terminals available, specify-S10. Version for Class 2 transformers available: Specify 45-700-P10-CL2 3.2 or 5A.
Physical Dimensions in inches All dimensions without tolerances are for reference only. In the interest of improved design and performance, E-T-A reserves the right to make changes in these specifications.	 <p>.85, 1.99, 2.126, 1.3</p> <p>recommended panel cutout</p> <p>Safety shield extension to avoid accidental switching is optional</p>	 <p>.75, .75, 1.52</p> <p>OFF ON</p>	 <p>.43, .75, 1.10</p> <p>OFF ON</p> <p>Shown: 41-06-P30</p>	 <p>.43, 1.10, .45</p> <p>Shown: 1410-G1</p>	 <p>.57, 1.14, 1.81</p> <p>OFF ON</p>	



1551 Bishop Court, Mount Prospect, IL 60056 • 847-827-7600 • FAX: 847-827-7655  
 236 Hood Road, Markham, Ontario Canada L3R 3K8 • 905-475-5886 • FAX: 905-475-5889

**Single Pole Overcurrent Circuit Breakers** *continued*



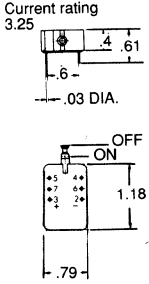
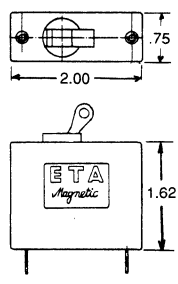
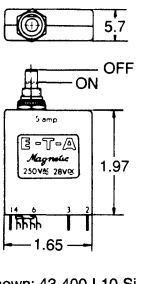
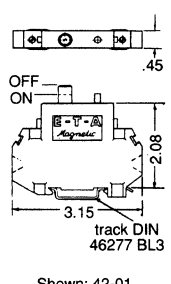
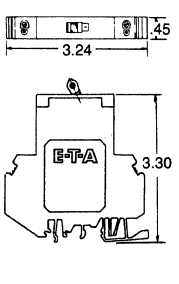


**E-T-A**  
**setting the  
 pace for  
 circuit  
 protection**

<b>46-500-P10</b>	<b>1658-P10</b>	<b>45-000-P10-H</b>	<b>46-400-L10-Si</b> <b>46-200-L10-Si-H</b>	<b>44-800-P10</b> <b>44-500-P10-H</b>	<b>Series</b>
Series trip automatic reset	Series trip Direct replacement for MP 1600 and P&B W58	Series trip on-off switching 2 pole: series 45-400 	Series trip two auxiliary contacts NO, NC 46-200-L10-Si-H has ON-OFF switch	Two independent circuits (relay-trip) 44-500-P10-H with ON-OFF switch 	<b>Description</b>
0.1 thru 15A	5 thru 35A	0.05 thru 25A	0.05 thru 16A	0.05 thru 8A	<b>Current ratings</b>
250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc	<b>Maximum voltage ratings</b>
6 times rated current of circuit breaker, 60A maximum	2000A UL tested according to std. 1077	10 times rated current of circuit breaker, normal use. UL up to 2000A	10 times rated current of circuit breaker, normal use. UL up to 2000A	main circuit 100A resistive. Control circuit 8 times rated current	<b>Maximum interrupting capacity</b> depending on current rating. UL 1077 approved breakers have been tested to 2000A
NA	NA	NA	1A resistive 4 solder terminals (Std.)	NA	<b>Current capacity of auxiliary contacts, NO, NC.</b>
10,000 cycles at 200% rated current	2000 cycles at rated current	6000 cycles (UL 1077) at rated current	6000 cycles at rated current	6000 cycles at rated current	<b>Life</b>
.250 quick connect	.250 quick connect	.250 quick connect	Solder terminals	.250 quick connect	<b>Terminals</b>
Optional; specify—A3	NA	Optional; specify—A3	Optional; specify—A3	Relay trip, standard	<b>Shunt circuit—A3, optional</b> 
UL: E29255 CSA: 16186 VDE	UL 1077: E67320 up to 25A CSA: 16186 up to 25A VDE	UL 1077: E67320 up to 16A CSA: 16186 up to 15A VDE Series 45-400: VDE only	UL 1077: E67320 up to 16A CSA: 16186 up to 15A VDE	CSA: 16186	<b>Approvals</b> E-T-A also has European approvals, such as VDE etc. Additional info upon request
Screw terminals 1,2 available (—S20), non-standard	Right angle quick connect or screw terminals available. 7/16 D mounting: -G41 3/8 D mounting: -G21	Screw terminals available. Specify-S10. UL approved for primary ON/OFF switching. 45-400: NC aux. contacts 5A max. continuous.	.250 quick-connect main terminals available, non-standard (—P10)	Screw terminals available non-standard (—S10), series 44-500-P10-H for ON/OFF switching.	<b>Design notes</b> See technical data sheets for data
	 Shown: 1658-G41-04-P10	 Shown: 45-000-P10-H	 Shown: 46-400-L10-Si	 SHOWN: 44-800-P10	<b>Physical Dimensions In Inches</b> All dimensions without tolerances are for reference only. In the interest of improved design and performance, E-T-A reserves the right to make changes in these specifications.



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 236 Hood Road, Markham, Ontario Canada L3R 3K8 • 905-475-5886 • FAX: 905-475-5889

 <b>E-T-A</b> setting the pace for circuit protection	Magnetic		Thermal-Magnetic Circuit Breakers		
Series	48-08	8340-F	43-400-P10 43-500-P10	42-01 42-01-2325	2210-T2
Description	Magnetic, undelayed trip, PC board mount, NO and NC contacts. ON-OFF switching.	Series trip Magnetic hydraulic auxiliary contacts available. 1, 2, 3, or 4 pole configuration available.	Series trip, UL approved for primary ON-OFF switching.	Series trip, ON-OFF switching, DIN track 3 mounting. Adapter for DIN track 1 available.	Series trip, ON-OFF switching. Aux. contacts std. 1, 2, 3 or 4 pole configuration. DIN track or panel mount configurations.
Current ratings	0.01 thru 3.25A	0.02 thru 30A	0.05 thru 15A	0.1 thru 15A	0.1 thru 20A*
Maximum voltage ratings	115V ac or 60V dc	250V ac or 65V dc	250V ac or 65V dc	250V ac or 65V dc	250V ac or 65V dc
Maximum interrupting capacity depending on current rating, UL 1077 approved breakers have been tested to 2000A	40A at 115Vac/60V dc 60A at 48V ac/dc 100A at 24V ac/dc	1000A normal use. UL up to 5000A.	200A normal use. UL up to 1000A. 1500A/250V ac version, current ratings 8-15A. E-T-A series 42-1-P10 (not-Si)	200A normal use. UL tested to 1000A.	500A normal use, not to exceed 100 times rated current
Current capacity of auxiliary contacts, NO, NC.	NO contacts: 5A continuous at 24V	10A resistive 3 terminals, optional	1A resistive 4 solder terminals optional.	NA	1A resistive, 1 set per pole, NO or NC (specify)
Life	10,000 cycles at rated current	10,000 cycles at rated current	6000 cycles (UL 1077) at rated current	6000 cycles (UL 1077) at rated current	10,000 cycles at rated current
Terminals	PC board pins	250 quick connect	Solder terminals	Screw clamp terminals	Screw clamp terminals
Shunt circuit—A3, optional	Can be arranged	Optional	Optional; specify—A3	NA	Panel mount version
Approvals  E-T-A also has European approvals, such as VDE etc. Additional info upon request.		UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 CSA: 16186 VDE  *approvals to 16A only
Design notes See technical data sheets for data	Series 48-08 has extra low impedance.	Shunt relay trip and impulse delay available. Single hole mount version available.	Quick connect or screw terminals available, non-standard. DUAL CONTROL available. UL approved for primary ON-OFF switching.	Half inch spacing makes this device especially attractive for modern control systems design.	Fits all popular DIN track. Panel mount version available upon request.
Physical Dimensions in inches All dimensions without tolerances are for reference only. In the interest of improved design and performance, E-T-A reserves the right to make changes in these specifications.	<p>Current rating 3.25</p> 		 <p>Shown: 43-400-L10-Si</p>	 <p>Shown: 42-01</p>	



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**Military Type Circuit Breakers**



 							<p><b>Series</b></p>
<p>483-G533 583-G533</p>	<p>48-2-S14-LN2</p>	<p>41-2-S14-LN2</p>	<p>41-3-S14-LN2</p>	<p>45-2-S-N2</p>	<p>44-7-S-H-N</p>	<p><b>Description</b></p>	
<p>Series trip, push pull ON-OFF switching. Single or Three pole</p>	<p>Series trip, push-pull ON-OFF switching. Similar devices also avail. for 2 pole (45-62-S) or 3 pole (45-82-S) use.</p>	<p>Series trip, push-pull, ON-OFF switching.</p>	<p>Series trip, push-pull, ON-OFF switching.</p>	<p>Series trip, push-pull, ON-OFF switching.</p>	<p>Series trip, push-pull, ON-OFF switching.</p>	<p><b>Current ratings</b></p>	
<p>1 thru 25A</p>	<p>3 thru 35A</p>	<p>1 thru 25A</p>	<p>30 thru 70A</p>	<p>60,70,80,90,100A</p>	<p>125,160,225,300,400</p>	<p><b>Maximum voltage ratings</b></p>	
<p>115V ac or 28V dc</p>	<p>115V ac or 28V dc</p>	<p>115V ac or 28V dc 250V ac upon request</p>	<p>115V ac or 28V dc 250V ac upon request</p>	<p>28V dc ac ratings upon request</p>	<p>28V dc</p>	<p><b>Maximum interrupting capacity</b> depending on current rating, UL 1077 approved breakers have been tested to 2000A</p>	
<p>Up to 2500A at 115V ac Up to 6000A at 28V dc</p>	<p>500A for current ratings 3-5A. 3500 A for current ratings 7.5 - 35A.</p>	<p>10 times rated current for current ratings 1-5A 1000A for current ratings 8-25A</p>	<p>2000A at 28V dc</p>	<p>8000A at 28V dc 1000A at 250V ac 2000A at 115V ac</p>	<p>10,000A at 28V dc</p>	<p><b>Current capacity of auxiliary contacts, NO, NC.</b></p>	
<p>on request</p>	<p>NA</p>	<p>NA</p>	<p>NA</p>	<p>NA</p>	<p>5A resistive 4 screw terminals, optional</p>	<p><b>Life</b></p>	
<p>10,000 cycles at rated current</p>	<p>5000 cycles at rated current</p>	<p>4000 cycles at 200% rated current</p>	<p>2000 cycles at rated current</p>	<p>1000 cycles at rated current</p>	<p>1000 cycles at rated current</p>	<p><b>Terminals</b></p>	
<p>Screw terminals</p>	<p>Screw terminals</p>	<p>Screw terminals</p>	<p>Screw terminals</p>	<p>Screw terminals</p>	<p>Screw terminals</p>	<p><b>Shunt circuit—A3, optional</b></p>	
<p>NA</p>	<p>NA</p>	<p>NA</p>	<p>NA</p>	<p>NA</p>	<p>NA</p>	<p><b>Approvals</b> E-T-A also has European approvals, such as VDE etc. Additional info upon request</p>	
<p>MIL-C-5809 MS3320 MS14154</p>	<p>will meet MIL E 5272 C</p>	<p>will meet MIL E 5272 C</p>	<p>will meet MIL E 5272 C</p>	<p>will meet MIL E 5272 C</p>	<p>will meet MIL E 5272 C</p>	<p><b>Design notes</b> See technical data sheets for data</p>	
<p>State-of-the-art, temperature compensated, dual chamber construction</p>	<p>Melamine housing. Corrosion, humidity, and fungus resistant. Front panel seal available. For detailed tech. data 2</p>	<p>Melamine housing. Corrosion, humidity, and fungus resistant. Front panel seal available.</p>	<p>Melamine housing. Corrosion, humidity, and fungus resistant. Front panel seal available.</p>	<p>Melamine housing. Corrosion, humidity, and fungus resistant. Front panel seal available.</p>	<p>Auxiliary circuits NO, NC available, order — SI.</p>	<p><b>Physical Dimensions in inches</b> All dimensions without tolerances are for reference only. In the interest of improved design and performance, E-T-A reserves the right to make changes in these specifications.</p>	
 <p>Shown: 483</p>							



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# Fuseholders · Fuse Clips

# Blown Fuse Indicators

## Commercial & Military Approved Panel Mount Fuseholders

Web Site: [www.ficcorp.com](http://www.ficcorp.com)  
E-mail: [ficcorp@ficcorp.com](mailto:ficcorp@ficcorp.com)



- Superior Clip Design for Solid Fuse Contact
- UL Recognized & C.S.A. Certified
- Most Commercial Models are recognized under the Marine Electrical and Fuel System (PEQZ2) as "Ignition Protected Devices"

- Blown Fuse Indicating & Non-Indicating
- High Impact Plastic for Superior Strength
- Dead-Front, Watertight
- Military Versions Meet MIL-F-19207

### Commercial Fuseholders All Recognized by Underwriters Laboratories

Model	Fuse Size	Qty	Indicating (I) or Non-Indicating (N)	Voltage AC/DC	UL Recognized Amps	UL Recognized Voltage
5000*	1/4x1 1/2"	1	N	250	0-30	250 max
5100*	1/4x1 1/2"	3	N	250	0-30	250 max
5200*	1/4x1 1/2"	1	N or I	250	0-30	250 max
*5300*	1/4x1 1/2"	2	N or I	250	0-30	250 max
*5400*	1/2x1 1/2"	1	N	600	0-30	600 max
*5500*	1/2x1 1/2"	3	N	600	0-30	600 max
*5600*	1/2x1 1/2"	1	N or I	600	0-30	600 max
*5700*	1/2x1 1/2"	2	N or I	600	0-30	600 max
*5800	3/8x2"	1	N or I	600	0-30	250 max
*5900	1/4x3"	1	N or I	600	31-60	250 max

\*CSA Certified  
\*Ignition Protected Devices

Indicating models can be modified for use in low voltage applications.

### Military Fuseholders

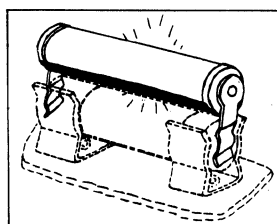
MIL-SPEC	Type	Fuse Size	Qty	Indicating (I) or Non-Indicating (N)	Amps	Volts	Moisture Protection
19207/1	FHL10U	1/4x1 1/2"	2	I	0-30	90-250	Unsealed
19207/2	FHL11U	1/4x1 1/2"	1	I	0-30	90-250	Unsealed
19207/3	FHL12U	1/2x1 1/2"	1	I	0-30	90-500	Unsealed
19207/4	FHL13G	3/8x2"	1	I	0-30	90-500	Drip-proof
19207/5	FHL14G	1/2x3"	1	I	31-60	90-500	Drip-proof
19207/6	FHL15G	1 1/4x5 1/2"	1	I	61-100	90-500	Drip-proof
19207/7	FHL16G	1 1/2x7 1/2"	1	I	101-200	90-500	Drip-proof
19207/17	FHN28WB	1/4x1 1/2"	1	N	0-30	250 Max	Watertight Body Sealed
19207/18	FHL29G	1/4x1 1/2"	2	I	0-30	12-90	Drip-proof
19207/19	FHL30G	1/4x1 1/2"	1	I	0-30	12-90	Drip-proof
19207/21	FHL32W	1/4x1 1/2"	1	I	0-30	90-250	Watertight
19207/22	FHL33W	1/4x1 1/2"	2	I	0-30	90-250	Watertight
19207/23	FHL34W	1/2x1 1/2"	2	I	0-30	90-500	Watertight
19207/24	FHL35W	1/2x1 1/2"	1	I	0-30	90-500	Watertight
19207/25	FHN41WB	1/2x1 1/2"	1	N	0-30	500 Max	Watertight Body Sealed
19207/30	FHN46WB	1/4x1 1/2"	3	N	0-30	250 Max	Watertight Body Sealed
19207/31	FHN47WB	1/2x1 1/2"	3	N	0-30	500 Max	Watertight Body Sealed

## Blown Fuse Indicators

When A Fuse Blows, A Light Glows!\*

### Several Models To Choose From

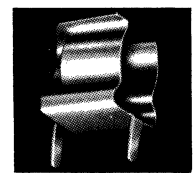
- Bolt Down for Rectifier Fuses
- Snap On for Ferrule Fuses
- Top Mounting for Knife Blade Fuses



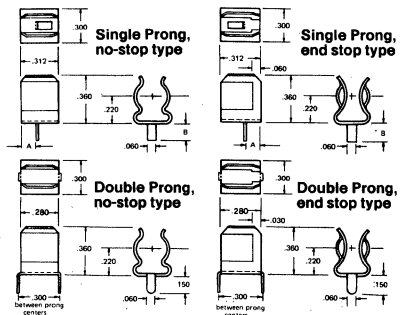
**FIC CORPORATION**  
P.O. Box 2046  
12216 Parklawn Drive  
Rockville, MD 20852

**TOLL FREE: 800/638-6594**  
**IN MD: 301/881-8124**  
**TWX: 710-828-9809**

## PC BOARD FUSE CLIPS



Low profile clips (.360" high) are soldered to printed circuit boards eliminating eyeletting or riveting. Available in Spring brass, beryllium copper or spring bronze with various platings.





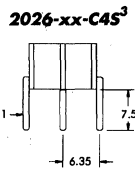
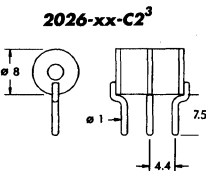
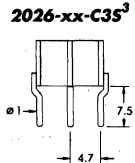
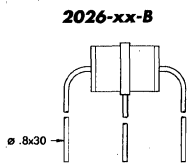
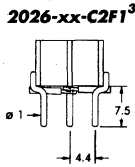
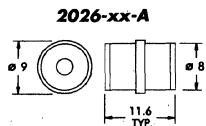
**JOSLYN ELECTRONIC SYSTEMS COMPANY**

6868 Cortona Drive, Goleta • California 93116-0817

Phone: (805) 968-3551 • Fax: (805) 968-2335 or -0922 • Customer Service: 1-800-752-8068

**BALANCED TRIGARD®**  
3-Pole Gas Discharge Tube/2026 Series

CHARACTERISTICS, Test Methods per ITU-T (CCITT) K.12, IEEE C62.31



Model Numbers	2026-09	2026-15	2026-20	2026-23
DC Sparkover,	100V/s ( $\pm 20\%$ )	90V	150V	200V
Impulse Sparkover,	110V/ $\mu$ s	500V	450V	475V
	1000V/ $\mu$ s	700V	600V	625V
625V				650V
Model Numbers	2026-25	2026-30	2026-35	2026-40
DC Sparkover,	100V/s ( $\pm 20\%$ )	250V	300V	350V
Impulse Sparkover,	110V/ $\mu$ s	550V	600V	700V
	1000V/ $\mu$ s	700V	800V	900V
900V				1000V
Impulse Transverse Delay	1000 V $\mu$ s			75 ns
Insulation Resistance (IR)	100 V, (50V for-09)			>10 <sup>10</sup> $\Omega$
Glow Voltage	10 mA			70 V
Arc Voltage	>1 A			10 V
Glow-Arc Transition Current				<0.5 A
Capacitance	1 MHz			<2 pF
DC Holdover Voltage	>135 V, (52V for-09, 80V for-15)			<150 ms
Impulse Discharge Current	40000 A, 8/20 $\mu$ s <sup>2</sup>			1 Operation
	20000 A, 8/20 $\mu$ s			10 Operations
	200 A, 10/700 $\mu$ s			500 Operations
	200 A, 10/1000 $\mu$ s			300 Operations
Alternating Discharge Current	130 Arms, 11 cycles <sup>2</sup>			1 Operation
	20 Arms, 1 s			10 Operations
Failsafe Operating Time	1 Arms			20 s
	5 Arms			8 s
	10 Arms			3 s
Operating Temperature				-55 to 250C
Warranty				1 Year

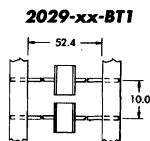
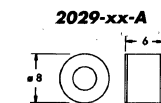
- Notes:
- Model number marking on tube: 26-xxxV
  - These Gas Discharge Tubes are available without preionizing material - add "Y" to the model number, i.e. 2026-xx-AY, disregard first dc sparkover value.
  - The rated Discharge Current for Trigard® Discharge Tubes is the total current equally divided between each line to ground
  - Sparkover limits  $\pm 25\%$  after life IR>10<sup>10</sup> $\Omega$

1. Tube meets BT requirement Type 14A and 14A/1 (210-310V)
2. Tube may exceed  $\pm 25\%$  after discharge, but will remain protecting without venting
3. For solderable terminals add "S" to the model number, i.e.-C2S

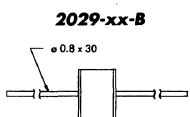
UL recognized component, UL File E153537

**MSP®**  
Heavy Duty 2-Pole Gas Discharge Tube/2029 Series

CHARACTERISTICS, Test Methods per ITU-T (CCITT) K.12, IEEE C62.31



**Tape and Reel**  
(per EIA RS-296-D  
1000 GDI/per spool)



Model Numbers	2029-23	2029-25	2029-35	2029-47
DC Sparkover,	100V/s ( $\pm 15\%$ )	230V	250V	350V
Impulse Sparkover,	100V/ $\mu$ s	550V	575V	650V
	1000V/ $\mu$ s	750V	775V	850V
850V				950V
Insulation Resistance (IR)	100 V			>10 <sup>10</sup> $\Omega$
Glow Voltage	10 mA			70 V
Arc Voltage	2 A			10 V
Glow-Arc Transition Current				<1 A
Capacitance	1 MHz			<1 pF
DC Holdover Voltage	>80 V			<150 ms
Impulse Discharge Current	20000 A, 8/20 $\mu$ s			10 Operations
	200 A, 10/1000 $\mu$ s			300 Operations
Alternating Discharge Current	20 Arms, 1s			10 Operation
Operating Temperature				-55 to 250C
Warranty				1 Year

- Notes:
- Model number marking on tube: 26-xxxV
  - Sparkover limits  $\pm 25\%$  after life, IR>10<sup>10</sup> $\Omega$



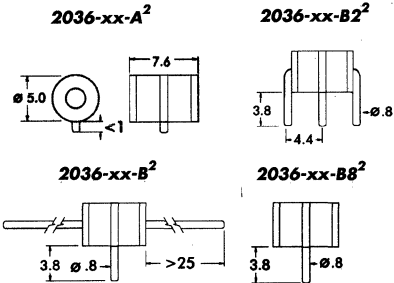
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**BALANCED MINI-TRIGARD®**  
 Miniature 3-Pole Gas Discharge Tube/2036 Series - Non Radioactive  
 Provides 100% More Performance Than Other Miniature Gas Tubes

CHARACTERISTICS, Test Methods per ITU-T (CCITT) K.12, IEEE C62.31

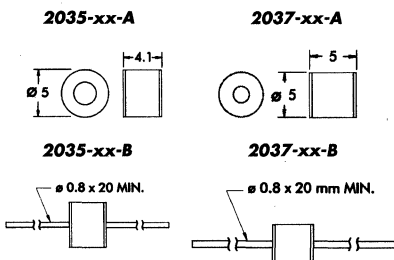


- Notes:
- Model number marking on tube: JES xxxV
  - The rated discharge current for MiniTrigard® Discharge Tubes is the total current equally divided between each line to ground
  - Sparkover limits  $\pm 25\%$  after life, IR  $> 10^9 \Omega$
1. Tube may exceed  $\pm 25\%$  after discharge, but will remain protecting without venting
  2. For added Fail-Safe feature add "F" to te model number, i.e. - B2F (Available in 1998)

Model Numbers	2036-07	2036-09	2036-15	2036-20	2036-23	2036-25
DC Sparkover, 100V/s ( $\pm 20\%$ )	75V	90V	150V	200V	230V	250V
Impulse Sparkover, 100V/ $\mu$ s	300V	300V	350V	425V	450V	475V
	500V	500V	500V	575V	600V	625V
Model Numbers	2036-30	2036-35	2036-42	2036-47	2036-60	
DC Sparkover, 100V/s ( $\pm 20\%$ )	300V	350V	420V	470V	600V	
Impulse Sparkover, 100V/ $\mu$ s	500V	550V	650V	750V	850V	
	650V	700V	800V	900V	1100V	
Impulse Transverse Delay	1000 V/ $\mu$ s				75 ns	
Insulation Resistance (IR)	100 V, (50V for 07,09)				$> 10^{10} \Omega$	
Glow Voltage	10 mA				70 V	
Arc Voltage	$> 1$ A				10 V	
Glow-Arc Transition Current					$< 0.5$ A	
Capacitance	1 MHz				$< 1$ pf	
DC Holdover Voltage	$> 135$ V, (52V for-07, -09, 80V for-15)				$< 150$ ms	
Impulse Discharge Current	20000 A, 8/20 $\mu$ s <sup>1</sup>				1 Operation	
	10000 A, 8/20 $\mu$ s				10 Operations	
	200 A, 10/700 $\mu$ s				500 Operations	
	200 A, 10/1000 $\mu$ s				300 Operations	
Alternating Discharge Current	20 Arms, 1s <sup>1</sup>				1 Operation	
	10 Arms, 1 s				10 Operations	
Operating Temperature					-55 to 250C	
Warranty					1 Year	

**MSP®**  
 Miniature 2-Pole Gas Discharge Tube/2035 & 2037 Series Non Radioactive

CHARACTERISTICS, Test Methods per ITU-T (CCITT) K.12, IEEE C62.31

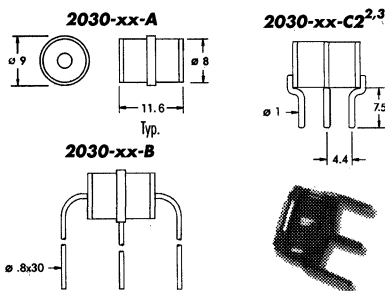


- Notes:
- Model number marking on tube: JES xxxV
  - Sparkover limits  $\pm 20\%$  ( $\pm 25\%$  for -09) after life IR  $> 10^9 \Omega$
1. Tube may exceed  $\pm 20\%$  ( $\pm 25\%$  for -09) after discharge, but will remain protecting without venting
  2. Other DC Sparkover ranges available on request

Model Numbers	2035-09	2035-15	2035-20	2035-23	2035-25	2035-30	2035-35
DC Sparkover, <sup>2</sup> 100V/s ( $\pm 15\%, \pm 20\%$ for 90V)	2037-09	2037-15	2037-20	2037-23	2037-25	2037-30	2037-35
Impulse Sparkover, 100V/ $\mu$ s	90V	150V	200V	230V	250V	300V	350V
	300V	350V	425V	450V	475V	500V	550V
1000V/ $\mu$ s	500V	550V	575V	600V	625V	650V	700V
Insulation Resistance (IR)	100 V, (50V for -09)					$> 10^{10} \Omega$	
Glow Voltage	10 mA					70 V	
Arc Voltage	1 A					10 V	
Glow-Arc Transition Current						$< 0.5$ A	
Capacitance	1 MHz					$< 1$ pf	
DC Holdover Voltage	$> 135$ V, (52V for -09, 80V for-15)					$< 150$ ms	
Impulse Discharge Current	20000 A, 8/20 $\mu$ s <sup>1</sup>					1 Operation	
	5000 A, 8/20 $\mu$ s					10 Operations	
	100 A, 10/1000 $\mu$ s					300 Operations	
	100 A, 10/700 $\mu$ s					500 Operations	
Alternating Discharge Current	20 Arms, 1s <sup>1</sup>					1 Operation	
	5 Arms, 1 s					10 Operations	
Operating Temperature						-55 to 250C	
Warranty						1 Year	

**BALANCED TRIGARD®**  
 3-Pole Gas Discharge Tube/2030 Series

CHARACTERISTICS, Test Methods per REA PE-80, IEEE C62.31



- Notes:
- Model number marking on tube: 30 xxxV
  - The rated discharge current for Trigard® Discharge Tubes is the total current equally divided between each line to ground
1. Tube will remain protecting without venting
  2. For added Fail-Safe feature add "F1" to the model number, i.e. - C2 F1
  3. New Fail-Safe Clip Model "F2" available

Model Numbers	2030-30	2030-40	2030-42	2030-47
DC Sparkover, 100V/s	300V	400V	420V	470V
Impulse Sparkover, 100V/ $\mu$ s	(250-350)	(300-500)	(350-500)	(380-560)
	500V	600V	650V	800V
1000V/ $\mu$ s	600V	700V	750V	950V
Impulse Transverse Delay	1000 V/ $\mu$ s			$< 200$ ns
Insulation Resistance	100 V			$> 10^{10} \Omega$
Glow Voltage	10 mA			180 V
Arc Voltage	2 A			25 V
Glow-Arc Transition Current				$< 1.5$ A
Capacitance	1 MHz			$< 2$ pf
DC Holdover Voltage	$> 150$ V, 200mA			$< 150$ ms
Impulse Discharge Current	40000 A, 8/20 $\mu$ s <sup>1</sup>			1 Operation
	10000 A, 8/20 $\mu$ s			10 Operations
	1000 A, 10/1000 $\mu$ s			400 Operations
				1 Operation
Alternating Discharge Current	135 Arms, 11 cycles <sup>1</sup>			1 Operation
	20 Arms, 1s			10 Operations
Operating Temperature				-55 to 250C
Warranty				1 Year





ISO 9002  
Certified

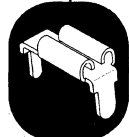
# Fuse Clips & Holders

## Automotive Blade Fuse Clips & Holders

### Miniature Blade Clips

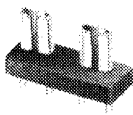


Mfg. No. 3544  
Vertical Mount  
Brass, Nickel Plate



Mfg. No. 3549  
Horizontal Mount  
Brass, Nickel Plate

### Miniature Blade Holder

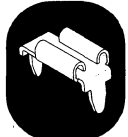


Brass, Nickel Plate  
UL 94V-O Nylon Base  
Mfg. No. 3544-2

### Standard Blade Clips

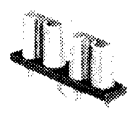


Mfg. No. 3522  
Vertical Mount  
Brass, Nickel Plate



Mfg. No. 3550  
Horizontal Mount  
Brass, Nickel Plate

### Standard Blade Holder



Brass, Nickel Plate  
UL 94V-O Nylon Base  
Mfg. No. 3522-2

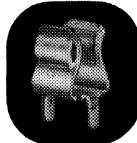
## 5mm Fuse Clips

### Low Profile PC Snap-In Clip



Brass, Tin Plate  
Mfg. No. 3521

### PC Clips with Orientation Leg



Brass, Tin Plate  
Mfg. No. 3517 w/o Orientation Leg  
Mfg. No. 3518P w/Orientation Leg

### PC Clip



Brass, Tin Plate  
Mfg. No. 3519

## 3AG - 1/4" Fuse Clips - PC Mount

### PC Snap-In Clip



Brass, Tin Plate  
Mfg. No. 3530

### PC Snap-In Clips with Orientation Leg



Brass, Tin Plate  
Mfg. No. 3516P w/Orientation Leg  
Mfg. No. 3515 w/o Orientation Leg

### PC Clips



Brass, Tin Plate  
Mfg. No. 3529 w/End Stop  
Mfg. No. 3510 w/o End Stop

## 3AG - 1/4" Fuse Clips - Rivet Mount

### Fuse Clip with End Stop



Brass, Nickel Plate  
Mfg. No. 3532

### Fuse Clip without End Stop



Brass, Nickel Plate  
Mfg. No. 3531

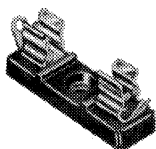
### Fuse Clip with Solder Lug



Brass, Nickel Plate  
Mfg. No. 3535

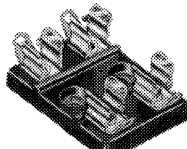
## 3AG & 5mm Fuse Holders

### 3AG Molded Fuse Holder



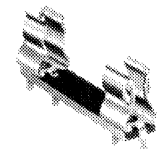
Brass, Bright Finish  
UL 94V-O Alkyd Base  
Mfg. No. 3523

### Dual 3AG Molded Fuse Holder



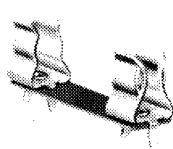
Brass, Bright Finish  
UL 94V-O Alkyd Base  
Mfg. No. 3524

### 3AG PC Mount Fuse Holder



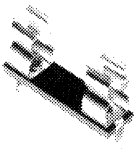
Brass, Tin Plate  
UL 94V-O Fiberglass Base  
Mfg. No. 4245

### 3AG PC Snap-In Fuse Holder



Brass, Tin Plate  
UL 94V-O Fiberglass Base  
Mfg. No. 4250

### 5mm PC Snap-In Fuse Holder



Brass, Tin Plate  
UL 94V-O Fiberglass Base  
Mfg. No. 3527

### 5mm Molded Fuse Holder with Cover



Brass, Tin Plate  
UL 94V-O  
Nylon Base  
Mfg. No. 4527 Holder  
Mfg. No. 4527C Cover Only

Full Line Engineering Catalog #990 Available

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e-mail: eem@keyelco.com • WebSite: <http://www.keyelco.com>

# Design in Surge Protection

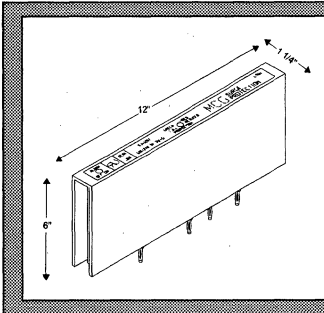
*From MCG - the first word in surge protection, and the last, since 1967*

Compact AC power line protectors you can design right in. Low profile devices fit anywhere to provide maximum protection against lightning, transients and surges. Applications include PCS sites, panelboard, switchgear, OEM, mobile vans, PLC's, monitoring systems, etc. Highest industrial-grade equipment protection available is an economical way to safeguard your critical systems. Custom applications welcome.



## SLIM JIM™ 80kA

Revolutionary protector installs inside of a panelboard or cabinet. Stackable protection capability enables the user to expand the level of protection simply by plugging in additional units. One unit is rated at 80kA, two at 160kA, three at 240kA, etc. Plug-in or hardware installation.



- Upgradable
- 40 mm MOVs
- Stackable
- Dual protection per phase
- Thermal sensor
- Bicolor LED
- Audible alarm

Model	Rated AC Voltage	Description	Energy	
			Absorption Joules Total	Typical Peak Suppression Voltage L-N 3kA (8/20µs)
SJB-120T	120/240 VAC	1φ, 3w + gnd	2849 j	488 V
SJB-120Y	120/208 VAC	1φ, 4w + gnd	4190 j	488 V
SJB-240DCT	240/120/120 VAC*	3φ, 4w + gnd, hi-leg	6600 j	700/488/488 V

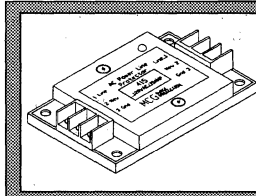
\* High-leg delta center tapped

### Electrical Specifications

Maximum continuous operating VAC: 115% rated line voltage  
 Response time: <5 nanoseconds  
 Modes of protection: L-N, L-G, L-L, N-G  
 Surge current per phase (8/20 µs): 1 Event – 80kA  
 Surge life per phase (8/20 µs): 10,000 Events – 6kA  
 Protection present indicator: Green/Full protection  
 Red/Reduced protection  
 Additional status indicators: Audible alarm with mute  
 Operating altitude: 13,000 ft. (4000m)  
 Temperature Operating: -40° to +70°C  
 Storage: -40 to +85°C  
 Enclosure material: Lexan, UL flammability – UL94HB  
 Enclosure dimensions: 10"L x 4.25"W x 1"D (SJB-120T)  
 13"L x 4.25"W x 1"D (SJB-120Y)  
 Mounting: Varied - consult factory  
 Connection: Banana plug or #12 AWG leads  
 Shipping weight: 1 lb.

## OEM STANDARD 400 Series - 10kA

These single phase, equipment-level protectors are reliably suppressing damaging surges and transients in thousands of pieces of OEM equipment around the world. Combines brute force surge protection with high impulse filtering to prevent equipment downtime or failure.



- Compact
- Absorption exceeds 400 joules
- 1 nanosecond response
- Sine tracking filter
- Automatic reset

Model	405	407	415	416	417
Rated voltage (50/60/400Hz)	120VAC	120VAC	120VAC	120VAC	240VAC
Rated current (rms) @ 40°C	5A	7.5A	15A	25A	25A
Service (phase)	1	1	1	1	1
Surge current (8/20µs) (kA)	10	10	10	10	10
Clamp voltage (1mA) peak	220V	220V	220V	220V	425V
Suppression voltage Impulse (B3) 6kV/3kA	392V	392V	392V	420V	760V
Ringwave (B3) 6kV/500A	250V	180V	120V	250V	330V
UL 1449 surge voltage rating	330V	400V	400V	400V	800V
Surge energy (joules), 10/1000µs	450	480	480	480	840
Filter attenuation MIL STD 220A (50 ohm)	-20db	45 kHz	30 kHz	30 kHz	30 kHz
	-30db	75 kHz	95 kHz	90 kHz	90 kHz
	-40db	150 kHz	300 kHz	300 kHz	300 kHz
	-50db	250 kHz	750 kHz	880 kHz	800 kHz
	-60db	405 kHz	1.5 MHz	1.4 MHz	1.0 MHz

### Electrical Specifications

Maximum continuous operating VAC: 115% rated line voltage  
 Response time: <5 nanoseconds  
 Modes of protection: L-N, L-G, N-G  
 Surge current per phase (8/20 µs): 1 Event – 10kA  
 (Based on Model 415) 2 5kA  
 100 2kA  
 1,000 1kA  
 10,000 500A  
 Protection present indicator: Green LED  
 Operating altitude: 13,000 ft. (4000m)  
 Temperature Operating: -40° to +70°C  
 Storage: -40 to +85°C  
 Enclosure material: High-impact plastic  
 Enclosure dimensions: 4.95" x 2.85" x 1.25"  
 Mounting: 4.20" x 2.25"/.185 ID – 4 holes  
 Dimensions (Model 405 only): 4.95" x 4.36" x 1.10"  
 Mounting (Model 405 only): 4.20" x 3.76"/.185 ID – 4 holes  
 Connection: Solderless screw terminals  
 Shipping weight: <1 lb.

# MCG SURGE PROTECTION

**Our 31st Year**  
**1-800-851-1508 Ext. 400**

12 Burt Drive, Deer Park, New York 11729  
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# MANUFACTURES A COMPREHENSIVE LINE OF BOTH SWITCHABLE AND PUSH-TO-RESET CIRCUIT BREAKERS

Whether for Aerospace, Defense, Commercial, or Consumer applications, MP manufactures reliable, high-quality circuit protection systems. These two pages describe our commercial product line.

Ask For Our Full-Line Catalog

Our full-line catalog offers detailed support for specifying MP Circuit Protection Devices. Call (517) 782-0391 and request a free copy TODAY.

For assistance call 517-782-0391  
FAX 517-782-2810



## Switchable Circuit Protectors

SERIES NO(S)	CONFIGURATION	FEATURES	OPERATING CHARACTERISTICS					REGULATORY APPROVAL				AMPERE RATING	VOLTAGE RATING		
			CALIBRATION @ 25° C.		OVERLOAD TRIP TIME: (in sec.)			INTER-RUPT	UL	CSA	VDE		OTHER	DC	AC
			HOLD	TRIP	200%	500%	1000%								
Series 22		Power "ON/OFF" Switch Combined with Circuit Protection Endurance: 50,000 switch cycles at rated load Snap-in Mounting, Inductive Load Rated at 250VAC. Meets Class A clearances per UL 1077	100%	125%	* Series Composite (see footnote)			2,000A @ 250VAC 1,000A @ 50VDC	1077	CSA	631	IEC **934	5 to 25 Amperes	50VDC	250VAC
Series 07		"Double Break" High Interrupt, Trip Free Circuit Protector/Breaker 752 Series is a Listed UL489 Molded Case Circuit Breaker. A minimum of 1/2" needed between terminals and grounded metal parts.	100%	125%	* Series Composite (see footnote)			752 Series 5,000A UL489	752 Series 489	CSA		IEC **934	Model 752 15 Amperes		Model 752 120VAC
Series 260/270		High Current Capacity Trip Free Circuit Protection Switchable for heavy-duty systems Extra heavy contacts and terminals Trouble-free contact life Vibration/shock resistant	260 Series		* Series Composite (see footnote)			5,000A @ 28VDC and 115VAC					Model 260 50 to 100 Amperes	28VDC	120VAC
			100%	135%											
			270 Series					3,000A @ 28VDC 2,500A @ 115VAC					Model 270 100 to 200 Amperes		
			100%	150%	10.0 to 80.0	1.2 to 6.5	0.4 to 2.0								

\*Trip times shown represent composite response of product family over a range of amperage ratings. For specific trip times, please consult the product section of the main catalog.

\*\* Please consult factory for approval status.

Model 772 has not been specifically approved by UL or CSA.



# Push-To-Reset Circuit Protectors

For assistance call 517-782-0391  
FAX 517-782-2810

SERIES NO(S)	CONFIGURATION	FEATURES	OPERATING CHARACTERISTICS					REGULATORY APPROVAL				AMPERE RATING	VOLTAGE RATING		
			CALIBRATION @ 25° C.		OVERLOAD TRIP TIME: (in sec.)			INTER-RUPT	UL	CSA	VDE		OTHER	DC	AC
HOLD		TRIP	200%	500%	1000%							3 to 15 Amperes		50VDC	250VAC
Series 20		Unique, Low Cost, Front Panel, Fuse Holder Replacement, Circuit Protector. Snap-in mount fits panel thickness 0.020 to 0.075. Mounting sizes incl. 5/8" dia. double D and square holes. Inductive Load Rated 4 120VAC (240VAC S10A).			* Series Composite (see footnote)			1,000A UL1077	UL	CSA	VDE		IEC ***934		
			100%	135%	2.2 to 15.0	0.35 to 1.1	0.12 to .4								
Series 16 Low		Low Ampere "Snap Acting" Circuit Protector. Various mounting sizes and termination styles available including "Snap-in"			* Series Composite (see footnote)			1,000A UL1077	UL	CSA	VDE	IEC ***934	0.05 to 4.50 Amperes	50VDC	250VAC
			100%	0.5A to 4.5A 125%	10.0 to 45.0	2.4 to 6.2	NA								
Series 16 Mid		Low cost, "Snap Acting" Circuit Protection. Various mounting sizes and termination styles available including "Snap-in". Series, Shunt, Relay and Dual Voltage Options.			* Series Composite (see footnote)			1,000A UL1077	UL	CSA	VDE	IEC ***934	Model 260 3 to 35 Amperes	50VDC	250VAC
			100%	125%	5.0 to 30.0	0.5 to 2.8	0.15 to 0.78								
Series 16 High		Heavy-duty, High Ampere Circuit Protector. Standard screw terminals.			* Series Composite (see footnote)			1,000A UL1077	**	**	**	**	40 to 70 Amperes	32VDC	250VAC
			100%	140%	5.0 to 30.0	0.5 to 2.8	0.15 to 0.78								
Series 02 252 600 601		"Double Break, High Interrupt Circuit Protection/Breaker". The 252 is a UL-recognized (UL489) Molded Case Circuit Breaker. A minimum of 1/2" is needed between terminals and grounded metal parts.			* Series Composite (see footnote)			252 Series 5,000A UL1489	UL 489	CSA	VDE	IEC ***934	252 Series 10 & 15 Amperes	120VAC	
			100%	125%	5.0 to 30.0	0.5 to 3.3	0.15 to 0.9								

\* Trip times shown represent composite of product family over a range of amperage ratings. For specific times, please consult the product section of the main catalog.  
 \*\* While not specifically approved by any regulatory body, Series 16 High-Amperage Circuit Breakers have been utilized in many products which have subsequently received agency approvals.  
 \*\*\* Please consult factory for approval status.



Mechanical Products, Inc.

MILITARY / AEROSPACE

Note: Reference information only. Specific technical data is contained in catalogs by series.

ILLUSTRATION:

SERIES NO(S):

DESCRIPTION:

CURRENT RATING:

VOLTAGE RATING:

CALIBRATION @ 25° C.  
(PERCENT OF RATING)

OVERLOAD TRIP TIME: 200%  
(in sec. @ 25°C) 500%  
1000%

INTERRUPTION:

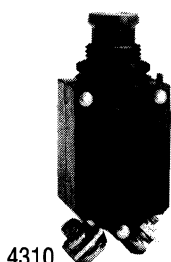
MIL SPEC:

NOTES:

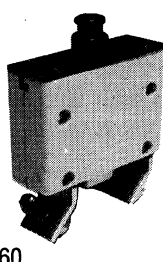
PHYSICAL DIMENSIONS:  
(INCHES)

SINGLE PHASE, SWITCHABLE

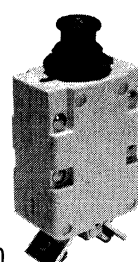
THREE PHASE, SWITCHABLE



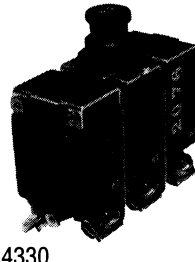
4310



160



700



4330

Subminiature, Lightweight, Hi-Rel Circuit Breaker

Rugged, High Current, Hi-Rel Circuit Breaker

Miniature, High Interruption Rated, Hi-Rel Circuit Breaker

Lightweight, Miniature, Hi-Rel, 3 Ø Circuit Breaker

1 to 25 Amperes

50 to 100 Amperes

5 to 50 Amperes

1 to 20 Amperes

115 VAC 400 Hz;  
28 VDC

115 VAC 400 Hz;  
28 VDC

115 VAC 400 Hz;  
28 VDC

200 VAC 400 Hz L - L,  
115 VAC 400 Hz L - N.

115% Hold  
138% Trip-within  
one hour  
(ambient temp  
compensated.)

105% Hold  
138% Trip-within  
one hour

115% Hold  
138% Trip-within  
one hour

110% Hold  
145% Trip-within  
one hour  
(ambient temp  
compensated.)

5.0 to 20.0  
0.5 to 2.0  
0.12 to 0.53

15.0 to 65.0  
1.2 to 7.0  
0.5 to 2.5

15.0 to 55.0  
1.4 to 4.0  
0.4 to 1.3

4.0 to 20  
0.4 to 2.0  
0.10 to 0.53

115 VAC-2000 to  
3500 Amperes.  
28 VDC-6000  
Amperes.

115 VAC-3500  
Amperes.  
28 VDC-6000  
Amperes.

115 VAC-3500  
Amperes.  
28 VDC-6000  
Amperes.

1 Ø 2000A L - N.  
3 Ø 1200A L - L.

MS3320. 1 to 20  
Amperes.

MS25361

MS25244, MS25244-P  
MS25244-PT. 5 to 35  
Amperes.

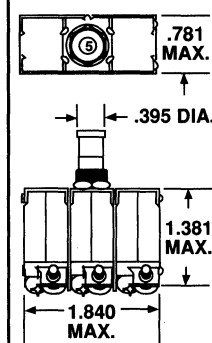
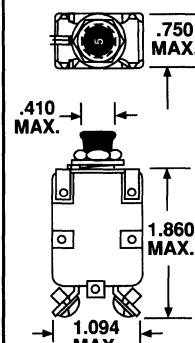
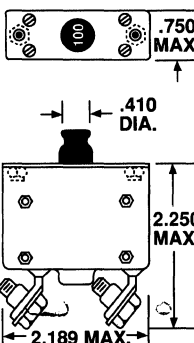
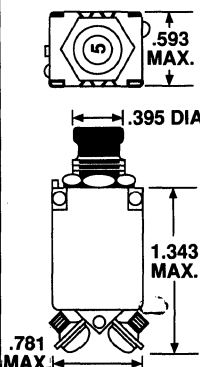
MS14154. 1 to 20  
Amperes.

Available with auxiliary switch and variations in termination and mounting. 1.5 & 25 Ampere rating: not MIL Spec approved. This series is long button and high vibration (V-level) qualified.

High vibration (V-level) qualified.

Available with auxiliary switch. P-Bracket allows variation of mounting.

Single hole mount. This series is long button and high vibration (V-level) qualified. Available with variation in termination and mounting.



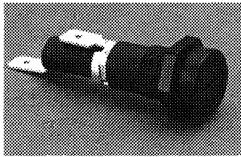
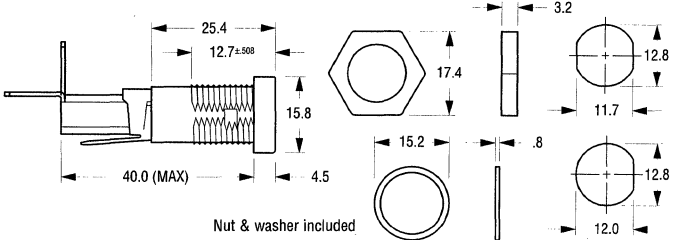
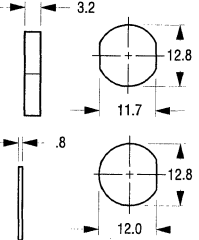
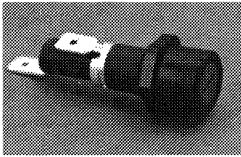
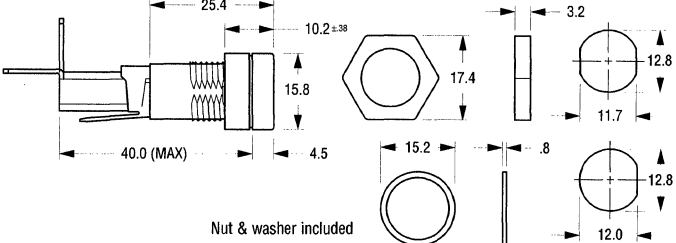
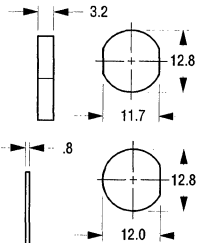
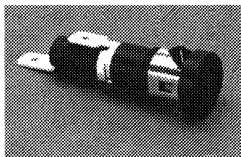
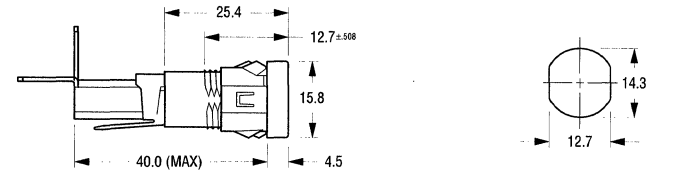
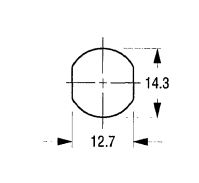
# International "Touchproof" Fuseholders

Interpower™ fuseholders accept both sizes of fuses that are used in the world today: the North American 1/4" x 1 1/4" (6.3 x 32mm) and the international 5x20mm fuses. International "touchproof" fuseholders have four important characteristics: 1) Fuseholder is accessible with a tool only; 2) Contacts are recessed and protected; 3) Fuse carrier is insulated; 4) Fuse carrier is retained in a spring-loaded carrier.

**Maximum panel thickness:** .762mm (.30")  
**Materials:** Body molded from polyphenylene sulfide thermoplastic resin; contacts, tin-plated brass. UL 94 V-0 flammability rating.  
**Markings:** All parts are marked "80910"  
**Approvals & Ratings:**

UL recog.	20A/250V
CSA cert.	16A/250V
VDE	10A/250V
SEMKO	10A/250V

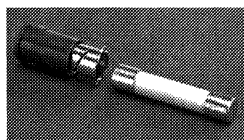
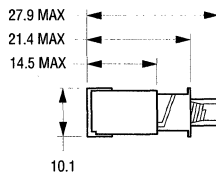
Three body styles are available, each with four contact styles. Order fuse carriers and fuses separately.

Body Style	Part Number	Contact style	Drawings	Mounting
<b>Low Profile • Rear Hex Nut</b> 	<b>80910010</b> <b>80910020</b> <b>80910030</b> <b>80910040</b>	4.8mm solder/QD angled 4.8mm solder/QD 6.3mm solder/QD angled 6.3mm solder/QD	 <p style="text-align: center;">Nut &amp; washer included</p>	
<b>High Profile • Rear Hex Nut</b> 	<b>80910050</b> <b>80910060</b> <b>80910070</b> <b>80910080</b>	4.8mm solder/QD angled 4.8mm solder/QD 6.3mm solder/QD angled 6.3mm solder/QD	 <p style="text-align: center;">Nut &amp; washer included</p>	
<b>Low Profile • Snap-in</b> 	<b>80910090</b> <b>80910100</b> <b>80910110</b> <b>80910120</b>	4.8mm solder/QD angled 4.8mm solder/QD 6.3mm solder/QD angled 6.3mm solder/QD		

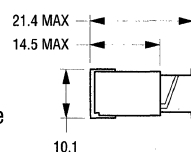
## Fuse Carriers (order separately)



**80910310:** carrier for international 5 x 20mm fuse



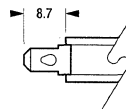
**80910300:** carrier for North American 1/4" x 1 1/4" fuse



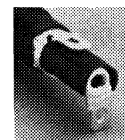
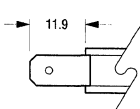
## Contact Styles



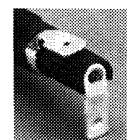
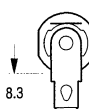
In-line 4.8mm solder/QDs



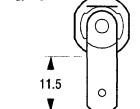
In-line 6.3mm QDs



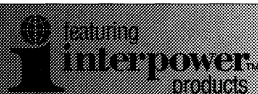
Angled 4.8mm solder/QDs



Angled 6.3mm QDs



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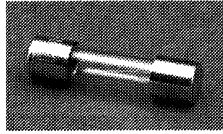
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# Interpower™ IEC 127 Int'l 5 x 20mm Fuses

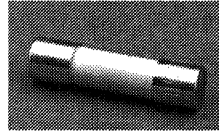
Fuses conform to IEC 127. SEMKO approved. Rated at 250VAC. Contact us for performance characteristics. Minimum order: 1 box (10 fuses).

## Quick-acting, low-breaking capacity



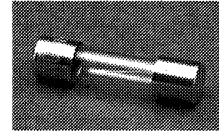
IEC 127-II; DIN 41661; SEMKO 104-1976; 250VAC. Glass tube.

## Quick-acting, high-breaking capacity



IEC 127-I; DIN 41660; SEMKO 104-1976; 250VAC. Ceramic, sand.

## Time-lag, low-breaking capacity



IEC 127-III; DIN 41662; SEMKO 104-1976; 250VAC. Glass tube.

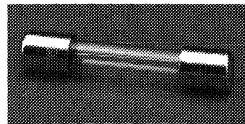
Part Number	Rated Current I <sub>n</sub>	Break. Cap. at 250V cosφ1	Part Number	Rated Current I <sub>n</sub>	Break. Cap. at 250V cosφ1	Part Number	Rated Current I <sub>n</sub>	Break. Cap. at 250V cosφ1
81411101	32mA*	35A	81413421	1.0A	1500A: at 250V, 50Hz, cosφ0.7-0.8	81412161	63mA	35A
81411181	71		81413441	1.25		81412181	71	
81411221	100		81413481	1.6		81412221	100	
81411241	125		81413501	2.0		81412241	125	
81411261	160		81413541	3.15		81412261	160	
81411281	200		81413601	6.3		81412281	200	
81411301	250		81413621*	8.0*		81412301	250	
81411321	315		81413641*	10.0*		81412321	315	
81411341	400					81412341	400	
81411361	500					81412361	500	
81411381	630					81412381	630	
81411401	800					81412401	800	
81411421	1.0A					81412421	1.0A	
81411441	1.25					81412441	1.25	
81411461	1.4					81412461*	1.4*	
81411481	1.6					81412481	1.6	
81411501	2.0					81412501	2.0	
81411521	2.5					81412521	2.5	
81411541	3.15			81412541	3.15			
81411561	4.0	10 I <sub>n</sub>				81412561	4.0	10 I <sub>n</sub>
81411581	5.0		81412581	5.0				
81411601	6.3		81412601	6.3				
81411621*	8.0*		81411621*	8.0*				
81411641*	10.0*		81411641*	10.0*				

\* not included in IEC 127 and do not carry SEMKO approval

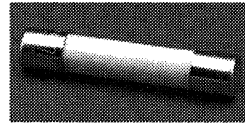
# North American 1/4" x 1 1/4" fuses (6.3 x 32mm)

Fuses conform to UL 198, CSA G22.2 No. 59. UL listed (or recognized), CSA certified fuses; contact us for performance characteristics. No minimum order.

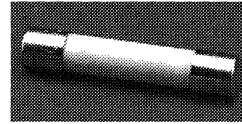
## Fast Acting UL & CSA, 250V; glass



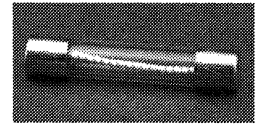
## Fast Acting UL & CSA, 250V; ceramic/sand



## Time delay UL & CSA, 250V; ceramic/sand



## Time delay UL & CSA, 250V; glass\*



Part Number	Rated Current I <sub>n</sub>	Part Number	Rated Current I <sub>n</sub>	Part Number	Rated Current I <sub>n</sub>	Part Number	Rated Current I <sub>n</sub>
813AGC-1/8	1/8A	813ABC-1/2	1/2A	813MDA-1/2	1/2A	813MSL-1/4	1/4A
813AGC-1/4	1/4	813ABC-1	1	813MDA-3/4	3/4	813MSL-1/2	1/2
813AGC-1/2	1/2	813ABC-2	2	813MDA-1	1	813MSL-3/4	3/4
813AGC-3/4	3/4	813ABC-3	3	813MDA-2	2	813MSL-1	1
813AGC-1	1	813ABC-5	5	813MDA-3	3	813MSL-2	2
813AGC-1-1/2	1 1/2	813ABC-6	6	813MDA-4	4	813MSL-3	3
813AGC-2	2	813ABC-8	8	813MDA-5	5	813MSL-4	4
813AGC-3	3	813ABC-10	10	813MDA-7	7	813MSL-5	5
813MTH-4	4	813ABC-15	15	813MDA-8	8	813MSL-6	6
813MTH-5	5	813ABC-20	20*	813MDA-10	10	813MSL-8	8
813MTH-6	6			813MDA-15	15		
813GLH-10	10 (125V)			813MDA-20	20*		

\*15A, UL recognized, no CSA

\* UL recognized; no CSA

\* spiral wound element for moderate in-rush current.

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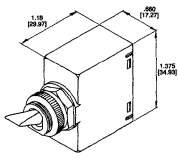
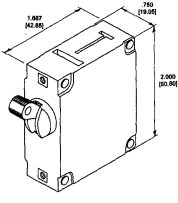
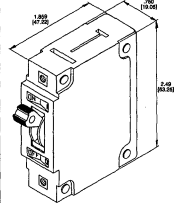
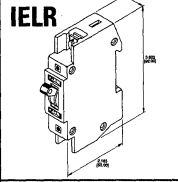
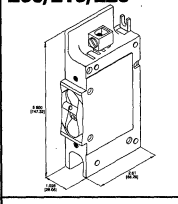
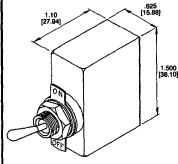
**Philips Technologies  
Airpax Protector Group**

807 Woods Road P.O. Box 520 Cambridge, MD 21613

Phone: 410-228-1500 Fax: 410-228-3456 E-mail: info@philipstechnologies.com

**Airpax Circuit Breakers** are available in ratings from 50 milliamps to 100 amperes and can be specified with instantaneous short, medium or long trip time delays. With more than fifty (50) configurations and styles, we can supply one to meet your specific application needs. Contact Philips Technologies, Airpax Protector Group, 807 Woods Road, Cambridge, Maryland 21613, Tel 410-228-1500 or Fax 410-228-3456.

**Magnetic Circuit Breakers**

	General Description	Max Poles	Current and Voltage Ratings	Interrupting Capacity	Approvals
<p><b>Snapak®</b></p> 	<ul style="list-style-type: none"> <li>• Compact magnetic protection</li> <li>• Patented snap action mechanism increases operational life</li> <li>• Paddle, baton, push-pull, push-to-reset and rocker actuation in choice of colors</li> <li>• Illuminated rocker handle with choice of colors and markings</li> <li>• Aesthetically pleasing for front panel mounting</li> </ul>	2	0.10 to 7.5 amperes at 50Vdc and 250Vac 0.10 to 20 amperes at 32Vdc 0.10 to 20 amperes at 125Vac 0.10 to 20 amperes at 125/250Vac 0.10 to 20 amperes at 32/65Vac (500Amp AIC)	5000 amperes, 240Vac, 50/60Hz 1500 amperes, 240Vac, 400Hz 7500 amperes, 80Vac 2000 amperes, 240Vac (VDE) 4000 amperes, 80Vac (VDE)	<ul style="list-style-type: none"> <li>• UL Recognized</li> <li>• CSA Certified</li> <li>• VDE Approved</li> <li>• CE Compliant</li> </ul>
<p><b>IAG/IUG/IEG</b></p> 	<ul style="list-style-type: none"> <li>• IEG versions meet IEC spacing requirements for installation in equipment that must comply with IEC 601 and 950, and VDE 0730, 0804, ad 0805</li> <li>• Interchangeable with APG/UPG to upgrade existing designs</li> <li>• Multi-pole versions, multi or single handle</li> <li>• Optional auxiliary switch</li> <li>• Snap-in mounting optional</li> </ul>	6	.050 - 50 amperes, 80 Vd, 240Vac .050 - 30 amperes, 277 Vac	5000 amperes, 240Vac, 50/60Hz 1500 amperes, 240Vac, 400Hz 7500 amperes, 80Vac 2000 amperes, 240Vac/415 Vac (VDE) 4000 amperes, 80Vac (VDE)	<ul style="list-style-type: none"> <li>• UL Recognized</li> <li>• CSA Certified</li> <li>• VDE Approved (IEG)</li> <li>• UL 1500 Certified</li> <li>• CE Compliant</li> </ul>
<p><b>IAL/IUL/IEL/LEL</b></p> 	<ul style="list-style-type: none"> <li>• IEG versions meet IEC spacing requirements for installation in equipment that must comply with IEC 601 and 950, and VDE 0730, 0804, ad 0805</li> <li>• Multi-pole versions, multi or single handle</li> <li>• Interchangeable with APG/UPG to upgrade existing designs</li> <li>• Auxiliary switch available</li> <li>• Snap-in mounting optional</li> <li>• Mid-trip handle optional</li> </ul>	6	.050 - 100 amperes, 65Vdc .050 - 70 amperes, 80Vdc, 240Vac .050 - 50 amperes, 277Vac .050 - 30 amperes, 277/480Vac	7500 amperes, 80Vac 5000 amperes, 250Vac 2000 amperes, 250Vac/41Vac (VDE) 4000 amperes, 80Vac (VDE)	<ul style="list-style-type: none"> <li>• UL Listed (LEL)</li> <li>• UL Recognized</li> <li>• CSA Certified</li> <li>• VDE Approved (IEL)</li> <li>• UL 1500 Certified</li> <li>• CE Compliant</li> </ul>
<p><b>IELR</b></p> 	<ul style="list-style-type: none"> <li>• Designed to mount on standard 35mm DIN rails</li> </ul>	4	.050 - 100 amperes, 65 Vdc .050 - 70 amperes, 80Vdc, 240Vac .050 - 50 amperes, 277Vac .050 - 30 amperes, 277/480Vac	7500 amperes, 80Vac 5000 amperes, 250Vac 2000 amperes, 250Vac/41Vac (VDE) 4000 amperes, 80Vac (VDE)	<ul style="list-style-type: none"> <li>• UL Listed</li> <li>• UL Recognized</li> <li>• CSA Certified</li> <li>• VDE Approved (IELR)</li> <li>• CE Compliant</li> </ul>
<p><b>209/219/229</b></p> 	<ul style="list-style-type: none"> <li>• Front-or-back connected terminal styles</li> <li>• E-Frame style model complies with UL standard 489</li> <li>• 249 Power Selector Breaker system is listed as a Branch Circuit Breaker per UL 489</li> <li>• Complies with International Requirements</li> </ul>	6	.05 to 70 amperes, 80Vdc .05 to 70 amperes, 80Vdc .05 to 50 amperes, 80Vdc, 250Vac (VDE)	5000 amperes 10000 amperes 4000 amperes (VDE)	<ul style="list-style-type: none"> <li>• UL Listed</li> <li>• UL Recognized</li> <li>• CSA Certified</li> <li>• VDE Approved</li> <li>• UL 1500 Certified</li> <li>• CE Compliant</li> </ul>
<p><b>AP/UP, AP/MIL</b></p> 	<ul style="list-style-type: none"> <li>• QPL to MIL-C-39019</li> <li>• Sealed protection</li> <li>• Can withstand 100G shock repeatedly</li> <li>• Tolerates 10G vibration from 10 to 2000Hz under full load</li> <li>• Trip point unaffected by ambient temperatures between -40C and +100C</li> <li>• Ideal for mobile equipment applications</li> </ul>	3	<b>AP Ratings</b> 0.50 to 20 amperes, 240Vac 50Vdc <b>UP Ratings</b> 0.50 to 20 amperes, 50Vdc .050 to 15 amperes, 120Vdc .050 to 7.5 amperes, 240Vdc	<b>AP Ratings</b> 500 amperes, 50Vdc, 120Vac 300 amperes, 240Vac <b>UP Ratings</b> 1000 amperes, 50Vdc, 240Vac	<ul style="list-style-type: none"> <li>• QPL to MIL-C-39019</li> <li>• UL Recognized (UP style only)</li> </ul>



# Raychem

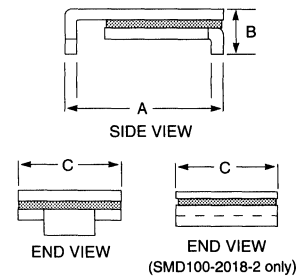
## PolySwitch Resettable Fuses

**PolySwitch circuit protection devices protect electrical and electronic circuits against excessive current. Like traditional fuses and circuit breakers, PolySwitch devices interrupt the flow of dangerously high current during fault conditions. But unlike traditional fuses and circuit breakers, PolySwitch devices automatically reset after the fault is cleared and power to the circuit is removed.**

### Surface Mount Devices

#### SMD

This product line is specifically designed for surface-mount applications. The products range in hold currents from 0.3 amp to 2.6 amps and voltages from 6 volts to 60 volts. These devices are ideally suited for high-density board applications in computer and computer peripheral products, telecommunications, and general electronics applications. They are designed to be reflowed onto a printed circuit board using standard surface-mount processes.



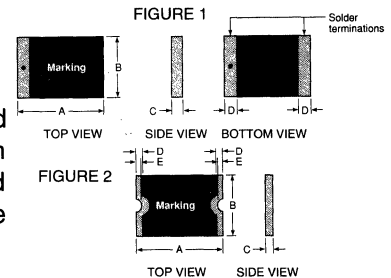
Part number	$I_H^*$ (A)	$V^{**max.}$ (V)				$I_{max.}$ (A)		$R_1$ max. ( $\Omega$ )	Agency recognition	Dimensions (millimeters/inches)		
		(V)	(A)	(V)	(A)	(V)	(A)			A (max.)	B (max.)	C (max.)
SMD030-2	0.30	60	10	12	60	5	125	4.800	UL, TÜV, CSA	7.98 (.310)	3.20 (.125)	5.44 (.210)
SMD050-2	0.50	60	10	12	60	5	125	1.400	UL, TÜV, CSA	7.98 (.310)	3.20 (.125)	5.44 (.210)
SMD075-2	0.75	30	40	12	60	5	125	1.000	UL, TÜV, CSA	7.98 (.310)	3.20 (.125)	5.44 (.210)
SMD100-2	1.10	30	40	12	60	5	125	0.480	UL, TÜV, CSA	7.98 (.310)	3.00 (.118)	5.44 (.210)
SMD100-2018-2	1.10	15	40	12	60	5	125	0.400	UL, TÜV, CSA	5.44 (.214)	1.52 (.060)	4.93 (.194)
SMD125-2	1.25	15	40	12	60	5	125	0.250	UL, TÜV, CSA	7.98 (.310)	3.00 (.118)	5.44 (.210)
SMD150-2	1.50	15	40	12	60	5	125	0.250	UL, TÜV, CSA	9.50 (.370)	3.00 (.118)	6.71 (.260)
SMD200-2	2.00	15	40	12	60	5	125	0.125	UL, TÜV, CSA	9.50 (.370)	3.00 (.118)	6.71 (.260)
SMD200-2018	2.00	6	40	-	-	-	-	0.100	pending	5.44 (.214)	1.52 (.060)	4.93 (.194)
SMD250-2	2.50	15	40	12	60	5	125	0.085	UL, TÜV, CSA	9.50 (.370)	3.00 (.118)	6.71 (.260)
SMD260-02	2.60	6	40	-	-	-	-	0.075	UL, TÜV, CSA	7.88 (.310)	3.00 (.118)	5.44 (.210)

\*Hold current 20°C.

\*\*Voltage rating is  $V_{rms}$  except for SMD100-2018, which is 15 Vdc.

#### miniSMD

This product line is also designed for surface-mount applications and complements the SMD product line. Its small size allows for installation in limited space applications, such as PC cards, subnotebook computers, and disk drives. The miniSMD product line is suitable for applications where space is constrained and circuit protection is desired.



Part number	$I_H^*$ (A)	$V_{max.}$ (V)	$I_{max.}$ (A)	$R_1$ max. ( $\Omega$ )	Agency recognition	Dimensions (millimeters/inches)					Fig.
						A (max.)	B (max.)	C (max.)	D (max.)	E (max.)	
miniSMD020-2	0.20	30	10	5.00	UL, TÜV, CSA	4.73 (.186)	3.41 (.134)	0.81 (.032)	0.65 (.025)		1
miniSMDC035	0.35	6	40	1.30	UL, TÜV, CSA	3.43 (.135)	2.80 (.110)	0.62 (.025)	0.35 (.014)	0.50 (.020)	2
miniSMD050-2	0.50	15	40	1.00	UL, TÜV, CSA	4.73 (.186)	3.41 (.134)	0.62 (.025)	0.65 (.025)		1
miniSMDC050-2	0.50	15	40	1.00	UL, TÜV, CSA	4.73 (.186)	3.41 (.134)	0.62 (.025)	0.30 (.012)	0.50 (.020)	2
miniSMD075-2	0.75	13.2	40	0.45	UL, TÜV, CSA	4.73 (.186)	3.41 (.134)	0.62 (.025)	0.65 (.025)		1
miniSMDC075-2	0.75	13.2	40	0.45	UL, TÜV, CSA	4.73 (.186)	3.41 (.134)	0.62 (.025)	0.30 (.012)	0.50 (.020)	2
miniSMDC110-2	1.10	6	40	0.21	UL, TÜV, CSA	4.73 (.186)	3.41 (.134)	0.62 (.025)	0.30 (.012)	0.50 (.020)	2

\*Hold current 20°C.

See Our Additional Data Pages In Section - B-5300

Raychem Corporation • 300 Constitution Drive, Menlo Park, CA 94025

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# Raychem

## PolySwitch Resettable Fuses

### Telecom Devices

#### TR/TC

This product line provides chip and radial-lead-  
ed devices that protect against short duration,  
high-voltage faults (250-600 Vrms) and are suit-  
able for telecommunications applications.  
TR devices are not intended for continuous utility  
line voltage operation (i.e. 120 V or 240 V).

FIGURE 1

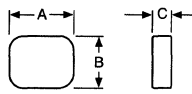


FIGURE 2

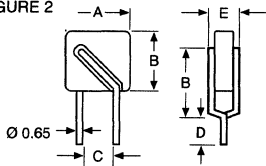


FIGURE 3

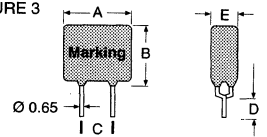
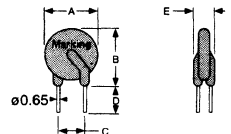


FIGURE 4



Part number	I <sub>H</sub> * (A)	Max. operating voltage (Vrms)	V max. (Vdc)	I max. (A)	R max. initial (Ω)	R max. (Ω)	Agency recognition	Dimensions (millimeters/inches)					
								A (max.)	B (max.)	C (nom.)	D (min.)	E (max.)	Fig.
TR250-080U	.080	60	250	3	20.0	30		4.8 (.190)	9.3 (.360)	5.00 (.197)	4.7 (.185)	3.80 (.150)	4
TR250-110U	.110	60	250	3	9.0	16		5.33 (.210)	9.4 (.370)	5.00 (.197)	4.7 (.185)	3.80 (.150)	4
TC250-120	.120	60	250	3	9.0	14		6.00 (.236)	6.00 (.236)	-	-	2.54 (.100)	1
TR250-120U**	.120	60	250	3	10.0	16	UL, CSA	6.00 (.236)	10.00 (.393)	5.00 (.197)	4.7 (.185)	3.80 (.150)	2
TR250-120UT-B-0.5	.120	60	250	3	12.0	16		6.00 (.236)	10.00 (.393)	5.00 (.197)	4.7 (.185)	3.80 (.150)	2
TR250-120**	.120	60	250	3	8.0	16	UL, CSA	6.50 (.256)	11.00 (.433)	5.00 (.197)	4.7 (.185)	4.60 (.180)	2
TR250-120T-RF-B-0.5	.120	60	250	3	10.5	16		6.50 (.256)	11.00 (.433)	5.00 (.197)	4.7 (.185)	4.60 (.180)	2
TR250-120T-R1-B-0.5	.120	60	250	3	9.0	14		6.50 (.256)	11.00 (.433)	5.00 (.197)	4.7 (.185)	4.60 (.180)	2
TR250-120T-R2-B-0.5	.120	60	250	3	10.5	16		6.50 (.256)	11.00 (.433)	5.00 (.197)	4.7 (.185)	4.60 (.180)	2
TC250-145	.145	60	250	3	6.0	14		6.00 (.236)	6.00 (.236)	-	-	2.54 (.100)	1
TR250-145U**	.145	60	250	3	6.5	14	UL, CSA	6.00 (.236)	10.00 (.393)	5.00 (.197)	4.7 (.185)	3.80 (.150)	2
TR250-145**	.145	60	250	3	6.0	14	UL, CSA	6.50 (.256)	11.00 (.433)	5.00 (.197)	4.7 (.185)	4.60 (.180)	2
TR250-145-RA-B-0.5	.145	60	250	3	5.5	12	UL, CSA	6.50 (.256)	11.00 (.433)	5.00 (.197)	4.7 (.185)	4.60 (.180)	2
TC250-180	.180	60	250	10	2.0	4		10.40 (.410)	6.60 (.260)	-	-	2.54 (.100)	1
TR250-180U**	.180	60	250	10	2.0	4	UL, CSA	10.40 (.410)	12.60 (.495)	5.00 (.197)	4.7 (.185)	3.60 (.140)	2
TR600-150**	.150	60	600	3	12.0	22	UL, CSA	13.50 (.531)	12.60 (.495)	5.00 (.197)	4.7 (.185)	6.0 (.236)	3
TR600-150-RA-B-0.5	.150	60	600	3	10.0	20	UL, CSA	13.50 (.531)	12.60 (.495)	5.00 (.197)	4.7 (.185)	6.0 (.236)	3
TR600-150-RB	.150	60	600	3	12.0	22	UL, CSA	13.50 (.531)	12.60 (.495)	5.00 (.197)	4.7 (.185)	6.0 (.236)	3
TR600-150-RB-B-0.5	.150	60	600	3	12.0	22	UL, CSA	13.50 (.531)	12.60 (.495)	5.00 (.197)	4.7 (.185)	6.0 (.236)	3
TR600-160**	.160	60	600	3	10.0	18	UL, CSA	16.00 (.630)	12.60 (.495)	5.00 (.197)	4.7 (.185)	6.0 (.236)	3
TR600-160-0.130	.160	60	600	3	10.0	18	UL, CSA	16.00 (.630)	12.60 (.495)	5.00 (.197)	3.3 (.130)	6.0 (.236)	3
TR600-160-RA-B-0.5-0.130	.160	60	600	3	7.0	14	UL, CSA	16.00 (.630)	12.60 (.495)	5.00 (.197)	3.3 (.130)	6.0 (.236)	3

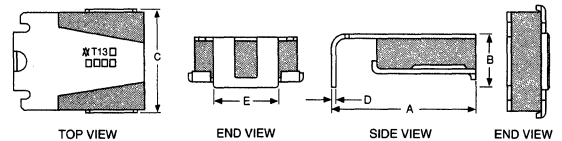
\*Hold current 20°C.

\*\*Denotes product available tape and reel per EIA RS-468-B.

### Telecom Surface-Mount Devices

#### TS

This product line provides surface-mount devices that protect  
against high-voltage faults (250-600 V) and are suitable for  
telecommunications applications. TS devices are not intend-  
ed for continuous utility line voltage (i.e., 120 V or 240 V).



Part number	I <sub>H</sub> * (A)	Max. operating voltage (Vrms)	V max. (Vdc)	I max. (A)	R initial (Ω)	R <sub>1</sub> max. (Ω)	Agency recognition	Dimensions (millimeters/inches)		
								A (max.)	B (max.)	C (max.)
TS250-130A-2	0.130	60	250 650	3.0 1.1	6.5-12.0	20.0	UL, CSA	9.4 (.370)	3.4 (.135)	7.4 (.290)
TS250-130A-RA-2	0.130	60	250 650	3.0 1.1	6.5-9.0	20.0	UL, CSA	9.4 (.370)	3.4 (.135)	7.4 (.290)
TS250-130A-RB-2	0.130	60	250 650	3.0 1.1	9.0-12.0	20.0	UL, CSA	9.4 (.370)	3.4 (.135)	7.4 (.290)
TS250-130A-RC-B-0.5-2	0.130	60	250 650	3.0 1.1	7.0-10.0 Resistance binned to 0.5 ohm	20.0	UL, CSA	9.4 (.370)	3.4 (.135)	7.4 (.290)

\*Hold current 20°C.

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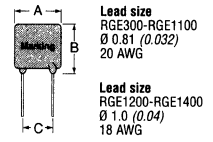
## PolySwitch Resettable Fuses

## R-line Devices

### RGE

This product line can be used in a wide variety of automotive, computer and general electronics applications. The RGE devices feature high current carrying capability (up to 14 amps) in a small package with fast trip times.

Part number	I <sub>H</sub> * (A)	V** max. (V)	I max. (A)	R <sub>1</sub> max. (Ω)	Agency recognition	Dimensions (millimeters/inches)		
						A (max.)	B (max.)	C (nom.)
RGE300	3.00	16	100	0.105	UL, TÜV, CSA	7.1 (0.28)	10.2 (0.40)	5.1 (0.20)
RGE400	4.00	16	100	0.063	UL, TÜV, CSA	8.9 (0.35)	11.9 (0.47)	5.1 (0.20)
RGE500	5.00	16	100	0.044	UL, TÜV, CSA	10.4 (0.41)	13.5 (0.53)	5.1 (0.20)
RGE600	6.00	16	100	0.030	UL, TÜV, CSA	10.7 (0.42)	16.3 (0.64)	5.1 (0.20)
RGE700	7.00	16	100	0.021	UL, TÜV, CSA	11.2 (0.44)	18.8 (0.74)	5.1 (0.20)
RGE900	9.00	16	100	0.015	UL, TÜV, CSA	14.0 (0.55)	20.8 (0.82)	5.1 (0.20)
RUE1100	11.00	16	100	0.010	UL, TÜV, CSA	17.5 (0.69)	25.1 (0.99)	5.1 (0.20)
RGE1200	12.00	16	100	0.009	pending	17.5 (0.69)	30.0 (1.18)	10.2 (0.40)
RUE1400	14.00	16	100	0.008	pending	27.9 (1.10)	30.0 (1.18)	10.2 (0.40)



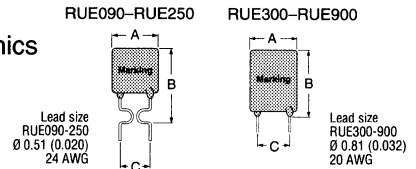
\*Hold current 25°C.

\*\*Device may withstand higher interrupt current at lower voltages. Each application will need to be individually evaluated.

### RUE

These devices are designed to be used in a wide variety of general electronics applications. RUE devices complement the RXE line by providing a smaller form factor with lower resistance and higher hold current capability (up to 9 amps).

Part number	I <sub>H</sub> * (A)	V** max. (V)	I max. (A)	R <sub>1</sub> max. (Ω)	Agency recognition	Dimensions (millimeters/inches)		
						A (max.)	B (max.)	C (nom.)
RUE090	0.90	30	40	0.22	UL, TÜV, CSA	7.4 (0.29)	12.2 (0.48)	5.1 (0.20)
RUE110	1.10	30	40	0.17	UL, TÜV, CSA	7.4 (0.29)	14.2 (0.56)	5.1 (0.20)
RUE135	1.35	30	40	0.13	UL, TÜV, CSA	8.9 (0.35)	13.5 (0.53)	5.1 (0.20)
RUE160	1.60	30	40	0.11	UL, TÜV, CSA	8.9 (0.35)	15.2 (0.60)	5.1 (0.20)
RUE185	1.85	30	40	0.09	UL, TÜV, CSA	10.2 (0.40)	15.7 (0.62)	5.1 (0.20)
RUE250	2.50	30	40	0.07	UL, TÜV, CSA	11.4 (0.45)	18.3 (0.72)	5.1 (0.20)
RUE300	3.00	30	40	0.08	UL, TÜV, CSA	11.4 (0.45)	17.3 (0.68)	5.1 (0.20)
RUE400	4.00	30	40	0.05	UL, TÜV, CSA	14.0 (0.55)	20.1 (0.79)	5.1 (0.20)
RUE500	5.00	30	40	0.05	UL, TÜV, CSA	14.0 (0.55)	24.9 (0.98)	10.2 (0.40)
RUE600	6.00	30	40	0.04	UL, TÜV, CSA	16.5 (0.65)	24.9 (0.98)	10.2 (0.40)
RUE700	7.00	30	40	0.03	UL, TÜV, CSA	19.1 (0.75)	26.7 (1.05)	10.2 (0.40)
RUE800	8.00	30	40	0.02	UL, TÜV, CSA	21.6 (0.85)	29.2 (1.15)	10.2 (0.40)
RUE900	9.00	30	40	0.02	UL, TÜV, CSA	24.1 (0.95)	29.7 (1.17)	10.2 (0.40)



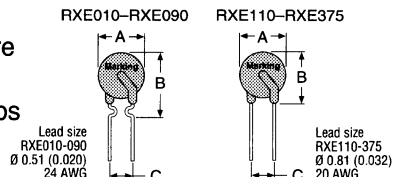
\*Hold current 20°C.

\*\*Device may withstand higher interrupt current at lower voltages. Each application will need to be individually evaluated.

### RXE

These products function as a general purpose line of resettable fuses and are well suited for power supplies, alarm systems, speakers, motors, and many other applications. Products range in hold currents from .10 amp to 3.75 amps and complement our RUE devices by providing a higher voltage rating.

Part number	I <sub>H</sub> * (A)	V** max. (V)	I max. (A)	R <sub>1</sub> max. (Ω)	Agency recognition	Dimensions (millimeters/inches)		
						A (max.)	B (max.)	C (nom.)
RXE010	0.10	60	40	7.50	UL, TÜV, CSA	7.4 (0.29)	12.7 (0.50)	5.1 (0.20)
RXE017	0.17	60	40	8.00	UL, TÜV, CSA	7.4 (0.29)	12.7 (0.50)	5.1 (0.20)
RXE020	0.20	60	40	4.40	UL, TÜV, CSA	7.4 (0.29)	12.2 (0.48)	5.1 (0.20)
RXE025	0.25	60	40	3.00	UL, TÜV, CSA	7.4 (0.29)	12.2 (0.50)	5.1 (0.20)
RXE030	0.30	60	40	2.10	UL, TÜV, CSA	7.4 (0.29)	13.0 (0.51)	5.1 (0.20)
RXE040	0.40	60	40	1.29	UL, TÜV, CSA	7.6 (0.30)	13.5 (0.53)	5.1 (0.20)
RXE050	0.50	60	40	1.17	UL, TÜV, CSA	7.9 (0.31)	13.7 (0.54)	5.1 (0.20)
RXE065	0.65	60	40	0.72	UL, TÜV, CSA	9.7 (0.38)	14.5 (0.57)	5.1 (0.20)
RXE075	0.75	60	40	0.60	UL, TÜV, CSA	10.4 (0.41)	15.2 (0.60)	5.1 (0.20)
RXE090	0.90	60	40	0.47	UL, TÜV, CSA	11.7 (0.46)	15.8 (0.62)	5.1 (0.20)
RXE110	1.10	60	40	0.38	UL, TÜV, CSA	13.0 (0.51)	18.0 (0.71)	5.1 (0.20)
RXE135	1.35	60	40	0.30	UL, TÜV, CSA	14.5 (0.57)	19.6 (0.77)	5.1 (0.20)
RXE160	1.60	60	40	0.22	UL, TÜV, CSA	16.3 (0.64)	21.3 (0.84)	5.1 (0.20)
RXE185	1.85	60	40	0.19	UL, TÜV, CSA	17.8 (0.70)	22.9 (0.90)	5.1 (0.20)
RXE250	2.50	60	40	0.13	UL, TÜV, CSA	21.3 (0.84)	26.4 (1.04)	10.2 (0.40)
RXE300	3.00	60	40	0.10	UL, TÜV, CSA	24.9 (0.98)	30.0 (1.18)	10.2 (0.40)
RXE375	3.75	60	40	0.08	UL, TÜV, CSA	28.5 (1.12)	33.5 (1.32)	10.2 (0.40)



\*Hold current 20°C.

\*\*Device may withstand higher interrupt current at lower voltages. Each application will need to be individually evaluated.

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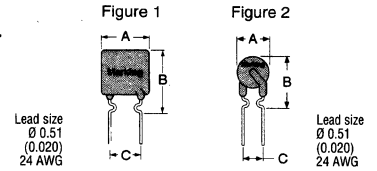
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## PolySwitch Resettable Fuses

### R-line Devices (Continued)

#### RUSB

Engineered specifically for Universal Serial Bus (USB) applications these leaded devices deliver lower voltage drops than comparable leaded devices. Designed for both single port and multiport USB applications these devices are the first generation of leaded devices specifically for USB applications.



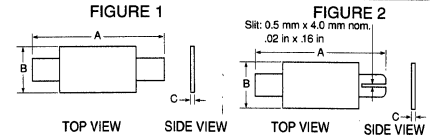
Part number	I <sub>H</sub> * (A)	V <sub>max.</sub> (Vdc)	I max. (A)	R max. initial (Ω)	Agency recognition	Dimensions (millimeters/inches)			Fig.
						A (max.)	B (max.)	C (max.)	
RUSB075	0.75	6	40	0.230	UL pending	6.9 (0.27)	11.4 (0.45)	5.1 (0.20)	2
RUSB090	0.90	6	40	0.180	UL	7.4 (0.29)	12.2 (0.48)	5.1 (0.20)	1
RUSB110	1.10	6	40	0.140	UL	7.4 (0.29)	14.2 (0.56)	5.1 (0.20)	1
RUSB120	1.20	6	40	0.140	UL pending	6.9 (0.27)	11.7 (0.46)	5.1 (0.20)	2
RUSB135	1.35	6	40	0.115	UL	8.9 (0.35)	13.5 (0.53)	5.1 (0.20)	1
RUSB160	1.60	6	40	0.110	UL	8.9 (0.35)	15.2 (0.60)	5.1 (0.20)	1
RUSB185	1.85	6	40	0.085	UL	10.2 (0.40)	15.7 (0.62)	5.1 (0.20)	1
RUSB250	2.50	6	40	0.060	UL	11.4 (0.45)	18.3 (0.72)	5.1 (0.20)	1

\*Hold current 20°C.

### Strap Devices

#### SRP

These products provide reliable, noncycling protection for rechargeable batteries. Weldable nickel leads and a narrow, low-profile design make these devices easy to install directly onto battery cells.

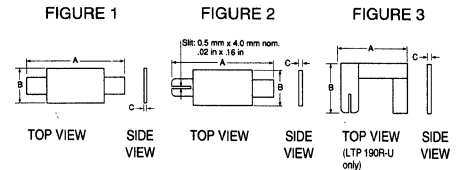


Part number	I <sub>H</sub> * (A)	V <sub>max.</sub> (V)	I max. (A)	R max. initial (Ω)	Agency recognition	Dimensions (millimeters/inches)			Fig.
						A (max.)	B (max.)	C (max.)	
SRP120	1.20	15	100	0.160	UL, TÜV, CSA	22.1 (0.87)	5.2 (0.20)	1.0 (0.04)	1
SRP120S	1.20	15	100	0.160	UL, TÜV, CSA	22.1 (0.87)	5.2 (0.20)	1.0 (0.04)	2
SRP175	1.75	15	100	0.090	UL, TÜV, CSA	23.1 (0.91)	5.2 (0.20)	1.0 (0.04)	1
SRP175S	1.75	15	100	0.090	UL, TÜV, CSA	23.1 (0.91)	5.2 (0.20)	1.0 (0.04)	2
SRP200	2.00	24	100	0.060	UL, TÜV, CSA	23.4 (0.92)	11.0 (0.43)	1.1 (0.04)	1
SRP350	3.50	24	100	0.031	UL, TÜV, CSA	31.8 (1.25)	13.5 (0.53)	1.1 (0.04)	1
SRP420	4.20	24	100	0.024	UL, TÜV, CSA	32.4 (1.28)	13.6 (0.54)	1.1 (0.04)	1

\*Hold current 20°C.

#### LTP

Similar to the SRP family of PolySwitch strap products, LTP devices provide reliable, noncycling protection for rechargeable batteries and have a slim, low-profile design that makes them easy to install. LTP devices also offer additional protection at elevated temperatures.



Part number	I <sub>H</sub> * (A)	V <sub>max.</sub> (V)	I max. (A)	R max. initial (Ω)	Agency recognition	Dimensions (millimeters/inches)			Fig.
						A (max.)	B (max.)	C (max.)	
LTP070	0.70	15	100	0.200	UL	22.1 (0.87)	5.2 (0.20)	1.2 (0.05)	1
LTP070S	0.70	15	100	0.200	UL	22.1 (0.87)	5.2 (0.20)	1.2 (0.05)	2
LTP100	1.00	24	100	0.130	UL	23.1 (0.91)	5.2 (0.20)	1.0 (0.04)	1
LTP100S	1.00	24	100	0.130	UL	23.1 (0.91)	5.2 (0.20)	1.0 (0.04)	2
LTP180	1.80	24	100	0.068	UL	26.0 (1.02)	5.2 (0.20)	1.0 (0.04)	1
LTP180S	1.80	24	100	0.068	UL	26.0 (1.02)	5.2 (0.20)	1.0 (0.04)	2
LTP190	1.90	24	100	0.057	UL	23.4 (1.92)	11.0 (0.43)	1.0 (0.04)	1
LTP190R-U	1.90	15	100	0.057	UL	20.8 (0.82)	14.3 (0.56)	0.76 (0.03)	3
LTP260	2.60	24	100	0.042	UL	26.0 (1.02)	11.9 (0.47)	1.0 (0.04)	1
LTP300	3.00	24	100	0.031	UL	31.8 (1.25)	13.5 (0.53)	1.1 (0.04)	1
LTP310	3.10	24	100	0.030	UL	26.0 (1.02)	15.9 (0.62)	1.1 (0.04)	1
LTP340	3.40	24	100	0.027	UL	26.0 (1.02)	15.9 (0.62)	1.0 (0.04)	1

\*Hold current 20°C.

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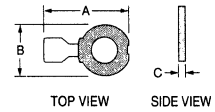
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## PolySwitch Resettable Fuses

### Strap Devices (Continued)

#### TAC

The new AAA cap part provides reliable noncycling protection for rechargeable batteries. Its unique cap design makes it easy to install directly on AAA size battery cells.

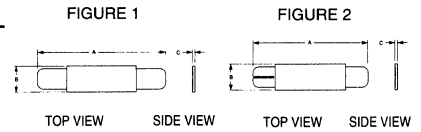


Part number	I <sub>H</sub> * (A)	V <sub>max.</sub> (V)	I max. (A)	R max. initial (Ω)	Agency recognition	Dimensions (millimeters/inches)		
						A (max.)	B (max.)	C (max.)
TAC100-09	1.0	15	50	0.155	UL	17.5 (0.69)	10.5 (0.42)	0.9 (0.036)
TAC170-09	1.7	15	50	0.098	UL	17.5 (0.69)	10.5 (0.42)	0.9 (0.036)
TAC210	2.1	15	50	0.062	UL pending	17.5 (0.69)	10.5 (0.42)	0.9 (0.036)

\*Hold current 20°C.

#### VTP

The new conductive polymer composite in the VTP battery overcurrent protection devices provide increased safety with extended battery time. These devices reach a high-resistance state at lower temperatures in NiMH and rechargeable lithium temperature-sensitive chemistries.

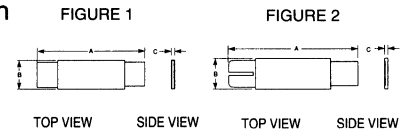


Part number	I <sub>H</sub> * (A)	V <sub>max.</sub> (Vdc)	I max. (A)	R max. initial (Ω)	Agency recognition	Dimensions (millimeters/inches)			Fig.
						A (max.)	B (max.)	C (max.)	
VTP170	1.7	16	100	0.052	UL pending	17.5 (0.69)	7.4 (0.29)	.75 (0.03)	1
VTP210G	2.1	16	100	0.030	UL	23.1 (0.91)	5.3 (0.21)	1.0 (0.04)	1
VTP210S	2.1	16	100	0.030	UL	23.1 (0.91)	5.3 (0.21)	1.0 (0.04)	2
VTP210L	2.1	16	100	0.030	UL	26.0 (1.02)	5.3 (0.21)	1.0 (0.04)	1

\*Hold current 20°C.

#### LR4

LR4 battery protective devices' new low-resistance material is combined with our proven strap product design to increase the operating range of these devices up to 6 amps. The smaller thermal mass of the devices also means reduced reaction time to overcurrent events. The LR4 devices are ideally suited for battery packs intended for computer and camcorder applications.



Part number	I <sub>H</sub> * (A)	V <sub>max.</sub> (Vdc)	I max. (A)	R max. initial (Ω)	Agency recognition	Dimensions (millimeters/inches)			Fig.
						A (max.)	B (max.)	C (max.)	
LR4-190	1.9	15	100	0.072	UL pending	22.1 (0.87)	5.5 (0.22)	1.0 (0.04)	1
LR4-190S	1.9	15	100	0.072	UL pending	22.1 (0.87)	5.5 (0.22)	1.0 (0.04)	2
LR4-260	2.6	15	100	0.042	UL	23.1 (0.91)	5.5 (0.22)	1.0 (0.04)	1
LR4-260S	2.6	15	100	0.042	UL	23.1 (0.91)	5.5 (0.22)	1.0 (0.04)	2
LR4-380	3.8	15	100	0.026	UL	26.0 (1.02)	7.5 (0.30)	1.0 (0.04)	1
LR4-450	4.5	20	100	0.020	UL pending	26.0 (1.02)	10.5 (0.41)	1.0 (0.04)	1
LR4-550	5.5	20	100	0.016	UL pending	37.0 (1.38)	7.5 (0.30)	1.0 (0.04)	1
LR4-600	6.0	20	100	0.014	UL pending	26.0 (1.02)	14.5 (0.57)	1.0 (0.04)	1
LR4-730	7.3	20	100	0.012	UL pending	29.1 (1.15)	14.5 (0.57)	1.1 (0.04)	1

\*Hold current 20°C.

**Agency approvals for PolySwitch devices**  
PolySwitch devices, where appropriate, have been tested and have gained the following safety agency approvals:

- \* UL Component Recognition in Category, XGPU2, Thermistor Type Devices
- \* CSA Component Acceptance Class 9073 32, Thermistors—PTC Type
- \* TÜV Rheinland Certification, PTC Resistors

#### Definitions

**I<sub>H</sub>** = Hold current—maximum current at which the device will not trip under specified conditions.

**I<sub>max.</sub>** = The highest fault current that can safely be used to trip a PolySwitch device under specified conditions.

**Max. operating voltage** = The maximum voltage across a PolySwitch device under a typical fault condition.

**V<sub>max.</sub>** = The highest voltage that can safely be dropped across a PolySwitch device in its tripped state under specified fault conditions.

**R<sub>1 max.</sub>** = Maximum device resistance under specified conditions measured 1 hour post trip or post reflow.

**R<sub>max. initial</sub>** = Maximum device resistance under specified conditions prior as supplied.

**Trip Current** = Minimum current at which a device will trip under specified conditions.

#### ⚠ WARNING!

• Operation beyond maximum ratings or improper use may result in device damage and possible electrical arcing and flame.

• These devices are intended for protection against occasional overcurrent or overtemperature fault conditions, and should not be used when repeated fault conditions are anticipated.



See Our Additional Data Pages In Section - B•5300

Raychem Corporation • 300 Constitution Drive, Menlo Park, CA 94025

For technical support and literature call **800-227-7040** • **FAX: 800-611-2323**



**Miniature Fuses –  
Resettable & Non-Resettable**



<b>Resettable Polymeric PTC</b>	 <i>Fuses cross to competitive resettable devices</i>	 <i>Fuses cross to competitive resettable devices</i>	 <i>Fuses cross to competitive resettable devices</i>	
	<b>Series</b>	<b>PFSM</b>	<b>PFRA</b>	<b>PFRX</b>
<b>Mounting terminals</b>	surface mount	radial leaded	radial leaded	strap (standard or slotted)
<b>Hold current <math>I_H</math> @ 23°C</b>	300mA to 2.5A	100mA to 9A	1.1A to 3.75A	1.2A to 4.2A

<b>Non-Resettable Surface Mount</b>	 <i>with or without fuse clips</i>					 <i>SMT or through-hole fuseholders</i>
	<b>Series / Voltage</b>	<b>MGA 125V</b>	<b>SFC 63V; SFP 125V</b>	<b>OMF 63V*</b>	<b>OMF 125V*</b>	<b>OMF 250V</b>
<b>Rated current</b>	200mA to 5A	1A-5A; 800mA-4A	63mA to 10A	63mA to 10A	250mA to 4A	125mA to 7A
<b>Time/current action</b>	quick-acting	quick-acting	quick-acting	quick-acting	quick-acting	quick-acting

\* Mating fuseholder available separately or with fuse pre-inserted into fuseholder

<b>Through-Hole</b>		 <i>Hermetically sealed</i>				 <i>High breaking capacity</i>
	<b>Series / Voltage</b>	<b>MSA 125V</b>	<b>MGL 125V</b>	<b>MSF 125V</b>	<b>MSF 250V</b>	<b>MST 250V</b>
<b>Rated current</b>	63mA to 15A*	200mA to 5A*	100mA to 5A	40mA to 5A	50mA to 6.3A	800mA to 6.3A
<b>Time/current action</b>	quick-acting	quick-acting	quick-acting	quick-acting	time-lag	time-lag

\* MSA: 12A-15A @ 32V; MGL: 4A-5A @ 32V

<b>Surge-Tolerant for Telecom</b>						
	<b>Series / Voltage</b>	<b>OSU 125V</b>	<b>OSU 250V</b>	<b>MSU 125V</b>	<b>MSU 250V</b>	<b>FRT 250V</b>
<b>Rated current</b>	250mA to 3.15A	250mA to 3.15A	250mA to 3.15A	250mA to 3.15A	250mA to 3.15A	250mA to 3.15A
<b>Time/current action</b>	quick-acting	quick-acting	quick-acting	quick-acting	quick-acting	quick-acting

<b>5 x 20mm (250V)</b>				
	<b>Series</b>	<b>SA/SP/SPT/FSM</b>	<b>FSF/FST/FTT/FSM</b>	<b>All series</b>

*Quick-acting and time-lag characteristics available, with low, medium or high breaking capacities. Pigtail leads optional.*

**For order numbers, pricing, samples and technical information contact Schurter at 707-778-6311;  
Fax 707-778-6401; E-mail [info@schurterinc.com](mailto:info@schurterinc.com); Website <http://www.schurterinc.com>**



Fuseholders –  
Panel and Pcb Mount

ISO 9001 / ISO 14001

<b>Panel Mount</b>		<i>Snap-in</i> 	<b>NEW</b> <i>Rear mount</i> 	<i>captive fuse carrier</i> 	<i>recessed fuse carrier</i> 
<b>Series</b>	<b>FPG</b>	<b>FPG</b>	<b>FPG</b>	<b>FBS</b>	<b>FEU</b>
Panel mount	•	•	• rear mount	•	•
Solder/quick terminals	•	•	•	•	•
Solder terminals					•
Holds 5x20mm fuse	•	•	•	•	
Holds 5x20mm or 1/4 x 1 1/4" fuse					•

Finger grip or slotted fuse carriers available for most styles – ordered separately. Watertight and medical grade versions available.

<b>Panel and Pcb Mount</b>	<i>High current</i> 		<i>Captive fuse carrier</i> 		
<b>Series</b>	<b>FIZ, FUL</b>	<b>FPG</b>	<b>FPG, FBS</b>	<b>FAC</b>	<b>FAU</b>
Panel mount	•				
Pcb mount		•	•	•	•
Quick terminals	•				
Holds 5x20mm fuse	•	•	•		
Holds 5x20mm or 1/4 x 1 1/4" fuse	•			•	•

Finger grip or slotted fuse carriers available for most styles – ordered separately. Watertight and medical grade versions available.


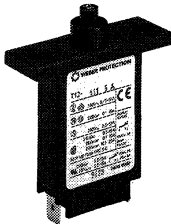


<b>Pcb Mount Blocks and Clips</b>					
	<i>SMT fuseholder</i>	<i>Fuse blocks</i>	<i>Fuse blocks</i>	<i>Fuse clips</i>	<i>Microfuse holders</i>
<b>Series</b>	<b>OMH</b>	<b>OG, OGN, OGD</b>	<b>UH, UHB, RSH</b>	<b>OG</b>	<b>FMS, FMR</b>
Surface mount	•	•			
Through-hole mount		•	•	•	•
Screw mount			•		
Holds SMT fuse	•				
Holds 5x20mm fuse		•	•	•	
Holds 5x20mm or 1/4 x 1 1/4" fuse		•	•	•	for series MSF 125V microfuse

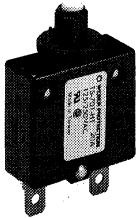
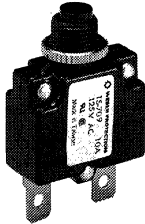
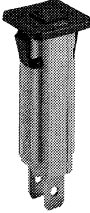
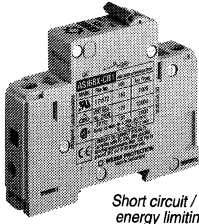
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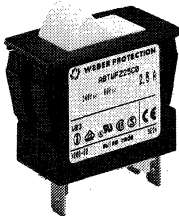
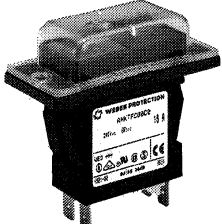
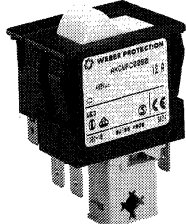
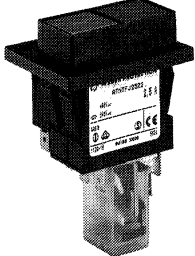
## Circuit Breakers For Equipment (CBEs)

ISO 9001 / ISO 14001

				
Series / poles	T11 / 1-pole	T12 / 1-pole	TM12 / 1-pole	T13 / 1-pole
Thermal	•	•		•
Thermal / magnetic			•	
Manual reset actuation	•	•	•	•
Manual trip actuation		•	•	• lever optional
Positive trip-free action	•	•	•	•
Latch action release	•	•	•	•

				
Series / poles	TS-701 / 1-pole	TS-709 / 1-pole	TS-710 / 1-pole	AS168X / 1-4 poles
Thermal	•	•	•	
Thermal / magnetic				•
Manual reset actuation	•	•	•	• on-off
Manual trip actuation				•
Positive trip-free action	cycling only	cycling only	cycling only	•
Latch action release				•

*Short circuit / energy limiting*

				
Series / poles	TA45 / 1 or 2 poles	TA45 / 1 or 2 poles	TA45 / 1-3 poles	TA45 / 1-3 poles
Thermal	• with or without	• with or without	• with or without	• with or without
Manual reset actuation	• power on-off / reset	• power on-off / reset	• power on-off / reset	• power on-off / reset
Manual trip actuation	•	•	•	•
Positive trip-free action	•	•	•	•
Latch action release	•	•	•	•

TA45 options include: rocker switch or pushbutton (lighted or unlighted), snap in or flange mounting, protective cover, mechanical lock-out latch, undervoltage release, shunt terminal, auxiliary contact (changeover), and assorted accessories

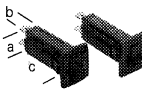
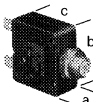
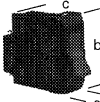

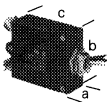





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# SIEMENS

Siemens Electromechanical Components Inc.  
200 South Richland Creek Drive, Princeton, Indiana 47671-0001  
Tel: 812.386.1000 • Fax: 812.386.2072 • e-mail: info@sec.siemens.com

## Circuit Breakers

Series	W28	W58	W33	W23	W31
<b>Potter &amp; Brumfield Circuit Breakers®</b>					
<b>Type</b>	Thermal	Thermal	Thermal	Thermal	Thermal
<b>Features</b>	<ul style="list-style-type: none"> <li>• On/off switchable option offered</li> <li>• Replaces slow blow glass cartridge fuse and holder</li> <li>• Labor-saving snap-in mounting</li> <li>• Button extends for visible trip indication</li> <li>• Push-to-reset operation</li> </ul>	<ul style="list-style-type: none"> <li>• Quick connect or screw terminals</li> <li>• Button extends for visible trip indication</li> <li>• Push-to-reset operation</li> </ul>	<ul style="list-style-type: none"> <li>• Rocker actuator in various colors</li> <li>• Convenient, snap-in mounting</li> <li>• Optional lighted rockers</li> <li>• Models with aux. switch available</li> <li>• Designed to meet IEC and VDE requirements.</li> </ul>	<ul style="list-style-type: none"> <li>• Push/pull actuation for manual on/off and reset</li> </ul>	<ul style="list-style-type: none"> <li>• Toggle actuation for manual on/off and reset</li> </ul>
<b>Approximate Size and Weight (per pole)</b>	 a b c .54" x .63" x 1.54"d (13.7 x 15.9 x 39.0d) .35 oz. (10g)	 a b c .66" x 1.38" x 1.38"d (16.8 x 34.9 x 34.9d) 1.5 oz. (43g)	 a b c .98" x 1.89" x 1.72"d (24.9 x 48 x 43.8d) 1.2 oz. (35g)	 a b c .69" x 1.38" x 1.6"d (17.5 x 34.9 x 40.6d) 2 oz. (57g)	 a b c .69" x 1.38" x 1.6"d (17.5 x 34.9 x 40.6d) 2 oz. (57g)
<b>No. of Poles</b>	1	1	1 or 2	1	1
<b>Circuit Function</b>	Series Trip	Series Trip	Series Trip, both poles or Series Trip, one pole: Switch only, one pole	Series Trip	Series Trip
<b>Current Rating</b>	0.25-20 Amps	1-35 Amps	5-20 Amps	0.5-50 Amps	0.5-50 Amps
<b>Max. Operating Voltage</b>	32VDC 250VAC	50VDC 250VAC	50VDC 250VAC	50VDC 250VAC	50VDC 250VAC
<b>Trip Time at 200% of Rating</b>	0.25-2A Models – 4.5 to 28 Sec. 3-20A Models – 2.2 to 15 Sec.	1-4A Models – 10 to 45 Sec. 5-35A Models – 6 to 30 Sec.	3 to 33 Sec.	0.5-4A Models – 11 to 30 Sec. 5-35A Models – 6 to 22 Sec.	0.5-4A Models – 11 to 30 Sec. 5-35A Models – 6 to 22 Sec.
<b>Interrupt Capacity</b>	1,000A @ 32VDC or 250VAC	2,000A @ 50VDC 1,000A @ 250VAC	1,000A @ 50VDC 2,000A @ 250VAC	0.5-25A Models – 2,000A @ 50VDC 1,000A @ 250VAC 30-50A Models – 1,000A @ 50VDC or 250VAC	0.5-25A Models – 2,000A @ 50VDC 1,000A @ 250VAC 30-50A Models – 1,000A @ 50VDC or 250VAC
<b>Terminal Options</b>	.250" (6.35) Quick Connect (Do not solder)	.250" (6.35) Quick Connect, #6-32 Screw	.250" (6.35) Quick Connect, Solder	#8-32 Screw	#8-32 Screw
<b>Mounting Options</b>	Snaps into 5/8" (15.9) panel cutout from the front	7/16"–28 Threaded Bushing, 15/32"–32 Threaded Bushing	Snaps into .875 x 1.75" (22.2 x 44.5) panel cutout from the front	3/8"–24 Threaded Bushing	15/32"–32 Threaded Bushing
<b>Fax Document #</b>	9280	9580	9330	9230	9230

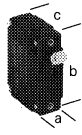

Specifications are subject to change without notice. Specifications and/or agency recognitions do not necessarily apply to all models within a particular series.

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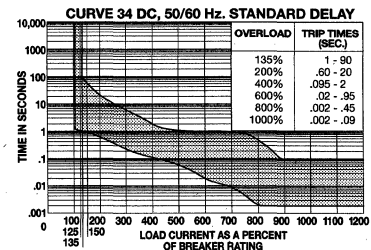
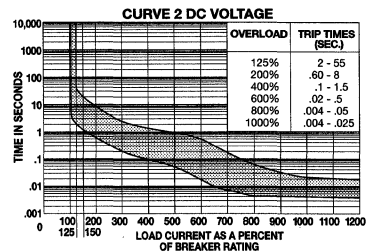
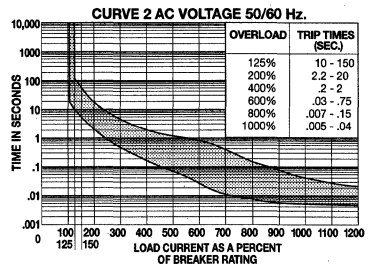
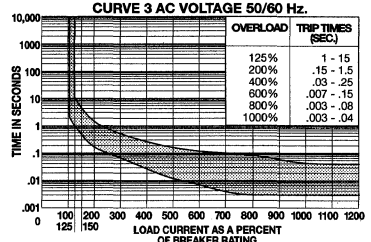
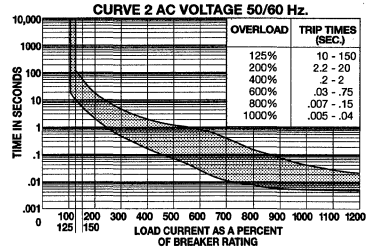
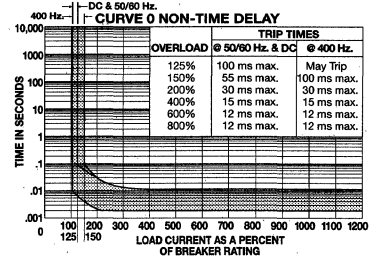
# SIEMENS

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 200 South Richland Creek Drive, Princeton, Indiana 47671-0001  
 Tel: 812.386.1000 • Fax: 812.386.2072 • e-mail: info@sec.siemens.com

## Circuit Breakers

<p>Potter &amp; Brumfield Circuit Breakers®</p>		
<p>Series</p>	<p><b>W6</b></p>	<p><b>W9</b></p>
<p>Type</p>	<p>Magnetic</p>	<p>Magnetic</p>
<p>Features</p>	<ul style="list-style-type: none"> <li>• Compact design</li> <li>• Variety of time delay options</li> <li>• Toggle actuation for manual on/off and reset</li> <li>• Optional aux. switch</li> </ul>	<ul style="list-style-type: none"> <li>• Variety of time delay options</li> <li>• Toggle actuation for manual on/off and reset</li> <li>• Optional aux. switch</li> </ul>
<p>Approximate Size and Weight (per pole)</p>	<p>a b c                  .75" x 2.0" x 1.64"d                  (19.1 x 50.8 x 42.1d)                  2.5 oz. (71g)</p>	<p>a b c                  .75" x 2.5" x 2.1"d                  (19.1 x 63.5 x 53.0d)                  2.5 oz. (71g)</p>
<p>No. of Poles</p>	<p>1 through 4</p>	<p>1 through 4</p>
<p>Circuit Function</p>	<p>Series Trip w/ or w/o Aux. Switch, Shunt Trip, Relay Trip, Dual Coil Series Trip, Dual Coil Shunt Trip</p>	<p>Series Trip w/ or w/o Aux. Switch, Shunt Trip, Relay Trip, Dual Coil Series Trip, Dual Coil Shunt Trip</p>
<p>Current Rating</p>	<p>0.25-50 Amps</p>	<p>0.25-50 Amps</p>
<p>Max. Operating Voltage</p>	<p>65VDC                  277VAC                  480VAC 3ø-Wye</p>	<p>65VDC                  277VAC                  480VAC 3ø-Wye</p>
<p>Trip Time at 200% of Rating</p>	<p>30ms to 100 Sec. depending upon trip curve specified.</p>	<p>30ms to 100 Sec. depending upon trip curve specified.</p>
<p>Interrupt Capacity</p>	<p>0.25-20A Models – 2,000A @ 65VDC                  5,000A @ 277VAC or 480VAC 3ø-Wye                  21-50A Models – 2,000A @ 65VDC                  2,500A @ 277VAC</p>	<p>2,000A @ 65VDC                  5,000A @ 277VAC                  5,000A @ 480VAC 3ø-Wye</p>
<p>Terminal Options</p>	<p>.250" (6.35) Quick Connect, #10-32 Screw</p>	<p>#10-32 Stud</p>
<p>Mounting Options</p>	<p>#6-32 Tapped Holes, M3 Tapped Holes, Snaps into panel cutout from the front</p>	<p>#6-32 Tapped Holes, M3 Tapped Holes</p>
<p>Fax Document #</p>	<p>9699</p>	<p>9699</p>

Time vs. Current Trip Curves for Stock W6/W9 Series Breakers

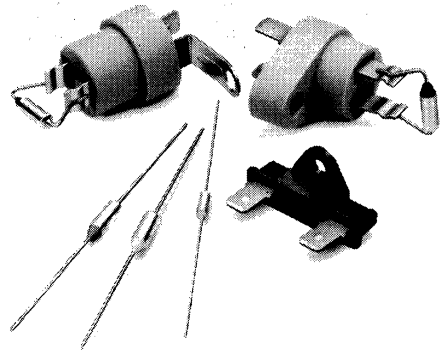


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Visit our website at [www.sec.siemens.com](http://www.sec.siemens.com) for detailed product specifications and other info about our firm. If you do not have web access you can still get detailed product specs by calling our fax-on-demand system at 812.386.2561.

# MICROTEMP® Thermal Cutoffs

MICROTEMP® thermal cutoffs from Therm-O-Disc offer an accurate, reliable solution to upper limit temperature protection. Known as a "fuse" or TCO, the MICROTEMP® thermal cutoff provides low-cost protection against potentially hazardous over-heating by interrupting an electrical circuit when operating temperatures exceed the rated temperature of the cutoff.



## Features and Benefits of the MICROTEMP®

- MICROTEMP® TCO features include:
- One shot operation cuts off electrical current
  - High current interrupt capacity for applications requiring up to 16 amps @ 250 VAC (25 amps @ 120 VAC)
  - Low resistance
  - Compact size facilitates mounting in confined spaces
  - Special configurations and mounting packages are available

## The Operating Principle of the MICROTEMP®

The active trigger mechanism of the thermal cutoff is an exclusively formulated, electrically non-conductive pellet. Under normal operating temperatures, the solid pellet holds spring loaded contacts closed.

When a predetermined temperature is reached, the pellet melts, allowing the barrel spring to relax. The trip spring then slides the contact away from the lead and the circuit is opened.

Once a MICROTEMP® thermal cutoff opens a circuit, the circuit will remain

open until the TCO is replaced. This replacement procedure must include correction of the fault condition before the product can be operated again.

## The MICROTEMP® Thermal Cutoff Series

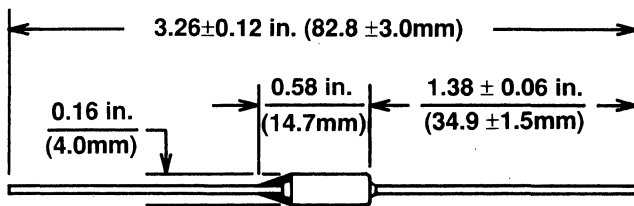
There are three primary types of MICROTEMP® thermal cutoffs recognized by all of the major approval agencies around the world. As shown in the chart at the right, MICROTEMP® TCOs are available in a range of temperatures from 72°C to 240°C with electrical ratings up to 21 Amps at 240 VAC (25 Amps at 120 VAC.)

Dimensions for the G4 and G5 Series thermal cutoffs are shown below. The G7 Series TCO is approximately 30% smaller than the G4 and G5 Series.

Please contact a Therm-O-Disc sales engineer at (419) 525-8300 for a free MICROTEMP® thermal cutoff sample and Technical Bulletin TCO-A which describes testing and installation procedures for thermal cutoffs.

MICROTEMP® TCO Temperature and Electrical Specifications

	G4 Series	G5 Series	G7 Series
Calibration Temperatures °C (Tolerance +0, -5°C)	72	72	—
	77	77	77
	84	84	84
	93	93	93
	98	98	98
	104	104	—
	110	110	110
	117	117	117
	121	121	121
	128	128	128
	144	144	144
	152	152	152
	167	167	167
	184	184	184
	192	192	—
	216	216	—
229	229	—	
240	240	—	
Electrical Ratings	250 VAC 10.0A Res. 8.0A Ind.	250 VAC 16.0A Res. 250 VAC 16.0A Res.	250 VAC 5.0A Res. 4.5A Ind.
	120 VAC 15.0A Res. 14.0A Ind.	120 VAC 25.0A Res. —	120 VAC 5.0A Res. 4.5A Ind.



G4 and G5 Series Thermal Cutoff

For further information on MICROTEMP® thermal cutoffs, contact a Therm-O-Disc sales engineer at 419-525-8300

# THERMODISC®

1320 South Main Street, Mansfield, Ohio 44907  
Phone: 419-525-8300 Fax: 419-525-8344  
Web Site Address: <http://www.thermodisc.com>

Therm-O-Disc, Inc. is a subsidiary of Emerson Electric Co.



# MINIATURE FUSES



## 5x20mm



• FaxBack No. 202



- 250V, Glass Tube
- International IEC 127-2/II,III

Series 19193 / Fast-Acting			
Rated Current	Amp Code	Breaking Capacity	Melting Integral (A <sup>2</sup> s Max)
50mA	022		0.005
63mA	025		0.0079
80mA	026		0.0032
100mA	027		0.007
125mA	028		0.014
160mA	030		0.024
200mA	034		0.018
250mA	035	L ≅ 35A	0.032
315mA	037	at	
400mA	040	250VAC	0.13
500mA	041		0.23
630mA	043		0.44
800mA	046		1.0
1.00A	048		1.4
1.25A	050		2.7
1.60A	053		4.3
2.00A	057		7.8
2.50A	058		13
3.15A	124		20
4.00A	062	L ≅ 40A ~	21
5.00A	063	L ≅ 50A ~	38
6.30A	066	L ≅ 63A ~	72

Series 19195 / Time-Lag			
Rated Current	Amp Code	Breaking Capacity	Melting Integral (A <sup>2</sup> s Min)
32mA	019		0.01
40mA	021		0.011
50mA	022		0.02
63mA	025		0.026
80mA	026		0.052
100mA	027		0.073
125mA	028		0.13
160mA	030		0.22
200mA	034		0.3
250mA	035	L ≅ 35A	0.32
315mA	037	at	1.1
400mA	040	250VAC	2.4
500mA	041		3.8
630mA	043		7.5
800mA	046		10
1.00A	048		11
1.25A	050		20
1.60A	053		36
2.00A	057		10
2.50A	058		14
3.15A	124		26
4.00A	062	L ≅ 40A ~	42
5.00A	063	L ≅ 50A ~	70
6.30A	066		120
8.00A*	069	L ≅ 63A	240
10.00A*	071	at	400
12.50A*	126	250VAC	650
16.00A*	074		1000

\* Not mentioned in the Standards.

## 5x20mm



• FaxBack No. 203



- 250V, Ceramic Tube
- International IEC 127-2/I,V

Series 19194 / Fast-Acting			
Rated Current	Amp Code	Breaking Capacity	Melting Integral (A <sup>2</sup> s Max)
200mA	034		0.007
250mA	035		0.013
315mA	037		0.015
400mA	040	H ≅ 10,000A	0.027
500mA	041	at	0.041
630mA	043	125VAC	0.075
800mA	046		0.12
1.00A	048		0.29
1.25A	050		0.7
1.60A	053		1.0
2.00A	057		1.8
2.50A	058		3.0
3.15A	124	H ≅ 15000A	7.8
4.00A	062	at	15
5.00A	063	250VAC	35
6.30A	066		75
8.00A*	069		110
10.00A*	071		150

Series 19181 / Time-Lag			
Rated Current	Amp Code	Breaking Capacity	Melting Integral (A <sup>2</sup> s Min)
125mA*	028		0.025
160mA*	030		0.035
200mA*	034		0.084
250mA*	035	H ≅ 10,000A	0.11
315mA*	037	at	0.19
400mA*	040	250VAC	0.34
500mA*	041		0.56
630mA*	043		0.77
800mA*	046		1.6
1.00A	048		1.0
1.25A	050		1.6
1.60A	053		2.6
2.00A	057	H ≅ 15000A	4.5
2.50A	058	at	10
3.15A	124	250VAC	19
4.00A	062		32
5.00A	063		66
6.30A	066		110
8.00A*	069	H ≅ 10000A	77
10.00A*	071	at 250VAC	180

\* Not mentioned in the Standards. Contact WICKMANN for alternative high breaking capacity fuses for use in CENELEC nations.

## 5x20mm



• FaxBack No. 201



- 250V, Glass Tube
- North American UL 248-14

Series 197 / Time-Lag (Normal Blow)			
Rated Current	Amp Code	Breaking Capacity	Melting Integral (A <sup>2</sup> s Avg)
125mA	0125		
160mA	0160		
200mA	0200	10,000A	
250mA	0250	at	0.033
300mA	0300	125VAC	0.055
350mA	0350		0.084
400mA	0400		0.11
500mA	0500	35A	0.24
600mA	0600	at	0.35
700mA	0700	250VAC	0.5
800mA	0800		0.51
1.00A	1100		1.4
1.25A	1125	10,000A at	2.2
1.60A	1160	125VAC	4.3
2.00A	1200		7.3
2.50A	1250	100A at	10
3.00A	1300	250VAC	18
3.50A	1350		26
4.00A*	1400		36
5.00A*	1500	10,000A	55
6.00A*	1600	at	102
7.00A*	1700	125VAC	134

Series 198 / Time-Delay			
Rated Current	Amp Code	Breaking Capacity	Melting Integral (A <sup>2</sup> s Min)
80mA	0080		0.019
100mA	0100		0.038
125mA	0125	10,000A	0.066
150mA	0150	at	0.1
200mA	0200	125VAC	0.18
250mA	0250		0.29
300mA	0300		0.5
400mA	0400		1.0
500mA	0500	35A	1.6
600mA	0600	at	2.7
700mA	0700	250VAC	3.7
800mA	0800		5.6
1.00A	1100		9.5
1.25A	1125	10,000A at	15
1.60A	1160	125VAC	25
2.00A	1200		46
2.50A	1250	100A at	83
3.00A	1300	250VAC	110
3.50A	1350		180

\* Rated at 125VAC Contact for Series 191, Fast-Acting

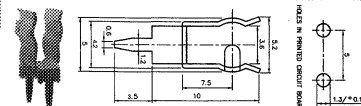
• Order-Information:	Qty.	Order-Number	Series	Amp Code	Packaging

- Packaging:
  - FS: Pack (10 pcs. per Pack)
  - L0: Axial Leads/Bulk
  - L1: Bulk (1000 pcs. per Box)
  - L1: Axial Leads/Tape & Reel (1000 pcs. per Reel)

## MOUNTING OPTIONS • FaxBack No. 510

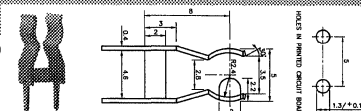
### No. 520

- Type: PC-Mount clip
- Material: Tin bronze, tin-plated
- Rated Voltage: 500V
- Rated Current: 6.3A



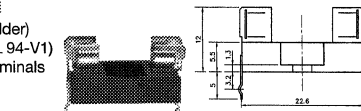
### No. 521

- Type: PC-Mount clip (90° pin shift)
- Material: Tin bronze, tin-plated
- Rated Voltage: 500V
- Rated Current: 6.3A



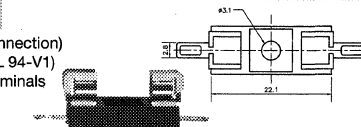
### No. 646

- Type: PC-Mount Block (direct solder)
- Material: Thermoplastic body (UL 94-V1) Copper alloy, tinned terminals
- Rated Voltage: 250V
- Rated Current: 6.3A



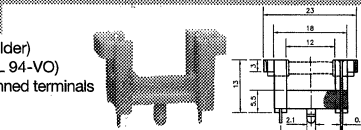
### No. 647

- Type: PC-Mount Block (cable connection)
- Material: Thermoplastic body (UL 94-V1) Copper alloy, tinned terminals
- Rated Voltage: 250V
- Rated Current: 6.3A



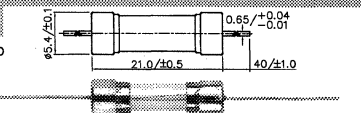
### No. 649

- Type: PC-Mount Block (direct solder)
- Material: Thermoplastic body (UL 94-V0) Enclosed copper alloy, tinned terminals
- Rated Voltage: 250V
- Rated Current: 6.3A



### Axial Leads -L0 / -L1

- Material: Nickel-plated brass cap Tin-plated copper lead
- Rated Voltage: 500V
- Rated Current: 8.0A



WICKMANN USA, INC.

• 4100 Shirley Dr. • Atlanta, GA 30336 • Tel: (404) 699-7820 • Fax: (404) 699-9176  
• FaxBack: (800) 251-5490 • Web: www.wickmannusa.com



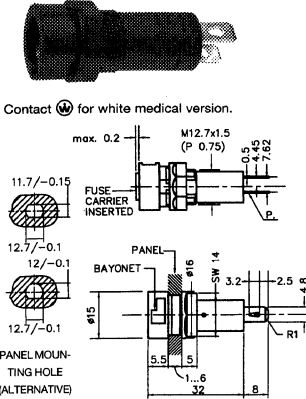
# SHOCK-SAFE FUSEHOLDERS



## 5x20mm

No. 820

• FaxBack No. 503



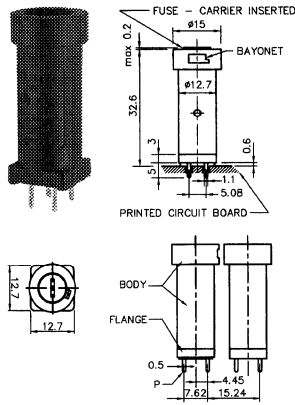
- **Type:** Panel-Mount Holder
- **Terminals:** Solder/Quick connect
- **Rated Voltage:** 250V
- **Rated Current, approved:** 10A/2.5W according to VDE/SEMKO 16A according to UL/CSA
- **Admissible fuse power dissipation:** 4W at 40°C
- **Approvals:** UL Recognized: File No. E 70164 CSA Certified: File No. 47574 VDE: File No. 53714 SEMKO: File No. 8916209
- **High Profile:** contact for No. 821

• UL 512, IEC 127, VDE 0820/2



No. 831

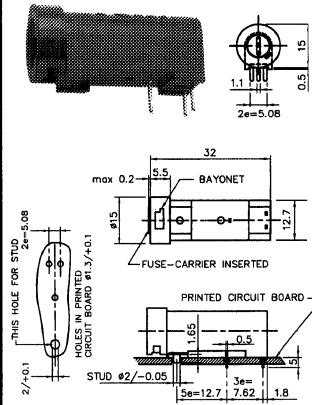
• FaxBack No. 507



- **Type:** PC-Board Holder, Vertical
- **Terminals:** (4) Solder pins
- **Rated Voltage:** 250V
- **Rated Current, approved:** 6.3A/2.5W according to VDE/SEMKO 10A according to UL/CSA
- **Admissible fuse power dissipation:** 2.5W at 40°C
- **Approvals:** UL Recognized: File No. E 70164 CSA Certified: File No. 47574 VDE: File No. 57398 SEMKO: File No. 8839041
- **2-Pin type:** contact for No. 834

No. 830

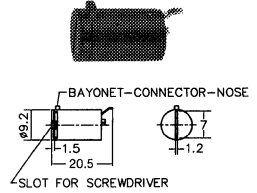
• FaxBack No. 508



- **Type:** PC-Board Holder, Horizontal
- **Terminals:** (3) Solder pins
- **Rated Voltage:** 250V
- **Rated Current, approved:** 6.3A/2.5W according to VDE/SEMKO 10A according to UL/CSA
- **Admissible fuse power dissipation:** 2.5W at 40°C
- **Approvals:** UL Recognized: File No. E 70164 CSA Certified: File No. 47574 VDE: File No. 55787 SEMKO: File No. 8839041

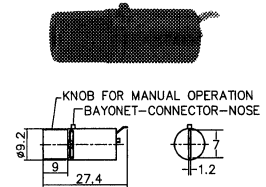
## FUSE CARRIERS

No. 835 / Flush Mount



For white medical version, use No. 19835-20

No. 837 / Finger Grip



• To order Holder with Carrier: (Example)

Carrier Type	Order No.
Flush Mount	820B35
Finger Grp	820B37

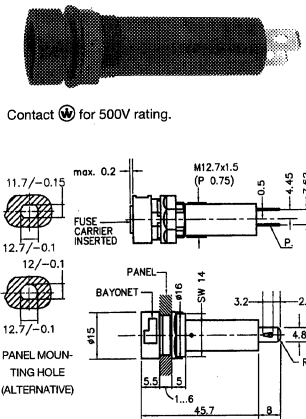
## 1/4"x1 1/4" & 5x20mm

• UL 512, IEC 127, VDE 0820/2



No. 800

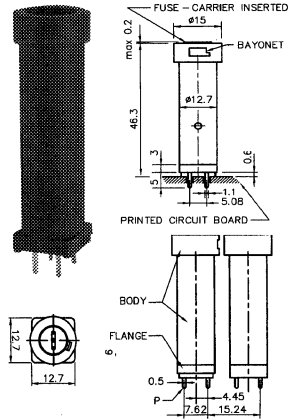
• FaxBack No. 501



- **Type:** Panel-Mount Holder
- **Terminals:** Solder/Quick connect
- **Rated Voltage:** 250V
- **Rated Current, approved:** 10A/2.5W according to VDE/SEMKO 16A according to UL/CSA
- **Admissible fuse power dissipation:** 4W at 40°C
- **Approvals:** UL Recognized: File No. E 70164 CSA Certified: File No. 47574 VDE: File No. 49838 SEMKO: File No. 8727099
- **High Profile:** contact for No. 801/802

No. 811

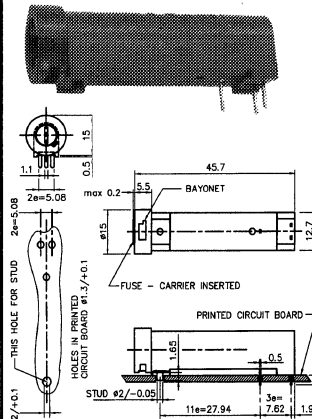
• FaxBack No. 505



- **Type:** PC-Board Holder, Vertical
- **Terminals:** (4) Solder pins
- **Rated Voltage:** 250V
- **Rated Current, approved:** 6.3A/2.5W according to VDE/SEMKO 10A according to UL/CSA
- **Admissible fuse power dissipation:** 2.5W at 40°C
- **Approvals:** UL Recognized: File No. E 70164 CSA Certified: File No. 47574 VDE: File No. 55787 SEMKO: File No. 8903044
- **2-Pin type:** contact for No. 814

No. 810

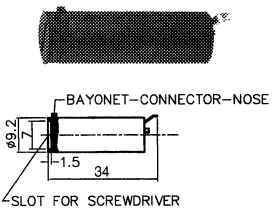
• FaxBack No. 506



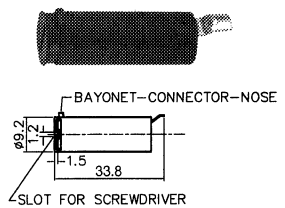
- **Type:** PC-Board Holder, Horizontal
- **Terminals:** (3) Solder pins
- **Rated Voltage:** 250V
- **Rated Current, approved:** 6.3A/2.5W according to VDE/SEMKO 10A according to UL/CSA
- **Admissible fuse power dissipation:** 2.5W at 40°C
- **Approvals:** UL Recognized: File No. E 70164 CSA Certified: File No. 47574 VDE: File No. 55787 SEMKO: File No. 8815062
- **2-Pin type:** contact for No. 813

## FUSE CARRIERS

No. 815 / 5x20mm



No. 816 / 1/4" x 1 1/4"



• To order Holder with Carrier: (Example)

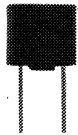
Carrier Type	Order No.
5x20mm	800B15
1/4" x 1 1/4"	800B16

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# SUBMINIATURE FUSES



**TR5**



• FaxBack No. 301

- 250V, Thermoplastic Body
- North American UL 248-14



**TR5**



• FaxBack No. 300

- 250V, Thermoplastic Body
- International IEC 127-3

Series 19373 / Fast-Acting				Series 19374 / Time-Lag				Series 19370 / Fast-Acting				Series 19372 / Time-Lag			
Rated Current	Amp Code	Breaking Capacity	Melting Integral (A <sup>2</sup> s Max)	Rated Current	Amp Code	Breaking Capacity	Melting Integral (A <sup>2</sup> s Min)	Rated Current	Amp Code	Breaking Capacity	Melting Integral (A <sup>2</sup> s Max)	Rated Current	Amp Code	Breaking Capacity	Melting Integral (A <sup>2</sup> s Min)
50mA	022		0.0001	50mA	022		0.0056	50mA	022		0.00035	50mA	022		0.01
63mA	025		0.00023	63mA	025		0.009	63mA	025		0.0005	63mA	025		0.02
80mA	026		0.00037	80mA	026		0.014	80mA	026		0.0014	80mA	026		0.023
100mA	027		0.0013	100mA	027		0.025	100mA	027		0.0038	100mA	027		0.047
125mA	028		0.0019	125mA	028		0.044	125mA	028		0.0066	125mA	028		0.066
160mA	030		0.004	160mA	030		0.058	160mA	030		0.014	160mA	030		0.14
200mA	034		0.0065	200mA	034		0.1	200mA	034		0.03	200mA	034		0.2
250mA	035		0.014	250mA	035		0.17	250mA	035		0.051	250mA	035		0.28
315mA	037		0.032	315mA	037		0.26	315mA	037		0.1	315mA	037		0.36
400mA	040	50A	0.016	400mA	040	50A	0.32	400mA	040	35A	0.025	400mA	040	35A	0.9
500mA	041	at	0.024	500mA	041	at	0.6	500mA	041	at	0.037	500mA	041	at	1.3
630mA	043	250VAC	0.039	630mA	043	250VAC	0.75	630mA	043	250VAC	0.066	630mA	043	250VAC	2.5
800mA	046		0.069	800mA	046		0.98	800mA	046		0.11	800mA	046		3.8
1.00A	048		0.11	1.00A	048		2.1	1.00A	048		0.2	1.00A	048		5.5
1.25A	050		0.2	1.25A	050		3.2	1.25A	050		0.31	1.25A	050		7.9
1.60A	053		0.38	1.60A	053		4.5	1.60A	053		0.53	1.60A	053		14
2.00A	057		0.63	2.00A	057		7.5	2.00A	057		0.98	2.00A	057		17
2.50A	058		1.2	2.50A	058		14	2.50A	058		1.8	2.50A	058		25
3.15A	124		1.9	3.15A	124		22	3.15A	124		3.1	3.15A	124		46
4.00A	062		3.5	4.00A	062		36	4.00A	062	40A ~	6.7	4.00A	062	40A ~	91
5.00A	063		6.2	5.00A	063		59	5.00A	063	50A ~	⊕	5.00A	063	50A ~	94
6.30A	066		9.1	6.30A	066		110								
10.00A*	071		47	10.00A*	071		190								

\* Series 19378 for short circuit backup only.

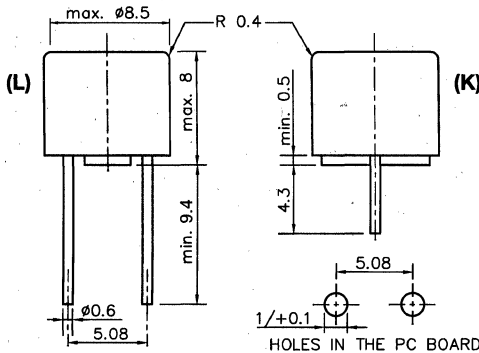
\* Series 19379 for short circuit backup only.

**Time/Current Characteristics (xI<sub>rated</sub>)**  
 100% > 4hrs  
 200% < 60sec

**Time/Current Characteristics (xI<sub>rated</sub>)**  
 150% > 1hr  
 210% < 30min  
 275% 10ms-3s  
 400% 3-300ms

**Time/Current Characteristics (xI<sub>rated</sub>)**  
 150% > 1hr  
 210% < 2min  
 275% 400ms-10s  
 400% 150ms-3s

## SPECIFICATIONS



**Approvals:**

UL Listed: File No. E 67006  
 CSA Certified: File No. 51378  
 VDE: File No. 51963  
 SEMKO: File No. 82734  
 UL Recognized: File No. E 67006  
 cUL Recognized: File No. E 67006

**Soldering Heat Resistance:**  
 260°C, 10 sec. (IEC 68-2-20)

**Solderability:**  
 260°C, ≤ 3 sec. (Wave)  
 350°C, ≤ 1 sec. (Manual)

**Material:**

Base and Cap: Brown thermoplastic (Polyamide PA 6.6), UL 94-V0  
 Round Pins: Copper alloy, tin-plated for soldering

**Vibration Resistance:**  
 10 - 2000Hz at 0.75mm amplitude, 6 hrs.

**Acceleration Tolerance:**  
 Up to 10g, 11 msec.

**Order Information:**

Qty.	Order Number	Series	Amp Code	Packaging
------	--------------	--------	----------	-----------

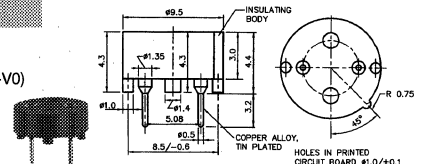
**Packaging:**

- L: Long Leads/Bulk
- K: Short Leads/Bulk
- C1: Tape/Ammopack (1000 pieces per Pack)

## TR5 / TE5 HOLDERS • FaxBack No. 304

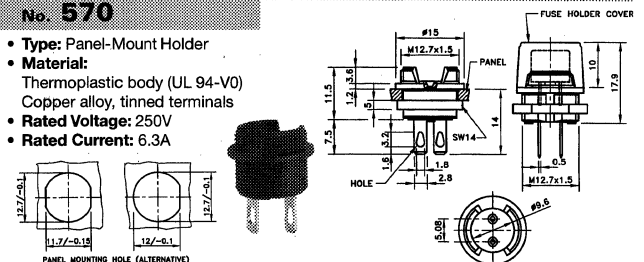
**No. 560**

- **Type:** PC-Mount Holder
- **Material:** Thermoplastic body (UL 94-V0) Beryllium copper Brass terminals, tin-plated
- **Rated Voltage:** 250V
- **Rated Current:** 6.3A



**No. 570**

- **Type:** Panel-Mount Holder
- **Material:** Thermoplastic body (UL 94-V0) Copper alloy, tinned terminals
- **Rated Voltage:** 250V
- **Rated Current:** 6.3A



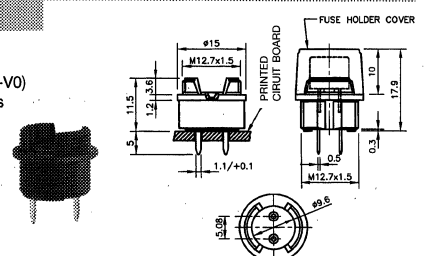
**No. 575**

- **Type:** Plastic cover For No. 570 / No. 571
- **Material:** Thermoplastic (UL 94-V0)



**No. 571**

- **Type:** PC-Mount Holder
- **Material:** Thermoplastic body (UL 94-V0) Copper alloy, tinned terminals
- **Rated Voltage:** 250V
- **Rated Current:** 6.3A
- **Mounting:** Holes in PC Board: Ø 1.3/±0.1mm, Hole spacing: 7.62mm



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# SUBMINIATURE FUSES



**TE5**



- 125V, Thermoplastic Body
- North American UL 248-14

• FaxBack No. 302



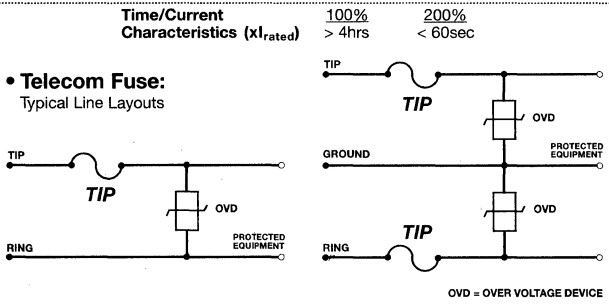
**TIP**



- 125V, Thermoplastic Body
- North American UL 248-14

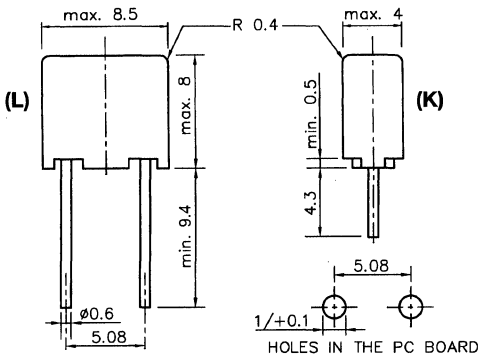
• FaxBack No. 314

Series 19395 / Fast-Acting				Series 19396 / Time-Lag				Series 385 / Time-Lag Telecom Interface Protector						
Rated Current	Amp Code	Breaking Capacity	Melting Integral (A's Max)	Rated Current	Amp Code	Breaking Capacity	Melting Integral (A's Min)	Rated Current	Amp Code	Breaking Capacity	Melting Integral (A's Min)	FCC 47 Pt. 68 2 Pulses 10/560µs (A Max)	ITU-T K.20 30 Pulses 10/700µs (A Max)	Bellcore 50 Pulses 10/1000µs (A Max)
50mA	022		0.0001	50mA	022		0.0056	350mA	0350	50A	0.55	32	36	19
63mA	025		0.00013	63mA	025		0.009	500mA	0500	at	1.2	48	61	26
80mA	026		0.0002	80mA	026		0.014	800mA	0800	125VAC	3.0	80	67	42
100mA	027		0.00065	100mA	027		0.025	1.00A	1100	35A	4.0	100	67	52
125mA	028		0.0015	125mA	028		0.044	1.25A	1125	at	6.5	128	67	65
160mA	030		0.0033	160mA	030		0.058	1.50A	1150	125VDC	10.0	155	67	78
200mA	034		0.0063	200mA	034		0.1							
250mA	035		0.014	250mA	035		0.17							
315mA	037		0.03	315mA	037		0.26							
400mA	040	100A	0.019	400mA	040	100A	0.32							
500mA	041	at	0.022	500mA	041	at	0.58							
630mA	043	125VAC	0.026	630mA	043	125VAC	0.75							
800mA	046		0.055	800mA	046		0.98							
1.00A	048		0.07	1.00A	048		2.8							
1.25A	050		0.11	1.25A	050		3.8							
1.60A	053		0.24	1.60A	053		5.2							
2.00A	057		0.38	2.00A	057		7.5							
2.50A	058		0.57	2.50A	058		14							
3.15A	124		0.82	3.15A	124		22							
4.00A	062		2.5	4.00A	062		27							
5.00A	063		3.8	5.00A	063		59							
6.30A	066		6.4	6.30A	066		100							



Time/Current Characteristics (xI<sub>rated</sub>) 100% > 4hrs 200% < 60sec

## SPECIFICATIONS



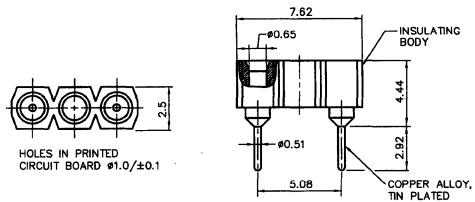
- **Approvals:**  
UL Listed: File No. E 67006  
cUL Listed: File No. E 67006  
MITI: File No. 32-1410 (1.00-5.00A)
- **Soldering Heat Resistance:**  
260°C, 10 sec. (IEC 68-2-20)
- **Solderability:**  
260°C, ≤ 3 sec. (Wave)  
350°C, ≤ 1 sec. (Manual)
- **Material:**  
Base and Cap: Brown thermoplastic (Polyamide PA 6.6), UL 94-V0  
Round Pins: Copper alloy, tin-plated for soldering
- **Vibration Resistance:**  
10 - 2000Hz at 0.75mm amplitude, 6 hrs.
- **Acceleration Tolerance:**  
Up to 10g, 11 msec.

Order-Information:	Qty	Order-Number	Series	Amp Code	Packaging
--------------------	-----	--------------	--------	----------	-----------

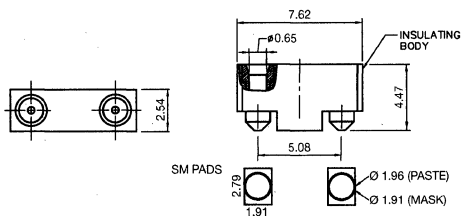
- **Packaging:**  
- L: Long Leads/Bulk  
- K: Short Leads/Bulk  
- E1: Tape/Ampopack (1250 pieces per Pack)  
000: Tape/Ampopack (1250 pieces per Pack) for Series 385 only

## TR5 / TE5 HOLDERS • FaxBack No. 304

- **No. 562**
- **Type:** PC-Mount Holder
- **Material:**  
Thermoplastic body (UL 94-V0)  
Beryllium copper  
Brass terminals, tin-plated
- **Rated Voltage:** 250V
- **Rated Current:** 6.3A



- **No. 562-SM**
- **Type:** Surface-Mount Holder
- **Material:**  
Thermoplastic body (UL 94-V0)  
Beryllium copper  
Brass terminals, tin-plated
- **Rated Voltage:** 250V
- **Rated Current:** 6.3A



# SURFACE MOUNT FUSES



## CF 447 - 125V • UL 248-14



### Series 447 / Fast-Acting

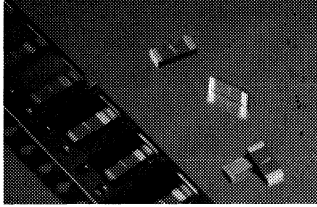
#### • FaxBack No. 323

Rated Current	Amp Code	Breaking Capacity	Melting Integral (A <sup>2</sup> s Max)
750mA	0750		
1.00A	1100	50A	on request
1.50A	1125	at	
2.00A	1200	125VAC/DC	
2.50A	1250		
3.15A	1315		

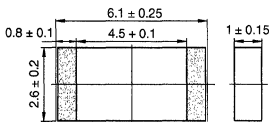
\* For higher Current Ratings contact (M)

**Time/Current Characteristics (xI<sub>rated</sub>)**

100%	250%
> 4hrs	< 5sec

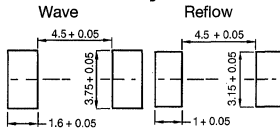


### SPECIFICATIONS



Chip Size 6125

#### • Solder Pad Layout:



- Material:**  
Housing: Ceramic substrate  
Glass encapsulated  
Terminals: Tinned, metallized
- Soldering Conditions:**  
Wave (235°C, 2s), Reflow (215°C, 3s)
- Soldering Heat Resistance:**  
260°C, 10s (IEC 68-2-58)
- Packaging:**  
Blister Tape, 3000 pcs. per Reel (00)
- Approvals:**  
UL Listed: File No. E 67006  
cUL Listed: File No. E 67006

## CF 448 - 125V • UMF



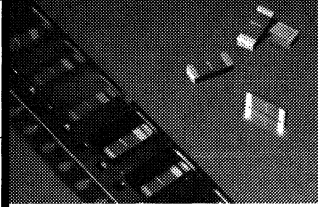
### Series 448 / Time-Lag

#### • FaxBack No. 323

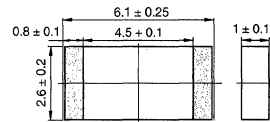
Rated Current	Amp Code	Breaking Capacity	Melting Integral (A <sup>2</sup> s Min)
500mA	0500		0.25
630mA	0630		0.4
800mA	0800		0.64
1.00A	1100	50A	1
1.25A	1125	at	1.6
1.60A	1160	125VAC/DC	
2.00A	1200		on request
2.50A	1250		
3.15A	1315		

**Time/Current Characteristics (xI<sub>rated</sub>)**

125%	200%	1000%
> 1hrs	< 2min	> 10ms

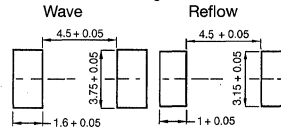


### SPECIFICATIONS



Chip Size 6125

#### • Solder Pad Layout:



- Material:**  
Housing: Ceramic substrate  
Glass encapsulated  
Terminals: Tinned, metallized
- Soldering Conditions:**  
Wave (235°C, 2s), Reflow (215°C, 3s)
- Soldering Heat Resistance:**  
260°C, 10s (IEC 68-2-58)
- Packaging:**  
Blister Tape, 3000 pcs. per Reel (00)
- Approvals:**  
UL Listed: File No. E 67006  
cUL Listed: File No. E 67006  
VDE: pending

## CF 443 - 63V • UL 248-14



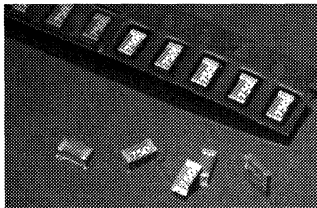
### Series 443 / Fast-Acting

#### • FaxBack No. 321

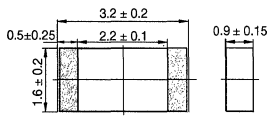
Rated Current	Amp Code	Breaking Capacity	Melting Integral (A <sup>2</sup> s Max)
250mA	0250		on request
400mA	0400		on request
500mA	0500		
750mA	0750	50A	0.03
1.00A	1100	at	0.05
1.50A	1150	63VAC/DC	0.2
2.00A	1200		0.4
2.50A	1250		on request
3.15A	1315		on request

**Time/Current Characteristics (xI<sub>rated</sub>)**

100%	250%
> 4hrs	< 5sec

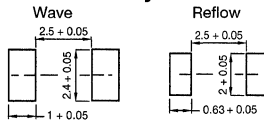


### SPECIFICATIONS



Chip Size 3216

#### • Solder Pad Layout:



- Material:**  
Housing: Ceramic substrate  
Glass encapsulated  
Terminals: Tinned, metallized
- Soldering Conditions:**  
Wave (235°C, 2s), Reflow (215°C, 3s)
- Soldering Heat Resistance:**  
260°C, 10s (IEC 68-2-58)
- Packaging:**  
Blister Tape, 3000 pcs. per Reel (00)
- Approvals:**  
UL Recognized: File No. E 67006  
cUL Recognized: File No. E 67006

## CF 445 - 125V • UMF



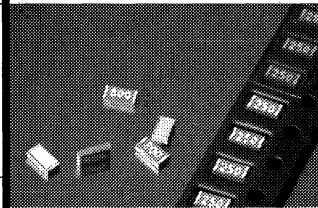
### Series 445 / Very Fast-Acting

#### • FaxBack No. 322

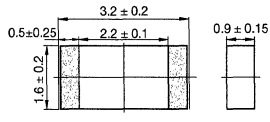
Rated Current	Amp Code	Breaking Capacity	Melting Integral (A <sup>2</sup> s Max)
80mA	0080		
100mA	0100		
125mA	0125		on request
160mA	0160		
200mA	0200		
250mA	0250	50A	0.0002
315mA	0315	at	0.0004
400mA	0400	125VAC/DC	0.0008
500mA	0500		0.002
630mA	0630		0.004
800mA	0800		0.01
1.00A	1100		0.02
1.25A	1125		on request
1.60A	1160		
2.00A	1200		

**Time/Current Characteristics (xI<sub>rated</sub>)**

125%	200%	1000%
> 1hrs	< 2min	< 1ms

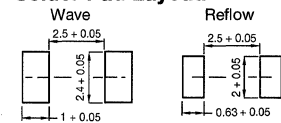


### SPECIFICATIONS



Chip Size 3216

#### • Solder Pad Layout:



- Material:**  
Housing: Ceramic substrate  
Glass encapsulated  
Terminals: Tinned, metallized
- Soldering Conditions:**  
Wave (235°C, 2s), Reflow (215°C, 3s)
- Soldering Heat Resistance:**  
260°C, 10s (IEC 68-2-58)
- Packaging:**  
Blister Tape, 3000 pcs. per Reel (00)
- Approvals:**  
UL Listed: File No. E 67006  
cUL Listed: File No. E 67006  
VDE: pending

Order-Information:	Qty.	Order-Number	Series	Amp Code	Packaging
					0

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Idec  
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SL 1011 SERIES (Gas Tubes)

ELECTRICAL CHARACTERISTICS @ 25°C

OTHER RATINGS

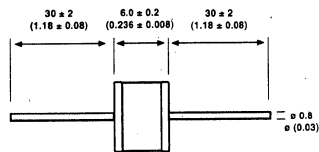
PART NUMBER (SUFFIX MUST BE ADDED)	DC BREAKDOWN VOLTAGE 100V/5 VOLTS	IMPULSE BREAKDOWN VOLTAGE		DC HOLDOVER VOLTAGE* VOLTS MIN	AC FOLLOW CURRENT 60HZ 1/2 CYCLE AMP PEAK	IMPULSE LIFE 10/1000µs 500A TIMES	AC DISCHARGE CURRENT 60HZ	
		100V/µs VOLTS MAX	10KV/µs VOLTS MAX				REPEAT 10 TIMES AMP RMS	SINGLE 11 CYCLE AMP RMS
SL1011B090	90 ± 20%	400	900	52	20	1000	20	65
SL1011B145	145 ± 20%	500	900	90	40	1000	20	65
SL1011B230	230 ± 15%	600	900	150	80	1000	20	65
SL1011B250	250 ± 15%	600	1000	150	80	1000	20	65
SL1011B300	300 ± 15%	700	1000	150	80	1000	20	65
SL1011B350	350 ± 15%	700	1000	150	80	1000	20	65
SL1011B400	400 ± 15%	700	1000	150	80	1000	10	65
SL1011B470	470 ± 15%	700	1000	150	80	1000	10	65
<b>YX SUFFIX MODEL</b>								
SL1011B090YX	70-110	700	1200	52	10	1000	20	90
SL1011B145YX	115-175	700	1200	52	40	1000	20	90
SL1011B230YX	180-280	700	1200	52	80	1000	20	90
SL1011B250YX	200-300	700	1200	52	80	1000	20	90
SL1011B350YX	290-430	700	1200	52	80	1000	20	90

- Insulation Resistance: 10,000 Megohm Min.
- Capacitance (1 MHz): 1.0pF Max. 1.5pF Max (YX)
- Impulse Discharge Current at 8/20µs: 10 impulses at 10KA. Single Impulse at 20KA.
- YX Suffix: Impulse Discharge Current at 8/20µs: 10 impulses at 15KA. Single impulse at 20KA.

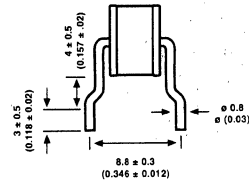
**PART NUMBER SUFFIX GUIDE**  
All dimensions are nominal except where mentioned. Dimensions expressed in millimeters (inches).

For DC Holdover Voltage specifications, see Definitions on Page 8. All parts UL497B recognized (File #E128662 except YX suffix model which is pending). UL 1449 and CSA certification also available. Contact World Products for more information regarding approvals.

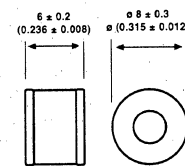
Type A (Suffix A-8T)



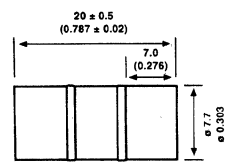
Type B (Suffix B-8T)



Type C (Suffix C-T)



Type YX (Suffix YX)



SL1021 SERIES (Gas Tubes)

ELECTRICAL CHARACTERISTICS @ 25°C

OTHER RATINGS

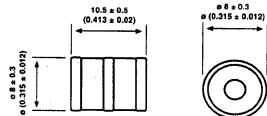
PART NUMBER (SUFFIX MUST BE ADDED)	DC BREAKDOWN VOLTAGE 100V/5 VOLTS	IMPULSE BREAKDOWN VOLTAGE		DC HOLDOVER VOLTAGE* VOLTS MIN	AC FOLLOW CURRENT 60HZ 1/2 CYCLE AMP PEAK	IMPULSE LIFE 10/1000µs 500A TIMES	AC DISCHARGE CURRENT 60 Hz	
		100V/µs VOLTS MAX	10KV/µs VOLTS MAX				REPEAT 10 TIMES AMP RMS	SINGLE 11 CYCLE AMP RMS
SL1021B090	90 ± 20%	700	1000	52	10 x 2	400	10 x 2	65 x 2
SL1021B145	145 ± 20%	700	1000	52	10 x 2	400	10 x 2	65 x 2
SL1021B230	230 ± 20%	500	800	150	40 x 2	400	10 x 2	65 x 2
SL1021B250	250 ± 20%	500	800	150	40 x 2	400	10 x 2	65 x 2
SL1021B300	300 ± 20%	600	900	150	40 x 2	400	10 x 2	65 x 2
SL1021B350	350 ± 20%	600	900	150	40 x 2	400	10 x 2	65 x 2
SL1021B400	400 ± 25%	700	1000	150	40 x 2	400	10 x 2	65 x 2

- Insulation Resistance: 10,000 Megohm Min.
- Capacitance (1 MHz): 0.8pF Max (Line-to-Line) 1.5pF Max (Line-to-Ground)
- Impulse Discharge Current at 8/20µs: 5 impulses each side at 10KA. Single impulse each side at 20KA.

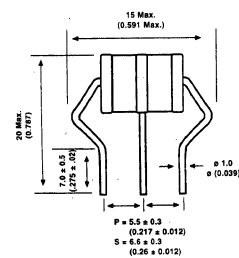
**PART NUMBER SUFFIX GUIDE**  
All dimensions are nominal except where mentioned. Dimensions expressed in millimeters (inches).

For DC Holdover Voltage specifications, see Definitions on page 8. All parts UL497B recognized (File #E128662). UL1449 and CSA certification also available. Contact World Products for more information regarding approvals.

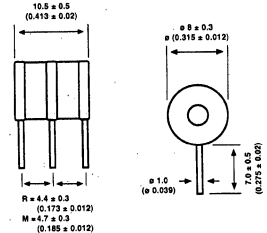
Type C (Suffix C-T)



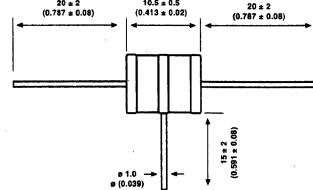
Type P and S (Suffix P-1T and S-1T)



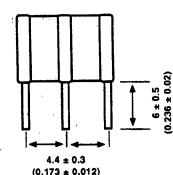
Type R and M (Suffix R-1T and M-1T)



Type X (Suffix X-1T)



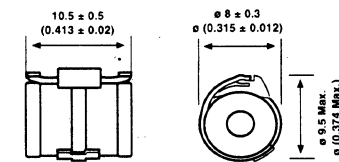
Type T (Suffix T-1T)



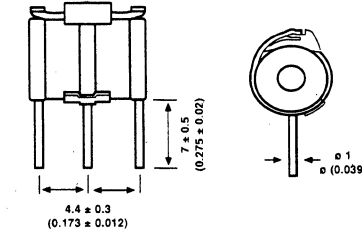
Fail Safe Devices

All dimensions are nominal except where mentioned. Dimensions expressed in millimeters (inches).

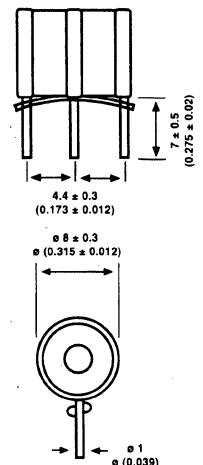
Type CF (Suffix CF-T)



Type RF (Suffix RF-1T)



Type RW (Suffix RW-1T)



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W O R L D P R O D U C T S

SL1122 SERIES (Gas Tubes)

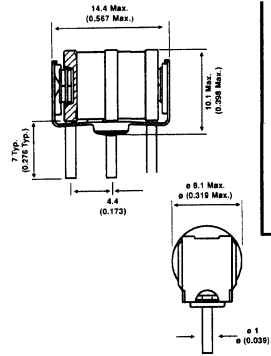
ELECTRICAL CHARACTERISTICS @ 25°C

PART NUMBER	CAPACITANCE 1MHz LINE-TO-GROUND pF (MAX)	DC BREAKDOWN VOLTAGE 100V/μ VOLTS	IMPULSE BREAKDOWN VOLTAGE 1KV/μSEC VOLTS MAX	*DC HOLDOVER VOLTAGE VOLTS MIN	AC DISCHARGE CURRENT 5 TIMES/1 SEC DURATION AT 3 MIN INTERVALS AMP RMS	IMPULSE DISCHARGE CURRENT 8/20μS EACH POLARITY, 5 TIMES (KA)	INSULATION RESISTANCE (Ohm) @
SL1122-090RCIT	300	70-120	150	50	5	5	50Vdc = 1 x 10 <sup>8</sup>
SL1122-200RCIT	300	140-250	250	120	5	5	120Vdc = 1 x 10 <sup>8</sup>
SL1122-260RCIT	200	210-350	350	135	5	5	175Vdc = 1 x 10 <sup>8</sup>
SL1122-450RCIT	200	420-600	600	135	5	5	400Vdc = 1 x 10 <sup>8</sup>

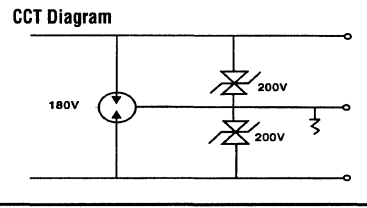
\*Measured using test based on ITU (formerly CCITT) K12.

Outline Dimensions

All dimensions are nominal except where mentioned. Dimensions expressed in millimeters (inches).

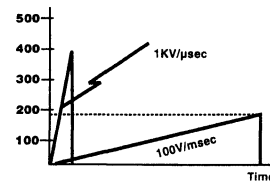


Method Of Operation (Typical for SL1122-200RCIT)

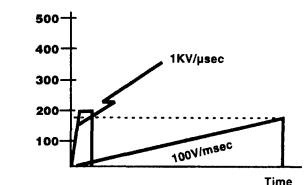


The voltage of the Gas Discharge Tube is set below the voltage breakdown of the silicon TVS diode. Under slow ramp up rates (i.e. <100v/msec) the DC breakdown of the Hybrid is determined by the DC breakdown of the Gas Discharge Tube (typical 180v). As the ramp rate of the transient increases further, the dv/dt switching delay of the Gas Discharge Tube causes an increase in the level of let through voltage before breakdown (normally around 400V for 1KV/μsec). In this instance the TVS diodes clamp the voltage (at typical 200v) until the Gas Discharge Tube has had sufficient time for the gas to ionize, therefore breaking over and diverting the remaining energy in the pulse.

GDT Only



Hybrid



SL1001 SERIES (Gas Tubes)

ELECTRICAL CHARACTERISTICS @ 25°C

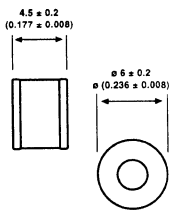
PART NUMBER (SUFFIX MUST BE ADDED)	CAPACITANCE 1MHz LINE-TO-GROUND pF (MAX)	DC BREAKDOWN VOLTAGE 100V/μ VOLTS	IMPULSE BREAKDOWN VOLTAGE 1KV/μSEC VOLTS MAX	*DC HOLDOVER VOLTAGE VOLTS MIN	AC DISCHARGE CURRENT 5 TIMES/1 SEC DURATION AT 3 MIN INTERVALS AMP RMS	IMPULSE DISCHARGE CURRENT 8/20μS EACH POLARITY, 5 TIMES (KA)	INSULATION RESISTANCE AT 100VDC (Ohm)
SL1001L230	1.5	184-276	500	>135	2.5	2.5	10 x 10 <sup>9</sup>
SL1001L300	1.5	250-350	700	>135	2.5	2.5	10 x 10 <sup>9</sup>

UL and CSA pending. \*CCITT-47441 test method.

Part Number Suffix Guide

All dimensions are nominal except where mentioned. Dimensions expressed in millimeters (inches).

Type C (Suffix C-T)



SL1002 SERIES (Gas Tubes)

ELECTRICAL CHARACTERISTICS @ 25°C

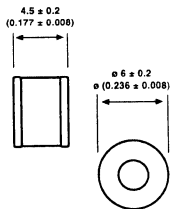
PART NUMBER (SUFFIX MUST BE ADDED)	CAPACITANCE 1MHz LINE-TO-GROUND pF (MAX)	DC BREAKDOWN VOLTAGE 100V/μ VOLTS	IMPULSE BREAKDOWN VOLTAGE 1KV/μSEC VOLTS MAX	*DC HOLDOVER VOLTAGE VOLTS MIN	AC DISCHARGE CURRENT 5 TIMES/1 SEC DURATION AT 3 MIN INTERVALS AMP RMS	IMPULSE DISCHARGE CURRENT 8/20μS EACH POLARITY, 5 TIMES (KA)	INSULATION RESISTANCE AT 100VDC (Ohm)
SL1002A230	1.5	184-276	500	>135	5	5	10 x 10 <sup>9</sup>
SL1002A300	1.5	250-350	700	>135	5	5	10 x 10 <sup>9</sup>

UL497B recognized (File #E128662). UL 1449 and CSA pending. \*CCITT-47441 test method.

Part Number Suffix Guide

All dimensions are nominal except where mentioned. Dimensions expressed in millimeters (inches).

Type C (Suffix C-T)



SL1003 SERIES (Gas Tubes)

ELECTRICAL CHARACTERISTICS @ 25°C

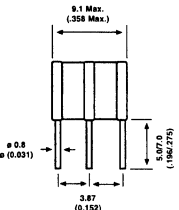
PART NUMBER (SUFFIX MUST BE ADDED)	CAPACITANCE 1MHz LINE-TO-LINE LINE-TO-GROUND pF (MAX)	DC BREAKDOWN VOLTAGE 100V/μ VOLTS	IMPULSE BREAKDOWN VOLTAGE 1KV/μSEC VOLTS MAX	*DC HOLDOVER VOLTAGE VOLTS MIN	AC DISCHARGE CURRENT 5 TIMES/1 SEC DURATION AT 3 MIN INTERVALS AMP RMS	IMPULSE DISCHARGE CURRENT 8/20μS EACH POLARITY, 5 TIMES (KA)	INSULATION RESISTANCE AT 100VDC (Ohm)
SL1003A230	<2	184-276	500	>135	5	5	10 x 10 <sup>9</sup>
SL1003A260	<2	210-310	600	>135	5	5	10 x 10 <sup>9</sup>
SL1003A300	<2	250-350	700	>135	5	5	10 x 10 <sup>9</sup>

UL and CSA pending. \*CCITT-47451 test method.

Part Number Suffix Guide

All dimensions are nominal except where mentioned. Dimensions expressed in millimeters (inches).

Type R (Suffix R-8T)



Type C (Suffix C-T)

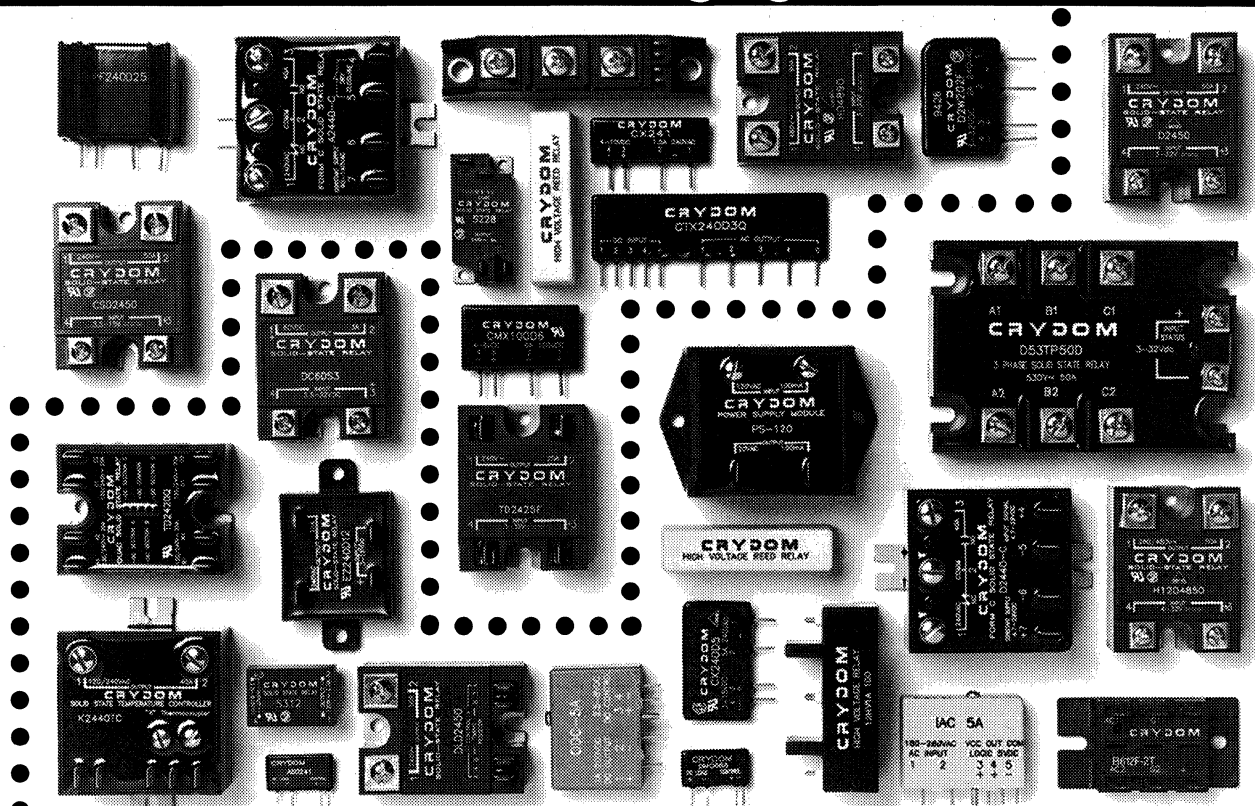


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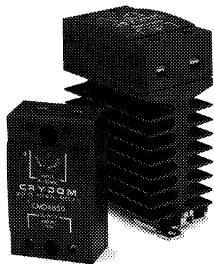
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### RELAYS

Manufacturer	Starting EEM Page No.	Mercury Wetted Contacts	Reed	Solid State	Hybrid	Thermal	Time Delay	General Purpose	Latching	Current Sensing	Power	High Voltage	RF	Plug-in	PC Mount	Surface Mount	Terminal Mount	Hermetic
Aleph International Corp.	B•1288		√					√		√	√	√	√		√	√		√
Altech Corp.	B•1290										√			√	√			
American Relays, Inc.	B•1292	√	√					√	√	√	√	√			√	√		√
American Zettler	B•1297			√				√	√		√			√	√	√	√	
Amperite Company, Inc.	B•1302			√		√	√			√				√			√	√
Babcock, Inc.	B•1304							√*	√*		√*			√*			√	√*
Communications Instruments Inc.	B•1305			√*			√*	√	√*		√*		√*	√*	√*	√	√	√*
Cornell Dubilier	B•1318						√	√	√	√	√			√	√		√	√
Coto Technology	B•1319		√	√				√						√	√	√		
CR Magnetics, Inc.	B•1323			√						√								
Crouzet Corp.	B•1325		√	√			√	√		√	√	√		√	√	√	√	√
Crydom	B•1334		√	√				√			√	√			√		√	
DARE Electronics, Inc.	B•1344			√*	√*		√*	√	√*	√*	√*			√*			√	√*
Deltrol Controls	B•1342							√	√	√	√		√	√	√		√	
Electrodyne, Inc.	B•1345							√	√	√			√	√	√		√	
Fujitsu Takamisawa America, Inc.	B•1346			√				√			√		√		√		√	√
Greenwich Electronics	B•1348							√			√			√	√		√	
Hamlin Inc.	B•1349		√												√			
Hasco Components International Company	B•1350		√	√				√	√	√	√	√		√	√	√	√	√
Idec Corp.	B•1357			√	√		√	√	√		√			√	√		√	
Instrumentation and Control Systems	B•1359						√			√					√			
International Rectifier Corp.	B•1360			√				√			√	√			√	√		
Jennings Technology Corp.	B•1362								√*	√*	√*	√*	√*		√*			√*
Leach International	B•1365						√	√	√		√				√	√	√	√
Line Electric Products	B•1374							√*		√*	√			√*	√		√	√*
Logitek, Inc.	B•1375						√*							√	√		√	

\* MIL Spec.

## RELAYS

Manufacturer	Starting EEM Page No.	Mercury Wetted Contacts	Reed	Solid State	Hybrid	Thermal	Time Delay	General Purpose	Latching	Current Sensing	Power	High Voltage	RF	Plug-in	PC Mount	Surface Mount	Terminal Mount	Hermetic
Magnecraft Electric Company	B•1386	√	√*	√			√	√	√	√	√			√	√		√	√*
Master Electronic Controls	B•1392	√		√			√	√	√		√	√		√			√	√
Matrix Systems Corp.	B•1397	√	√	√									√					√
Meder Electronic	B•1398		√					√	√	√	√	√	√		√		√	√
National Controls Corp.	B•1400			√			√							√			√	
NEC Electronics Inc.	B•1401							√	√		√	√	√		√	√		
Omron Electronics, Inc.	B•1406			√			√	√	√		√		√	√	√	√	√	√
Ross Engineering Corp.	B•1413						√		√		√	√					√	
Scientific Technologies Inc.	B•1414						√*										√	√
Semitronics Corporation	B•1416			√*		√										√	√	
Siemens Electromechanical Components, Inc.	B•1417		√	√			√	√	√	√	√	√		√	√	√	√	√
Solid State Optronics	B•1432			√				√				√				√		
Stancor	B•1436							√			√			√	√		√	
Standex Electronics	B•1438		√								√				√			
Stetron International, Inc.	B•1431							√			√				√		√	
T-Bar Data Switch Corp.	B•1439							√	√								√	√
Teledyne Relays	B•1440			√*	√			√*	√*		√		√		√*	√	√	√
Yaskawa Electric America, Inc.	B•1449		√								√	√			√			√

\* MIL Spec.



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Sigma  
Solid State Optronics  
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Master Electronics  
Midtex  
Omron  
Siemens / Potter & Brumfield  
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EECO / Transico  
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Idec  
McGill  
Microswitch  
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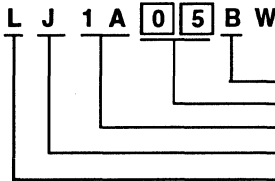
1026 Griswold Avenue • San Fernando, CA 91340  
Telephone: (800) 423-5622 • (818) 365-9856  
Fax: (818) 365-7274

## REED RELAYS

### SURFACE MOUNT REED RELAYS

L series • M series

.71 x .24 x .23 in. .71 x 20 x .17 in.  
18 x 6 x 6 mm 18 x 5 x 4 mm

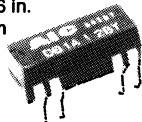


- SMT process compatibility
- Ultra miniature size
- Power-B: 10W C: 3W (1C)
- Nominal coil voltage-5V, 12V
- Contact form-1A, 1B, 1C
- Termination -J: J-lead G: Gull wing
- L: Sensitive coil M: Electrostatic shield

### DIP REED RELAYS

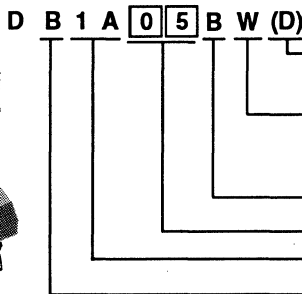
8PIN DIP / DA • DB series

.75 x .28 x .26 in.  
19 x 7 x 6 mm



4PIN DIP / DF series

.75 x .28 x .26 in.  
19 x 7 x 6 mm

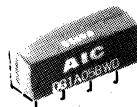


- DIP transfer molded package
- Miniature size
- Standard DIP footprint
- Various contact configurations
- UL Models Available
- D: Diode (optional)
- X: Magnetic shield (optional on DA1A, DB1A, DB1C, DF1A) W: Standard
- Y: Electrostatic shield (optional on DB1A, DB1C)
- Z: Magnetic & Electrostatic shield (optional on DB1A, DB1C)
- Power-B: 10W C: 3W (1C) D: 50W (Mercury)
- N: 50W (Mercury high speed)
- Nominal Coil voltage-5V, 12V, 24V
- Contact form-1A, 2A, 1B, 1C
- A: 8-pin DIP with pin #13 not connected
- B: 8-pin DIP F: 4-pin DIP

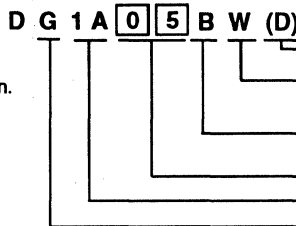
### SIP REED RELAYS

SIP / DG series

.76 x .28 x .28 in.  
19 x 7 x 7 mm



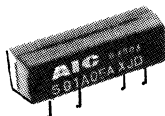
SIP / DH series  
.75 x .20 x .21 in.  
19 x 5 x 5 mm



- Ultra miniature size
- UL Models Available
- Industry standard footprint
- D: Diode (optional)
- W: Standard
- X: Magnetic shield (optional on DG1A, DE1A)
- Power-B: 10W D: 50W (Mercury)
- N: 50W (Mercury high speed)
- Nominal coil voltage-5V, 12V, 24V
- Contact form-1A, 1B
- H: Ultra miniature G & E: Standard size

SIP / SG series

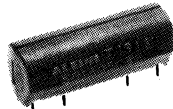
.91 x .28 x .30 in.  
23 x 7 x 7 mm



- Various contact configurations
- UL Models Available
- Up to 4000VAC isolation
- D: Diode (optional)
- W: Standard X: Magnetic shield (optional on SG series, standard on SE series)
- Power-A: 10W F: 3W (1C) E: 50W (Mercury)
- Nominal coil voltage-5V, 12V, 24V
- Contact form-1A, 1B, 1C

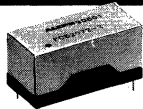
SIP / SD series

1.00 x .35 x .37 / 1.20 x .40 x .42 in.  
25 x 9 x 9 / 30 x 10 x 10 mm



- Industry standard footprint
- High power contacts
- UL Models Available
- W: Standard X: Magnetic shield (optional)
- Y: Electrostatic shield (optional on SD1A)
- Z: Magnetic & Electrostatic shield (optional on SD1A)
- Power-A: 10W C: 50W D: 25W (high voltage)
- C: 3W (1C)
- Nominal coil voltage-5V, 12V, 24V
- Contact form-1A, 1C

### CURRENT SENSING RELAYS



Current Sensing / PCS series  
1.1 x .59 x .60 in.  
29 x 15 x 15 mm



- 1:6 Ω coil
- 2:8 Ω coil
- 3:10 Ω coil

- For telephone line sensing
- High Coil-to-Contact insulation 4000 VAC
- Choice of coil resistances
- Dual coil models available
- Optional magnetic shielding
- 300 mA max coil current
- 14 mA nominal current



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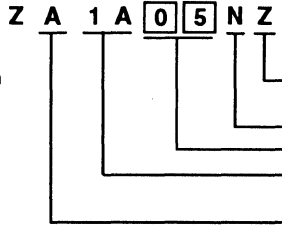
## REED RELAYS

### ULTRA COMPACT REED RELAYS

ZA, ZC, ZH series  
.78 x .20 x .23 in. / .20 x 5 x 6 mm  
ZM series  
.78 x .24 x .26 in. / .20 x 6 x 7 mm



ZF series  
.98 x .30 x .30 in. / 25 x 7 x 7 mm

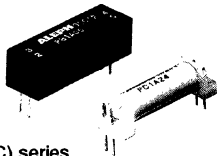


- Ultra compact package
- GHz Models Available
- Metal can for interference immunity
- Coaxial shields

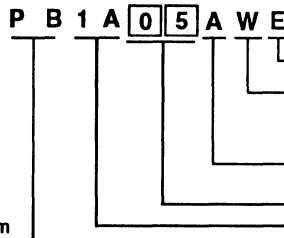
X: Magnetic shield (standard on ZF series)  
 Z: Magnetic & Electrostatic shield (standard on ZA, ZC, ZH, ZM series)  
 Power-A: 10W C: 3W (1C) N: 50W (Mercury)  
 Nominal coil voltage-5V, 12V  
 Contact form-1A, 1C  
 ZA: General applications ZC: Contact form-1C  
 ZF: Magnetic shield only ZH: RF applications  
 ZM: Stable high speed operation between 0 to 200Hz

### ECONO-OPEN REED RELAYS

PB (PC) 1A, 1C series  
1.18 x .37 x .39 in. / 30 x 9 x 10 mm



PB(PC) series  
1.18 x .47 x .39 in. / 30 x 12 x 10 mm



- Industry standard package
- Open frame and encased package
- Various contact configurations
- .10" & .15" Grids Available
- UL Models Available

E: Side coil termination G: End coil termination  
 W: Standard X: Magnetic shield (optional)  
 Y: Electrostatic shield (optional)  
 Z: Magnetic & Electrostatic shield (optional)  
 Power-A: 10W C: 50W D: 25W (high voltage)  
 F: 3W (1C) E: 50W (Mercury)  
 Nominal coil voltage-5V, 12V, 24V  
 Contact form-1A 2A, 1B, 1C, 2B, 2C, 3A Types are available  
 PB: ECONO type (with plastic case) PC: OPEN frame

### HIGH VOLTAGE REED RELAYS

PG 1A, 1B series  
3.0 x 1.37 x 1.14 in.  
76 x 35 x 29 mm



PG 2A, 2B, 1D series  
3.0 x 2.36 x 1.14 in. / 76 x 60 x 29 mm



- High voltage contacts
- High Coil-to-Contact breakdown (2K-6KVDC)
- High Coil-to-Contact breakdown (10K-15KVDC)

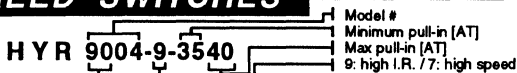
Breakdown voltage (open contact)-H: 5KV J: 10KV  
 K: 15KV M: 10KV (high power-300W)  
 Nominal coil voltage-5V, 12V, 24V  
 Contact form-1A, 1B, 2A, 2B, 1D (1A & 1B type)

PM series  
2.5 x .79 x .90 in.  
65 x 20 x 23 mm



Breakdown voltage (open contact)-  
 H: 5KV J: 10KV K: 15KV  
 Nominal coil voltage-5V, 12V, 24V  
 Contact form-1A

### REED SWITCHES



90: Mercury switch / 50: 50 mm glass length  
 40: 40 mm glass length  
 20: 20 mm glass length / 10: 10 mm glass length

#### General application switches

Switching power rating of 10-15 watt.  
\*UL Listed

- HYR 1532\* >
- HYR 2001\* >
- HYR 2031\* >
- HYR 2034 >
- HYR 4001 >
- HYR 5051 >

#### Form "C" switches

Feature break-before-make, single pole double throw (SPDT)

- HYR 1554 >
- HYR 1555 >
- HYR 4003 >

#### High Voltage breakdown switches

Breakdown voltage rated from 1,000 up to 15 KV.  
Vacuum internal atmosphere for high dielectric withstand voltages.

- HYR 1559\* >
- HYR 2016\* >
- HYR 5006 >
- HYR 5007 >
- HYR 5008 >

#### High power switches

Switching power rating between 20 and 70 watt

- HYR 1531\* >
- HYR 2003-1 >
- HYR 2016\* >

#### Mercury Wetted Switches

- HYR 9001 (General purpose) >
- HYR 9001-1 >
- HYR 9001-9 >
- HYR 9003 >
- HYR 9005-1 >
- HYR 9005-9 >

HYR 8001 Precision Hg Tilt Switch. For acceleration, tilt and vibration sensing



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## DOLD SAFETY MODULES

Safety Modules are a mandatory requirement of European Machinery Directive EMD 89/392 EEC. This requirement is for risk reduction purposes in order to protect personnel and machinery. Built for the International Market and Global Machine Design, all fail-to-safe modules are designed with Dual Logic Circuits, each of which provides a safety function carried out by safety relays with forced guided contacts.

### Safety Module Selector Guide



USA

CANADA

GERMANY

SWITZERLAND

SWEDEN

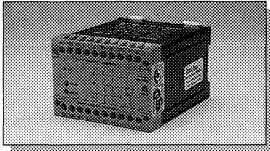
DENMARK

GERMANY

### Application

### Features

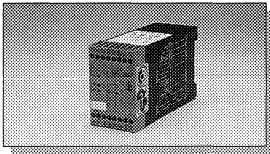
#### BN 5983



Emergency Stop Module  
Safety Gate Monitor

- Coil Voltage: 24, 48, 110, 127, 230, 240V AC, or 24V DC
- Max. Switching Current: 10A
- Max. Switching Voltage: 415V AC, 250V DC
- Dimension: 100mm
- 3 NO output contacts
- LED indicator for channels 1 and 2
- Quick disconnect terminal strips
- Front mounted fuse (optional)

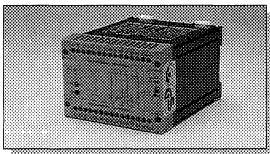
#### BD 5987



Emergency Stop Module  
Safety Gate Monitor

- Coil Voltage: 24, 48, 110, 127, 230, 240V AC, or 24V DC
- Max. Switching Current: 10A
- Max. Switching Voltage: 250V AC, 250V DC
- Dimension: 45mm
- 2 NO output contacts
- LED indicator for channel 1, channel 2, and line voltage
- Internal overvoltage protection with auto-reset
- Line fault detection at ON pushbutton
- Cross fault detection (optional)

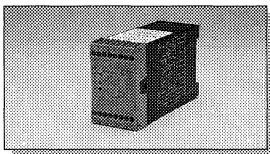
#### BO 5988



Emergency Stop Module  
Safety Gate Monitor

- Coil Voltage: DC 24V+ AC 48/110/230 or 240V, DC 24V
- Max. Switching Current: 10A
- Max. Switching Voltage: 250V AC, 250V DC
- Dimension: 100mm
- 6 NO output contacts
- LED indicator for channel 1, channel 2 and line voltage
- Internal overvoltage protection with auto-reset
- Quick disconnect terminal strips
- Line fault detection at ON pushbutton
- Cross fault detection (optional)
- Time delay optional

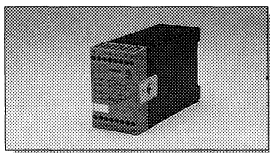
#### BD 5935



Emergency Stop Module  
Safety Gate Monitor

- Coil Voltage: 24, 48, 110, 127, 230, 240V AC, or 24V DC
- Max. Switching Current: 10A
- Max. Switching Voltage: 250V AC, 250V DC
- Dimension: 45mm
- 3 NO output contacts
- LED indicator for channel 1, channel 2 and line voltage
- Internal overvoltage protection with auto-reset
- Quick disconnect terminal strips
- Line fault detection at ON pushbutton
- Cross fault and auto-on selection switch located behind front panel

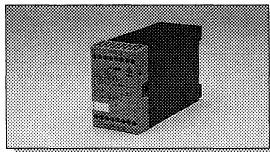
#### BD 5985N



Safety Gate Monitor

- Coil Voltage: 24, 42, 110, 230, 240V AC, 24V DC
- Max. Switching Current: 10A
- Max. Switching Voltage: 250V AC, 250V DC
- Dimension: 45mm
- 2 NO output contacts
- Internal overvoltage protection with auto-reset
- Gate closing time 3 s

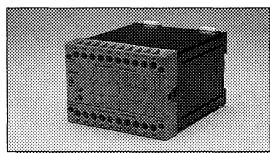
#### BD 5980N



2-Hand Safety Module

- Coil Voltage: 24, 42, 110, 230, 240V AC, 24V DC, 24V DC+ AC
- Max. Switching Current: 10A
- Max. Switching Voltage: 250V AC, 250V DC
- Dimension: 45mm
- 2 NO output contacts
- Internal overvoltage protection with auto-reset
- Simultaneous input closing demand of 500 ms

#### BN 3081



Extension Module

- Coil Voltage: 110, 230V AC, UC 24V
- Max. Switching Current: 10A
- Max. Switching Voltage: 415V AC, 250V DC
- Dimension: 100mm
- 7 NO output contacts
- LED indicator for channels 1 and 2
- Quick disconnect terminal strips



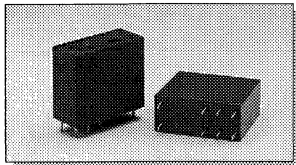
## DOLD SAFETY RELAYS

Safety Relays with forced-guided contacts are the core components for safety devices and are indispensable when designing safety circuits. Safety devices are designed to protect both man and machine as demanded in OSHA CFR 1910 Regulations, "General Requirements for All Machinery". This is a mandatory requirement of the European Machinery Directive EMD 89/392 EEC. DOLD Safety Relays are approved for use in safety applications to IEC 60204, EN 60204, DIN/VDE 0113 as used in the: Emergency Stop, Safety Gate, 2-Hand Safety, Light Curtains, Safety Mats, etc.

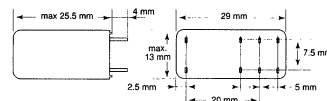


### Safety Relay Selector Guide *Note: The following measurements are in millimeters. To convert to inches, divide by 25.4.*

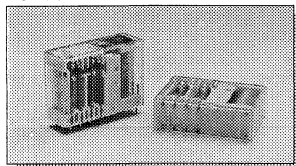
#### OA/OW5669



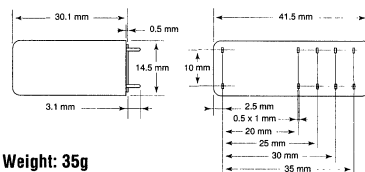
- Contact Arrangements: 1NO/1NC, 2CO, 2NO, 2NC
- Contact Material: AgNi10+0.2µmAu  
AgCdO+0.2µmAu, AgNi10+5µmAu
- Coil Voltage: 5, 6, 12, 20, 24, 48, 60, 110, 230V DC
- Coil Power Dissipation: 0.7W
- Maximal Switching Voltage: 110V DC, 250V AC
- Maximal Switching Current: 8A
- Mechanical Life: 50x10<sup>6</sup> operation cycles • Ambient Temperature: -40...+60°C • Weight: 15g



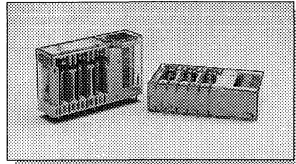
#### OA5611



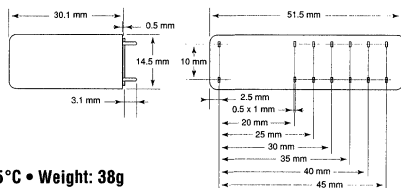
- Contact Arrangements: 2NO/2NC, 3NO/1NC
- Contact Material: AgCdO+0.2µmAu  
AgNi10+0.2µmAu, AgNi10+5µmAu
- Coil Voltage: 6, 12, 24, 48, 60, 110, 230V DC
- Coil Power Dissipation: 0.6W
- Maximal Switching Voltage: 250V DC, 400V AC
- Maximal Switching Current: 8A
- Mechanical Life: 50x10<sup>6</sup> operation cycles • Ambient Temperature: -25...+85°C • Weight: 35g



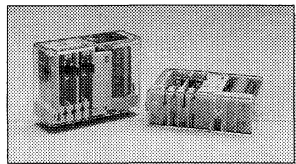
#### OA5612



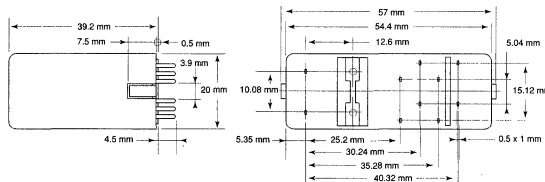
- Contact Arrangements: 2NO/4NC, 3NO/3NC, 4NO/2NC
- Contact Material: AgCdO+0.2µmAu  
AgNi10+0.2µmAu, AgNi10+5µmAu
- Coil Voltage: 6, 12, 24, 48, 60, 110, 230V DC
- Coil Power Dissipation: 0.8W-1.0W
- Maximal Switching Voltage: 250V DC, 400V AC
- Maximal Switching Current: 8A
- Mechanical Life: 50x10<sup>6</sup> operation cycles • Ambient Temperature: -25...+85°C • Weight: 38g



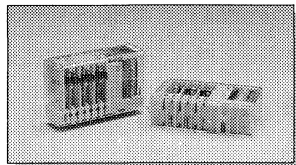
#### OA5601



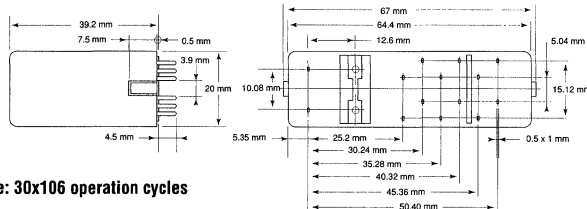
- Contact Arrangements: 2NO/2NC, 3NO/1NC
- Contact Material: AgCdO+0.2µmAu  
AgNi10+0.2µmAu, AgNi10+5µmAu
- Coil Voltage: 6, 12, 24, 48, 60, 110, 230V DC
- Coil Power Dissipation: 0.75W
- Maximal Switching Voltage: 250V DC, 380V AC
- Maximal Switching Current: 10A
- Mechanical Life: 30x10<sup>6</sup> operation cycles
- Ambient Temperature: -25...+80°C • Weight: 78g



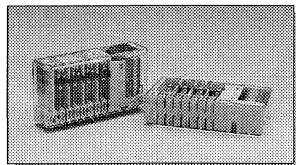
#### OA5602



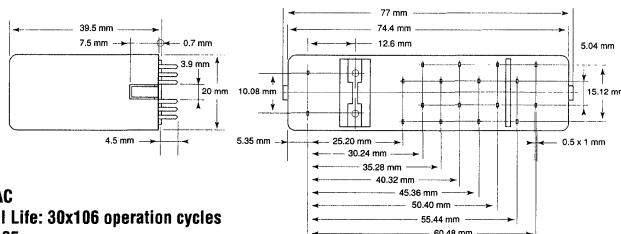
- Contact Arrangements: 2NO/4NC, 3NO/3NC, 4NO/2NC
- Contact Material: AgCdO+0.2µmAu  
AgNi10+0.2µmAu, AgNi10+5µmAu
- Coil Voltage: 6, 12, 24, 48, 60, 110, 230V DC • Coil Power Dissipation: 1.0W
- Maximal Switching Voltage: 250V DC, 380V AC
- Maximal Switching Current: 10A • Mechanical Life: 30x10<sup>6</sup> operation cycles
- Ambient Temperature: -25...+80°C • Weight: 85g



#### OA5603



- Contact Arrangements: 7NO/1NC, 6NO/2NC, 5NO/3NC, 4NO/4NC, 3NO/5NC, 2NO/6NC
- Contact Material: AgCdO+0.2µmAu  
AgNi10+0.2µmAu, AgNi10+5µmAu
- Coil Voltage: 6, 12, 24, 48, 60, 110, 230V DC
- Coil Power Dissipation: 1.25-1.65W
- Maximal Switching Voltage: 250V DC, 380V AC
- Maximal Switching Current: 10A • Mechanical Life: 30x10<sup>6</sup> operation cycles
- Ambient Temperature: -25...+75°C • Weight: 95g





# REED RELAYS

From **American Relays, Inc.**

Whether you're looking for a **REED RELAY** that will meet FCC surge requirements, or a sensitive **Low-Level REED RELAY** to switch ATE signal...

## AMERICAN RELAYS HAS IT ALL

High Quality — Low Price — On time Delivery  
 Dry and Mercury Wet contacts  
 With High Voltage, High Power or Low Level switching  
 Standard or Specified to YOUR Application,  
**AMERICAN RELAYS** can build the **REED RELAY** you need.

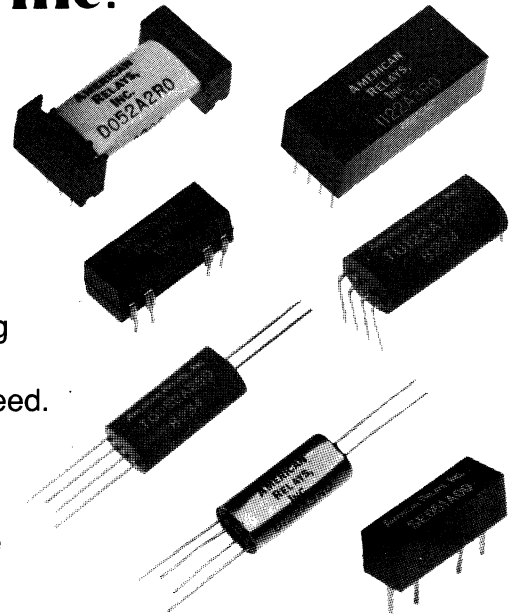
### PACKAGE STYLES

- Encapsulated
- Open Frame
- Axial Leads
- DIP • SIP

### SWITCHING TYPE

- General Purpose Dry Reed
- Low Level Switching
- High Power • High Voltage
- Mercury Wetted Contacts

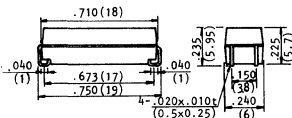
• UL Recognized Relays Available



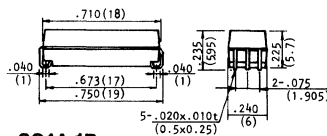
## SURFACE MOUNT SERIES

### OUTLINE DIMENSIONS

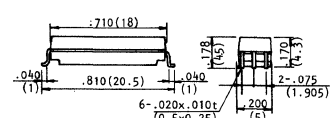
**SJ1A-1B**



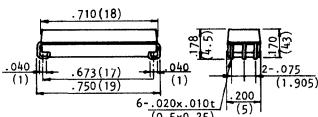
**SJ1C**



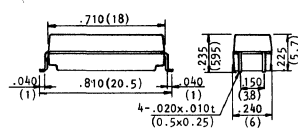
**SG1A (with coaxial shield)**



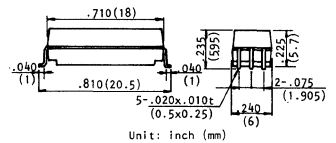
**SJ1A (with coaxial shield)**



**SG1A-1B**



**SG1C**



Unit: inch (mm)

### GENERAL SPECIFICATIONS

Specifications	Form A/B	Form C
Operate time max. (incl. bounce)	1.0 ms	2.0 ms
Release time max.	0.5 ms	0.5 ms
Contact resistance max. (initial)	0.2 Ohms	0.2 Ohms
Breakdown voltage min. (cont-coil)	500 VDC	500 VDC
Insulation resistance min.	10 <sup>10</sup> Ohms	10 <sup>9</sup> Ohms
Life (low level)	3 x 10 <sup>8</sup> Oper.	10 <sup>8</sup> Oper.
(rated load)	8 x 10 <sup>5</sup> Oper.	2 x 10 <sup>6</sup> Oper.

- Miniature surface mount package
- True SMT process compatible
- Sensitive coil
- Coaxial shield for RF Switching

### PART NUMBERS AND OPERATING CHARACTERISTICS (@ 25°C)

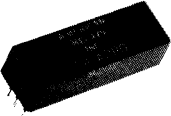

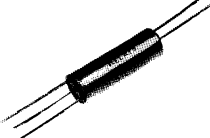
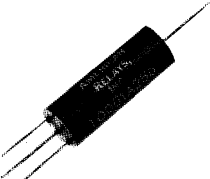

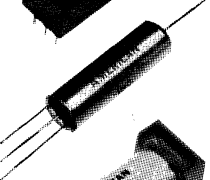
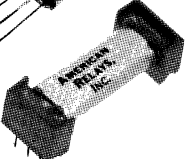
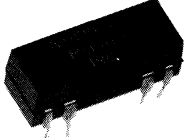
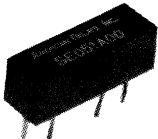
Contact Form	Part Number		Coil Voltage VDC	Coil Resistance OHMS	Must Operate VDC	Must Release VDC	Contact Ratings	Breakdown Voltage VDC	Schematics
	J-Lead	Gull Wing							
1A	SJ051A00	SG051A00	5	500	3.8	0.5	10 Watts 150 VDC 0.5 Amps	200	
	SJ121A00	SG121A00	12	1000	9.0	1.0			
1A (with coaxial shield)	SJ051A0B	SG051A0B	5	150	3.8	0.5	10 Watts 150 VDC 0.5 Amps	200	
	SJ121A0B	SG121A0B	12	600	9.0	1.0			
1B	SJ051B00	SG051B00	5	500	3.8	0.5	10 Watts 150 VDC 0.5 Amps	200	
	SJ121B00	SG121B00	12	500	9.0	1.0			
1C	SJ051C00	SG051C00	5	200	3.8	0.5	3 Watts 100 VDC 0.5 Amps	200	
	SJ121C00	SG121C00	12	500	9.0	1.0			



# American Relays, Inc.

10306 Norwalk Blvd., Santa Fe Springs, CA 90670 • Tel: (562) 944-0447 • Fax: (562) 944-0590

## REED RELAY INDEX

RELAY TYPE	DESCRIPTION	TERMINAL GRID	CONTACT FORMS AVAILABLE POLES	PACKAGE
<b>ENCAPSULATED</b>	Epoxy encapsulated. Total Environmental protection. Wide range of contact forms and coil voltages are available.	1.000 x .100 1.000 x .150	Form A (1 to 6) Form B (1 & 2) Form A/B (1 & 2) Form C (1 to 4) Form A Latching (1 & 2)	
<b>OPEN FRAME</b>	Durable glass filled polyester bobbin construction. Switch and coil leads are securely held with epoxy potting. Cost efficient plug-in type reed relay.	1.000 x .100 1.000 x .150	Form A (1 to 4) Form B (1 & 2) Form C (1, 2, 3) Form A Latching (1)	
<b>AXIAL</b>	Rugged axial lead tubular relay. Nickel plated metal jacket provides magnetic shield. 1.000" center formed leads are available.	Axial 1.000 x .100	Form A (1 & 2) Form B (1) Form C (1 & 2) Form A Latching (1)	
<b>T SERIES</b>	Most economical, high performance tubular relay. Completely sealed in a flame retardant plastic tube. 1.000" center formed leads are available.	Axial 1.000 x .100	Form A (1 & 2) Form B (1) Form C (1)	
<b>HIGH POWER</b>	50W contact rating. Available with encapsulated, open frame and axial lead packages.	Axial 1.000 x .100 1.000 x .150	Form A (1 & 2)	
<b>HIGH VOLTAGE</b>	25W, 1000 VDC switching. 2500 VDC breakdown voltage. Miniature size. Available with encapsulated, open frame and axial lead package.	Axial 1.000 x .100 1.000 x .150	Form A (1 & 2)	
<b>MERCURY WETTED</b>	Mercury wetted contact relay. 50W contact rating. Extremely long life expectancy. No contact bounce. Stable low contact resistance.	Axial 1.000 x .100 1.000 x .150	Form A (1 & 2) Form C (1 & 2)	
<b>DIP RELAYS</b>	Epoxy molded DIP reed relay. Logic compatible. Stable contact resistance. Fits all standard DIP sockets and is automatic insertion compatible.	DIP .300 x .100	Form A (1 & 2) Form B (1) Form C (1)	
<b>SIP RELAYS</b>	High quality economical Single-In-Line package reed relays. Epoxy encapsulated package. Various contact ratings are available. UL recognized series available.	SIP .2 x .4 x .2 .2 x .2 x .2	Form A (1) Form B (1) Form C (1)	
<b>SPECIAL RELAYS</b>	Let us design reed relays for your specific application. Special relays are cost competitive with standard relays in most cases. Consult the factory or your local representative with your specific requirements.			

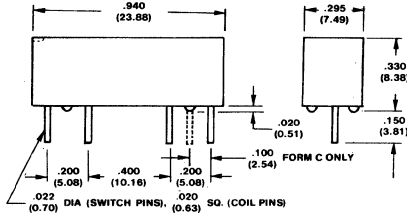


# American Relays, Inc.

# REED RELAYS

10306 Norwalk Blvd., Santa Fe Springs, CA 90670 • Tel: (562) 944-0447 • Fax: (562) 944-0590

## SINGLE-IN-LINE SERIES (S SERIES)



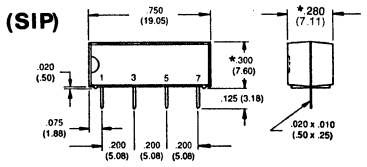
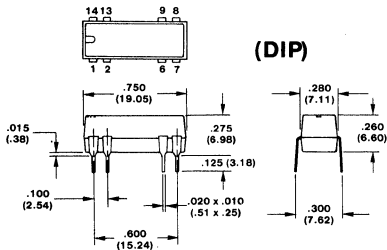
- High Quality Low Cost Single-In-Line
- Sturdy Bobbin and Encapsulated in a Polyester Case
- UL Recognized (File #E104383)

### GENERAL SPECIFICATIONS

**Contact resistance:** .150 ohms max.  
**Operate time:** 0.5 ms typ.  
**Release time:** 0.2 ms typ.  
**Bounce time:** (Form A & B) 0.25 ms typ. (form C, NO/NC) 0.5/1.5 ms typ.  
**Insulation resistance:** 10<sup>10</sup> ohms min. (form A), 10<sup>9</sup> ohms min. (form C)  
**Operating temperature:** -40° to +85°C  
**Vibration:** 20G (10 — 2000 Hz)  
**Shock:** 50G @ 11 ms duration

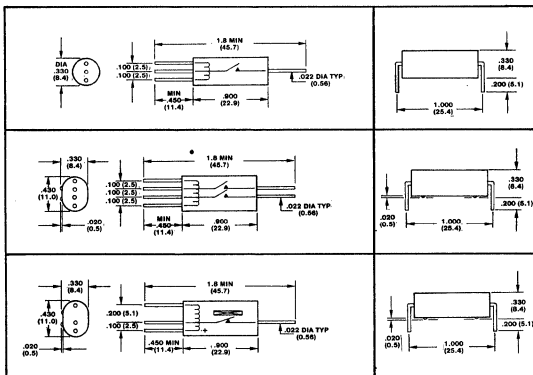
Contact Form	Part Number	Coil VDC	Coil Res. (Ohms)	Must Operate VDC	Must Re-lease VDC	Contact Ratings	Break Down Voltage	Schematic
1A Standard	SE051A00	5-6	500	3.8	0.5	10 Watts	250	
	SE061A00	5-6	125	3.8	0.5	200 VDC		
	SE121A00	12	500	8.0	1.0	0.5 Amps		
	SE241A00	24	2000	16.0	2.0			
1A High Power	SE051A10	5-6	300	3.8	0.5	50 Watts	500	
	SE061A10	5-6	125	3.8	0.5	200 VDC		
	SE121A10	12	500	8.0	1.0	1.0 Amps		
	SE241A10	24	2000	16.0	2.0			
1A High Voltage	SE051A20	5-6	300	3.8	0.5	25 Watts	2500	
	SE061A20	5-6	125	3.8	0.5	1000 VDC		
	SE121A20	12	500	8.0	1.0	1.0 Amps		
	SE241A20	24	2000	16.0	2.0			
1A Mercury	SE051A30	5-6	200	4.0	0.5	50 Watts	1500	
	SE061A30	5-6	125	4.0	0.5	500 VDC		
	SE121A30	12	500	9.0	1.0	1.0 Amps		
	SE241A30	24	2000	18.0	2.0			
1A Low Level Ruthenium Contact	SE051A40	5-6	500	3.8	0.5	10 Watts	300	
	SE061A40	5-6	125	3.8	0.5	200 VDC		
	SE121A40	12	500	8.0	1.0	0.5 Amps		
	SE241A40	24	2000	16.0	2.0			
1B	SE051B00	5-6	300	3.8	0.5	10 Watts	250	
	SE061B00	5-6	125	3.8	0.5	200 VDC		
	SE121B00	12	500	8.0	1.0	0.5 Amps		
	SE241B00	24	2000	16.0	2.0			
1C	SE051C00	5-6	200	3.8	0.5	3 Watts	200	
	SE061C00	5-6	125	3.8	0.5	100 VDC		
	SE121C00	12	500	8.0	1.0	0.25 Amps		
	SE241C00	24	2000	16.0	2.0			

## DIP AND SIP REED RELAYS



\* MICRO SIP WIDTH .200  
 \* MICRO SIP HEIGHT .225  
 \* MICRO SIP W/DIODE HEIGHT .300

Contact Form	Part Number		Coil VDC	Coil Res. (Ohms)	Must Operate VDC	Must Re-lease VDC	Contact Ratings	Break Down Voltage	Schematic
	No Diode	With Diode							
1A	AD1A05	AD1A05D	5	500	3.8	0.5	10 Watts	250	
	AD1A12	AD1A12D	12	850	8.0	1.0	200 VDC		
	AD1A24	AD1A24D	24	2200	16.0	2.0	0.5 Amps		
2A	AD2A05	AD2A05D	5	200	3.8	0.5	10 Watts	250	
	AD2A12	AD2A12D	12	500	8.0	1.0	200 VDC		
	AD2A24	AD2A24D	24	1750	16.0	2.0	0.5 Amps		
1B	AD1B05	AD1B05D	5	500	3.8	0.5	10 Watts	250	
	AD1B12	AD1B12D	12	500	8.0	1.0	200 VDC		
	AD1B24	AD1B24D	24	1750	16.0	2.0	0.5 Amps		
1C	AD1C05	AD1C05D	5	200	3.8	0.5	3 Watts	200	
	AD1C12	AD1C12D	12	500	8.0	1.0	100 VDC		
	AD1C24	AD1C24D	24	1750	16.0	2.0	0.25 Amps		
1A Hg Wet	AD1A05HG	AD1A05HGD	5	160	4.0	0.5	50 Watts	1000	
	AD1A12HG	AD1A12HGD	12	500	9.0	1.0	500 VDC		
	AD1A24HG	AD1A24HGD	24	1440	18.0	2.0	2.0 Amps		
1A Mini SIP	SD1A05	SD1A05D	5	500	3.8	0.5	10 Watts	250	
	SD1A12	SD1A12D	12	850	8.0	1.0	200 VDC		
	SD1A24	SD1A24D	24	2200	16.0	2.0	0.5 Amps		
1A Micro SIP	SH1A05	SH1A05D	5	500	3.8	0.5	10 Watts	200	
	SH1A12	SH1A12D	12	1500	8.0	1.0	200 VDC		
	SH1A24	SH1A24D	24	1500	16.0	2.0	0.5 Amps		



**“T” SERIES** • Most Economical High Quality Relay  
 • Axial Leads for Flexible Mounting  
 • Formed Leads for P.C. Board Mounting

Contact Form	Part Number		Coil VDC	Coil Res.	Must Operate	Must Release	Contact Ratings	Break Down Voltage
	Axial	Formed (1.00" Center)						
1A	T0051A500	TU051A500	5	500	4.0	0.5	10 Watts	300
	T0121A500	TU121A500	12	500	9.0	1.2	200 VDC	
	T0241A2K0	TU241A2K0	24	2000	18.0	2.4	0.5 Amps	
2A	T0052A250	TU052A250	5	250	4.0	0.5	10 Watts	300
	T0122A1K0	TU122A1K0	12	1000	9.0	1.2	200 VDC	
	T0242A2K0	TU242A2K0	24	2000	18.0	2.4	0.5 Amps	
1B	T0051B250	TU051B250	5	250	4.0	0.5	10 Watts	300
	T0121B1K0	TU121B1K0	12	1000	9.0	1.2	200 VDC	
	T0241B2K0	TU241B2K0	24	2000	18.0	2.4	0.5 Amps	

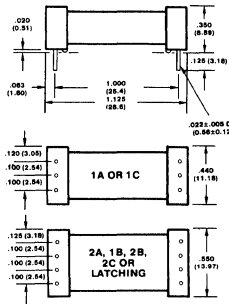


# American Relays, Inc.

10306 Norwalk Blvd., Santa Fe Springs, CA 90670 • Tel: (562) 944-0447 • Fax: (562) 944-0590

# REED RELAYS

## OPEN FRAME REED RELAYS (SERIES C AND D)



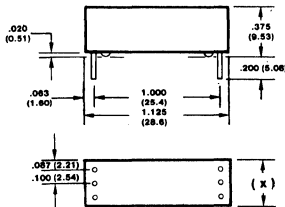
- High Performance, Low Cost Open Frame, PC Mount Dry Reed Relays
- Popular 1.000" x .100" or 1.000" x .150" Pin Spacing
- Rigid Polyester Relay Body with Epoxy Filled Ends

Specifications	Form A/B	Form C
<b>Power (Resistive Load)</b>	10 Watts	3 Watts
<b>Voltage (Max. Switching)</b>	200 VDC	100 VDC
<b>Voltage (Min. Breakdown)</b>	300 VDC	200 VDC
<b>Current (Max. Switching)</b>	0.5 Amps	0.25 Amps
<b>Current (Max. Carry)</b>	2.0 Amps	1.2 Amps
<b>Capacitance (Typical)</b>	0.2 Pf	0.8 Pf.
<b>Contact Resistance (Max. Initial)</b>	0.2 Ohms	0.2 Ohms
<b>Operate Time (Typical)</b>	0.5 ms	0.5 ms
<b>Release Time (Typical)</b>	0.2/0.5 ms	0.5 ms
<b>Insulation Resistance (Min.)</b>	10 <sup>10</sup> Ohms	10 <sup>9</sup> Ohms
<b>Life (Low Level)</b>	100 x 10 <sup>6</sup> Oper.	50 x 10 <sup>6</sup> Oper.
<b>Life (Rated Load)</b>	10 x 10 <sup>6</sup> Oper.	5 x 10 <sup>6</sup> Oper.
<b>Temperature</b>	-40°C to +85°C	
<b>Vibration</b>	20G to 2000 Hz	
<b>Shock</b>	50G @ 11 MS Duration	

Contact Form	Part Number		Nom. Coil VDC	Coil Res. (Ohms) ±10%	Max. Pick-up VDC	Min. Drop-out VDC	Width	Schematic Top View C End Coil	Schematic Top View D Side Coil
	C End Coil	D Side Coil							
1A	C051A2R0	D051A2R0	5	500	3.8	0.5	.440		
	C121A2R0	D121A2R0	12	1000	9.0	1.2			
	C241A2R0	D241A2R0	24	2000	18.0	2.4			
2A	C052A2R0	D052A2R0	5	300	3.8	0.5	.550		
	C122A2R0	D122A2R0	12	750	9.0	1.2			
	C242A2R0	D242A2R0	24	1500	18.0	2.4			
4A	C054A2R0	D054A2R0	5	150	3.8	0.5	.640		
	C124A2R0	D124A2R0	12	375	9.0	1.2			
	C244A2R0	D244A2R0	24	1000	18.0	2.4			
1B	C051B2R0	D051B2R0	5	500	3.8	0.5	.550		
	C121B2R0	D121B2R0	12	1000	9.0	1.2			
	C241B2R0	D241B2R0	24	2000	18.0	2.4			
1C	C051C2R0	D051C2R0	5	500	3.8	0.5	.440		
	C121C2R0	D121C2R0	12	1000	9.0	1.2			
	C241C2R0	D241C2R0	24	2000	18.0	2.4			
2C	C052C2R0	D052C2R0	5	300	3.8	0.5	.550		
	C122C2R0	D122C2R0	12	750	9.0	1.2			
	C242C2R0	D242C2R0	24	1500	18.0	2.4			
Latching	C051K3R0	D051K3R0	5	375	3.8	0.5	.550		
	C121K2R0	D121K2R0	12	500	9.0	1.2			
	C241K3R0	D241K3R0	24	2000	18.0	2.4			

## ENCAPSULATED REED RELAYS (SERIES I AND J)

- Total Environmental Protection
- A Wide Variety of Coil and Contact Arrangement Available



Specifications	Form A/B	Form C
<b>Power (Resistive Load)</b>	10 Watts	3 Watts
<b>Voltage (Max. Switching)</b>	200 VDC	100 VDC
<b>Voltage (Min. Breakdown)</b>	300 VDC	200 VDC
<b>Current (Max. Switching)</b>	0.5 Amps	0.25 Amps
<b>Current (Max. Carry)</b>	2.0 Amps	1.2 Amps
<b>Capacitance (Typical)</b>	0.2 Pf	0.8 Pf
<b>Contact Resistance (Max. Initial)</b>	0.2 Ohms	0.2 Ohms
<b>Operate Time (Typical)</b>	0.5 ms	0.5 ms
<b>Release Time (Typical)</b>	0.2/0.5 ms	0.5 ms
<b>Insulation Resistance (Min.)</b>	10 <sup>10</sup> Ohms	10 <sup>9</sup> Ohms
<b>Life (Low Level)</b>	100 x 10 <sup>6</sup> Oper.	50 x 10 <sup>6</sup> Oper.
<b>Life (Rated Load)</b>	10 x 10 <sup>6</sup> Oper.	5 x 10 <sup>6</sup> Oper.
<b>Temperature</b>	-40°C to +85°C	
<b>Vibration</b>	20G to 2000 Hz	
<b>Shock</b>	50G @ 11 MS Duration	

Contact Form	Part Number		Nom. Coil VDC	Coil Res. (Ohms) ±10%	Max. Pick-up VDC	Min. Drop-out VDC	Width (X)	Schematic Top View I End Coil	Schematic Top View J Side Coil
	I End Coil	J Side Coil							
1A	I051A2R0	J051A2R0	5	500	3.8	0.5	.375		
	I121A2R0	J121A2R0	12	1000	9.0	1.2			
	I241A2R0	J241A2R0	24	2000	18.0	2.4			
2A	I052A2R0	J052A2R0	5	300	3.8	0.5	.475		
	I122A2R0	J122A2R0	12	750	9.0	1.2			
	I242A2R0	J242A2R0	24	1500	18.0	2.4			
3A	I053A2R0	J053A2R0	5	250	3.8	0.5	.575		
	I123A2R0	J123A2R0	12	500	9.0	1.2			
	I243A3R0	J243A3R0	24	2000	18.0	2.4			
4A	I054A2R0	J054A2R0	5	150	3.8	0.5	.700		
	I124A2R0	J124A2R0	12	375	9.0	1.2			
	I244A2R0	J244A2R0	24	1000	18.0	2.4			
1B	I051B2R0	J051B2R0	5	500	3.8	0.5	.475		
	I121B2R0	J121B2R0	12	1000	9.0	1.2			
	I241B2R0	J241B2R0	24	2000	18.0	2.4			
1A1B	I052F2R0	J052F2R0	5	250	3.8	0.5	.575		
	I122F2R0	J122F2R0	12	500	9.0	1.2			
	I242F3R0	J242F3R0	24	2000	18.0	2.4			
1C	I051C2R0	J051C2R0	5	500	3.8	0.5	.375		
	I121C2R0	J121C2R0	12	1000	9.0	1.2			
	I241C2R0	J241C2R0	24	2000	18.0	2.4			
2C	I052C2R0	J052C2R0	5	300	3.8	0.5	.500		
	I122C2R0	J122C2R0	12	750	9.0	1.2			
	I242C2R0	J242C2R0	24	1500	18.0	2.4			
4C	I054C2R0	J054C2R0	5	50	3.8	0.5	.875		
	I124C2R0	J124C2R0	12	300	9.0	1.2			
	I244C2R0	J244C2R0	24	800	18.0	2.4			
Latching	I051K3R0	J051K3R0	5	375	3.8	0.5	.475		
	I121K2R0	J121K2R0	12	500	9.0	1.2			
	I241K3R0	J241K3R0	24	2000	18.0	2.4			

**NOTE:**  
 1. Electro-static shielding (E) is optional.  
 2. On latching relays, (+) indicates set positive.



# American Relays, Inc.

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# REED RELAYS

## HIGH POWER SERIES

- Miniature High Power Reed Relays. 50W Contact Rating.
- Capable of Handling High Inrush, Inductive and Capacitive Loads
- Open Frame, Encapsulated and Axial Lead Packages are Available

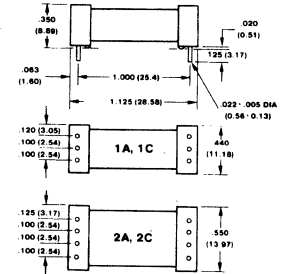
## HIGH VOLTAGE SERIES

- Miniature High Voltage Reed Relays
- Meets FCC Part 68 Voltage Breakdown Requirement
- Open Frame, Encapsulated and Axial Lead Packages are Available

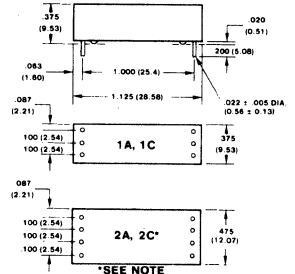
## MERCURY WETTED SERIES

- Miniature Reed Relay with Mercury Wetted Contacts
- No Contact Bounce
- 50 Watts Contact Rating
- Open Frame, Encapsulated and Axial Lead Packages are Available

## OPEN FRAME



## ENCAPSULATED



Note: Dimension for 2 Form C Mercury Encapsulated Relays. Length: 1.175, Width: .600, Height: .375.

Specifications	High Power	High Voltage	Mercury Wetted	
			Form A	Form C
Power (Resistive Load)	50 Watts	25 Watts	50 Watts	50 Watts
Voltage (Max. Switching)	200 VDC	1000 VDC	500 VDC	500 VDC
Voltage (Min. Breakdown)	300 VDC	2500 VDC	1500 VDC	1500 VDC
Current (Max. Switching)	1 Amp	1 Amp	2 Amps	1 Amp
Current (Max. Carry)	2 Amps	2 Amps	3 Amps	2 Amps
Capacitance (Typical)	0.2 Pf	0.2 Pf	0.3 Pf	0.7 Pf
Contact Resistance (Max. Initial Typ.)	0.5 Ohms	0.2 Ohms	0.07 Ohms	0.07 Ohms
Operate Time (Typical)	0.5 ms	0.5 ms	1.5 ms	2.0 ms
Release Time (Typical)	0.5 ms	0.2 ms	1.0 ms	2.0 ms
Insulation Resistance (Min. Typ)	10 <sup>10</sup> Ohms	10 <sup>10</sup> Ohms	10 <sup>10</sup> Ohms	10 <sup>9</sup> Ohms
Life (Medium Load)	10 x 10 <sup>6</sup> Oper	100 x 10 <sup>6</sup> Oper.	10 <sup>9</sup> Oper.	10 <sup>9</sup> Oper.
Life (Rated Load)	1 x 10 <sup>6</sup> Oper	10 x 10 <sup>6</sup> Oper	5 x 10 <sup>7</sup> Oper.	5 x 10 <sup>7</sup> Oper.

## PART NUMBERS AND OPERATING CHARACTERISTICS (@ 25°C)

Contact Form	Nom. Coil VDC	Max. Pick-up VDC	Min. Drop-out VDC	High Power		Coil Res. (Ohms) ±10%	High Voltage		Coil Res. (Ohms) ±10%	Mercury Wetted*		Schematic Top View
				Part Number			Part Number			Part Number		
				Open Frame	Encapsulated		Open Frame	Encapsulated		Open Frame	Encapsulated	
1A	5	3.8	0.5	500	C051A2TO I051A2TO	500	C051A2HO I051A2HO	125	C051A1MO I051A1MO			
	6	4.5	0.6	125	C061A1TO I061A1TO	125	C061A1HO I061A1HO	125	C061A1MO I061A1MO			
	12	9.0	1.2	750	C121A1TO I121A1TO	1000	C121A2HO I121A2HO	750	C121A1MO I121A1MO			
	24	18.0	2.4	2000	C241A2TO I241A2TO	2000	C241A2HO I241A2HO	2000	C241A2MO I241A2MO			
2A	5	3.8	0.5	100	C052A1TO I052A1TO	100	C052A1HO I052A1HO	100	C052A1MO I052A1MO			
	6	4.5	0.6	100	C062A1TO I062A1TO	100	C062A1HO I062A1HO	100	C062A1MO I062A1MO			
	12	9.0	1.2	300	C122A1TO I122A1TO	750	C122A2HO I122A2HO	300	C122A1MO I122A1MO			
	24	18.0	2.4	1500	C242A2TO I242A2TO	1500	C242A2HO I242A2HO	1500	C242A2MO I242A2MO			
1C	5	4.0	0.5	—	NA	—	—	100	C051C1MO I051C1MO			
	12	9.0	1.2	—	NA	—	—	350	C121C1MO I121C1MO			
	24	18.0	2.4	—	NA	—	—	1500	C241C1MO I241C1MO			
2C	5	4.0	0.5	—	NA	—	—	75	C052C1MO I052C1MO			
	12	9.0	1.2	—	NA	—	—	300	C122C1MO I122C1MO			
	24	18.0	2.4	—	NA	—	—	1200	C242C1MO I242C1MO			

\* Mercury wetted relays should be mounted within ±30° from vertical position.

## AXIAL LEAD SERIES

- Encapsulated Axial Lead Reed Relays
- Axial Leads Allows Various Mounting Configurations.
- Total Environmental Protection
- Nickel Plated Metal Tube Provides Magnetic Shielding
- Formed Leads are Also Available

- 1 Form A, 2 Form A, 1 Form B, 1 Form C and 2 Form C Types are Available
- Various Contact Ratings Available
- Contact American Relays, Inc. for Specific Part Numbers and Additional Options

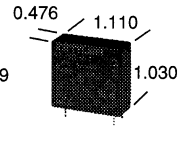
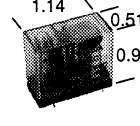
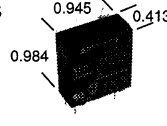
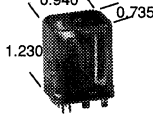
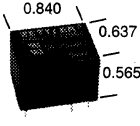
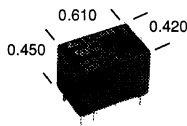
## SPECIAL RELAY DESIGN

American Relays, Inc. is a custom relay specialist. Our major objective is to design and build parts that fulfill special requirements for the reed relay user.

Our facility is designed and equipped for prompt, systematic processing of samples, prototype and production orders.



# Relay Selection Guide



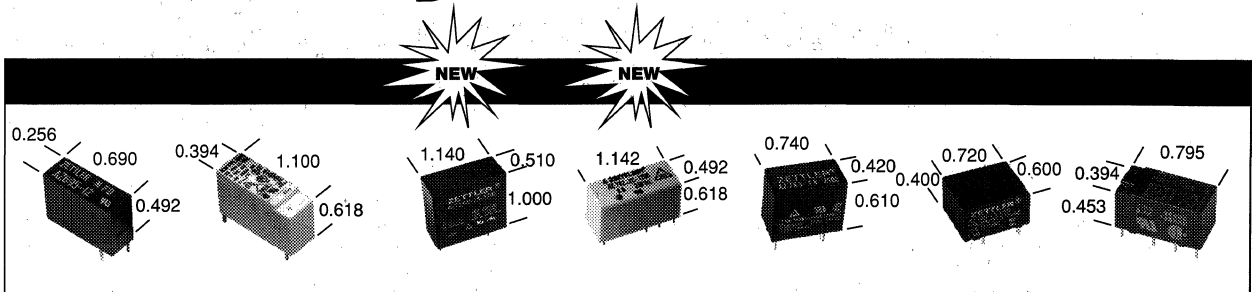
SERIES		AZ5	AZ8	AZ420	AZ672	AZ683/723/726	AZ690/725/730
<b>FEATURES</b>		<ul style="list-style-type: none"> <li>High sensitivity</li> <li>Subminiature size</li> <li>Low cost</li> <li>Meets FCC Part 68.302 and 68.304</li> </ul>	<ul style="list-style-type: none"> <li>High sensitivity (110 mW)</li> <li>Class B (130°C) insulation standard</li> <li>Class F (155°C) insulation available</li> <li>VDE versions available</li> </ul>	<ul style="list-style-type: none"> <li>Versatile contact configurations</li> <li>Wide switching range</li> <li>High sensitivity</li> <li>Long life</li> </ul>	<ul style="list-style-type: none"> <li>High dielectric strength, 4000 Vrms</li> <li>Withstands surges up to 10,000 volts</li> <li>High switching capacity in slim package</li> </ul>	<ul style="list-style-type: none"> <li>High dielectric strength, 5000 Vrms</li> <li>AC coils</li> <li>Flux tight package</li> <li>Isolation spacing greater than 8mm</li> </ul>	<ul style="list-style-type: none"> <li>High dielectric strength, up to 5000 Vrms</li> <li>Complete list of international approvals</li> <li>Up to 16 Amp switching in compact size</li> <li>Isolation spacing greater than 8mm</li> </ul>
<b>EPOXY SEALED</b>		Yes	Yes	Yes	Yes	No	Yes
<b>CONTACTS</b>	<b>Form</b>	1 Form C	1 Form A, C	1-6 Form C	1 Form A	AZ683/AZ726: 1 Form A or C AZ723: 2 Form A or C	AZ690/AZ725: 1 Form A, B, or C AZ730: 2 Form A, B, C
	<b>Ratings (Resistive)</b>	Standard duty: 1 A at 30 VDC 0.5 A at 120 VAC Heavy duty: 2 A at 30 VDC 1 A at 120 VAC	Light duty: 2 A at 28 VDC or 300 VAC Medium duty: 6 A at 28 VDC or 300 VAC Heavy duty: 10 A at 30 VDC or 120 VAC	2 A at 26 VDC or 115 VAC 3 A at 28 VDC or 115 VAC 7.5 A at 28 VDC or 115 VAC	10 A at 125 VAC 8 A at 30 VDC or 250 VAC TV-5 at 120 VAC 1/8 HP at 125 VAC or 277 VAC	AZ683: 10 A at 250 VAC 1/2 HP at 277 VAC AZ723: 5 A at 30 VDC or 250 VAC 1/3 HP at 240 VAC AZ726: 16 A at 250 VAC	AZ690/AZ730: 10 A at 30 VDC or 250 VAC AZ690: 1/4 HP at 120 VAC motor load AZ730: 1/8 HP at 120 VAC motor load AZ725: 16 A at 250 VAC
<b>COIL VOLTAGES</b>		5 thru 24 VDC	5 thru 48 VDC	3 thru 115 VDC	3 thru 48 VDC	6 thru 220 VAC	5 thru 48 VDC
<b>COIL POWER AT PICKUP VOLTAGE (typical)</b>		Standard coils: 220 mW Sensitive coils: 100 mW	Standard coils: 210 mW Sensitive coils: 140 mW (110 mW available)	Standard coils: 450 to 850 mW Sensitive coils: 40 mW per pole (25 mW per pole available)	300 mW	720 mW	AZ690/AZ730: Standard coils: 337 mW AZ690: Sensitive coils: 234 mW AZ725: 270 mW AZ730: Sensitive Coils: 250 mW
<b>DIELECTRIC STRENGTH (at sea level for 1 min.)</b>		Contact to coil: 1250 Vrms Between open contacts: 500 Vrms	Contact to coil: 3000 Vrms Between open contacts: 750 Vrms	Contact to coil: 1500 Vrms Between open contacts: 1000 Vrms	Contact to coil: 4000 Vrms Between open contacts: 1000 Vrms Surge contact to coil: 10,000 V	Contact to coil: 5000 Vrms Between open contacts: 1000 Vrms	Contact to coil: 4000 Vrms Between open contacts: 1000 Vrms AZ725: Contact to coil: 5000 Vrms AZ730: Contact set to contact set: 2500 Vrms
<b>TYPICAL LIFE</b>	<b>Electrical</b>	Standard duty: 5 x 10 <sup>5</sup> -1A/30VDC or 4 x 10 <sup>5</sup> -0.5A/120VAC Heavy duty: 2 x 10 <sup>5</sup> -2A at 30 VDC or 2 x 10 <sup>5</sup> -1A at 120VAC	LD: 3 x 10 <sup>5</sup> operations at rated load MD: 1.8 x 10 <sup>5</sup> operations at rated load HD: 1 x 10 <sup>5</sup> operations at rated load	1 x 10 <sup>8</sup> -10 mA/6VDC 1.5 x 10 <sup>6</sup> -2A/28VDC or 115VAC 2 x 10 <sup>5</sup> -5A/28VDC or 115VAC 1 x 10 <sup>5</sup> -7.5A/28VDC or 115 VA	1 x 10 <sup>5</sup> operations at rated load 3 x 10 <sup>4</sup> tungsten	1 x 10 <sup>5</sup> operations at rated load	AZ690: 1 x 10 <sup>5</sup> -10A/30 VDC/115 VAC 2 x 10 <sup>5</sup> at 8 A/250 VAC AZ725: 1 x 10 <sup>5</sup> -16A/125 VAC AZ730: 1 x 10 <sup>5</sup> -8A/30VDC 2 x 10 <sup>5</sup> -8A/115 VAC/250 VAC
	<b>Mechanical</b>	1 x 10 <sup>7</sup> operations	1 x 10 <sup>8</sup> operations	5 x 10 <sup>8</sup> operations	2 x 10 <sup>6</sup> operations	1 x 10 <sup>7</sup> operations	3 x 10 <sup>7</sup> operations
<b>SIZE IN INCHES L x W x H</b>		0.610 x 0.420 x 0.450	0.840 x 0.637 x 0.565	2 pole: 0.940 x 0.735 x 1.230 4 pole: 1.172 x 0.735 x 1.230 6 pole: 1.395 x 0.735 x 1.230	0.945 x 0.413 x 0.984	1.14 X 0.51 X 0.99	AZ690: 1.110 x 0.476 x 1.030 AZ725: 1.140 x 0.493 x 1.100 AZ730: 1.110 x 0.496 x 1.030
<b>TERMINALS</b>	<b>PC</b>	X	X	X	X	X	X
	<b>Solder/Plug-in</b>	—	—	X	—	—	—
	<b>Bracket Mount</b>	—	—	—	—	—	—
<b>APPROVAL</b>		UL/CSA	UL/CUR/VDE	UL/CUR	UL/CSA	UL/CUR	UL/CSA/VDE



## AMERICAN ZETTLER, INC.

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# Relay Selection Guide



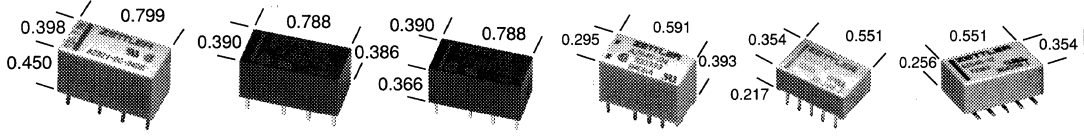
AZ695	AZ696	AZ733W	AZ742/763/764	AZ765	AZ766	AZ820/822
<ul style="list-style-type: none"> <li>Utilizes only 0.18 sq. in. of PCB area</li> <li>5 Amp switching in miniature size</li> <li>High dielectric strength, 3000 Vrms</li> <li>High sensitivity</li> </ul>	<ul style="list-style-type: none"> <li>Subminiature size</li> <li>10 Amp low profile</li> <li>High sensitivity</li> <li>Complete list of international approvals</li> <li>Dielectric strength 4000 Vrms</li> </ul>	<ul style="list-style-type: none"> <li>High dielectric strength, 5000 Vrms</li> <li>1.5 mm contact gap</li> <li>Isolation spacing greater than 8 mm</li> <li>Class B (130°C) insulation system standard</li> </ul>	<ul style="list-style-type: none"> <li>High dielectric strength, 5000 Vrms</li> <li>Isolation spacing greater than 10 mm</li> <li>PTI/CTI &gt;250</li> <li>International approvals</li> </ul>	<ul style="list-style-type: none"> <li>Small footprint</li> <li>Low cost</li> <li>Class B (130°C) insulation</li> <li>12 Amp switching capacity</li> </ul>	<ul style="list-style-type: none"> <li>Low seated height</li> <li>Low cost</li> <li>Class B (130°C) insulation</li> <li>12 Amp switching capacity</li> </ul>	<ul style="list-style-type: none"> <li>Ultra high sensitivity</li> <li>Bifurcated contacts</li> <li>Meets FCC Part 68.302 &amp; 68.304</li> <li>DIP package</li> <li>Low profile</li> <li>Fits standard 16-Pin IC socket</li> </ul>
Yes	Yes	Yes	Yes	Yes	Yes	Yes
1 Form A	1 Form A or C	2 Form A	AZ742: 2 Form C AZ763/AZ764: 1 Form C	1 Form A	1 Form A	2 Form C
5 A at 30 VDC or 250 VAC 1/10 HP at 250 VAC	10 A at 30 VDC or 250 VAC 1/4 HP at 120 VAC 1/2 HP at 250 VAC	10 A at 250 VAC 8 A at 30 VDC 10 A at 30 VDC at 250 VAC (TÜV)	AZ742: 8 A at 250 VAC 8 A at 30 VDC AZ763: 12 A at 250 VAC 12 A at 30 VDC AZ764: 16 a AT 250 VAC 16 a AT 30 VDC	12 A at 125 VAC 10 A at 30 VDC or 277 VAC	12 A at 125 VAC 10 A at 30 VDC or 277 VAC TV-5 at 120 VAC 1/4 HP at 125 / 250 VAC	AZ820: 2 A at 15 VDC or 30 VAC 1 A at 30 VDC or 60 VAC AZ822: 1 A at 24 VDC 0.5 A at 120 VAC
5 thru 24 VDC	5 thru 48 VDC	3 thru 60 VDC	5 thru 110 VDC	3 thru 24 VDC	3 thru 24 VDC	AZ820: 5 thru 48 VDC AZ822: 3 thru 48 VDC
100 mW	100 mW	356 mW	190 mW	253 mW	253 mW	AZ820: 250 mW AZ822: 74 mW
Contact to coil: 3000 Vrms Between open contacts: 750 Vrms	Contact to coil: 4000 Vrms Between open contacts: 1000 Vrms	Contact to coil: 5000 Vrms Between open contacts: 3000 Vrms Contact set to contact set: 3000 Vrms	Contact to coil: 5000 Vrms Between open contacts: 1000 Vrms Contact set to contact set: 3000 Vrms AZ742: Contact set to contact set: 3000 Vrms	Contact to coil: 2500 Vrms Between open contacts: 1000 Vrms	Contact to coil: 2500 Vrms Between open contacts: 1000 Vrms	Contact to coil: 1000 Vrms Between open contacts: 1000 Vrms AZ820: Contact set to contact set: 1500 Vrms AZ822: Contact set to contact set: 1000 Vrms Contact to coil surge: 1500 V
1 x 10 <sup>5</sup> at 5 A at 30 VDC or 250 VAC	1 x 10 <sup>5</sup> operations at rated load	1 x 10 <sup>5</sup> operations at rated load	1 x 10 <sup>5</sup> operations at rated load	1 x 10 <sup>5</sup> operations at rated load	1 x 10 <sup>5</sup> operations at rated load	AZ820: 5 x 10 <sup>5</sup> at 1 A at 30 VDC AZ822: 2 x 10 <sup>5</sup> at 0.5 A at 120 VAC 5 x 10 <sup>5</sup> at 1 A at 24 VDC
2 x 10 <sup>7</sup> operations	1 x 10 <sup>7</sup> operations	1 x 10 <sup>7</sup> operations	1 x 10 <sup>7</sup> operations	1 x 10 <sup>7</sup> operations	1 x 10 <sup>7</sup> operations	AZ820: 1 x 10 <sup>7</sup> operations AZ822: 1 x 10 <sup>8</sup> operations
0.690 x 0.256 x 0.492	1.100 x 0.394 x 0.618	1.140 x 0.510 x 1.000	1.142 x 0.492 x 0.618	0.740 x 0.420 x 0.610	0.720 x 0.600 x 0.400	AZ820: 0.795 x 0.394 x 0.453 AZ822: 0.787 X 0.386 X 0.472
X	X	X	X	X	X	X
—	—	—	—	—	—	—
—	—	—	—	—	—	—
UL/CSA	UL/CSA/VDE	UL/CUR/TÜV	UL/CSA/VDE/SEV	UL/CSA	UL/CSA	UL/CSA



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# Relay Selection Guide



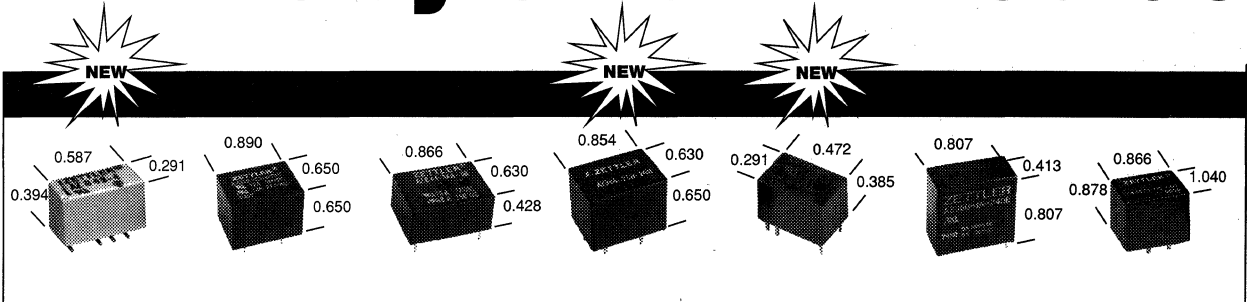
SERIES		AZ821/831	AZ830	AZ830P	AZ846/846P	AZ847	AZ848
FEATURES		<ul style="list-style-type: none"> <li>High sensitivity (100 mW)</li> <li>High switching capacity</li> <li>Fits standard 16-Pin IC socket</li> <li>Meets FCC Part 68.302 &amp; 68.304</li> </ul>	<ul style="list-style-type: none"> <li>Meets FCC Part 68.302 &amp; 68.304</li> <li>Bifurcated contacts (PdAg available)</li> <li>Polarized coil</li> <li>DIP package</li> </ul>	<ul style="list-style-type: none"> <li>2 + 4 Pole polarized magnetic bistable (latching) relay</li> <li>Meets FCC Part 68.302 &amp; 68.304</li> <li>Fits standard 16 pin IC socket (DIP)</li> <li>Bifurcated contacts</li> <li>High sensitivity, 90 mW</li> </ul>	<ul style="list-style-type: none"> <li>Meets Bellcore 2.5 KV surge</li> <li>Meets FCC 1500 V surge requirements</li> <li>Micro miniature size</li> <li>High sensitivity</li> <li>Single and dual coil latching versions</li> </ul>	<ul style="list-style-type: none"> <li>Micro miniature size</li> <li>High sensitivity</li> <li>Meets FCC Part 68.302</li> <li>Bistable (latching) versions available</li> </ul>	<ul style="list-style-type: none"> <li>Micro miniature size</li> <li>Surface mount (SMT)</li> <li>High sensitivity</li> <li>Meets FCC Part 68, 1500 V surge</li> <li>Bistable (latching) versions available</li> </ul>
EPOXY SEALED		Yes	Yes	Yes	Yes	Yes	Yes
CONTACTS	Form	2 Form C	2 Form C 4 Form C	2 Form C 4 Form C	2 Form C	2 Form C	2 Form C
	Ratings (Resistive)	2 A at 30 VDC or 60 VAC	2 Pole: 2 A at 30 VDC 1 A at 120 VAC 4 Pole: 2 A at 30 VDC 0.5 A at 120 VAC	2 Pole: 2 A at 30 VDC 1 A at 125 VAC 4 Pole: 1 A at 30 VDC 0.5 A at 120 VAC	2 A at 30 VDC 0.3 A at 110 VDC 0.5 A at 125 VAC	1 A at 30 VDC 0.5 A at 125 VAC	0.5 A at 125 VAC 2.0 A at 30 VDC 0.3 A at 110 VDC
COIL VOLTAGES		3 thru 48 VDC	5 thru 48 VDC	5 thru 48 VDC	3 thru 24 VDC	3 thru 24 VDC	1.5 thru 48 VDC
COIL POWER AT PICKUP VOLTAGE (typical)		AZ821: 250 mW AZ831: 100 mW	Standard: 200 mW Sensitive: 100 mW	Sensitive (2 coil): 90 mW 2 Pole: Standard coil: 176 mW 4 Pole: Standard (2 coil): 200 mW Sensitive (2 coil): 180 mW	AZ: 846: 80 mW AZ846P: Single coil: 56 mW to 100 mW Dual coil: 113 mW to 165 mW	Monostable coil: 70 mW (3-12 VDC) 100 mW (24 VDC) Bistable (latching) two coil: 100 mW (3-12 VDC) 150 mW (24 VDC)	Non-latching: 79-169 mW Latching (1 coil): 57-85 mW Latching (2 coil): 113-170 mW
DIELECTRIC STRENGTH (at sea level for 1 min.)		Contact to coil: 1500 Vrms Between open contacts: 1000 Vrms Contact set to contact set: 1000 Vrms	Contact to coil: 1500 Vrms Contact to coil: 1500 Vrms Between open contacts: 1000 Vrms Contact set to contact set: 1000 Vrms	Contact to coil: 1500 Vrms Between open contacts: 1000 Vrms 2C: Contact set to contact set: 1000 Vrms 4C: Contact set to contact set: 1500 Vrms	Between open contacts: 1000 Vrms Contact set to contact set: 1000 Vrms AZ846: Contact to coil: 1800 Vrms AZ846P: Contact to coil: 1000 Vrms Contact to coil surge: 2500 V	Contact to coil: 1250 Vrms Between open contacts: 1250 Vrms Contact set to contact set: 1250 Vrms	Contact to coil: 1000 Vrms Between open contacts: 750 Vrms Contact set to contact set: 750 Vrms
TYPICAL LIFE	Electrical	1 x 10 <sup>5</sup> at 2 A at 30 VDC	5 x 10 <sup>5</sup> at 2 A at 30 VDC or 1 A at 125 VAC 2 x 10 <sup>6</sup> at 1 A at 30 VAC or 0.5 A at 125 VAC	2C: 1 x 10 <sup>5</sup> at 2 A at 30 VAC or 1 A at 125 VAC 1 x 10 <sup>6</sup> at 1 A at 30 VAC or 0.5 A at 125 VAC 4C: 5 x 10 <sup>5</sup> at 2 A at 30 VDC 2 x 10 <sup>6</sup> at 0.5 A at 120 VDC	2 x 10 <sup>5</sup> at 1 A at 30 VDC 1 x 10 <sup>5</sup> at 0.5 A at 125 VAC	5 x 10 <sup>5</sup> at 1 A at 30 VDC 2 x 10 <sup>5</sup> at 0.5 A at 125 VAC	2 x 10 <sup>5</sup> at 0.5 A at 125 VAC 5 x 10 <sup>5</sup> at 1.0 A at 30 VDC
	Mechanical	1.5 x 10 <sup>7</sup> operations	1 x 10 <sup>8</sup> operations	1 x 10 <sup>8</sup> operations	1 x 10 <sup>8</sup> operations	1 x 10 <sup>8</sup> operations	1 x 10 <sup>8</sup> operations
SIZE IN INCHES L x W x H		0.799 x 0.398 x 0.450	2 Form C: 0.788 x 0.390 x 0.386 4 Form C 1.390 x 0.390 x 0.390	2 Pole: 0.788 x 0.390 x 0.366 4 Pole: 1.390 x 0.390 x 0.390	AZ846: 0.591 X 0.295 X 0.393 AZ846P: 0.587 x 0.291 x 0.382	0.551 X 0.354 X 0.217	0.551 x 0.354 x 0.256
TERMINALS	PC	X	X	X	X	X	SMT
	Solder/Plug-in	—	—	—	—	—	—
	Bracket Mount	—	—	—	—	—	—
APPROVAL		UL/CUR/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA



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# Relay Selection Guide



AZ849	AZ942	AZ944	AZ946	AZ955	AZ960	AZ970/971
<ul style="list-style-type: none"> <li>• Micro miniature size</li> <li>• Surface mount (SMT)</li> <li>• High sensitivity</li> <li>• Meets FCC Part 68, 1500 V surge</li> <li>• Bistable (latching) versions available</li> </ul>	<ul style="list-style-type: none"> <li>• High switching capacity</li> <li>• Extremely low cost</li> <li>• Class B (130°C) insulation system</li> <li>• High dielectric strength</li> </ul>	<ul style="list-style-type: none"> <li>• High switching capacity (2000 VA)</li> <li>• High sensitivity (128 mW pickup)</li> <li>• Low profile (under 1/2 inch)</li> <li>• DC coils up to 100 VDC</li> </ul>	<ul style="list-style-type: none"> <li>• Subminiature size</li> <li>• High sensitivity</li> <li>• Coils up to 24 VDC</li> <li>• Extremely low cost</li> </ul>	<ul style="list-style-type: none"> <li>• Micro miniature size</li> <li>• Designed for compact high density mounting</li> <li>• High sensitivity</li> <li>• Meets FCC Part 68</li> </ul>	<ul style="list-style-type: none"> <li>• High in-rush capability</li> <li>• Standard and sensitive coils</li> <li>• All plastics rated 94V-0</li> <li>• Hard to find 14 VDC coils</li> </ul>	<ul style="list-style-type: none"> <li>• Low cost automotive relay</li> <li>• Open or sealed versions available</li> <li>• US &amp; European PC layouts</li> <li>• 24 VDC coils available</li> </ul>
Yes	Yes	Yes	Yes	Yes	Yes	Yes
2 Form C	1 Form A 1 Form C	1 Form A 1 Form C	2 Form C	1 Form C	1 Form C	1 Form A, B, C
0.5 A at 125 VAC 2.0 A at 30 VDC 0.3 A at 110 VDC	12 A at 28 VDC or 277 VAC 1/3 HP at 125 VAC	16 A at 125 VAC (Res.) 10 A at 30 VDC (Res.) 8 A at 250 VAC (Res.) 1/4 HP at 125 VAC 1/10 HP at 277 VAC	5 A at 250 VAC 5 A at 24 VDC	1 A at 30 VDC or 125 VAC	5 A at 250 VAC 1/10 HP at 125 VAC or 250 VAC	1 Form A: 40 A at 12 VDC 1 Form B: 15 A at 28 VDC 1 Form C: 30 A at 12 VDC
1.5 thru 48 VDC	5 thru 48 VDC	5 thru 100 VDC	3 thru 24 VDC	1.5 thru 24 VDC	5 thru 48 VDC	6, 12, 24 VDC
Non-latching: 79-169 mW Latching (1 coil): 57-85 mW Latching (2 coil): 113-170 mW	230 mW	1 Form A: 128 mW 1 Form C: 256 mW	230 mW	85 mW	Standard coil: 176 mW Sensitive coil: 129 mW	6 Volt: 573 mW 12 & 24 Volt: 514 mW
Contact to coil: 1500 Vrms Between open contacts: 1000 Vrms Contact set to contact set: 750 Vrms	Contact to coil: 1750 Vrms Between open contacts: 1000 Vrms	Contact to coil: 1500 Vrms Between open contacts: 1000 Vrms	Contact to coil: 1000 Vrms Between open contacts: 750 Vrms Contact set to contact set: 750 Vrms	Contact to coil: 1000 Vrms Between open contacts: 500 Vrms Contact to coil surge: 1500 V	Contact to coil: 2000 Vrms Between open contacts: 750 Vrms	Contact to coil: 500 Vrms Between open contacts: 500 Vrms
2 x 10 <sup>5</sup> at 0.5 A at 125 VAC 5 x 10 <sup>5</sup> at 1.0 A at 30 VDC	1 x 10 <sup>5</sup> operations at rated load	1 x 10 <sup>5</sup> operations at rated load	1 x 10 <sup>5</sup> operations at rated load	1 x 10 <sup>5</sup> operations at rated load	1 x 10 <sup>5</sup> operations at rated load	1 x 10 <sup>5</sup> operations at rated load
1 x 10 <sup>8</sup> operations	1 x 10 <sup>7</sup> operations	1 x 10 <sup>7</sup> operations	2 x 10 <sup>7</sup> operations	1 x 10 <sup>8</sup> operations	1 x 10 <sup>7</sup> operations	5 x 10 <sup>6</sup> operations
0.587 x 0.291 x 0.394	0.890 x 0.650 x 0.650	0.866 x 0.630 x 0.428	0.854 x 0.630 x 0.650	0.492 x 0.291 x 0.385	0.807 x 0.413 x 0.807	Open (AZ970): 0.747 x 0.911 x 0.715 Sealed (AZ971): 0.866 x 1.040 x 0.878
SMT	X	X	X	X	X	X
—	—	—	—	—	—	—
—	—	—	—	—	—	—
UL/CSA	UL/CUR/VDE	UL/CUR	UL/CUR	UL/CUR	UL/CUR	—

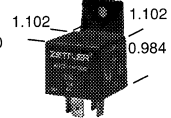
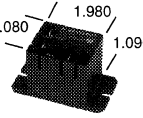
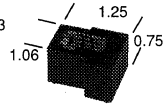
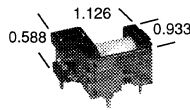
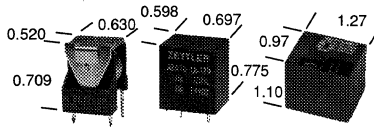


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# Relay Selection Guide

NEW



NEW

SERIES		AZ975/976	AZ2100	AZ2110	AZ2150	AZ2280	AZ9721
<b>FEATURES</b>		<ul style="list-style-type: none"> <li>• 20 A switching in compact size</li> <li>• Small footprint</li> <li>• Open, covered or sealed</li> <li>• For automotive use</li> </ul>	Low cost per switched power <ul style="list-style-type: none"> <li>• UL 873 spacing version</li> <li>• Class F (155°C) insulation available</li> </ul>	<ul style="list-style-type: none"> <li>• Low cost per switched power</li> <li>• UL 873 spacing version</li> <li>• Class F (155°C) insulation available</li> <li>• Coils to 120 VDC</li> </ul>	Low cost per switched power <ul style="list-style-type: none"> <li>• UL 873 spacing version</li> <li>• Class F (155°C) insulation available</li> </ul>	<ul style="list-style-type: none"> <li>• Quick-connects for coil &amp; contacts</li> <li>• AC and DC coils available</li> <li>• Coils to 240 VAC</li> </ul>	<ul style="list-style-type: none"> <li>• 40 A contact rating</li> <li>• High momentary carry current (60 A)</li> <li>• Quick connect terminals</li> <li>• Metal or plastic mounting bracket</li> <li>• Resistor or diode parallel to coil available</li> </ul>
<b>EPOXY SEALED</b>		Yes	Yes	No	Yes	Yes	No
<b>CONTACTS</b>	<b>Form</b>	1 Form U, V, or W	1 Form A, B, C	1 Form A, B, C	1 Form A, B, C	1 Form A, B, C	1 Form A or C
	<b>Ratings (Resistive)</b>	Max. switched current (make/break), continuous: 1 Form U: 2x40A/2X20A, 2X10A 1 Form V: 2x8A/2X7A, 2X7A 1 Form W (NO): 2X30A/2X15A, 2X7A 1 Form W (NC): 2X5A/2X5A, 2X5A	1 Form A: 30 A at 240 VAC 1 Form B: 15 A at 240 VAC 1 Form C (NO): 20 A at 240 VAC 1 Form C (NC): 15 A at 240 VAC	1 Form A: 30 A at 240 VAC 1 Form B: 15 A at 240 VAC 1 Form C (NO): 20 A at 240 VAC 1 Form C (NC): 15 A at 240 VAC	1 Form A: 30 A at 240 VAC 1 Form B: 15 A at 240 VAC 1 Form C (NO): 20 A at 240 VAC 1 Form C (NC): 15 A at 240 VAC	1 Form A: 30 A at 240 VAC 1 Form B: 15 A at 240 VAC 1 Form C (NO): 20 A at 240 VAC 1 Form C (NC): 15 A at 240 VAC	40 A at 12 VDC
<b>COIL VOLTAGES</b>		6 thru 24 VDC	3 thru 120 VDC	3 thru 120 VDC	3 thru 120 VDC	5 thru 48 VDC 12 thru 240 VAC	12 or 24 VDC
<b>COIL POWER AT PICKUP VOLTAGE (typical)</b>		5146 mW	500 mW	500 mW	500 mW	DC: 500 mW AC: 1.4 VA	0.76 mW
<b>DIELECTRIC STRENGTH (at sea level for 1 min.)</b>		Contact to coil: 500 VDC Between open contacts: 500 VDC	Contact to coil: 2500 Vrms Between open contacts: 1500 Vrms	Contact to coil: 2500 Vrms Between open contacts: 1500 Vrms	Contact to coil: 2500 Vrms Between open contacts: 1500 Vrms	Contact to coil: 2500 Vrms Between open contacts: 1500 Vrms	Contact coil: 750 Vrms Between open contacts: 750 Vrms
<b>TYPICAL LIFE</b>	<b>Electrical</b>	1 x 10 <sup>5</sup> operations at rated load	1 x 10 <sup>5</sup> operations at rated load	1 x 10 <sup>5</sup> operations at rated load	1 x 10 <sup>5</sup> operations at rated load	1 x 10 <sup>5</sup> operations at rated load	1 x 10 <sup>5</sup> operations at rated load
	<b>Mechanical</b>	1 x 10 <sup>8</sup> operations	1 x 10 <sup>7</sup> operations	1 x 10 <sup>7</sup> operations	1 x 10 <sup>7</sup> operations	1 x 10 <sup>7</sup> operations	1 x 10 <sup>7</sup> operations
<b>SIZE IN INCHES L x W x H</b>		AZ975: 0.630 x 0.520 x 0.709 AZ976: 0.697 x 0.598 x 0.775	1.27 x 0.97 x 1.10	1.126 x 0.933 x 0.588	1.25 x 1.06 x 0.751	1.980 x 1.080 x 1.090	1.02 x 1.102 x 0.984
<b>TERMINALS</b>	<b>PC</b>	X	X	X	X	—	—
	<b>Solder/Plug-in</b>	—	Quick-Connects	—	—	Quick-Connects	Quick-Connects
	<b>Bracket Mount</b>	—	—	—	—	X	X
<b>APPROVAL</b>		—	UL/CUR	UL/CUR	UL/CUR	UL/CUR	—



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- ▶ **Triggered Interval (one-shot)**
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# FLASHERS & TIMING CONTROLS

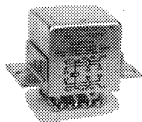
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FUNCTION	SERIES	INPUT VOLTAGE	CONTACT	TIMING RANGE	FEATURES	PACKAGE
<b>DELAY-ON-MAKE</b> (NORMALLY OPEN)	B	5-120 AC/DC	1 FORM A OR B; 3 AMP	2 SEC - 300 SECS	THERMAL	MINIATURE
	C	5-120 AC/DC	1 FORM A, B. OR C; 1 AMP	0.1 SEC - 300 SECS	SOLID STATE ANALOG HYBRID	MINIATURE
	C10	12-240 AC/DC	2 FORM C; 10 AMP	0.1 SEC - 480 SECS	SOLID STATE ANALOG HYBRID	OCTAL
	DC10	12-240 AC/DC	2 FORM C; 10 AMP	0.1 SEC - 60 HOURS	SOLID STATE DIGITAL HYBRID	OCTAL
	G	6-115 AC/DC	1 FORM A; 3 AMP	1 SEC - 300 SECS	HERMETICALLY SEALED GLASS TUBE	OCTAL/MINIATURE
	ST1	12-240 AC/DC	1 FORM A; 1 AMP	0.1 SEC - 100 HOURS	SOLID STATE DIGITAL	HOCKEY PUCK
	SWDC	12-240 AC/DC	2 FORM C; 10 AMP	0.1 SEC - 2.8 HOURS	DIGITAL SET	OCTAL
	SWPDC	12-240 AC/DC	2 FORM C; 10 AMP	0.1 SEC - 160 HOURS	SOLID STATE DIGITAL HYBRID	OCTAL
	SWUDC	12-120 AC/DC	2 FORM C; 10 AMP	0.1 SEC - 77.5 HOURS	SOLID STATE DIGITAL HYBRID	OCTAL
<b>DELAY-ON-RELEASE</b> (FORM A, B or C CONTACTS)	BR	5-120 AC/DC	1 FORM A OR B 3 AMP	10 SEC - 600 SECS	THERMAL	MINIATURE
	C	5-120 AC/DC	1 FORM A, B. OR C; 1 AMP	0.1 SEC - 300 SECS	SOLID STATE ANALOG HYBRID	MINIATURE
	C10	12-120 AC/DC	2 FORM C; 10 AMP	0.1 SEC - 480 SECS	SOLID STATE ANALOG HYBRID	OCTAL
	DC10	12-120 AC/DC	2 FORM C; 10 AMP	0.1 SEC - 60 HOURS	SOLID STATE DIGITAL HYBRID	OCTAL
	G	6-115 AC/DC	1 FORM A; 3 AMP	1 SEC - 300 SECS	HERMETICALLY SEALED GLASS TUBE	OCTAL/MINIATURE
	SWDC	12-120 AC/DC	2 FORM C; 10 AMP	0.1 SEC - 2.8 HOURS	DIGITAL SET	OCTAL
	SWUDC	12-120 AC/DC	2 FORM C; 10 AMP	0.1 SEC - 77.5 HOURS	SOLID STATE DIGITAL HYBRID	OCTAL
<b>TRIGGERED</b> DELAY-ON-RELEASE (FORM A, B or C CONTACTS)	CR	5-120 AC/DC	1 FORM A, B. OR C; 1 AMP	1 SEC - 600 SECS	SOLID STATE ANALOG HYBRID	MINIATURE
	CR10	12-120 AC/DC	2 FORM C; 10 AMP	0.1 SEC - 600 SECS	SOLID STATE ANALOG HYBRID	OCTAL
	DCR10	12-120 AC/DC	2 FORM C; 10 AMP	0.1 SEC - 60 HOURS	SOLID STATE DIGITAL HYBRID	OCTAL
	SWUDC	12-120 AC/DC	2 FORM C; 10 AMP	0.1 SEC - 77.5 HOURS	SOLID STATE DIGITAL HYBRID	OCTAL
<b>DELAY-ON-DROPOUT</b> (TRUE OFF-DELAY)	DOD	12-120 AC/DC	2 FORM C; 4 AMP	0.1 SEC - 300 SECS	SOLID STATE ANALOG HYBRID	OCTAL
<b>INTERVAL</b> (ONE-SHOT, NORMALLY OPEN)	CI	12-120 AC/DC	2 FORM C; 10 AMP	0.1 SEC - 600 SECS	SOLID STATE ANALOG HYBRID	OCTAL
	SWUDC	12-120 AC/DC	2 FORM C; 10 AMP	0.1 SEC - 77.5 HOURS	SOLID STATE DIGITAL HYBRID	OCTAL
<b>TRIGGERED INTERVAL</b> (ONE-SHOT, NORMALLY OPEN)	CIR	12-120 AC/DC	2 FORM C; 10 AMP	0.1 SEC - 480 SECS	SOLID STATE ANALOG HYBRID	OCTAL
	SWUDC	12-120 AC/DC	2 FORM C; 10 AMP	0.1 SEC - 77.5 HOURS	SOLID STATE DIGITAL HYBRID	OCTAL
<b>RECYCLING</b> (FLASHER)	BF	5-120 AC/DC	1 FORM B; 3 AMP	10 - 60 FPM	THERMAL	MINIATURE
	D	6-120 AC/DC	1 FORM A; 2 AMP	2 - 1000 FPM	SOLID STATE ANALOG	MINIATURE
	DF	12-120 AC/DC	1 FORM A; 2 AMP	2 - 1000 FPM	SOLID STATE ANALOG	MINIATURE
	DF10	12-120 AC/DC	2 FORM C; 10 AMP	10 - 240 FPM	SOLID STATE ANALOG	OCTAL
	DFA	12-120 AC/DC	2 FORM C; 10 AMP	0.1 SECS - 240 HRS	SOLID STATE DIGITAL HYBRID	OCTAL
	DFS	12-120 AC/DC	1 FORM A; 3 OR 12 AMP	1 - 1000 FPM	SOLID STATE ANALOG	HOCKEY PUCK
	DFV	12-120 AC/DC	2 FORM C; 10 AMP	1 - 240 FPM	SOLID STATE ANALOG HYBRID	OCTAL
	DFW	12-24 DC	2 FORM A; 15 AMP	10 - 120 FPM	SOLID STATE ANALOG HYBRID	AUTOMOTIVE
	DFWS	12-120 AC/DC	2 FORM A; 10 AMP	1 - 1000 FPM	ALTERNATING FLASHER	AUTOMOTIVE
	GF	6-115 AC/DC	1 FORM B; 0.5 AMP	10-90 FPM	HERMETICALLY SEALED GLASS TUBE	OCTAL/MINIATURE
	STOP-ALERT	12V DC	1 FORM B; 5 AMP	300 FPM 85% DUTY CYCLE	SOLID STATE ANALOG	MINIATURE
	<b>THERMAL SWITCH</b>	TSW	12-120 AC/DC	1 FORM C; 1 AMP	N.A.	THERMAL CUT-OUT SWITCH

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# BABCOCK



RELAYS · CONTACTORS · REMOTE POWER CONTROLLERS

SERIES	Type	Size in Inches	Contact Form	Contact Rating	Coil Voltage	Operate Power @ Pickup	MIL Spec Type
BR5	Relay	.405x.205x.605	1 Form C	Low Level to 1A	12-26 VDC	100 mW	MIL-R-5757
BR44	Relay	.500x.235x.405	2 Form C	Low Level to 1A	6-26 VDC	100 mW	MIL-R-39016
BR8	Relay	.790x.360x.1.190	2 Form C	Low Level to 2A	6-26 VDC, 115 VDC	250 or 150 mW	MIL-R-5757
BR150	Relay	.610x.610x.320	4 Form C	Low Level to 2A	6-36 VDC	250 mW	* MIL-R-39016
BR16	Relay	.810x.400x.410	2 Form C	Low Level to 2A	6-48 VDC	175 mW	MIL-R-39016
BR17	Relay *	.810x.410x.400	* 2 Form C	Low Level to 2A	6-26 VDC	175 or 90 mW	MIL-R-39016
BR26	Relay	.810x.400x.410	2 Form C	Low Level to 2A	6-26 VDC	250 mW	MIL-R-39016
BR42	Relay	.810x.400x.410	2 Form C	Low Level to 2A	6-26 VDC	100 mW	MIL-R-39016
BR13	Relay	.810x.410.1.290	2 Form C	Low Level to 5A	6-26 VDC, 115 VDC	250/100/40 mW	MIL-R-39016
BR15	Relay	1.075x1.000x1.300	4 Form C	Low Level to 10A	6-26VDC, 115VD/AC	1000/500/400 mW	MIL-R-39016
BR19	Relay	1.075x.515x1.300	2 Form C	Low Level to 10A	6-48VDC, 115VD/AC	500 or 175 mW	MIL-R-39016
BR20	Relay *	1.075x.515x1.300	* 2 Form C	Low Level to 10A	6-48 VDC, 115 VDC	250 or 130 mW	MIL-R-39016
BR23	Relay *	1.075x1.000x1.300	* 4 Form C	Low Level to 10A	6-48 VDC, 115 VDC	500 or 250 mW	MIL-R-39016
BR24	Relay	1.015x.515x.885	2 Form C	Low Level to 10A	6-26 VDC	400 mW	MIL-R-39016
BR230	Relay	1.025x1.025x1.010	4 Form C	Low Level to 10A	6-48 VDC, 115 VAC	500 mW	* MIL-R-83536
BR231	Relay *	1.025x1.025x1.010	* 4 Form C	Low Level to 10A	6-48 VDC, 115 VAC	500 mW	* MIL-R-83536
BR246	Relay	1.025x.525x1.125	2 Form C	Low Level to 10A	6-48 VDC, 115 VAC	500 mW	* MIL-R-83536
BR247	Relay *	1.025x.525x1.125	* 2 Form C	Low Level to 10A	6-48 VDC, 115 VAC	500 mW	* MIL-R-83536
BR235	Relay	1.025x1.025x1.010	3 Form C	Low Level to 25A	6-48 VDC, 115 VAC	500 mW	* MIL-R-6106
BR236	Relay *	1.025x1.025x1.010	* 3 Form C	Low Level to 25A	6-48 VDC, 115 VAC	500 mW	* MIL-R-6106
BR237	Relay *	1.025x1.025x1.010	*3 Form A/1 Form C	Low Level to 25A	6-48 VDC, 115 VAC	500 mW	MIL-R-6106
BR238	Relay	1.025x1.025x1.010	3 Form A/1 Form C	Low Level to 25A	6-48 VDC, 115 VAC	500 mW	MIL-R-6106
BR250	Relay	1.025x.525x1.010	1 Form C	Low Level to 25A	6-48 VDC, 115 VAC	500 mW	* MIL-R-6106
BR251	Relay *	1.025x.525x1.010	* 1 Form C	Low Level to 25A	6-48 VDC, 115 VAC	500 mW	* MIL-R-6106
613	Contactors	3.300x1.600x2.390	1 Form C	50A	115 VAC	2.42 W	MIL-R-6106
614	Contactors	3.300x1.600x2.690	1 Form C	50A	28 VDC	1.23 W	MIL-R-6106
630	Contactors	3.300x1.600x2.390	1 Form C	50A	115 VAC	2.42 W	MIL-R-6106
612	Contactors	3.290x1.600x2.700	1 Form X	100A	28 VDC	1.23 W	MIL-R-6106
619	Contactors	3.300x2.310x2.980	1 Form C	100A	28 VDC	1.52 W	MIL-R-6106
631	Contactors	3.800x3.250x2.880	1 Form X	100A - 200A	28 VDC, 115 VAC	1.5 W	MIL-R-6106
708	I Sensor	2.130x1.600x3.250	2 Form C	2A	N/A	N/A	N/A
710	RPC	3.800x3.250x4.230	1 Form X	200A	28 VDC	1.5 W	MIL-R-6106
702	RPC	4.260x1.200x3.250	1 Form X	Up to 200A	28 VDC, 115 VAC	N/A	MIL-R-83383
703	RPC	4.260x3.690x2.250	3 Form X	Up to 100A	115 VAC	N/A	MIL-R-83383

\* = Latching

\* = QPL Listed

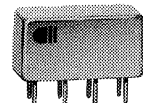
**CONSULT THE FACTORY FOR:**

- Other ratings
  - Terminal styles
  - Coil suppression & options
  - Mounting Configurations
  - Applications requiring higher shock and vibration
  - Ultra-High Reliability (Space Level)
- Specifications contained herein are subject to change without notice.

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# High Performance Relays

	HFW • HFW4A & 5A • 3SAV*	HMB • 3SAV*	HMS • 3SAV*	C
				
	<b>Standard Half Size</b>	<b>Bifilar Half Size</b>	<b>Sensitive Half Size</b>	<b>Single Pole Half Size</b>
	MIL-R-39016/6 & 55 QUALIFIED	MIL-R-39016/22 QUALIFIED	MIL-R-39016/44 QUALIFIED	DESIGNED TO MIL-R-39016
FEATURES	2 Form C	2 Form C	2 Form C	1 Form C
	5 to 56 Vdc	6 to 26.5 Vdc	5 to 36 Vdc	6 to 26.5 Vdc
	Up to 5 amps switching	Up to 2 amps switching	Up to 2 amps switching	Up to 10 amps switching
	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Optional terminals / diode</li> <li>• Optional mounting styles</li> <li>• Excellent RF switching</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> <li>• Excellent RF switching</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> <li>• Excellent RF switching</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> </ul>
	RATE COIL CNFG.			
	LS • LR	SS • SR	MFW	2G • 3SBC*
				
	<b>Latching Half Size</b>	<b>4 &amp; 6 Pole Half Size</b>	<b>1/6 Size</b>	<b>1/5 Size</b>
	DESIGNED TO MIL-R-39016/45 (LS)	MIL-R-39016/40 QUALIFIED (SR)	MIL-R-39016/34 QUALIFIED	M39016/13, 37 & 38 QUALIFIED
FEATURES	2 Form C (LS) 4 Form C (LR)	4 Form C (SR) 6 Form C (SS)	2 Form C	2 Form C
	5 to 48 Vdc	6 to 26.5 Vdc	3.5 to 53 Vdc	5 to 36 Vdc
	Up to 2 amps switching	Up to 2 amps switching	Up to 1 amp switching	Up to 2 amps switching
	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> <li>• Hi-density latching design</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> <li>• Hi-density design</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• Compact size</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> <li>• Excellent RF switching</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Optional / flexible terminals</li> <li>• Optional mounting styles</li> <li>• Optional diode / dual diode</li> </ul>
	RATE COIL CNFG.			
	3SBH*	3SBM*	3SCM*	3SCP*
				
	<b>4 Pole 1/5 Size</b>	<b>4 Pole 1/5 Size Latching</b>	<b>1/10 Size Sensitive Latching</b>	<b>1/10 Size Sensitive</b>
	M39016/14, 53 & 54 QUALIFIED	M39016/31, 35 & 36 QUALIFIED	MIL-R-39016/47 QUALIFIED	MIL-R-39016/48 QUALIFIED
FEATURES	4 Form C	4 Form C	2 Form C	2 Form C
	4 to 46 Vdc	2 to 63 Vdc	5 to 24 Vdc	5 to 26.5 Vdc
	Up to 2 amps switching	Up to 2 amps switching	Up to 0.5 amp switching	Up to 0.5 amp switching
	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> <li>• Optional diode / dual diode</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> <li>• Optional diode / dual diode</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• DIP terminals</li> <li>• Lightweight</li> <li>• Sensitive pulse operated</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• DIP terminals</li> <li>• Lightweight</li> <li>• 68 milliwatt sensitivity</li> </ul>
	RATE COIL CNFG.			

WORLDWIDE LEADER IN HIGH PERFORMANCE SWITCHING TECHNOLOGY <sup>SM</sup>

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# High Performance Relays

FW • FW5A • 3SAF* • 3SBK* SF • SF5A • 3SAT* • 3SBF*		3SAE* • 3SAC*		07	
					
Standard Full Size		Tall Full Size		"S" Header Crystal Can	10 Amp Full Size
M5757/10 QUALIFIED (FW)		DESIGNED TO MIL-R-5757/13		DESIGNED TO MIL-R-5757	M5757/23, MS27245 & MS27247
2 Form C		2 Form C		2 Form C	2 Form C
6.3 to 110 Vdc		1.8 to 40 Vdc		3.9 to 76 Vdc	6 to 120 Vdc, 115 Vac
Up to 5 amps switching		Up to 5 amps switching		Up to 2 amps switching	Up to 10 amps switching
<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> <li>• Excellent RF switching</li> </ul>		<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> <li>• 40mW &amp; 80mW sensitivity</li> </ul>		<ul style="list-style-type: none"> <li>• Small, lightweight design</li> <li>• High shock &amp; vibration ratings</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> <li>• 200mW &amp; 300mW sensitivity</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> <li>• DC, AC &amp; diode-suppressed coils</li> </ul>
RH		3SDM* • 3SAM*		RD • 02 • 03	RFK • RFB • 3SAV*
					
4 Pole Full Size		2 Amp Latching		2, 4 & 6 Pole	Half & Full Size RF Coaxial
DESIGNED TO MIL-R-39016/39		DSGN. TO MIL-R-39016/32 (3SAM)		M5757/1, 7 & 8 QUALIFIED	DESIGNED TO M5757 & M39016/33
4 Form C		2 Form C		02 : 2 Form C, RD4 : 4 Form C RD6 & 03 : 6 Form C	2 Form C Coax or 1 Form C Coax & 1 Form C auxiliary contacts
6 to 26.5 Vdc		6 to 24 Vdc		6 to 26.5 Vdc	4.8 to 56 Vdc
Up to 2 amps switching		Up to 2 amps switching		Up to 2 amps switching	Up to 2 amps switching
<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• Low contact resistance</li> <li>• Compact 4 pole design</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> </ul>		<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• No hang up feature</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> <li>• Special contact / coil available</li> </ul>		<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• Multi-pole configurations</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• Form A, B &amp; C models available</li> <li>• Optional terminals &amp; mtg. styles</li> <li>• Excellent RF switching</li> <li>• Optional 50/75 ohm coax. cables</li> </ul>
MA • 3SBS* • 1MA		MAD • 3SBS* • 1MAD		MADD • 3SBS* • 1MADD	MAT • 1MAT
					
Standard TO-5		Standard Diode TO-5		Standard Dual Diode TO-5	Standard Transistor TO-5
MIL-R-39016/7 & 9 QUALIFIED		MIL-R-39016/15 & 23 QUALIFIED		MIL-R-39016/20 & 24 QUALIFIED	MIL-R-28776/1 & 5 QUALIFIED
2 Form C (MA, 3SBS) 1 Form C (1MA)		2 Form C (MAD, 3SBS) 1 Form C (1MAD)		2 Form C (MADD, 3SBS) 1 Form C (1MADD)	2 Form C (MAT) 1 Form C (1MAT)
5 to 30 Vdc		5 to 30 Vdc		5 to 26.5 Vdc	5 to 26.5 Vdc
Up to 1 amp switching		Up to 1 amp switching		Up to 1 amp switching	Up to 1 amp switching
<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Spreader pads</li> <li>• Excellent RF switching</li> </ul>		<ul style="list-style-type: none"> <li>• Suppression diode</li> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Spreader pads</li> <li>• Excellent RF switching</li> </ul>		<ul style="list-style-type: none"> <li>• Suppression &amp; protection diodes</li> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Spreader pads</li> <li>• Excellent RF switching</li> </ul>	<ul style="list-style-type: none"> <li>• Transistor driver &amp; sup. diode</li> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Spreader pads</li> <li>• Excellent RF switching</li> </ul>

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# High Performance Relays

	MS • 1MS	MSD • 1MSD	MSDD • 1MSDD	MST • 1MST
RATE COIL CNFG.	 <b>Sensitive TO-5</b>	 <b>Sensitive Diode TO-5</b>	 <b>Sensitive Dual Diode TO-5</b>	 <b>Sensitive Transistor TO-5</b>
	MIL-R-39016/10 & 11 QUALIFIED	MIL-R-39016/16 & 25 QUALIFIED	MIL-R-39016/21 & 26 QUALIFIED	MIL-R-28776/3 & 4 QUALIFIED
	2 Form C (MS) 1 Form C (1MS)	2 Form C (MSD) 1 Form C (1MSD)	2 Form C (MSDD) 1 Form C (1MSDD)	2 Form C (MST) 1 Form C (1MST)
	5 to 48 Vdc	5 to 48 Vdc	5 to 48 Vdc	5 to 48 Vdc
FEATURES	Up to 1 amp switching	Up to 1 amp switching	Up to 1 amp switching	Up to 1 amp switching
	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Spreader pads</li> <li>• Excellent RF switching</li> </ul>	<ul style="list-style-type: none"> <li>• Suppression diode</li> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Spreader pads</li> <li>• Excellent RF switching</li> </ul>	<ul style="list-style-type: none"> <li>• Suppression &amp; protection diodes</li> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Spreader pads</li> <li>• Excellent RF switching</li> </ul>	<ul style="list-style-type: none"> <li>• Transistor driver &amp; sup. diode</li> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Spreader pads</li> <li>• Excellent RF switching</li> </ul>
	MGA • MGAD	MGADD	MGAT	SMGA • SMGAD • SMGADD
	 <b>Standard .100 Grid</b>	 <b>Standard Dual Diode .100 Grid</b>	 <b>Standard MOSFET .100 Grid</b>	 <b>Std .100 Grid Surface Mount</b>
MIL-R-39016/17 & 18 QUALIFIED	MIL-R-39016/19 QUALIFIED	MIL-R-28776/6 QUALIFIED	DESIGNED TO M39016/17, 18 & 19	
2 Form C	2 Form C	2 Form C	2 Form C	
5 to 26.5 Vdc	5 to 26.5 Vdc	5 to 26.5 Vdc	5 to 26.5 Vdc	
Up to 1 amp switching	Up to 1 amp switching	Up to 1 amp switching	Up to 1 amp switching	
<ul style="list-style-type: none"> <li>• Suppression diode (MGAD)</li> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Mounting pads</li> <li>• Excellent RF switching</li> </ul>	<ul style="list-style-type: none"> <li>• Suppression &amp; protection diodes</li> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Mounting pads</li> <li>• Excellent RF switching</li> </ul>	<ul style="list-style-type: none"> <li>• MOSFET, zener &amp; sup. diodes</li> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Mounting pads</li> <li>• Excellent RF switching</li> </ul>	<ul style="list-style-type: none"> <li>• Suppression diode (SMGAD)</li> <li>• Dual diodes (SMGADD)</li> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Excellent RF switching</li> </ul>	
MGS • MGSD	MGSDD	MGST	SMGS • SMGSD • SMGSDD	
 <b>Sensitive .100 Grid</b>	 <b>Sensitive Dual Diode .100 Grid</b>	 <b>Sensitive MOSFET .100 Grid</b>	 <b>Sens .100 Grid Surface Mount</b>	
MIL-R-39016/41 & 42 QUALIFIED	MIL-R-39016/43 QUALIFIED	MIL-R-28776/7 QUALIFIED	DESIGNED TO M39016/41, 42 & 43	
2 Form C	2 Form C	2 Form C	2 Form C	
5 to 48 Vdc	5 to 48 Vdc	5 to 26.5 Vdc	5 to 48 Vdc	
Up to 1 amp switching	Up to 1 amp switching	Up to 1 amp switching	Up to 1 amp switching	
<ul style="list-style-type: none"> <li>• Suppression diode (MGSD)</li> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Mounting pads</li> <li>• Excellent RF switching</li> </ul>	<ul style="list-style-type: none"> <li>• Suppression &amp; protection diodes</li> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Mounting pads</li> <li>• Excellent RF switching</li> </ul>	<ul style="list-style-type: none"> <li>• MOSFET, zener &amp; sup. diodes</li> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Mounting pads</li> <li>• Excellent RF switching</li> </ul>	<ul style="list-style-type: none"> <li>• Suppression diode (SMGSD)</li> <li>• Dual diodes (SMGSDD)</li> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Excellent RF switching</li> </ul>	

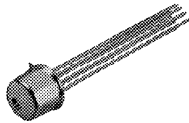
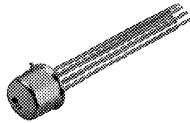
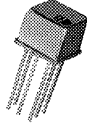
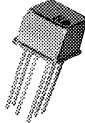
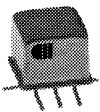
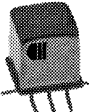
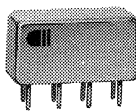
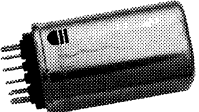
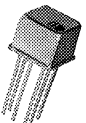
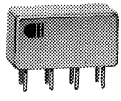
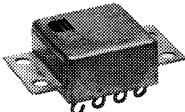
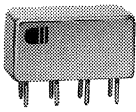
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# Commercial / Industrial Relays

	HM • HMD	HS • HSD	HC • HCD	HCS • HCSD
				
	<b>Standard TO-5</b>	<b>Sensitive TO-5</b>	<b>Standard .100 Grid</b>	<b>Sensitive .100 Grid</b>
	COMMERCIAL / INDUSTRIAL	COMMERCIAL / INDUSTRIAL	COMMERCIAL / INDUSTRIAL	COMMERCIAL / INDUSTRIAL
FEATURES RATE COIL CNFG	2 Form C	2 Form C	2 Form C	2 Form C
	5 to 30 Vdc	5 to 48 Vdc	5 to 26.5 Vdc	5 to 48 Vdc
	Up to 1 amp switching	Up to 1 amp switching	Up to 1 amp switching	Up to 1 amp switching
	<ul style="list-style-type: none"> <li>• Suppression diode (HMD)</li> <li>• Hermetically sealed</li> <li>• Spreader pads</li> <li>• Excellent RF switching</li> </ul>	<ul style="list-style-type: none"> <li>• Suppression diode (HSD)</li> <li>• Hermetically sealed</li> <li>• Spreader pads</li> <li>• Excellent RF switching</li> <li>• 90mW sensitivity</li> </ul>	<ul style="list-style-type: none"> <li>• Suppression diode (HCD)</li> <li>• Hermetically sealed</li> <li>• Spreader pads</li> <li>• Excellent RF switching</li> </ul>	<ul style="list-style-type: none"> <li>• Suppression diode (HCSD)</li> <li>• Hermetically sealed</li> <li>• Spreader pads</li> <li>• Excellent RF switching</li> <li>• 90mW sensitivity</li> </ul>
	SHC • SHCD	SHCS • SHCSD	HFC • HFC4A & 5A	3SAA* • 3SCA*
				
	<b>Std .100 Grid Surface Mount</b>	<b>Sens .100 Grid Surface Mount</b>	<b>Standard Half Size</b>	<b>Miniature Industrial / Power</b>
	COMMERCIAL / INDUSTRIAL	COMMERCIAL / INDUSTRIAL	COMMERCIAL / INDUSTRIAL	COMMERCIAL / INDUSTRIAL
FEATURES RATE COIL CNFG	2 Form C	2 Form C	2 Form C	1 Pole to 6 Pole
	5 to 26.5 Vdc	5 to 48 Vdc	5 to 26.5 Vdc	0.9 to 265 Vdc
	Up to 1 amp switching	Up to 1 amp switching	Up to 5 amps switching	Up to 10 amps switching
	<ul style="list-style-type: none"> <li>• Suppression diode (SHCD)</li> <li>• Hermetically sealed</li> <li>• Mounting pads</li> <li>• Excellent RF switching</li> </ul>	<ul style="list-style-type: none"> <li>• Suppression diode (SHCSD)</li> <li>• Hermetically sealed</li> <li>• Mounting pads</li> <li>• Excellent RF switching</li> <li>• 90mW sensitivity</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• Economic configuration</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• Multi-contact arrangement</li> <li>• Optional terminals (3SAA)</li> <li>• Optional mounting styles</li> <li>• Optional 115 Vac Coil</li> </ul>
	3SDS*	3SCC*	3SDH*	3SCV*
				
	<b>Long Life TO-5 Relay</b>	<b>Long Life 1/5 Size</b>	<b>Long Life 4 Pole 1/5 Size</b>	<b>Long Life Half Size</b>
	COMMERCIAL / INDUSTRIAL	COMMERCIAL / INDUSTRIAL	COMMERCIAL / INDUSTRIAL	COMMERCIAL / INDUSTRIAL
FEATURES RATE COIL CNFG	2 Form C	2 Form C	4 Form C	2 Form C
	3.5 to 35 Vdc	5 to 48 Vdc	4 to 46 Vdc	5 to 56 Vdc
	Up to 1 amp switching	Up to 2 amps switching	Up to 2 amps switching	Up to 2 amps switching
	<ul style="list-style-type: none"> <li>• Suppression &amp; protection diodes</li> <li>• Hermetically sealed</li> <li>• Low contact resistance</li> <li>• Excellent RF switching</li> <li>• 50,000,000 ops @ low levels</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High reliability</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> <li>• 100,000,000 ops @ low levels</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High shock &amp; vibration ratings</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> <li>• 100,000,000 ops @ low levels</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High reliability</li> <li>• Optional terminals</li> <li>• Optional mounting styles</li> <li>• 100,000,000 ops @ low levels</li> </ul>

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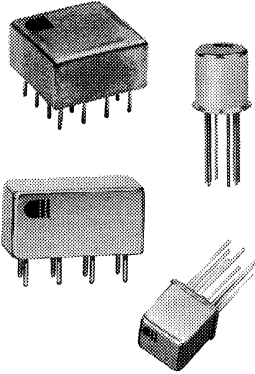
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# Hi-Rel Space Relays

HIGH RELIABILITY	PRODUCTS	SERVICES	FEATURES
	<ul style="list-style-type: none"> <li>• <b>Half Size Non-Latching*</b> 1, 2, 4 &amp; 6 Form C config's, Low level to 10 amps switching</li> <li>• <b>Half Size Latching*</b> 2 and 4 Form C configurations, Low level to 2 amps switching</li> <li>• <b>1/5th Size Non-Latching*</b> 2 and 4 Form C configuration, Low level to 2 amps switching</li> <li>• <b>1/5th Size Latching*</b> 4 Form C, Low level to 2 amps switching</li> <li>• <b>TO-5/100 Grid*</b> 2 Form C, round and square outlines, Low level to 1 amp switching</li> </ul>	<ul style="list-style-type: none"> <li>• Precision cleaning</li> <li>• Small particle inspection</li> <li>• Particle impact noise detection</li> <li>• Serialized test data</li> <li>• High shock / Vibration testing</li> <li>• X-Ray testing</li> <li>• Qualification testing</li> <li>• Additional testing per customer requirements</li> </ul>	<ul style="list-style-type: none"> <li>• High shock ratings</li> <li>• High vibration ratings</li> <li>• Latching versions</li> <li>• Class 100 Clean room</li> <li>• Welded assemblies</li> </ul>
			<b>APPLICATIONS</b>
			<ul style="list-style-type: none"> <li>• Space satellites (telecommunications)</li> <li>• Weather tracking</li> <li>• Surveillance</li> <li>• Infrared observation instrumentation</li> <li>• Missile systems</li> <li>• Torpedo guidance circuits</li> </ul>

## High Performance Electronic Products

	DS11 SERIES	TS SERIES	JDS9-1Y	JPS10 SERIES
	 <p><b>COTS</b> Version Available</p> <p><b>2 Amp Solid State</b></p>	 <p><b>COTS</b> Version Available</p> <p><b>50 to 250 mA Solid State</b></p>	 <p><b>COTS</b> Version Available</p> <p><b>2 Amp Solid State</b></p>	 <p><b>COTS</b> Version Available</p> <p><b>25 Amp Solid State</b></p>
	DESC 86062 QUALIFIED	MEETS MIL-R-28750/5, 6 & 7	MIL-R-28750/9 QUALIFIED	MIL-R-28750/10 QUALIFIED
OUTPUT VOLT	60 Vdc	40 Vac or Vdc (TS5-1Y), 40 Vdc (TS6-1Y) & 250 Vdc (TS7-1Y)	250 Vrms	250 Vrms
CURR	2 Adc	50 mAac or mAdc (TS5-1Y), 250 mAac (TS6-1Y) & 100 mAac (TS7-1Y)	2 Arms	25 Arms
FEATURES	<ul style="list-style-type: none"> <li>• Hermetically sealed DIP pkg</li> <li>• Thick film hybrid construction</li> <li>• Optically isolated</li> <li>• Low on-resistance (MOSFET output)</li> <li>• Optional : Switch status, short circuit protection, trip status</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed TO-5 pkg</li> <li>• Transformer coupled</li> <li>• High speed switching</li> <li>• Low on-resistance (TS5-1Y)</li> <li>• TS5-1Y switches AC or DC</li> <li>• TTL compatible input (TS6-1Y &amp; TS7-1Y)</li> </ul>	<ul style="list-style-type: none"> <li>• Hermetically sealed DIP pkg</li> <li>• Thick film hybrid construction</li> <li>• Optically isolated</li> <li>• Zero voltage turn-on</li> <li>• High transient immunity</li> <li>• 3.8 to 32 Vdc current regulated input</li> </ul>	<ul style="list-style-type: none"> <li>• Rugged encapsulated module</li> <li>• Optically isolated</li> <li>• Zero voltage turn-on</li> <li>• High transient immunity</li> <li>• 3.8 to 32 Vdc current regulated input</li> </ul>
	PS12-1Y	TIMERS	TIMERS	SENSORS
	 <p><b>COTS</b> Version Available</p> <p><b>10 Amp Solid State</b></p>			
	DESC 86031 QUALIFIED	RELAY OUTPUT	SOLID STATE OUTPUT	VOLTAGE, FREQUENCY & PHASE
OUTPUT VOLT	250 Vrms	<ul style="list-style-type: none"> <li>• <b>1600/1700 Series</b> Delay on operate, Adjustable or fixed AC or DC input, Optional mtg. styles</li> <li>• <b>4600/4700 Series</b> Interval timers, Adjustable or fixed, AC or DC input, Optional mtg. styles</li> <li>• <b>5600/5700 Series</b> Delay on release, Adjustable or fixed, Optional mounting styles</li> <li>• <b>2400 Series</b> Delay on operate, miniature package, fixed, Optional mounting styles</li> </ul>	<ul style="list-style-type: none"> <li>• <b>1800/1900 Series</b> Delay on operate, Adjustable or fixed Optional mounting styles</li> <li>• <b>4800 Series</b> Interval timers, fixed time delay, Optional mounting styles</li> <li>• <b>6001/6155 Series</b> Delay on operate, fixed time delay, 14 pin metal DIP, thick film hybrid, meets MIL-R-83726/13</li> </ul>	<ul style="list-style-type: none"> <li>• <b>1300/1350 Series</b> Voltage sensors, DC and AC input, Optional mounting styles</li> <li>• <b>7000 Series</b> Frequency sensors, 50 to 440 Hz, digital logic design, Optional mounting styles</li> <li>• <b>1400 Series</b> Phase sensors, 60 or 400 Hz, Optional mounting styles</li> </ul>
CURR	10 Arms			
FEATURES	<ul style="list-style-type: none"> <li>• Rugged encapsulated module</li> <li>• Optically isolated</li> <li>• Zero voltage turn-on</li> <li>• High transient immunity</li> <li>• 3.8 to 32 Vdc current regulated input</li> </ul>			

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\* Includes products formerly manufactured by Genicom Corporation Relays Division

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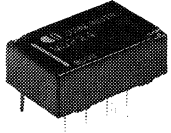
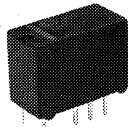
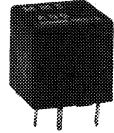
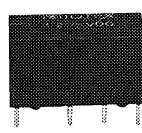





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# Low Level Relays

	<b>MQS</b>	<b>MQP</b>	<b>MN</b>	<b>MM</b>	<b>MDX/S</b>
Series					
Features	1 A micro-miniature bifurcated contacts surface mount Meets FCC part 68	1 A micro-miniature bifurcated contacts latching/non-latching Meets FCC part 68	1 A micro-miniature bifurcated contacts Meets belcore 2500V Meets FCC part 68	2 A micro-miniature bifurcated contacts Meets FCC part 68 low RF	2 A micro-miniature bifurcated contacts 16 pin DIP pinout Meets FCC part 68
Agency Approvals					
Contact Arrangement	2 Form C	2 Form C	2 Form C	2 Form C or A 1 Form C or A	2 Form C
Contact Material	Gold clad silver pd/silver pd alloy	Gold clad silver pd/silver pd alloy	Gold clad silver	Gold clad silver pd	Gold clad silver pd
Max Contact Ratings	1A@30 VDC 0.5A@125VAC	1A@30VDC 0.5A@125VADC	1A@30VDC 0.5A@120VAC	2A@24VDC 1A@120VAC	1A@24VDC 0.5A@120VAC
Initial C.R.	50 m ohms	50 m ohms	50 m ohms	100 m ohms	50 m ohms
Can Voltage	3-24 VDC	3-24 VDC	3-48 VDC	3-24 VDC	3-48 VDC
Can Power Consumption	Latch: 100-300mW Nonlatch: 140-200mW	Latch: 100-300mW Nonlatch: 140-200mW	Latch: 100-300mW Nonlatch: 140-200mW	200-330mW	150-560mW
Dielectric Strength	1000 VAC (all points) meets FCC part 68	1000 VAC (all points) meets FCC part 68	1000 VAC (contacts, pole-pole) 1500 VAC (all other) meets belcore 2500V meets FCC part 68	500VAC (all points) Meets FCC part 68	1000VAC (all points) Meets FCC part 68
Life (Operations)	100 million mech. 200k @ 1A 30VDC 100k @ 0.5 A 125VAC	100 million mech. 200k @ 1A/30VDC 100k @ 0.5 A/125VAC	100 million mech. 300k @ 1A/30VDC 200k @ 0.5 A/120VAC	100 million mech. 100k@rated load	100 million mech. 500k@1A/24VDC 200k@0.5A/120VAC
Physical Dimensions (W x H x D)	.559"x.366"x.209" (14.2x9.3x5.3mm)	.551"x.354"x.197" (14x9x5mm)	.591"x.295"x.433" (15x7.5x11mm)	.410"x.410"x.428" (10.4x10.4x10.87mm)	.795"x.394"x.472" (20.2x10x12mm)
Terminations	PCB	PCB	PCB	PCB	PCB
Sealed	Yes	Yes	Yes	Yes	Yes
Options		Latching (1or 2 coils)	Latching (1or 2 coils)	1or 2 pole Form A & Form C	MDX: Std. sensitivity MDS: Ultra. sensitive

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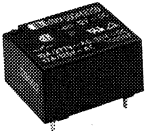

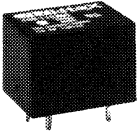
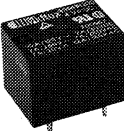
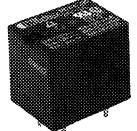





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Low Level Relays		PC Board Power Relays			
Series	191	MS	498	502	590
Features	1 A sub-miniature bifurcated contacts Meets FCC part 68	2 A sub-miniature bifurcated contacts Meets FCC part 68	20 A miniature power PCB VDE Spacing High Dielectric	25 A miniature power PCB	30 A miniature Power PCB Meets UL 508 & UL 873 UL Class F insulation system
Agency Approvals					
Contact Arrangement	1 Form C	1 Form C	1 Form A	1 Form A	1 Form A 1 Form C
Contact Material	Gold clad silver	Gold clad silver pd	Silver Cadmium Oxide	Silver Tin Oxide	Silver tin oxide
Max Contact Ratings	1A@24 VDC 0.5A@125VAC	1A@24VDC 0.5A@120VAC	16A@250VAC/30VDC 20A@125VAC	25A@250VAC TV-10	30A@277VAC 20A@30VDC 800VA@125VAC
Initial HP Value	100 m ohms	100 m ohms	1/2HP@250/125VAC	1.5HP@250VAC	2 HP@250VAC 1 HP@125VAC
Coil Voltage	3-24 VDC	3-24 VDC	3-60 VDC	3-48 VDC	3-110 VDC
Coil Power Consumption	150mW	200-450mW	530mW	900mW	930mW
Dielectric Strength	400 VAC (contacts) 1000 VAC (contacts)	1000 VAC (all points)	4000/5000 VAC (coil/contacts) 1000 VAC (contacts)	3600 VAC (coil/contacts) 1200 VAC (contacts)	1500Vrms (coil/contacts) UL 873 1500Vrms (coil/contacts)
Life (Operations)	5 million mech. 500k @ rated load	50 million mech. 500k @ 1A/24VDC 200k @ 0.5 A/120VAC	10 million mech. 100k @ rated load	10 million mech. 100k@rated load	10 million mech. 100k@rated load
Package L x W x H	.492"x.295"x.394" (12.2x7.5x10mm)	.610"x.420"x.445" (15.4x10.6x11.3)	1.142"x.512"x1.004" (29x13x25.5mm)	1.220"x.730"x1.200" (31.0x18.5x30.5mm)	1.270"x1.085"x.805" (32.2x27.5x20.4mm)
Terminations	PCB	PCB	PCB	PCB & 1/4" QC (top)	PCB
Sealed	Yes	Yes	Optional	No	Optional
Options			Flux-tight Sealed	PCB PCB & 1/4" QC	Open dust cover flux-tight sealed UL Class F VDE spacing

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# PC Board Power Relays


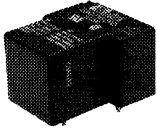
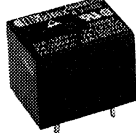
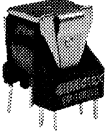

	500	501	496	596	597
Series					
Features	12 A sub-miniature power PCB low profile high dielectric UL Class B Insulation System	12 A sub-miniature power PCB slim profile high dielectric UL Class B Insulation System	10 A sub-miniature PCB	12 A sub-miniature power PCB low profile UL Class B Insulation System	15 A sub-miniature power PCB
Agency Approvals					
Contact Arrangement	1 Form A	1 Form A	1 Form A 1 Form C	1 Form A 1 Form C	1 Form A 1 Form C
Contact Material	Silver Tin Oxide	Silver Tin Oxide	Silver Cadmium Oxide	Silver Tin Oxide	Silver Tin Oxide
Max. Contact Ratings	10A@277VAC/30VDC TV-5 12A@125VAC	10A@277VAC/30VDC 12A@125VAC	10A@120VAC/28VDC 5A@250VAC	7A@277VAC/30VDC 12A@125VAC TV-5	10A@250VAC/30VDC 15A@125VAC TV-8
H.P. ratings	1/4HP@250/125VAC	1/4HP@250/125VAC	1/3HP@120VAC	1/4HP@250/125VAC	1/2HP@250/125VAC
Coil Voltage	3-36 VDC	3-36 VDC	3-48 VDC	3-48VDC	3-60 VDC
Coil Power Consumption	450mW	450mW	360mW	360mW	360mW
Dielectric Strength	2500VAC (coil/contacts) 1000VAC (contacts)	2500VAC (coil/contacts) 1000VAC (contacts)	1500VAC (coil/contacts) 750VAC (contacts)	1500VAC (coil/contacts) 750VAC (contacts)	1500VAC (coil/contacts) 1000VAC (contacts)
Life (Operations)	10 million mech. 100k @ rated load	10 million mech. 100k @ rated load	5 million mech. 100k @ rated load	10 million mech. 100k@rated load	10 million mech. 100k@rated load
Package L x W x H	.750"x.630"x.430" (19x16x11mm)	.740"x.300"x.615" (18.8x7.6x15.6mm)	.840"x.625"x.650" (21.3x15.9x16.5mm)	.830"x.630"x.640" (21x16x16.3mm)	.886"x.650"x.800" (22.5x16.5x20.2mm)
Terminations	PCB	PCB	PCB	PCB	PCB
Sealed	Optional	Optional	Yes	Optional	Optional
Options	Flux-tight Sealed	Flux-tight Sealed		Flux-tight Sealed UL class B	Flux-tight Sealed

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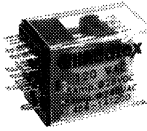
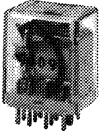

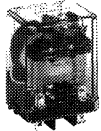






# Automotive Power Relays

	V4	V590	V596	VM	VP
Series					
Features	40 A miniature plug-in automotive	10 A miniature PCB automotive	15 A sub-miniature PCB automotive	20 A sub-miniature PCB automotive	40 A compact PCB automotive
Agency Approvals					
Contact Arrangement	1 Form A 1 Form C	1 Form A 1 Form C	1 Form A 2 Form C	1 Form A 2 Form C	1 Form A 1 Form C
Contact Material	Silver Tin oxide	Silver Tin oxide	Silver Tin oxide	Silver Nickel	Silver Nickel
Max. Contact Ratings	30-40A@12VDC	30A@14VDC	15A@14VDC	20A@14VDC	40A@14VDC
Operate Temp	-40~+85°C	-40~+125°C	-40~+85°C	-40~+85°C	-40~+125°C
Coil Voltage	6-36 VDC	6-36 VDC	6-36 VDC	6-36 VDC	6-36 VDC
Coil Pwr Consumption	1.8 W	1.5 W	640mW	1.1W	1.5W
Dielectric Strength	500Vrms (all points)	2500VAC (coils/contacts) 1500VAC (contacts)	1500VAC (coil/contacts) 750VAC (contacts)	500Vrms (all points)	500Vrms (all points)
Life (Operations)	10 million mech. 100k @ rated load	10 million mech. 100k @ rated load	10 million mech. 100k @ rated load	10 million mech. 100k@rated load	10 million mech. 100k@rated load
Package L x W x H	1.10"x1.10"x.985" (28x28x25mm)	1.27"x.1.09"x.81" (32.2x27.5x20.4mm)	.827"x.630"x.642 (21x16x16.3mm)	.63"x.52x.71" (16x13.2x18mm)	.99"x.83"x.79 (25x21x20mm)
Terminations	PCB/plug-in	PCB	PCB	PCB	PCB
Sealed	No	Optional	Optional	Optional	Optional
Options	Flange cover metal bracket diode or resistor across coil 1 form X & 1 form U	Open dust cover flux-tight Sealed	Flux-tight Sealed	Open dust cover sealed other contact configurations available	USA footprint Euro footprint open dust cover Sealed

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# General Purpose Relays

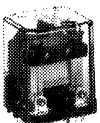

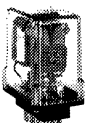
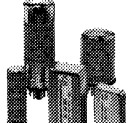
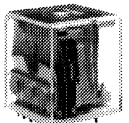




	156	158	258	157	155
Series					
Features	3 & 5 A miniature 2 or 4 pole plug-in/solder lug PCB	10 A miniature 1 or 2 pole	10 & 15 A miniature 1 or 2 pole plug-in/solder lug PCB	5, 10, 15A General purpose 1, 2, or 3 pole	10 A Plug-in 8-11 pin octal base 1, 2, or 3 pole
Agency Approvals					
Contact Arrangement	2 Form C 2 Form C	1 Form A, B or C 2 Form A, B or C	1 Form A 2 Form C	1, 2 or 3 Form A, B or C	1, 2 or 3 Form C
Contact Material	Silver cadmium oxide Gold flash silver Gold diffused silver	Silver cadmium oxide Gold flash silver	Silver Cadmium Oxide	Silver cadmium oxide Gold flash silver Gold diffused silver	Silver Cadmium Oxide
Coil Ratings	5A@250VAC/28VDC	10A@120VAC/28VDC 7A@240VAC	1 Pole:15A@240VAC 2 Pole:10A@240VAC 28 VDC	15A@120VAC/277VAC 10A@28VDC 3A@480/600VAC	10A@120VAC/28VDC 5A@240VAC
Coil Ratings		1/3HP@120/240VAC	1/3HP@125VAC 1/2HP@250VAC	1/3Hp@120VAC 1/2HP@240-600VAC	1/6HP@120VAC 1/3HP@240VAC
Coil Voltage	6-110 VDC 12-240 VAC	5-110 VDC 6-240 VAC	6-110 VDC 12-240 VAC	6-110 VDC 6-480 VAC	6-110 VDC 6-240 VAC
Coil Power Consumption	DC: 900mW AC: 1.2 VA	DC: 900mW AC: 1.2 VA	DC: 900mW AC: 1.2 VA	DC: 1.2W AC: 2.7 VA-3.1 VA	DC: 1.2W AC: 2.3 VA
Standard Voltage	500VAC (contacts) 1500VAC (all other)	500VAC (contacts) 1500VAC (all other)	1000VAC (contacts) 1500VAC (all other)	750Vrms (contacts) 2500Vrms (all other) 3750 Vrms (all points, special)	1000VAC (contacts) 1500VAC (all other)
Life (Mechanical)	10 million mech. 100k @ rated load	50 million mech. 100k @ rated load	10 million mech. 100k @ rated load	10 million mech. 100k@rated load	10 million mech. 100k@rated load
Physical Dimensions	1.08"x.846"x1.420" (27.5x21.5x36.0mm)	.859"x.1.109"x.1.281" (21.8x28.2x32.5mm)	1.08"x.85"x1.39" (27.5x21.6x35.2mm)	1.525"x1.4"x1.091" (38.7x35.6x48.3mm)	1.38"x1.30"x2.15" (35x33x54.5mm)
Terminations	PCB solder/plug-in	PCB solder/plug-in octal plug-in	PCB solder/plug-in	PCB solder/QC plug-in	8 Pin octal plug-in 11 pin plug-in
Sealed	Optional	Optional	Optional	No	No
Options	Flange cover push button ind. lamp hermetically sealed Sealed gold flash silver contacts	Push button Ind. lamp Sealed 1 form X & Y	Flange cover push button ind. lamp Sealed	Push button ind. lamp flange cover magnetic latching magnetic blow-out 3mm contact gap	Push button Indicator lamp or LED Open, special

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# Power Relays

# Speciality Relays

	187	188	136	160-169	LA/LB/LC
Series					
Features	20 & 25 A power relay 2 pole 6 mounting options	30 A power relay single pole 6 mounting options	Traffic control relay 30 A UL rated CALTRANS approved NEMA approved	2 & 5A mercury wetted no bounce long life/hi rel. consistent contact res.	1 A multi-pole miniature bifurcated contacts
Agency Approvals					
Contact Arrangement	2 Form C 2 Form A or B	1 Form X, Y or Z	1 & 2 Form C 3 Form A	1 Form C & D	4 pole-12 pole
Contact Material	Silver cadmium oxide fine silver	Silver cadmium oxide	Silver Cadmium Oxide Silver palladium	Mercury wetted	Gold clad silver pd
Max. Contact Ratings	25A@120-277VAC 25@28VAC 10A@480/600VAC	30A@120-277VAC 30@28VAC 15A@480/600VAC	30A@120/240VAC 20@28VAC 1KW Tungsten@ 120/240VAC	5A, 250VA 2A, 100VA 500VDC	1A@28VDC 0.5A@115VAC
H.P. ratings	3/4HP@120VAC 1.5HP@240VAC	1HP@120VAC 2HP@208-277VAC	1/4HP@120/240VAC	15m ohms 20m ohms max.	100 m ohms
Coil Voltage	6-110 VDC 6-480 VAC	6-110 VDC 6-480 VAC	6-110 VDC 6-240 VAC	2-125VDC Current sensing	6-48 VDC
Coil Pwr. Consumption	DC: 1.2W AC: 2.7 VA	DC: 1.2W AC: 2.7 VA	DC: 2.4W AC: 1.0 VA	20-100mW	1.1W
Dielectric Strength	750VAC (coil/contacts) 2500VAC (all other)	750VAC (contacts) 2500VAC (all other)	1500VAC (all points)	100 Vrms/VDC	500 Vrms/ (all points)
Life (Operations)	100 million mech. 100k @ rated load	10 million mech. 100k @ rated load	5 million mech. 100k @ rated load 250k Tungsten load	1 billion@rated load	100 million mech. 100k @ rated load
Package L x W x H	1.525"x1.4"x1.901" (38.7x35.6x48.3mm)	1.525"x1.4"x1.9" (38.7x35.6x48.3mm)	2.38"x1.75"x3.30" (60.5x44.5x83.8mm)	Consult factory on package style	LA: 1.07"x.75"x.124" LB: 1.07"x1"x1.24" LC: 1.27"x1"x1.24"
Terminations	PCB solder, 1/4" QC	PCB solder, 1/4" QC	Jones plug solder, 1/4" QC PCB	PCB Octal Plug-in	PCB Plug-in
Sealed	No	No	No	Encapsulated	No
Options	Magnetic blow-out magnetic latching 3750 VAC dielectric open type end stud mount varnished coil	Magnetic latching 3750 VAC dielectric open type end stud mount varnished coil	Open frame mounting custom configurations in 1 & 3 pole	Consult factory for special contact forms and packages	Mixed contact configs. (e.g., 5D & 1C)

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Internet http://www.midtex.com

# High Voltage DC Relays & Contactors

Contact Voltage Vdc	Current (Amps DC)	Power Switching	RF Rating	Contact Form	Part No.
28 Vdc	50	YES	NO	1PST-NO	AL50
	90	YES	NO	1PST-NO	AL90
	150	YES	NO	1PST-NO	AL150
	350	YES	NO	1PST-NO	AL350
	500	YES	NO	1PST-NO	AL500
270 Vdc	5	YES	NO	1PST-NO	AP5A
	5	YES	NO	1PST-NC	AP5B
	5	YES	NO	1PDT	AP5C
	5	YES	NO	1PST-Latch	AP5P
	5	YES	NO	1PDT-Latch	AP5R
	10	YES	NO	1PST-NO	AP10A
	10	YES	NO	1PST-NC	AP10B
	10	YES	NO	1PST-Latch	AP10P
	10	YES	NO	2PST-NO	AP11A
	15	YES	NO	1PST-Latch	AP44P
	50	YES	NO	1PST-NO	AP50X
	90	YES	NO	1PST-NO	AP90X
	150	YES	NO	1PST-NO	AP150X
	265	YES	NO	1PST-NO	AP265X
	265	YES	NO	1PST-NO	AP265P
	500	Special	NO	1PST-NO	AP350X
	320 Vdc	4	Make Only	NO	1PST-NO
5		Yes	NO	1PST-NO	PD5A
5		Yes	NO	1PST-NC	PD5B
5		Yes	NO	1PST-Latch	PD5C
5		Yes	NO	1PST-Latch	PD5R

Contact Voltage Vdc	Current (Amps DC)	Power Switching	RF Rating	Contact Form	Part No.
320 Vdc	10	Yes	NO	1PST-NO	PD10A
	10	Yes	NO	1PST-NC	PD10B
	10	Yes	NO	1PST-Latch	PD10P
	90	Yes	NO	1PST-NO	PD90X
	150	Yes	NO	1PST-NO	PD150X
	400	Special	NO	1PST-NO	EV250
500	500	Special	NO	1PST-NO	EV500
	500	Special	NO	1PST-NO	PD350X
	1.5 kV	3	NO	YES	1PST-NO
2.0 kV	6	NO	YES	1PST-NO	S06CBA
3.0 kV	2	NO	NO	1PST-NO	S02DNA
3.5 kV	8	Make Only	NO	1PDT	HC-5
	15	YES	NO	1PDT	HC-3
	25	NO	YES	1PDT	HC-1
5.0 kV	6	NO	YES	1PST-NO	S06FNA
	15	NO	YES	1PDT	K45C
	15	SPECIAL	YES	1PST-NO	K41A
	15	NO	YES	1PST-NC	K41B
	15	NO	YES	1PDT	K41C
	15	NO	YES	1PST-Latch	K41P
	25	NO	YES	1PDT-Latch	K41R
35	NO	YES	1PST-Latch	K40P	
5.5 kV	10	Make Only	NO	2PDT	KM-13
	10	YES	NO	2PDT	KM-14
	10	YES	NO	2PDT	KM-16
	10	YES	NO	2PDT	KM-17
	10	YES	NO	2PDT	KM-17

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# High Voltage DC Relays & Contactors

Contact Voltage Vdc	Current (Amps DC)	Power Switching	RF Rating	Contact Form	Part No.
7 kV	6	YES	NO	2PST-NO	S06HBA
8kV	6	YES	NO	1PST-NC	S06JNB
	8	YES	NO	1PDT	HC-6
	10	YES	NO	1PDT	H-18
	12	YES	NO	1PST-NO	K47A
	12	YES	NO	1PST-NC	K47B
	15	YES	NO	1PDT	HC-4
	25	YES	NO	1PDT	HC-2
10 kV	45	YES	NO	1PST-Latch	K44P
	5	YES	NO	1PST-NO	S05LTA
	5	YES	NO	1PST-NC	S05LTB
	10	Special	NO	1PST-NO	K81A
	10	SPECIAL	NO	1PST-NC	K81B
	10	SPECIAL	NO	1PDT	K81C
	15	SPECIAL	YES	1PST-NO	K43A
	15	SPECIAL	YES	1PST-NC	K43B
	15	SPECIAL	YES	1PDT	K43C
	15	NO	YES	1PDT-Latch	K43R
12 kV	24	NO	YES	1PST-Latch	K43P
	30	NO	YES	2PDT	H-14
12 kV	30	NO	YES	2PDT	H-16
	5	NO	NO	1PST-NO	S05MTA
15 kV	12	Make Only	NO	1PDT	KC-15
	12	Make Only	NO	1PDT	KC-16
	15	Special	NO	1PDT	KC-14
	15	Special	NO	1PDT	KC-18

Contact Voltage Vdc	Current (Amps DC)	Power Switching	RF Rating	Contact Form	Part No.
15 kV	30	NO	YES	1PDT	KC-12
	30	NO	YES	4PDT	H-26
	30	NO	YES	1PDT	KC-8
	50	NO	YES	1PDT	KC-2
	50	NO	YES	1PDT	KC-11
20 kV	30	NO	YES	2PDT	H-19
25 kV	15	Make Only	NO	1PST-NC	KC-38
	18	Special	NO	1PST-NO	K62A
	18	Special	NO	1PST-NC	K62B
	18	Special	NO	1PDT	K62C
	30	Special	YES	1PDT	H-17
	30	Make Only	NO	1PST-NO	KC-28
	45	Special	NO	1PST-NC	KC-32
	55	NO	YES	1PST-NC	KC-30
	65	Special	NO	1PST-NO	KC-22
	110	NO	YES	1PST-NO	KC-20
30 kV	30	NO	YES	1PST-NC	H-23
	30	NO	YES	1PST-NO	H-24
35 kV	10	Make Only	NO	1PST-NO	K61A
	10	Make Only	NO	1PST-NC	K61B
	10	Make Only	NO	1PDT	K61C
50 kV	10	Make Only	NO	1PDT	K64C
	30	Special	NO	1PDT	H-25
70 kV	10	Make Only	NO	1PST-NO	K70A
	10	Make Only	NO	1PST-NC	K70B
	10	Make Only	NO	1PDT	K70C

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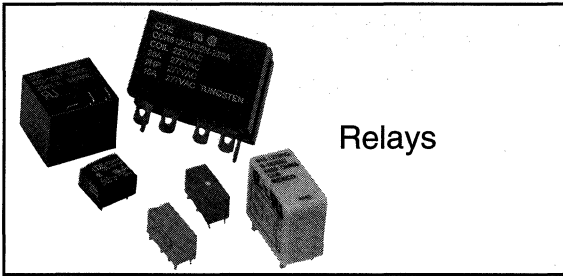
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Relays

Cornell Dubilier markets 26 series of relays ranging from sensitive types that operate directly from low-level TTL logic to general purpose units driving up to four sets of contacts and switching up to 40 amps.

	General Purpose CDR10	General Purpose CDR20	General Purpose CDR21/22	General Purpose CDR30	General Purpose CDR40	General Purpose CDR50	Miniature 603	Miniature 613	Miniature 653
<b>Coil</b>	12-240	12-240	12-240	6-240	12-240	12-240	3-48	3-48	3-48
<b>Voltagages</b>	6-120	6-120	6-120	6-120	6-120	6-120	UL/CSA	UL/CSA	UL/CSA
<b>Approvals</b>	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA
<b>Contact</b>	5A@250Vac	10A@240Vac	30A@277Vac	10A@120Vac	10A@240Vac	15A@120Vac	3A@240Vac	10A@277Vac	5A@240Vac
<b>Ratings</b>	5A@28Vdc	10A@28Vdc	25A@28Vdc	10A@28Vdc	10A@28Vdc	15A@28Vdc	3A@28Vdc	10A@28Vdc	5A@28Vdc
<b>Contact Form</b>	DPDT/4PDT	SPDT/DPDT/3PDT	SPDT/DPDT/3PDT	DPDT/DPDT/3PDT	SPNO/SPDT	SPST/SPDT	SPST/SPDT	SPST/SPDT	SPST/SPDT
<b>Nominal Coil</b>	900mW	1200mW	1200mW	1200mW	900mW	900mW	900mW	900mW	900mW
<b>Power</b>	1.2VA	2.0VA	3.0VA	2.0VA	1.2VA	1.2VA	1.2VA	1.2VA	1.2VA
<b>Typical Operating Time</b>	15ms	15ms	25ms	15ms	15ms	15ms	10ms	10ms	10ms
<b>Typical Release Time</b>	10ms	10ms	20ms	10ms	10ms	10ms	10ms	10ms	10ms
<b>Mechanical Life (min.)</b>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>
<b>Rated Life (min. op.)</b>	100k	100k	100k	100k	100k	100k	100k	100k	100k
<b>Dielectric Strength:</b>									
<b>Contact-Contact</b>	500 Vac (1 min)	500 Vac (1 min)	1000 Vac (1 min)	500 Vac (1 min)	500 Vac (1 min)	500 Vac (1 min)	500Vac (2 sec)	500Vac (2 sec)	500Vac (2 sec)
<b>Contact-Coil</b>	1500 Vac (1 min)	1500 Vac (1 min)	1600 Vac (1 min)	1500 Vac (1 min)	1500 Vac (1 min)	1500 Vac (1 min)	1000Vac (2sec)	1000Vac (2 sec)	1000Vac (2 sec)
<b>Live Pts-Grd</b>	1500 Vac (1 min)	1500 Vac (1 min)	1600 Vac (1 min)	1500 Vac (1 min)	1500 Vac (1 min)	1500 Vac (1 min)	NA	NA	NA
<b>Sealed Version</b>	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes
<b>Terminal</b>	PC, QC	PC, QC	QC	Octal-8 pin	PC, QC	PC, QC	PC	PC	PC
<b>Types</b>	Solder lug, Plug-in	Solder lug	Solder lug	Octal-11 pin	Solder lug	Solder lug	Solder lug	Solder lug	Solder lug

	Min. High Diel. CDR66	Min. High Diel. CDR67	Subminiature CDR70	Subminiature CDR72	Subminiature CDR73	Subminiature CDR74	Telcomm DIP CDR75	Subminiature CDR76	Subminiature CDR77
<b>Coil</b>	5-48	3-120	3-48	3-24	3-48	3-48	3-48	3-24	3-24
<b>Voltagages</b>	UL/CSA	UL/CSA/TÜV	UL/CSA/TÜV	UL	UL/CSA/TÜV	UL/CSA	UL	UL/CSA/TÜV	UL
<b>Approvals</b>	5A-16A@250Vac	16A@250Vac	12A@125Vac	5A@120Vac	15A@125Vac	12A@125Vac	1A@30Vac	10A@277Vac	5A@120 Vac
<b>Contact</b>	30 Vdc	5A@30Vdc	5A@30Vdc	3A@24Vdc	3A@30Vdc	1A@24Vdc	10A@30Vdc	10A@277Vac	1A@120Vac
<b>Ratings</b>									
<b>Contact Form</b>	SPST/SPDT/ DPS/DPDT	SPST/SPDT	SP/ST/SPDT	SPDT	SPST/SPDT	SPST/SPDT	DPDT	SPNO	DPDT
<b>Nom. Coil</b>	530mW	530mW	360mW	360mW	360mW	450mW	150mW-500mW	450mW	450mW
<b>Power</b>	100mW(sensitive)	100mW(sensitive)		180mW(sensitive)	180mW(sensitive)	320mW (sensitive)			
<b>Typical Operating Time</b>	15ms	20ms	10ms	5ms	10ms	10ms	8ms	10ms	10ms
<b>Typical Release Time</b>	10ms	15ms	10ms	5ms	10ms	10ms	4ms	5ms	5ms
<b>Mechanical Life (min)</b>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>
<b>Rated Life (min op)</b>	100k	100k	100k	100k	100k	100k	100k	100k	100k
<b>Dielectric Strength:</b>									
<b>Contact-Contact</b>	1000 Vac (1 min)	1000 Vac (1 min)	500 Vac (1 min)	500 Vac (1 min)	750 Vac (1 min)	750Vac (1 min)	750Vac (1 min)	1000Vac (1 min)	500Vac (1 min)
<b>Contact-Coil</b>	5000 Vac (1 min)	5000 Vac (1 min)	1500 Vac (1 min)	1500 Vac (1 min)	1500 Vac (1 min)	2000Vac (1 min)	1000Vac (1 min)	2500Vac (1 min)	1000Vac (1 min)
<b>Live Pts-Grd</b>	5000 Vac (1 min)	5000 Vac (1 min)	NA	NA	NA	NA	NA	NA	NA
<b>Sealed Version</b>	Yes	Yes	Yes (nib)	Yes (taped tab)	Yes (epoxy nib)	Yes	Yes	Yes	Yes(taped tab)
<b>Terminal</b>	PC	PC	PC	PC	PC	PC	PC	PC	PC
<b>Types</b>									

	Subminiature CDR79	High Power CDR81	Automotive CDR85	Automotive CDR93	High Power/Temp. 800
<b>Coil</b>	3-24	6-240	12	6-24	5-110
<b>Voltagages</b>	UL/CSA/TÜV	3-220	NA	NA	UL
<b>Approvals</b>	10A@277Vac	UL/CSA/TÜV	40A@120Vac	15A@12Vac	30A@240Vac noisw
<b>Contact</b>		30A@277Vac(SPDM)			30A@277Vac (SPNO)
<b>Ratings</b>		25A277Vac(DPDM)			SPST/SPDT
<b>Contact Form</b>	SPNO	SPDM/DPDM	SPST/SPDT-DM	SPST/SPDT-DB	
<b>Nominal Coil</b>	450mW	1900mW	1800mW	1100mW	900mW
<b>Power</b>		1.7-2.7VA			
<b>Typical Operating Time</b>	10ms	30ms	10ms	6ms	10ms
<b>Typical Release Time</b>	10ms	30ms	10ms	3ms	5ms
<b>Mechanical Life (min)</b>	10 x 10 <sup>6</sup>	5 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>
<b>Rated Life (min op)</b>	100k	100k	100k	100k	100k
<b>Dielectric Strength:</b>					
<b>Contact-Contact</b>	1000Vac (1 min)	2000Vac (1 min)	500 Vac (1 min)	500 Vac (1 min)	1500 Vac (1 min)
<b>Contact-Coil</b>	2500Vac (1 min)	4000Vac (1 min)	500 Vac (1 min)	500 Vac (1 min)	1500 Vac (1 min)
<b>Live Pts-Grd</b>	NA	NA	NA	NA	NA
<b>Sealed Version</b>	Yes	Yes	No	Yes	Yes
<b>Terminal</b>	PC	PC, QC	QC	PC	PC, QC

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**Relays:** Calexico, CA (011) 526-561-6519  
**All Other Products:** New Bedford, MA (508) 996-8564

For product specifications, outline drawings, and application support visit our web side at <http://www.cornell-dubilier.com>  
**See Our Other Pages In Volume A, Section 1500**

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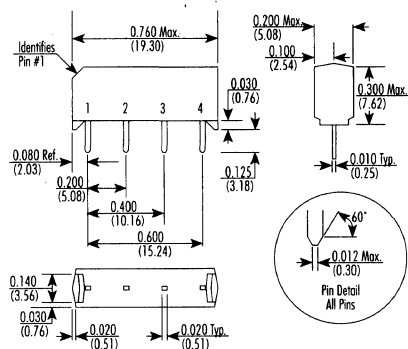


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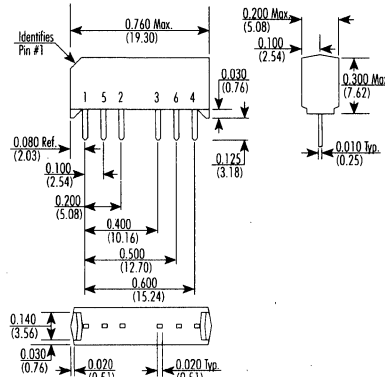
# MOLDED REED RELAYS SIP (SERIES 9000), MINI SIP (SERIES 9090)

## MECHANICAL SPECIFICATIONS

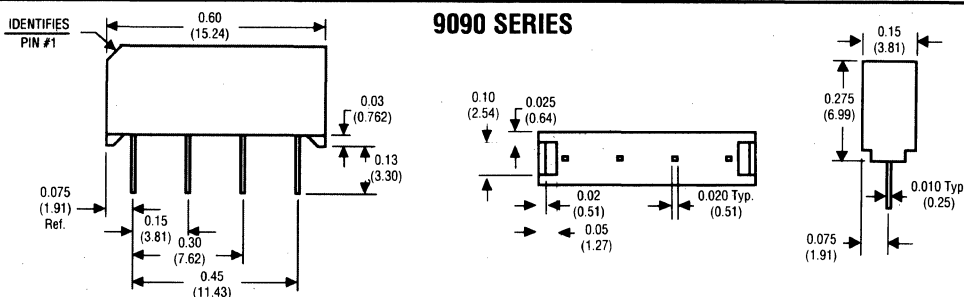
### 9001 SERIES



### 9002 SERIES



### 9090 SERIES



Model Number	Parameters	Test Conditions	Units	9001	9002	9090
Coil Resistance (±10%)	5.0 Volt Coil	25° C	Ω	500	350	500
	12.0 Volt Coil		Ω	1000	750	1000
Coil Drive Voltage Max.	5.0 Volt Coil	25° C	VDC	6.5	6.5	6.5
	12.0 Volt Coil		VDC	15	15	15
Relay Operate Voltage	5 Volt Coil	5 Volt Coil	VDC	3.75	3.75	3.75
	12 Volt Coil		VDC	9.0	9.0	9.0
Relay Release Voltage	5 Volt Coil	5 Volt Coil	VDC	0.4	0.4	0.4
	12 Volt Coil		VDC	1.0	1.0	1.0
Switching Voltage (DC/Peak AC, Resistive)			Volts	200	200	200
Switching Current (DC/Peak AC, Resistive)			Amps	0.5	0.5	0.5
Carry Current (DC/Peak AC, Resistive)			Amps	1.0	1.0	1.0
Contact Power Rating (DC/Peak AC, Resistive)			W	10	10	10
Life Expectancy		(@ Signal Level <1.0V, .010A) (Switching >1.0V, Consult Factory)	x 10 <sup>6</sup> x 10 <sup>8</sup>	500 —	500 —	500 —
Static Contact Resistance (Max. initial, measured with .050 V, .010A)			Ω	0.150	0.150	0.150
Dynamic Contact		(Max. initial, meas. w/.050 V, .050 A @ 100 Hz 1.5 msec after closure)	Ω	0.200	0.200	0.200
Insulation Resistance (Between all isolated pins) Measured With 100 V @		25°C, 40% RH	Ω	10 <sup>12</sup>	10 <sup>12</sup>	10 <sup>12</sup>
		40°C, 95% RH	Ω	10 <sup>10</sup>	10 <sup>10</sup>	—
Dielectric Strength (DC/Peak AC)		Across Open Contacts:	Volts	250	250	250
		Contacts To Shield:	Volts	—	500	—
		Contacts & Shield To Coil:	Volts	1500	1500	1500
Capacitance Across Open Contactants		No shield	pf	1.0	—	1.00
		Shield floating	pf	—	1.0	—
		Shield guarding	pf	—	0.30	—
		No shield	pf	2.0	—	2.5
Open Contactants To Coil		Shield floating	pf	—	2.0	—
		Shield guarding	pf	—	1.0	—
Contact to shield		Contacts open and shield floating	pf	—	1.6	—
Operated Time (Incl. bounce @ Nom. voltage)		No suppression	msec.	1.0	1.0	1.0
		Diode suppression	msec.	0.10	0.10	—
		Diode & Zener suppressed	msec.	0.50	0.50	0.50
			msec.	0.20	0.20	0.20
Temperature Range		Operate:	°C	-20 to 70	-20 to 70	-20 to 70
		Storage:	°C	-50 to 100	-50 to 100	-50 to 100
		Max. allowable temp during mounting process:	°C	221	221	221
All Ratings At 25°C Unless Noted.						
<b>PIN DIAGRAM (Top View)</b>						
*If diode is selected, pin #2 is positive.						

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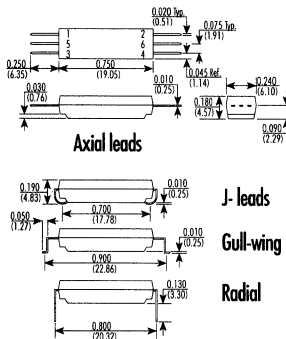
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# SURFACE MOUNT REED RELAYS & ECONOMY DIP

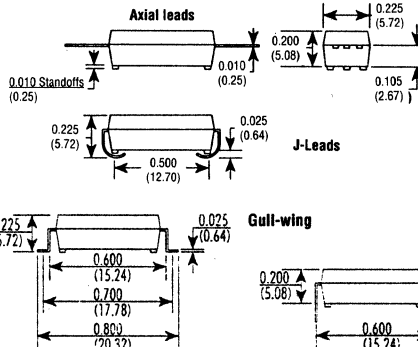
## 9200, 9400 & 9800 SERIES SURFACE MOUNT REED RELAYS - 50Ω COAXIAL

Coil Specs	Model Numbers			9202		9402		9802	
	Parameters	Test Conditions	Units	1 Form A		1 Form A		1 Form A	
Coil Specs	Nominal Coil Voltage		VDC	5	12	5	12	5	12
	Max Coil Voltage		VDC	6.5	15.0	6.5	15.0	6	15.0
	Coil Resistance	+/-10%, 25°C	Ω	150	650	200	825	150	150
	Operate Voltage	Must operate by	VDC - Max	3.75	9.0	3.75	9.0	3.8	9.0
	Release Voltage	Must release by	VDC - Min	0.4	1.0	0.4	1.0	0.4	1.0
Contact Ratings	Switching Voltage	Max DC/Peak AC Resistive	Volts	200		200		100	
	Switching Current	Max DC/Peak AC Resistive	Amps	0.5		0.5		0.25	
	Carry Current	Max DC/Peak AC Resistive	Amps	1.5		1		0.5	
	Contact Rating	Max DC/Peak AC Resistive	Watts	10		10		3	
	Life Expectancy - Typical	Signal Level <1.0V, <10mA	x 10 <sup>6</sup> Ops.	1000		250		100	
	Static Contact Resistance (Max. Initial)	50 mV, 10mA	Ω	0.150		0.150		0.200	
	Dynamic Contact Resistance (Max. Initial)	0.5V, 50mA at 100 Hz, 1.5 msec	Ω	0.200		0.200		0.200	
Relay Specifications	Insulation Resistance (Minimum)	Between All Isolated Pins at 100V, 25°C, 40%RH	Ω	10 <sup>12</sup>		10 <sup>12</sup>		10 <sup>10</sup>	
	Capacitance - Typical	Across Open Contacts	pF	0.2		0.1		0.2	
		Open Contact to Coil	pF	1.4		1.1		0.5	
		Open Contact to Shield	pF	1.4		1.1		1.0	
	Dielectric Strength Minimum	Between Contacts	VDC/Peak AC	300		300		150	
		Contacts to Shield	VDC/Peak AC	1500		1500		150	
	Operate Time - Typical	At Nominal Coil Voltage	μsec	400		400		200	
		Including Bounce	30Hz Square Wave	μsec	1500		1500		150
Release Time - Typical	Zener-Diode Suppression	μsec	100		100		35		
	Diode Suppression	μsec					50		

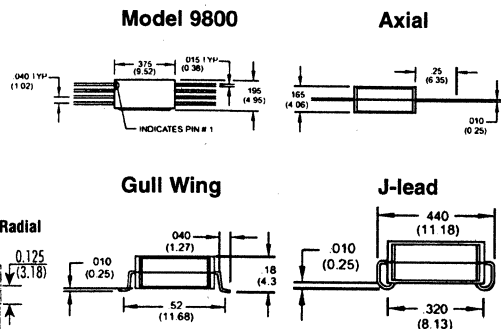
9200 Series



9400 Series

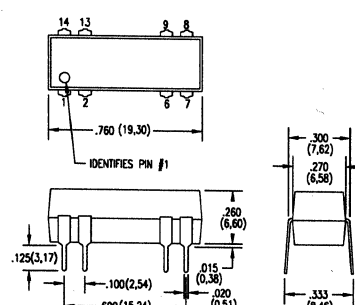


9800 Series Axial Leads



## 8L00 SERIES ECONOMY DIP

Contact Form	Model Number	Coil Voltage VDC	Operate Voltage VDC max.	Release Voltage VDC min.	Coil Res. Ω±10% @25°C	Contact Rating Watts	Switching Voltage Volts	Switching Current Amps	Carry Current Amps	Schematic Top View
1A	8L01-05-001	5	3.8	0.5	500	10	200	0.5	1.0	
	8L01-12-001	12	9.6	1.0	500	10	200	0.5	1.0	
	8L01-24-001	24	19.2	2.0	2150	10	200	0.5	1.0	
1C	8L41-05-001	5	3.8	0.5	200	3	100	0.25	0.5	
	8L41-12-001	12	9.6	1.0	500	3	100	0.25	0.5	
	8L41-24-001	24	19.2	2.0	2000	3	100	0.25	0.5	
2A	8L02-05-00	5	3.8	0.5	500	10	200	0.5	1.0	
	8L02-12-00	12	9.6	1.0	500	10	200	0.5	1.0	
	8L02-24-00	24	19.2	2.0	2000	10	200	0.5	1.0	
1B	8L21-05-00	5	3.8	0.5	500	10	200	0.5	1.0	
	8L21-12-00	12	9.6	1.0	500	10	200	0.5	1.0	
	8L21-24-00	24	19.2	2.0	2000	10	200	0.5	1.0	



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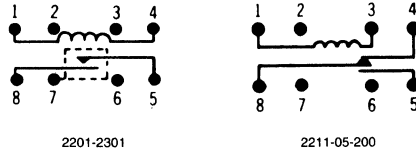
55 Dupont Drive, Providence, RI 02907  
401-943-2686 ♦ FAX: 401-942-0920

# MICROMINIATURE REED RELAYS

## MICROMINIATURE REED RELAYS SERIES 2200, 2300, AND 2900

The Coto microminiature relays are ideally suited for Automatic Test Equipment and RF applications. Relays are available in several different configurations including 1, 2, and 3 form A and 1 and 2 form C. All of the parts are encapsulated in an epoxy coated steel shell which provides magnetic shielding. Optional coaxial and electrostatic shields are available on some models.

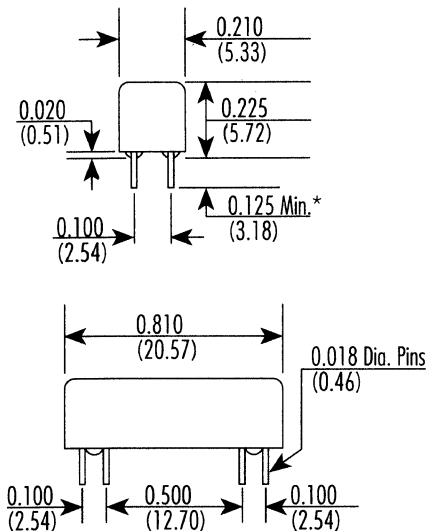
Schematics (Bottom View) Not to scale



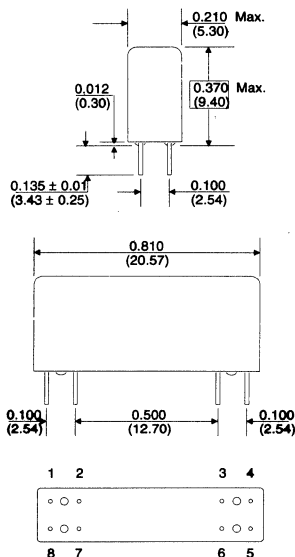
Model Number			2211-XX-3X1	2200-2301	2333	2342	2904-05-401 2904-12-301	2911-XX-3X1
Parameters	Test Conditions	Units	1 Form C	1 Form A Electrostatic Shield	3 Form A	2 Form C	1 Form A	1 Form C
Nominal Coil Voltage		VDC	5 12	5	5 12	5 12	5 12	5 12
Coil Resistance		Ω	230 1500	150	175 1000	175 1000	370 1500	230 1500
Operate Voltage	+/-10%, 25°C Must operate by	VDC - Max	3.8 9.0	3.6	3.8 9.0	4 9.0	3.8 9.0	3.8 9.0
Release Voltage	Must release by	VDC - Min	0.4 1.0	0.5	0.4 1.0	0.4 1.0	0.4 1.0	0.4 1.0
Switching Voltage	Max DC/Peak AC Resistive	Volts	100	200	200	100	200	100
Switching Current	Max DC/Peak AC Resistive	Amps	0.25	0.5	0.5	0.25	0.5	0.25
Carry Current	Max DC/Peak AC Resistive	Amps	0.5	1.0	1.5	0.5	1.5	1.0
Contact Rating	Max DC/Peak AC Resistive	Watts	3	10	10	3	10	3
Life Expectancy - Typical	Signal Level: <1.0V, <10mA	x 10 <sup>6</sup> Ops.	100	500	1000	100	500	100
Rated Loads	Note 1		5	5			5	5
Static Contact Resistance (Max. Initial)	50mV, 10mA	Ω	0.150	0.150	0.150	0.200	0.100	0.150
Dynamic Contact Resistance (Max. Initial)	0.5V, 50mA	Ω	0.200	0.200	0.200	0.250	0.200	0.200
Insulation Resistance Minimum	Between All Isolated Pins at 100V, 25°C, 40%RH	Ω	10 <sup>10</sup>	10 <sup>11</sup>	10 <sup>12</sup>	10 <sup>9</sup>	10 <sup>12</sup>	10 <sup>10</sup>
Capacitance - Typical Across Open Contacts	No Shield Shield Guarded	pF	0.9	0.9	0.8	2.0	1.0	2.0
Dielectric Strength Minimum	Between Contacts	VDC/Peak AC	200	250	250	200	350	200
	Contacts to Shield	VDC/Peak AC	—	250	n/a	n/a	1500	1500
	Contacts or Shield to Coil	VDC/Peak AC	1500	1500	1000	1000		
Operate Time - Typical Including Bounce	At Nominal Coil Voltage 30Hz Square Wave	μsec	1000	550	500	1500	500	1000
Release Time - Typical	Note 2	μsec	2000	100	150	2000	100	2000
Bottom View-Dot stamped on top of relay refers to pin #1 location. Pin numbers are for reference only, unused pins are omitted. Electrostatic shield is connected to pin #6. Coaxial shield is connected to pins 6 and 7.								

Note 1: Consult Factory for life expectancy at other switching loads.  
Note 2: Consists of 20V Zener Diode and IN4002 Diode is connected to coil.

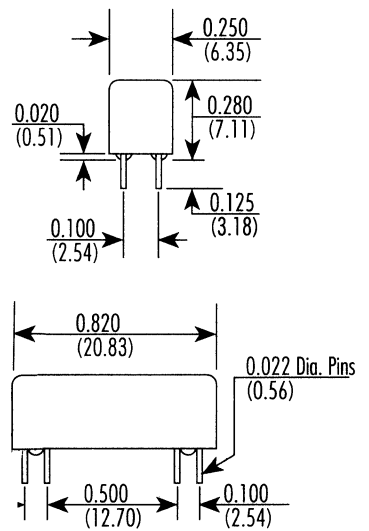
### 2200 SERIES



### 2300 SERIES



### 2900 SERIES



All dimensions are nominal

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# SOLID STATE RELAYS

## G2 SERIES - SOLID STATE RELAYS

		Contact Form									
		Normally Open			Normally Closed		1 Normally Open & 1 Normally Closed				
Operating Parameters	Switching Voltage (dc/pk-ac)	400			250	150	400	250	400		250
	Switching Current (mA)	150		120	150	500	150	200	140	150	200
	On Resistance (Ω)	24	18	35	18	5	20	13	28	24	13
	Current Limit (Typ.; mA)	270	n/a	210	360	n/a	n/a	n/a	n/a	270*	n/a
Relay Configuration	Single Channel (1 Input/1 Output) Model	G2-1A02 (Fig. #1)	G2-1A03 (Fig. #1)	G2-1A05 (Fig. #1)	G2-1A06 (Fig. #1)	G2-1A07 (Fig. #1)	G2-1B01 (Fig. #1)	G2-1B02 (Fig. #1)			
	Dual Channel (2 Inputs/2 Outputs) Model	G2-DA01 (Fig. #3)	G2-DA03 (Fig. #3)	G2-DA02 (Fig. #3)	G2-DA06 (Fig. #3)		G2-DB01 (Fig. #3)	G2-DB02 (Fig. #3)		G2-AB01 (Fig. #3)	G2-AB02 (Fig. #3)
	Telecom (1 Relay/1 Current Sensor) Model		G2-1T01 (Fig. #4)								

(\*) = Current Limit on Normally Open Contact Only

**Figure #1**  
Single Channel

**Model #**  
G2-1A02  
G2-1A03  
G2-1A05  
G2-1A06  
G2-1A07

G2-1B01  
G2-1B02

Top View Schematic

**Figure #3**  
Dual Channel

**Model #**  
G2-AB01  
G2-AB02

G2-DA01  
G2-DA02  
G2-DA03  
G2-DA06

G2-DB01  
G2-DB02

Top View Schematic

**Figure #4**  
Telecom Relay

**Model #**  
G2-1T01

Top View Schematic

**6-Pin DIP Package Drawing**

**6-Pin SOP Package Drawing**

**8-Pin DIP Package Drawing**

**8-Pin SOP Package Drawing**

### ORDERING INFORMATION

- For Relays in DIP package shipped in Tubes: G2-xxxx-TT
- For Relays in SOP package shipped in Tubes: G2-xxxx-ST
- For Relays in SOP package shipped in Tape & Reel: G2-xxxx-SR

— Specific Model Number as noted above.

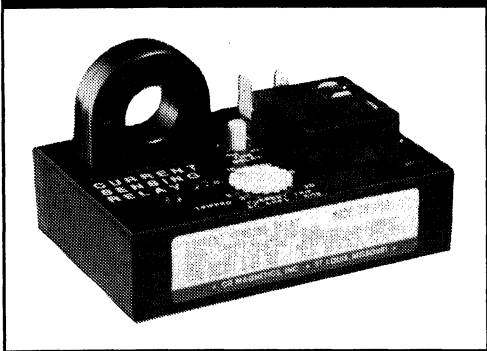
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# CURRENT SENSING RELAY

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- **Sense Motor Over/Under Loads**
- **Detect Lamp Burn-out**
- **Indicate Phase Loss**

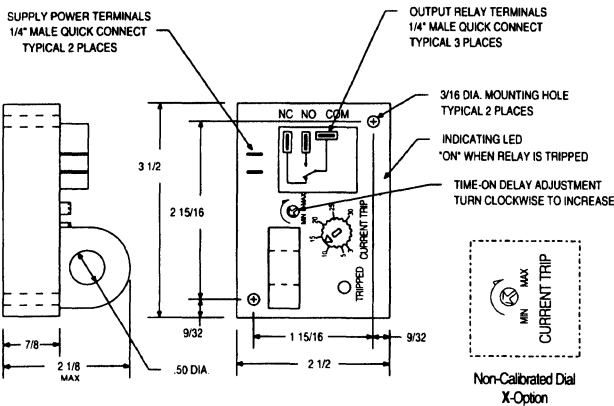
DOWN LOAD OUR CATALOG AT  
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<http://www.crmagnetics.com>



## FEATURES

- Variable trip point and time delay
- Monitors currents from 10 ma. to 100 AC Amps
- Electrical isolation between circuits
- Output relay rated up to 20 Amps
- LED relay status indicator
- Dead band prevents relay chatter
- Calibrated dial option available
- External current transformers available
- Also available in a low cost, DIN rail version

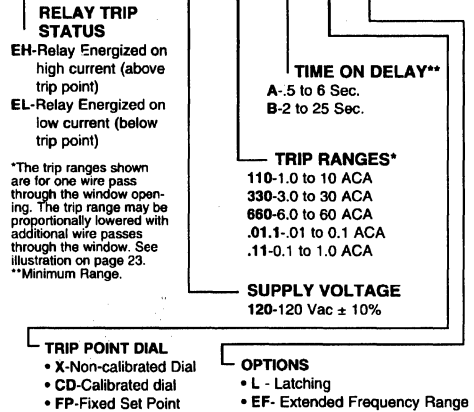
## OUTLINE DRAWINGS



CALIBRATED DIAL OPTION (CD) SHOWN

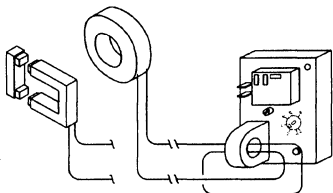
## PART NUMBERS

CR4395 - □□ - □□□ - □□□ - □ - □□ - □

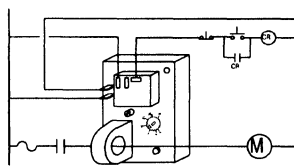


## TYPICAL APPLICATIONS

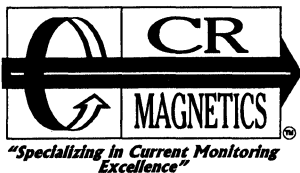
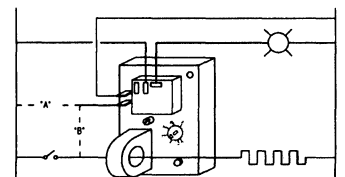
### EXTERNAL CURRENT TRANSFORMERS



### MOTOR OVER/UNDER MONITOR



### OPEN HEATER/LAMP DETECTOR



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Includes helpful Application Case Studies and product details.  
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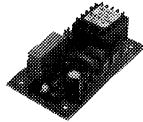
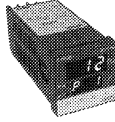
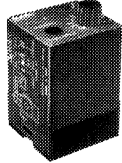
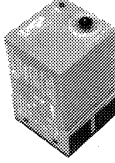
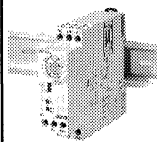
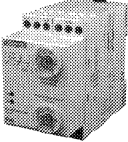

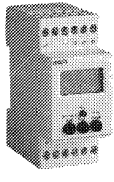
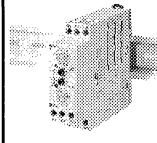
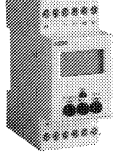
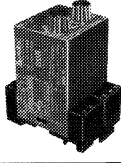
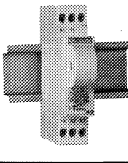
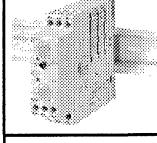
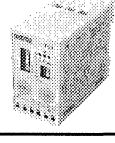
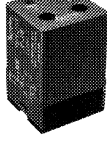
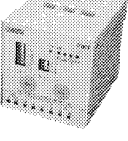
# SIEMENS



# SCHRACK

## CONTROL RELAYS

Crouzet offers several variations of Syrelec control relays. Five models for liquid level controls, 3 phase 230V, 380V, 440V and 480V for phase loss or reversal protection, current and voltage detection and control, motion detection, and alternating relays are also available. If a standard control requires modification or a special product is needed to meet your exact needs, please call us or the Crouzet Sales Representative nearest you. Crouzet has controls to meet your CE, UL, and CSA requirements.

	SERIES	FUNCTION	FEATURES		SERIES	FUNCTION	FEATURES
	<b>NNR Series</b> Liquid Level Control	Liquid Level Control	PC Board liquid level control. Pump up/Pump down. 4.7 to 47K ohm sensitivity. SPDT 10A output relay 3.62" x 2.16"		<b>CTD/CTH Series</b> Temperature Controllers	P, PI, PID On/Off Auto Tuning Heat/Cool	Single and dual display models. Thermocouple and RTD inputs. Auto-tuning for PID mod. Soft start function.
	<b>NR Series</b> LLC Pump Down <b>NRU Series</b> LLC Pump Up	Liquid Level Control Pump Down Liquid Level Control Pump Up	Plug-in or Din-Rail mount. 4.7 to 100K ohm sensitivity. 1.89"H x 1.89"W x 3.9"L		<b>WRL Series</b> Phase Monitor	Phase Control Relay Monitors: - Phase Sequence - Loss of Phase - Under Voltage	Plug-in or Din-Rail mount. 3 x 230 VAC, 3 x 380 VAC, 3 x 480 VAC, 1.89"H x 1.89"W x 3.9"L
	<b>EN Series</b> <b>END Series</b> Liquid Level Control	Liquid Level Control	Din-Rail/surface mount. Pump up/Pump down. 5K to 100K ohm sensitivity. 80mmH x 22.5mmW x 100mmL		<b>FW Series</b> Phase Monitor	Monitors: - Phase Loss - Phase Reversal - Undervoltage	Din-Rail or surface mount. 3 x 230 VAC, 3 x 380 VAC, 3 x 480 VAC, 3 x 600 VAC. 45mm wide enclosure. Adjustable time inhibit. LED power on and relay status. 79mmH x 45mmW x 100mmL
	<b>IR.T Series</b> Current Control Relay	Monitors Current with Relay Output	Plug-in or Din-Rail mount. Adjustable inhibit time for start up. LED Relay output indicator. 3mAmp to 7Amps-AC, 5mA to 10Amps DC. 1.89"H x 1.89"W x 3.9"L		<b>HDU Series</b> Voltage Control Relay	Monitors Voltage. With Relay Output. With LCD Display.	.2 to 600 Volt AC/DC voltage monitoring range. Over and under voltage functions. With LCD display. Shows actual and setpoints. Din-Rail mount. 81mmH x 36mmW x 81mmL
	<b>EIL EIH EIT Series</b> Current Control Relay	Monitors Current with Relay Output	Din-Rail/surface mount. Adjustable time inhibits. 2mAmp to 10Amps AC/DC. for EIL/EIH .01 to 100Amps for EIT w/transformer. 80mmH x 22.5mmW x 100mmL		<b>HDI Series</b> Current Control Relay	Monitors Current. With Relay Output. With LCD Display.	2mA to 10Amp; AC/DC current monitoring range. Over and under current functions. With LCD display. Shows actual and setpoints. Din-Rail mount. 81mmH x 36mmW x 66mmL
	<b>UR Series</b> Voltage Control Relay	Monitors Voltage with Relay Output	Plug-in or Din-Rail mount .1 to 400 Volts AC/DC. With latching function selectable. LED output indication. 1.89"H x 1.89"W x 3.9"L		<b>MCI Series</b> Current Control Relay	Monitors Current. With Relay Output. With Built-in Transformer	1 to 20Amp AC/DC current monitoring range. Built-in transformer. Relay output-SPDT Over and under current functions. 81mmH x 17.5mmW x 83mmL
	<b>EUL, EUH Series</b> Voltage Control Relay	Monitors Voltage with Relay Output	Din-Rail/surface mount. Adjustable time inhibit. .2 to 600 Volts AC/DC. Selectable latching feature. 80mmH x 22.5mmW x 100mmL		<b>F3I Series</b> Motor Protection Relay	Motor Protection for Phase Loss Phase Unbalance Current Surge	8 to 630Amp current range. LED diagnostics. Adjustable trip timers. Phase loss test switch. Front panel reset. 79mmH x 45mmW x 95mmL
	<b>JR Series</b> Alternating Relay	Duplex Alternating Relay	Plug-in style. Designed for dual pump system. Selector switch versions available. 1.89"H x 1.89"W x 3.9"L		<b>FWIT Series</b> Motor Protection Relay	Motor Protection for Phase Loss Phase Unbalance Phase Reversal Current Surge Overheating	7 to 630Amp current range. LED diagnostics. Adjustable trip timers Phase loss test switch. Front panel reset. 80mmH x 78mmW x 99mmL

Products and specifications subject to change without notice.  
Consult factory for application assistance.

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### TIME DELAY RELAYS

Crouzet Corporation offers a broad line of Syrelec Brand Timers to meet the requirements of most industrial and instrument applications. Numerous accessories and options are available for convenient and compatible installation. If a standard Syrelec Brand Timer does not meet your exact requirements, a custom designed or modified standard device could be the solution to fit your need. Contact your nearest Crouzet Sales Office or our Customer Service Department at 1-800-677-5311, for information regarding custom Timers and Controls. Crouzet has timers to meet your CE, UL and CSA requirements.

	SERIES	FUNCTION	FEATURES		SERIES	FUNCTION	FEATURES
	<b>814 Series</b> <b>812 Series</b> <b>815 Series</b> <b>816 Series</b> Digital Timers LCD Display Backlit Option	1. Delay on Make 2. Interval 3. Single Shot 4. Delay on Break 5. Repeat Cycle	Six timing functions, eleven time ranges, and memory features available. Housed in a 1/16 DIN-style (48 x 48mm) enclosure.		<b>TR Series</b> Slimline DIN Rail Mount Timers	1. Delay on Make 2. Single Shot 3. Interval 4. Delay on Break 5. Repeat Cycle	Slimline, DIN-rail or surface mounting, LED indicators for output and timing status, and (optional) remote potentiometer setting.
	<b>88 857 Series</b> Multi-function LCD Timer with Memory	1. Delay on Make 2. Single Shot 3. Interval 4. Delay on Break 5. Repeat Cycle	1/16 Din-sized (48 x 48mm) package, front panel mounting, large LCD display, NEMA 4 front panel, memory functions.		<b>MR Series</b> Miniature DIN Rail Mount Timers	1. Delay on Make 2. Single Shot 3. Delay on Break 4. Repeat Cycle	Miniature, 17.5mm wide, DIN-rail or surface mounting, LED indicator for output status. Multi-operation modes, multi supply voltages.
	<b>LR2 U Series</b> Multi-function Timer	1. Delay on Make 2. Single Shot 3. Interval 4. Delay on Break	1/16 Din-sized (48 x 48mm) package. Easy to set dial, direct reading, multi-time ranges, LED indicators.		<b>AR2 U Series</b> <b>AR U Series</b>	Delay on Make	8 pin plug-in or a Din-rail enclosure. Multi-time ranges, direct reading and LED indicators.
	<b>AXR2 U Series</b> Delay on Make Timer	Delay on Make DPDT or Delay on Make with instantaneous SPDT	1/16 Din-sized (48 x 48mm) package, especially suited for front panel mounting applications.		<b>LR2 U Series</b> <b>LR U Series</b> Multifunction Timer	1. Delay on Make 2. Interval 3. Single Shot 4. Delay on Break	Multi-function timer in a plug-in housing. Multi-time ranges, direct reading, multi-voltage and LED indicators.
	<b>DR2 U Series</b> Repeat Cycle Timer	Repeat Cycle with independently adjustable "On" and "Off" Time	Enclosed in a front panel mounting Din-sized (48 x 48mm) package. Independent "On" & "Off" times.		<b>DR2 U Series</b> <b>DR U Series</b>	Repeat Cycle	8 pin plug-in or a Din-rail enclosure. On and Off time can be adjusted independently. Multi-time ranges.
	<b>TOP 36 Series</b> Delay on Make Timer	Delay on Make	Low cost Delay on Make timer enclosed in a Din-sized (36 x 36mm) package.		<b>88 901 Series</b> Analog Timer	Delay on Make	3 wire VDC 2 wire AC. 22mm diameter cutout. Used for timers for PLCs. Also can drive contactors and relays.
	<b>88 226 Series</b> Multi-function Timer	1. Delay on Make 2. Interval 3. Single Shot 4. Delay on Make with Memory	This synchronous motor driven reset timer is available in two standard time ranges (0.3 sec to 12 hrs). Cycle progress dial.		<b>SAS Series</b> <b>SHS Series</b>	Delay on Make Interval	Low cost epoxy encapsulated timer housed in a Din-rail and back panel mounting enclosure with a SCR solid state output.
	<b>88 645 and</b> <b>88 646 Series</b> Cam Timers	Multiple On/Off	Cam timers are specifically adapted to applications requiring 1 to 22 circuits.		<b>QAS Series</b> <b>QHS Series</b> <b>QBS Series</b> <b>QCS Series</b>	Delay on Make Interval Single Shot Delay on Break	Low cost epoxy encapsulated timer housed in a 2" x 2" enclosure with a SCR solid state output.

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## SAFETY RELAYS

### CE machinery certification and marking

CROUZET direct safety components combine all the elements of the machinery directive 89/392/EEC and the safety standards set by the European Community. They are an effective and fail-safe way of meeting the regulatory requirements and of obtaining conformity with the directives as well as the CE marking for your machines.

All safety components shown on this page (CE conforming, UL and CUL recognized).

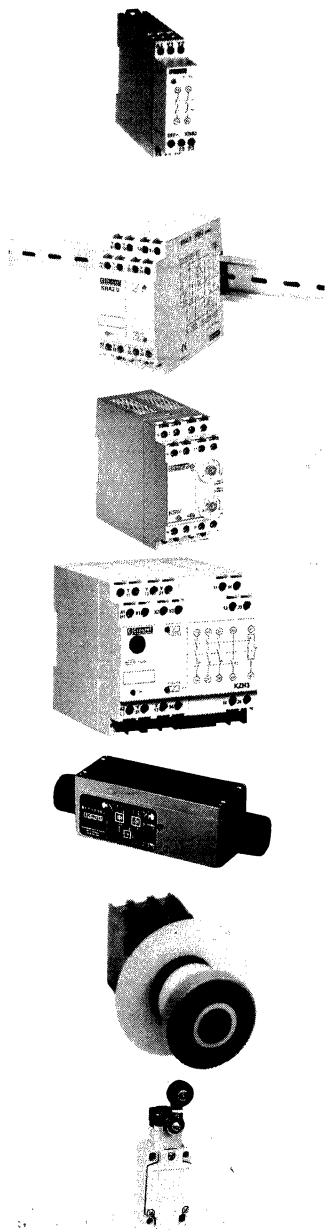


### Performance and cost-effectiveness

The CROUZET range of safety components provides a simple solution to the problem of risk assessment of machine control systems.

The range of components relies on redundancy, self-checking and **positive opening** to ensure the availability and safety of machines without incurring excessive installation costs.

The safety relay range satisfies safety requirements up to Level 4 regarding EN 60204 (IEC 204) and EN 954.



SERIES	FUNCTION	FEATURES	OUTPUT
<b>KNA2 Series</b> Safety Relay	Multifunction: Emergency stop safety gate	1 input Safety Level 3 Operating voltage 24V AC/DC Width 22.5 mm (0.90")	2 N/O safety contacts. 4 A @ 250 VAC resistive.
<b>KNA2U/KNA3/KNA5 Series</b> Safety Relay	Multifunction: Emergency stop safety gate safety mats	Integrity of 2 inputs. Safety Level 4 Operating voltages: 24 VDC 24/48/110/230 VAC Width: 45mm (1.75") KNA3: 90 mm (3.54") KNA5: 135 mm (5.31")	2 N/O safety contacts. 4 A @ 250 VAC resistive. KNA3: 3 N/O safety contacts 2 auxiliary contacts KNA5: 5 N/O safety contacts 2 auxiliary contacts 6 A @ 250 VAC resistive
<b>KSW Series</b> Safety Relay	Stand still (zero speed) condition of AC and DC, 1 or 3 phase motors up to 600 VAC for interlocking of safety gates.	Integrity of 2 inputs Safety level 4 Operating voltage 24VDC 24/48/110/230 VAC Width: 45 mm (1.75")	2 N/O safety contacts. 4A @ 250 VAC
<b>KZH3 Series</b> Electrical Safety Relay	Multifunction: 2 Hand control Emergency stop Safety gates Safety mats	Integrity of 2 inputs Safety level 4 Operating voltage 24VDC 24/48/110/230 VAC Width: 90 mmL Can be used with Crouzet 2 Hand Console USP	3 N/O safety contacts. 2 auxiliary contacts. 6 A @ 250 VAC resistive
<b>KZH</b> Pneumatic Safety Relay and Console	Multifunction: 2 Hand control Safety gate monitoring	Safety level 3 Safety logic block integrated in console Operating pressure: 30 to 120 psi	1 output Flow at 90 psi: 7cfm
<b>79 697 001</b> <b>79 697 002</b> Emergency Stop Push Buttons	Emergency stop for safety applications. Version 79 697 002 has double insulated enclosure (IP 657)	Positive opening contacts, 2 position push pull mushroom head. Push button with positive mechanical action. Diameter of mushroom head: 40 mm (1.57") Conforms to IEC 947.5.1	2 N/C and 1 N/O 6 A @ 230 VAC resistive
<b>83 862 301</b> Positive Break Limit Switch	Overtravel and position of mechanical parts (safety gate monitoring)	Positive opening contacts Rugged metal body construction. I 866 Conforms to IEC 947.5.1 5.19"H x 1.59"W x 1.09"L	1 SPDT 6 A @ 250 VAC

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## Panel Mount AC Output Solid State Relays

### G, GA Series Power Relays

- Current Ratings to 90A
- Output Voltage ratings to 660 VAC with 24VAC Minimum
- AC or DC Inputs
- 4KV Optical Isolation
- Zero Voltage Turn-on (Random Available)
- RC Snubber Network for Inductive Loads
- UL Recognized, CSA Certified
- TUV Certified

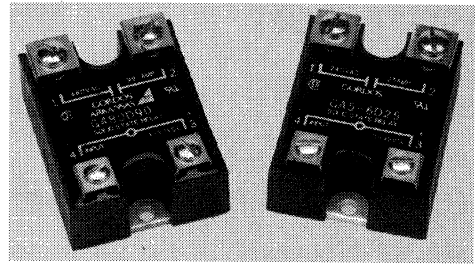
### G Series Power Relays

- Back-to-Back (dual) SCR Output for Severe Inductive Loads
- Superior False Turn-on Immunity and Positive Turn-off at High dv/dt



### GA Series Power Relays

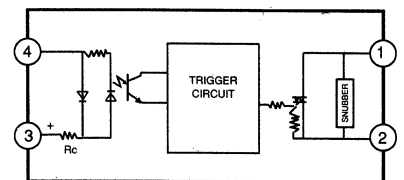
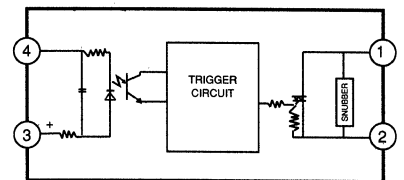
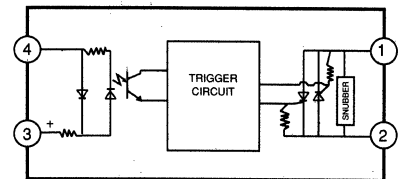
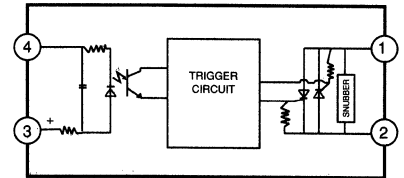
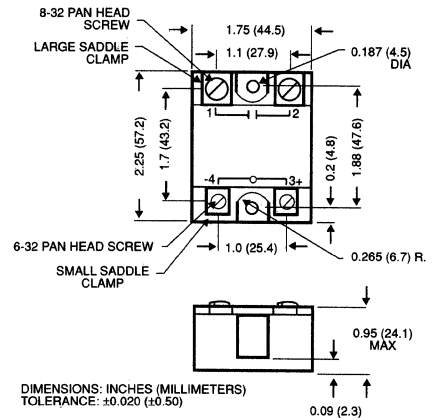
- Economical Triac Output for General Purpose Application



G and GA Series

### G SERIES

MODELS	OUTPUT VOLTAGE RATING (VAC)	OUTPUT CURRENT RATING	CONTROL VOLTAGE
G240A10	24-280	10A	90-280VAC
G240A25	24-280	25A	90-280VAC
G240A45	24-280	45A	90-280VAC
G240A75	24-280	75A	90-280VAC
G240A90	24-280	90A	90-280VAC
G480A10	36-660	10A	90-280VAC
G480A25	36-660	25A	90-280VAC
G480A50	36-660	50A	90-280VAC
G480A75	36-660	75A	90-280VAC
G480A90	36-660	90A	90-280VAC
G575A10	36-660	10A	90-280VAC
G575A25	36-660	25A	90-280VAC
G575A50	36-660	50A	90-280VAC
G575A75	36-660	75A	90-280VAC
G575A90	36-660	90A	90-280VAC
G240D10	24-280	10A	3-32VDC
G240D25	24-280	25A	3-32VDC
G240D45	24-280	45A	3-32VDC
G240D75	24-280	75A	3-32VDC
G240D90	24-280	90A	3-32VDC
G480D10	36-660	10A	3-32VDC
G480D25	36-660	25A	3-32VDC
G480D50	36-660	50A	3-32VDC
G480D75	36-660	75A	3-32VDC
G480D90	36-660	90A	3-32VDC
G575D10	36-660	10A	3-32VDC
G575D25	36-660	25A	3-32VDC
G575D50	36-660	50A	3-32VDC
G575D75	36-660	75A	3-32VDC
G575D90	36-660	90A	3-32VDC
G240E10	24-280	10A	18-36VAC
G240E25	24-280	25A	18-36VAC
G240E45	24-280	45A	18-36VAC
G240E75	24-280	75A	18-36VAC
G240E90	24-280	90A	18-36VAC
G480E10	36-660	10A	18-36VAC
G480E25	36-660	25A	18-36VAC
G480E50	36-660	50A	18-36VAC
G480E75	36-660	75A	18-36VAC
G480E90	36-660	90A	18-36VAC
G575E10	36-660	10A	18-36VAC
G575E25	36-660	25A	18-36VAC
G575E50	36-660	50A	18-36VAC
G575E75	36-660	75A	18-36VAC
G575E90	36-660	90A	18-36VAC



### GA SERIES

MODELS	OUTPUT VOLTAGE RATING (VAC)	OUTPUT CURRENT RATING	CONTROL VOLTAGE
GA5-6A10	24-280	10A	90-280VAC
GA5-6A25	24-280	25A	90-280VAC
GA5-6D10	24-280	10A	3-32VDC
GA5-6D25	24-280	25A	3-32VDC
GA5-6E10	24-280	10A	18-36VAC
GA5-6E25	24-280	25A	18-36VAC

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### 3 Phase Solid State Relays

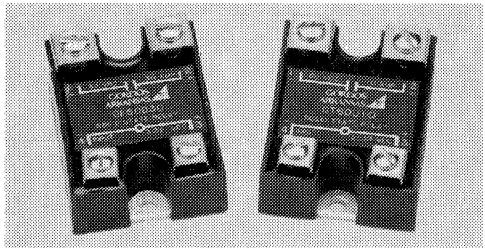
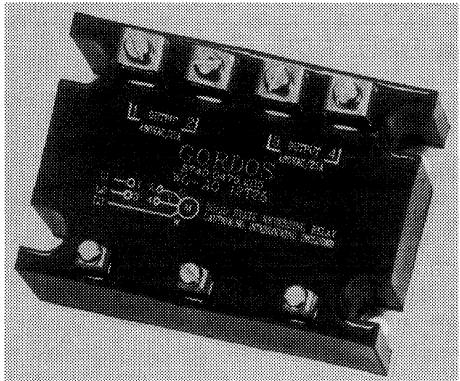
#### GA3 Series: 3 Phase SSR

#### GA0 Series: 3 Phase Reversing SSR

The GA3 and GA0 Series feature industry standard packaging, output over voltage protection, and a 4 to 32VDC current regulated input. Enclosure measures 25 x 74 x 104mm. The GA0 Series are random turn-on. All series have 4 kv optical isolation and are UL and CSA approved, TUV Certified.

PART NUMBER	Control Voltage	Maximum Output Current (A)	Output Voltage
GA3-12D10R	4 - 32VDC	10	24 - 660VAC
GA3-12D10Z	4 - 32VDC	10	24 - 660VAC
GA3-12D25R	4 - 32VDC	25	24 - 660VAC
GA3-12D25Z	4 - 32VDC	25	24 - 660VAC
GA3-12D45R	4 - 32VDC	45	24 - 660VAC
GA3-12D45Z	4 - 32VDC	45	24 - 660VAC
GA3-12A25R	90 - 280VDC	25	24 - 660VAC
GA3-12A25Z	90 - 280VDC	25	24 - 660VAC
GA3-12A45R	90 - 280VDC	45	24 - 660VAC
GA3-12A45Z	90 - 280VDC	45	24 - 660VAC
GA0-12D25	3 - 32VDC	25	24 - 660VAC

("R" Suffix denotes Random Turn-On, "Z" Suffix denotes Zero Crossing)



### Panel Mount DC Output Solid State Relays

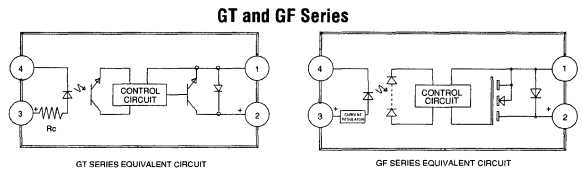
#### GF Models Utilize FET Output

- Low leakage of 10µA
- Milliohm On-State Resistance
- 1500 VAC Optical Isolation
- Long Life Switching of DC Loads to 30A

#### GT Models Utilize Transistor Output

- Cost Effective General Purpose DC SSR
- Long Life Switching DC Loads to 10A
- 4KV Optical Isolation
- Fast 25µSec Maximum Turn-on Time

MODEL	MAX. OUTPUT VOLTAGE RATING (VAC)	OUTPUT CURRENT RATING	CONTROL VOLTAGE
GF50D30	1-50	30A	3-32VDC
GF100D15	1-100	15A	3-32VDC
GF200D10	1-200	10A	3-32VDC
GT60D10	3-60	10A	3-32VDC

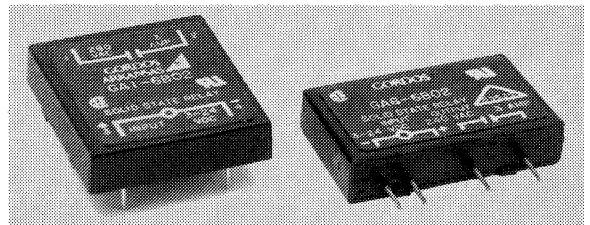


### Printed Circuit Board Mountable AC Output Solid State Relays

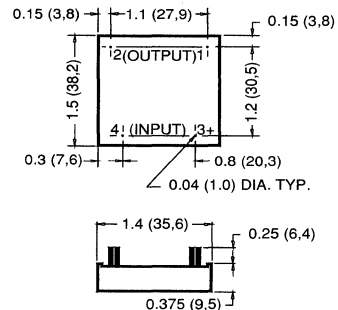
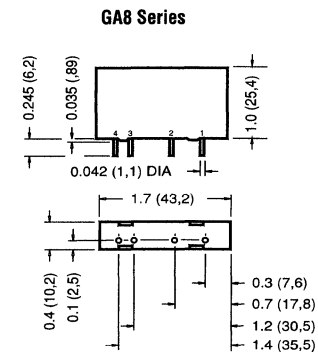
#### GA1, GA8, Series SSR

- Industry Standard Packaging, SIP or Flat Pack
- 4KV Optical Isolation
- 100A Surge Capability
- UL recognized, CSA Certified
- VDE Approval on Some Models
- DEMKO EN60950 Certified

MODEL	MAX. OUTPUT VOLTAGE RATING (VAC)	OUTPUT CURRENT RATING @ 25°C TA	CONTROL VOLTAGE
GA1-6B02	280	4A	3-24VDC
GA8-6B02	280	4A	3-24VDC
GA8-6D05	280	5A	3-24VDC
GA8-6D05R	280	5A	3-24VDC



G1 and GA8 Series



DIMENSIONS: INCHES (MILLIMETERS)  
TOLERANCE: ±0.020 (± 0,50)

Products and specifications subject to change without notice.  
Consult factory for application assistance.

# I/O MODULES & MOUNTING BOARDS

# GORDOS

## MODULE BOARDS

Gordos I/O Mounting Boards are available for Standard, SM, Quad and Miniature I/O module sizes and everything you need to interface with any 5, 15, or 24 volt logic unit is included. Since the function is self-contained in each module, you determine the layout of your own system boards. The plug-in modules with single hold-down screw make later revisions easy; modules are replaceable without disconnecting the wires.

- Plug-compatible logic contacts on 8, 16, 24, and 32 position boards. Screw terminal logic connections on 4 position boards.
- Barrier strip with screw terminals for load connections
- Circuitry for pull-up resistors
- 5 amp field replaceable fuses
- LED status indicators
- All even pins logic GND
- UL Recognized

### MODULE BOARDS FOR STANDARD MODULES

MODEL	POSITION
PB-4	4
PB-4R*	4
PB-8	8
PB-16	16
PB-24	24
PB-32D	32

### FOR MINIATURE MODULES

MODEL	POSITION
PB-8M	8
PB-16M	16
PB-24M	24
PB-32M	32
PB-24MD	24

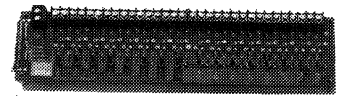
### FOR QUAD-PACK MODULES

PB-16Q	4
PB-24Q	6
PB-32Q	8

### FOR SM MODULES

PB-8SM	8
PB-16SM	16
PB-24SM	24
PB-32SM	32

\*Output I/O only



Module Boards

## MINIATURE I/O MODULES (M AND SM)

Gordos I/O Modules get a minimum of 300% testing-multiple component and functional tests that made Gordos the reliability standard in SSRs. Across the line, Gordos' average field return rate is well below the industry average.

- SM plug into standard I/O Mounting Boards or SM Series Mounting Boards
- M plug into M Series Mounting Boards Only
- High Current Thyristor for 100A Surge Capability
- 4KV Optical Isolation
- 33% Thinner than Standard I/O Modules
- UL Recognized/CSA Certified
- DEMKO Certification Pending

### M and SM SERIES

- Zero or Random Turn-on available in AC output

### SM SERIES

INPUT MODULES	MODEL	INPUT VOLTAGE RATING	LOGIC VOLTAGE	MAX. OUTPUT CURRENT
	SM-IAC5	90-140VAC/VDC	5	50MADC
SM-IAC15	90-140VAC/VDC	15	50MADC	
SM-IAC24	90-140VAC/VDC	24	50MADC	
SM-IAC5A	180-280VAC/VDC	5	50MADC	
SM-IAC24A	180-280VAC/VDC	24	50MADC	
SM-IDC5	3.3-32VDC	5	50MADC	
SM-IDC15	3.3-32VDC	15	50MADC	
SM-IDC24	3.3-32VDC	24	50MADC	

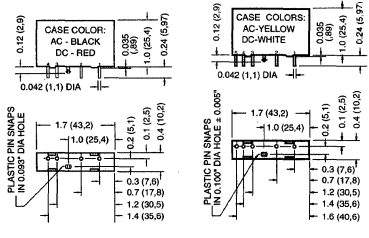
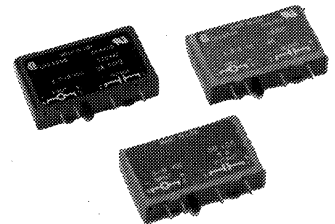
OUTPUT MODULES	MODEL	INPUT VOLTAGE RATING	OUTPUT VOLTAGE RATING	MAX. OUTPUT CURRENT
	SM-OAC5	2.75-8VDC	12-140VAC	3.5Arms
SM-OAC15	9-18VDC	12-140VAC	3.5Arms	
SM-OAC24	18-32VDC	12-140VAC	3.5Arms	
SM-OAC5A	2.75-8VDC	24-280VAC	3.5Arms	
SM-OAC24A	18-32VDC	24-280VAC	3.5Arms	
SM-ODC5	2.75-8VDC	3-60VDC	3.0A	
SM-ODC15	9-18VDC	3-60VDC	3.0A	
SM-ODC24	18-32VDC	3-60VDC	3.0A	
SM-ODC5A	2.75-8VDC	3-250VDC	3.0A	

### M SERIES

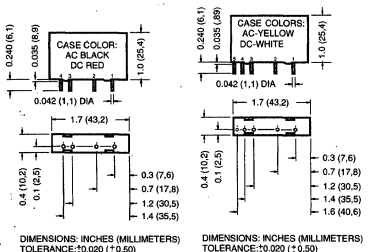
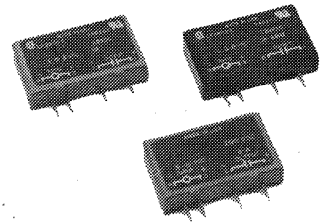
INPUT MODULES	MODEL	INPUT VOLTAGE RATING	LOGIC VOLTAGE	MAX. OUTPUT CURRENT
	M-IAC5	90-140VAC/VDC	5	50MADC
M-IAC15	90-140VAC/VDC	15	50MADC	
M-IAC24	90-140VAC/VDC	24	50MADC	
M-IAC5A	180-280VAC/VDC	5	50MADC	
M-IAC24A	180-280VAC/VDC	24	50MADC	
M-IDC5	3.3-32VDC	5	50MADC	
M-IDC15	3.3-32VDC	15	50MADC	
M-IDC24	3.3-32VDC	24	50MADC	

OUTPUT MODULES	MODEL	INPUT VOLTAGE RATING	OUTPUT VOLTAGE RATING	MAX. OUTPUT CURRENT
	M-OAC5	2.75-8VDC	12-140VAC	3.5Arms
M-OAC15	9-18VDC	12-140VAC	3.5Arms	
M-OAC24	18-32VDC	12-140VAC	3.5Arms	
M-OAC5A	2.75-8VDC	24-280VAC	3.5Arms	
M-OAC24A	18-32VDC	24-280VAC	3.5Arms	
M-ODC5	2.75-8VDC	3-60VDC	3.0A	
M-ODC15	9-18VDC	3-60VDC	3.0A	
M-ODC24	18-32VDC	3-60VDC	3.0A	



SM Series I/O Module



M Series I/O Module

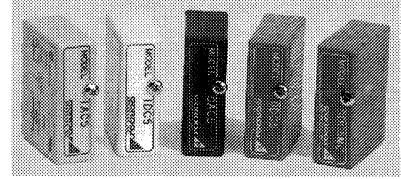
Products and specifications subject to change without notice. Consult factory for application assistance.

Crouzet Corporation 3237 Commander Dr., Carrollton, TX 75006-2506 • Tel: 972-250-1647 • 1-800-677-5311 • Fax: 972-250-3865



### Standard Size I/O Modules

- Zero AC or Random Turn-on Output Modules
- Industry Standard Packaging
- Plug into Standard I/O Mounting Racks
- UL Recognized / CSA Certified
- DEMKO Certification Pending

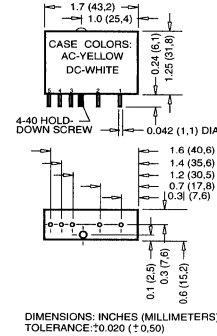


Standard Size I/O Modules

INPUT MODULES	MODEL	INPUT VOLTAGE RATING	LOGIC VOLTAGE	MAXIMUM OUTPUT CURRENT
	IAC5	90-140VAC/VDC	5	50MADC
IAC15	90-140VAC/VDC	15	50MADC	
IAC24	90-140VAC/VDC	24	50MADC	
IAC5A	180-280VAC/VDC	5	50MADC	
IAC24A	180-280VAC/VDC	24	50MADC	
IDC5	3.3-32VDC	5	50MADC	
IDC15	3.3-32VDC	15	50MADC	
IDC24	3.3-32VDC	24	50MADC	

OUTPUT MODULES	MODEL	INPUT VOLTAGE RATING	OUTPUT VOLTAGE RATING	MAXIMUM OUTPUT CURRENT
	OAC5	2.75-8VDC	12-140VAC	3.5Arms
OAC15	9-18VDC	12-140VAC	3.5Arms	
OAC24	18-32VDC	12-140VAC	3.5Arms	
OAC5A	2.75-8VDC	24-280VAC	3.5Arms	
OAC24A	18-32VDC	24-280VAC	3.5Arms	
ODC5	2.75-8VDC	3-60VDC	3.0A	
ODC15	9-18VDC	3-60VDC	3.0A	
ODC24	18-32VDC	3-60VDC	3.0A	
ODC5A	2.75-8VDC	3-250VDC	3.0A	

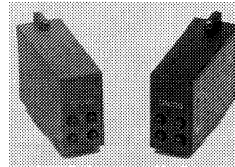


### Standard Size I/O Modules

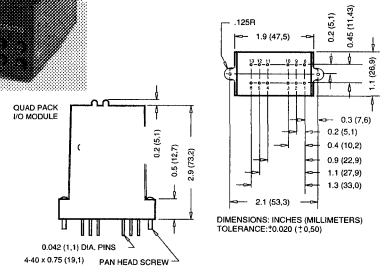
INPUT MODULES	MODEL	INPUT VOLTAGE RATING	LOGIC VOLTAGE	MAXIMUM OUTPUT CURRENT
	IAC5Q	90-140VAC/VDC	5	50MADC
IAC5AQ	90-280VAC/VDC	5	50MADC	
IAC5EQ	18-36VAC/VDC	5	50MADC	
IDC5Q	10-60VDC	5	50MADC	
IDC5BQ	4-32VDC	5	50MADC	

OUTPUT MODULES	MODEL	OUTPUT VOLTAGE RATING	MAXIMUM OUTPUT CURRENT
	OAC5Q	2.75-8VDC	12-140VAC
ODC5Q	2.75-8VDC	3-60VDC	3.0A



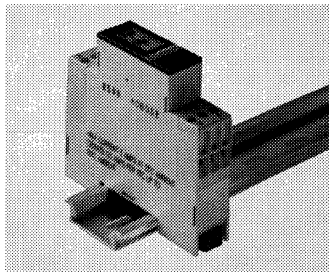
Quad Pack Modules



### DIN Rail Mountable (17.5 mm wide)

#### Single Point Output Modules

- AC Output Rating 5 Amp at 12 to 280 VAC, with 350 Amp Single Cycle Surge Capability
- DC Output Rating 3 Amp at 5 to 60 VDC
- 4 to 32 VDC Input Current regulated
- Zero Voltage Turn-on for AC Module
- 4 KV Optical Isolation with LED Indicator
- Barrier Strips Accept 14 to 28 AWG Wire
- Configured for Panel Mounting
- UL / cUL Recognized

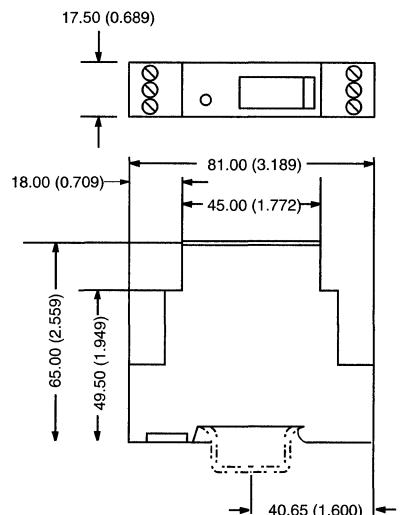


#### Input Modules

PART NUMBER	Input Voltage	Output Voltage	Maximum Current
84115501	90 - 140VAC/DC	4.5 - 30VDC	50mA
84115502	140 - 280VAC/DC	4.5 - 30VDC	50mA
84115503	4 - 32VAC/DC	4.5 - 30VDC	50mA

#### Output Modules

PART NUMBER	Input Voltage	Output Voltage	Maximum Current
84130104	4 - 32VDC	5 - 60VDC	3 Amps
84130105	4 - 32VDC	24 - 280VAC	5 Amps



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Consult factory for application assistance.

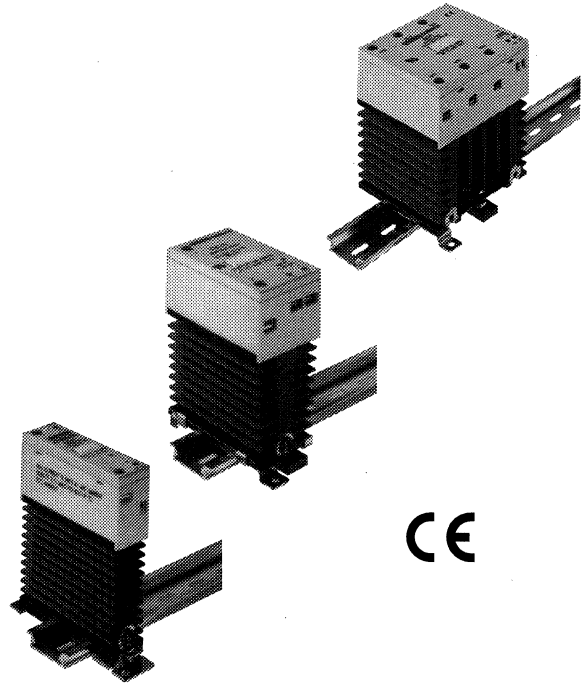


## Din Rail Mount AC Output Solid State Relay

- Input LED
- Current Regulated Input
- Touch Safe (IP20) Enclosure
- EN60950 Compliant
- RC Snubber Network for Inductive Loads
- Zero Voltage Turn-on (Random Available)
- Complies with IEC 1004-4 and 1004-2 Level 3 Requirements

MODEL	OUTPUT VAC	OUTPUT CURRENT	CONTROL VOLTAGE
<b>TRIAC OUTPUT (22.5MM)</b>			
84130100	24-280	10A	180-280 VAC
84130101	24-280	10A	4-32 VDC
84130102	24-280	25A	180-280 VAC
84130103	24-280	25A	4-32 VDC
84130150	24-280 VAC	10A	90-140 VAC
84130152	24-280 VAC	25A	90-140 VAC
<b>SCR OUTPUT (22.5MM)</b>			
84130116	48-660	25A	4-32 VDC
84130117	48-660	25A	4-32 VDC (RANDOM)
84130118	48-660	25A	180-280 VAC
84130158	48-660 VAC	25A	90-140 VAC
<b>SCR OUTPUT (45MM)</b>			
84130110	48-660	35A*	90-280 VAC
84130111	48-660	35A*	4-32 VDC
84130112	48-660	35A*	4-32 VDC (RANDOM)
84130113	48-660	45A	4-32 VDC
84130114	48-660	45A	4-32 VDC (RANDOM)
84130115	48-660	45A	90-280 VAC
<b>SCR OUTPUT (90MM) 2 PHASE</b>			
84130220	48-660	35A	4-32 VDC
84130221	48-660	35A	4-32 VDC (RANDOM)
84130222	48-660	35A	90-280 VAC
<b>SCR OUTPUT (90MM) 3 PHASE</b>			
84130310	48-660	25A (1)	4-32 VDC
84130311	48-660	25A (1)	90-280 VAC
84130312	48-660	25A (1)	4-32 VDC (RANDOM)

\*FREE AIR 25 C (1) Per Phase

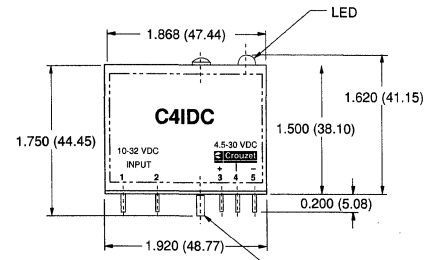
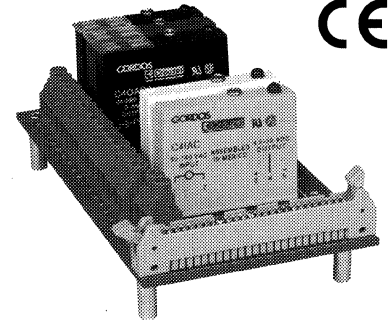


## I/O MODULES

- Built-in LED Status Indicator
- Regulated Supply Voltage
- New Industry Standard Packaging
- 4000 VAC Optical Isolation
- Replaceable 2AG Type Fuse (output modules only)
- Universal Logic Voltage
- UL/CUL Recognized

## C4 I/O MODULES

MODELS		INPUT VOLTAGE RANGE	LOGIC VOLTAGE	MAXIMUM OUTPUT CURRENT
INPUT MODULES	C4IAC	90-140 VAC	4.5-30 VDC	50mA DC
	C4IACA	140-280 VAC	4.5-30 VDC	50mA DC
	C4IDC	10-32 VDC	4.5-30 VDC	50mA DC
	C4IDCB	4-16 VDC	4.5-30 VDC	50mA DC
	C4IDCG	35-60 VDC	4.5-30 VDC	50mA DC
	C4IDCK	2.5-16 VDC	4.5-30 VDC	50mA DC
	C4SWIN	N/A	4.5-30 VDC	50mA DC
	OUTPUT MODULES	C40AC	4-32 VDC	OUTPUT VOLTAGE RANGE 12-140 VAC
C40ACA		4-32 VDC	24-280 VAC	3 amps
C40DC		4-32 VDC	5-60 VDC	3 amps
C40DCA		4-32VDC	3-250VDC	1 amps
C4SWOUT		N/A	1-250VAC	3 amps

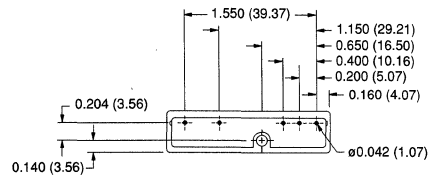


## MODULE BOARDS

- Accept either Input or Output Modules
- Includes Spare Fuse and Fuse Tester

## C4 MOUNTING BOARDS

MODEL	POSITION
PB-4C4	4
PB-8C4	8
PB-16C4	16
PB-16C4T	16
PB-24C4	24
PB-32C4	32



Products and specifications subject to change without notice.  
Consult factory for application assistance.

**REED RELAYS**



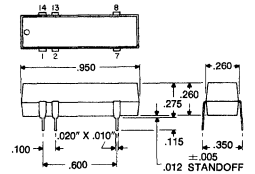
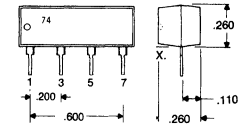
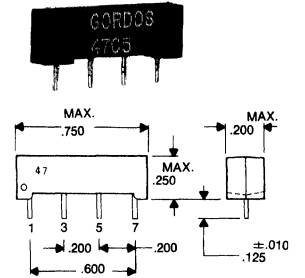
**MOLDED REED RELAYS SELECTION CHART**

Series 47 Mini-Sip Dry Reed Relays  
Series 74 Sip Dry Reed Relays

MODEL	NOMINAL COIL VDC	COIL RES OHMS	DIODE SUSPENSION	SCHEMATIC (TOP VIEW)
4705	5	500	NO	
4705D	5	500	YES	
4712	12	1200	NO	
4712D	12	1200	YES	
741A-1	5	380	NO	
741A-2	5	380	YES	
741A-9	5	500	NO	
741A-10	5	500	YES	
741A-3	12	1000	NO	
741A-4	12	1000	YES	
741A-7	24	1750	NO	
741A-8	24	1750	YES	
741C-1	5	200	NO	
741C-2	5	200	YES	
741C-4	12	500	YES	
741C-6	24	1750	NO	

Series 83 continued

MODEL	NOMINAL COIL VDC	COIL RES OHMS	DIODE SUSPENSION	SCHEMATIC (TOP VIEW)
836C-1	5	200	NO	
836C-2	5	200	YES	
836C-3	12	500	NO	
836C-4	12	500	YES	
836C-5	24	1750	NO	
836C-6	24	1750	YES	
832A-1	5	200	NO	
832A-2	5	200	YES	
832A-3	12	500	NO	
832A-4	12	500	YES	
832A-5	24	1750	NO	
832A-6	24	1750	YES	



846 Series

**6 PIN DIP RELAYS / 846 SERIES HIGH VOLTAGE**

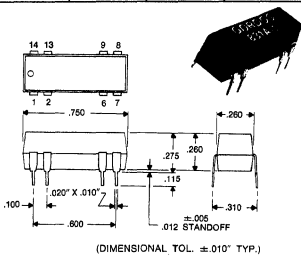
CONTACT ARRANGEMENT	NOMINAL COIL VOLT	COIL RES OHMS ±10%	ACLAMP DIODE	PART NUMBER	SCHEMATIC (TOP VIEW)
1A SPST N.O.	5	150	NO	846A-1	
		500	YES	846A-2	
	12	500	NO	846A-3	
		17500	YES	846A-4	
	24	17500	NO	846A-5	
		17500	YES	846A-6	

**4 PIN DIP RELAYS / 848 SERIES HIGH VOLTAGE**

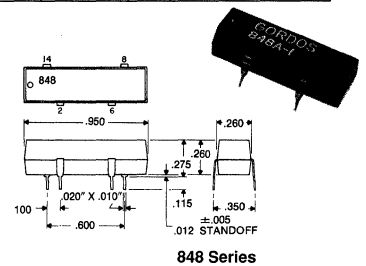
CONTACT ARRANGEMENT	NOMINAL COIL VOLT	COIL RES OHMS ±10%	ACLAMP DIODE	PART NUMBER	SCHEMATIC (TOP VIEW)
1A SPST N.O.	5	150	NO	848A-1	
		500	YES	848A-2	
	12	500	NO	848A-3	
		17500	YES	848A-4	
	24	17500	NO	848A-5	
		17500	YES	848A-6	

**Series 83 Molded DIP Thru-Hole and Surface Mount Dry Reed Relay**

831A-1	5	380	NO	
831A-2	5	380	YES	
831A-3	5	500	NO	
831A-4	5	500	YES	
831A-5	12	1000	NO	
831A-6	12	1000	YES	
831A-7	24	1750	NO	
831A-8	24	1750	YES	
831C-1	5	200	NO	
831C-2	5	200	YES	
831C-3	12	500	NO	
831C-4	12	500	YES	
831C-5	24	1750	NO	
831C-6	24	1750	YES	



83 Series



848 Series

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Consult factory for application assistance.



# Your reliable source for Solid State Relays and more...

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Toll-Free **800-8 CRYDOM (827-9366)**



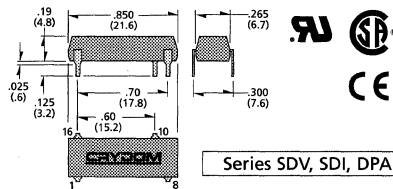
## PCB Mount SSRs

### SERIES SDV, SDI, DPA 1-1.5 Amp • 120/240Vac • 16 PIN DIP Package

Fast Fax No. 101, 102

This Series of compact 16 pin DIP solid state relays are rated at 1.0 - 1.5 Amp RMS at ambient temperatures up to 40°C. The package is perfect for high density printed circuit boards. Your choice of either voltage or current operated versions are offered.

- High-Density, DC Control, SCR Output
- Switching: Zero-Cross, Random Turn-On



Type	Operating Voltage Range (Vrms)	Transient Over Voltage (Vp)	Max. Load Current @ 40°C (Arms)	Control Voltage Range (Vdc)
SDV2415	12-280	600	1.5	3.5-10
SDV2415R*	12-280	600	1.5	3.5-10
DPA4119	20-140	400	1.0	3.5-10
DPA6119	20-280	600	1.0	3.5-10

Type	Operating Voltage Range (mA)	Transient Over Voltage (Vp)	Max. Load Current @ 40°C (Arms)	Control Current Range (mA)
SDI2415	12-280	600	1.5	10-50
SDI2415R*	12-280	600	1.5	10-50
DPA4111	20-140	400	1.0	10-50
DPA6111	20-280	600	1.0	10-50

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vac): 4000  
\* R suffix - Random Turn-On Version

### SERIES AO, ASO 1-2.0 Amp • 120/240Vac • 16 MINI-SIP Package

Fast Fax No. 103

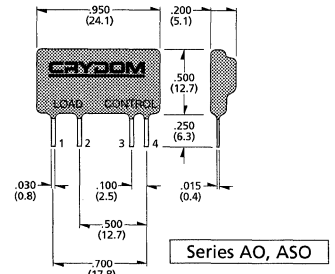
Models AO241/R, ASO241/R and ASO242/R are 1.0A/1.5A/2.0A rated SPST-NO miniature SIP solid state relays. ASO models are designed for switching highly inductive, low current loads such as solenoids.

- DC Control, AC Output
- Triac (AO) or SCR (ASO) Output



Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Aplk)
AO241	24-280	.02-1.0	4-10	40
AO241R*	24-280	.02-1.0	4-10	40
ASO241	12-280	.01-1.5	4-10	10
ASO241R*	12-280	.01-1.5	4-10	10
ASO242	12-280	.01-2.0	4-10	40
ASO242R*	12-280	.01-2.0	4-10	40

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vac): 2500  
\* R suffix - Random Turn-On Version



### SERIES DO, DMO 1-3.0 Amp • 60, 100Vdc • DC MINI-SIP Package

Fast Fax No. 104

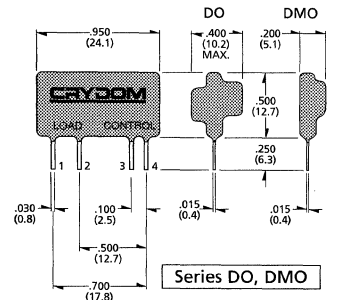
SPST-NO DC output relays in epoxy-coated packages utilize the popular .10" grid lead spacing. They are available with either bipolar transistor output (DO), or the DMO063 with MOSFET output is rated at 3A/60 VDC.

- DC Control
- Bipolar (DO) or MOSFET (DMO) DC Output



Type	Line Voltage Range (Vdc)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Sec (Aplk)
DO061A	3-60	.02-1.0	3-9	5.0
DO061B	3-60	.02-1.0	1.7-9	5.0
DMO063	0-60	0-3.0	3-10	12.0

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vac): 4000, 2500 (DMO)



### SERIES CX241, MCX241 1.5 Amp • 120/240Vac • AC SIP Package

Fast Fax No. 105, 106

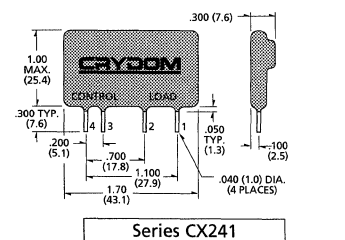
The CX241 AC relays are SPST-NO low profile SIP solid state relays. These models offer the ASO circuit with the popular CX pin-out.

- DC Control, SCR AC Output
- Low Minimum Operating Current



Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Aplk)
CX241	12-280	.01-1.5	4-10	10
CX241R*	12-280	.01-1.5	4-10	10

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vac): 4000  
Both models available in the MP package (See Series MP).  
Use "M" Prefix, Example: **MCX241** \* R suffix - Random Turn-On Version



### SERIES ASPF (POWERFIN - INTEGRAL HEATSINK) 3 Amp • 120/240Vac • AC MINI-SIP Package

Fast Fax No. 113

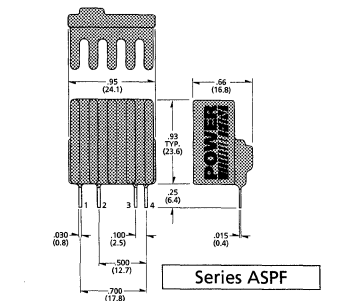
The Series ASPF incorporates Crydom's patented PowerFin™ design technology with integral heat sink. Rated at 3 Amps up to 45°C, this SPST-NO AC output SSR is designed for precise electrical power applications.

- DC Control, AC Output
- SCR Output, Crydom's Patented PowerFin Design



Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Aplk)
ASPF241	24-280	0.1-3.0	4-10	30
ASPF241R*	24-280	0.1-3.0	4-10	30

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vrms): 3750  
\* R suffix - Random Turn-On Version



### SERIES CMX 5-10 Amp • 60-100Vdc • DC SIP Package

Fast Fax No. 109

DC output SPST-NO solid state relays use MOSFET output for high switching capabilities in a PC-mount air-cooled package. Pinouts are compatible with Series 6 and ODC type I/O modules.

- DC Control, DC Output - MOSFET
- Extra Low On-State Resistance



Type	Line Voltage Range (Vdc)	Load Current Range (Aplk)	Control Voltage Range (Vdc)	Surge Current 10ms (Aplk)
CMX60D5	0-60	0-5	3-10	60
CMX60D10	0-60	0-10	3-10	100
CMX100D6	0-100	0-6	3-10	100

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vrms): 2500  
Note: See Series CX for Mechanical Drawing



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## PCB Mount SSRs

### SERIES MPF (POWERFIN - INTEGRAL HEATSINK) 4 Amp • 120/240Vac • AC Output, SIP Package

Fast Fax No. 114

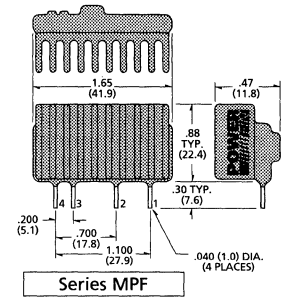
The Series MPF SSR offers Crydom's patented PowerFin™ design technology with integral heat sink. This economical SSR is rated at 4 Amps up to 45°C, this low profile SIP has the same pin-out as the popular Series CX.

- ▶ **Integral Heat Sink for High Ratings**
- ▶ **SCR Output, Crydom's Patented PowerFin Design**



Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
MPF240D4	12-280	0.1-4.0	4-10	40
MPF240D4	12-280	0.1-4.0	4-10	40

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vrms): 3750  
 \* R suffix - Random Turn-On Version



### SERIES CX, MCX 5 Amp • 120/240, 380, 480Vac • AC SIP Package

Fast Fax No. 107, 108

Crydom's family of SPST-NO relays achieves one of the highest power switching capabilities in a PC-mounted air-cooled package. Advanced features include exceptional steady state current, plus ultra-high surge ratings.

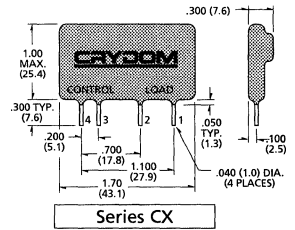
- ▶ **AC or DC Control, SCR Output**
- ▶ **Ultra-High Surge Rating**



AC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vac)	Surge Current 1-Cycle (Apk)
CX240A5	12-280	.06-5.0	90-140	250
CX240A5R*	12-280	.06-5.0	90-140	250
CX240A5	12-280	.06-5.0	18-36	250
CX240A5R*	12-280	.06-5.0	18-36	250

DC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
CX240D5	12-280	.06-5.0	3-15	250
CX240D5R	12-280	.06-5.0	3-15	250
CXE240D5	12-280	.06-5.0	15-32	250
CXE240D5R*	12-280	.06-5.0	15-32	250
CX380D5	48-530	.06-5.0	4-15	250
CXE380D5	48-530	.06-5.0	15-32	250
CX480D5	48-660	.06-5.0	4-15	250
CXE480D5	48-660	.06-5.0	15-32	250

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vac): 4000  
 \* R suffix - Random Turn-On Version  
 AVAILABLE OPTION: -B Normally Closed (CX240D5 Only)  
 All models available in MP package. Use M prefix.



### SERIES PF (POWERFIN - INTEGRAL HEATSINK) Up to 25 Amp • 120/240, 380, 480Vac • AC SIP Package

Fast Fax No. 115

Crydom's PowerFin™ series delivers the highest ratings of any single in-line package (SIP). The integral heat sink design can operate at 25 amps RMS in forced air at 85°C case temp. With natural convection in free air, it rates 10 amps RMS at 25°C ambient.

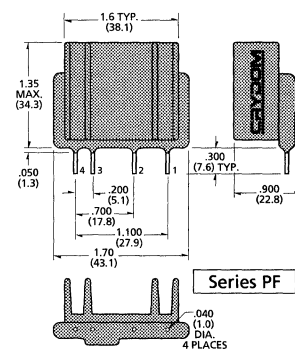
- ▶ **AC or DC Control, SCR Output**
- ▶ **Switching: Zero-Cross, Random Turn-On**



AC CONTROL Type	Line Voltage Range (Vrms)	Load Current** Range (Arms)	Control Voltage Range (Vac)	Surge Current 1-Cycle (Apk)
PF240A25	12-280	.06-25	90-140	250
PFE240A25	12-280	.06-25	18-36	250
PF240A25R*	12-280	.06-25	90-140	250
PFE240A25R*	12-280	.06-25	18-36	250

DC CONTROL Type	Line Voltage Range (Vrms)	Load Current** Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
PF240D25	12-280	.06-25	3-15	250
PFE240D25	12-280	.06-25	15-32	250
PF240D25R*	12-280	.06-25	3-15	250
PFE240D25R*	12-280	.06-25	15-32	250
PF380D25	48-530	.06-25	4-15	250
PFE380D25	48-530	.06-25	15-32	250
PF480D25	48-660	.06-25	4-15	250
PFE480D25	48-660	.06-25	15-32	250

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vrms): 2500  
 \* R suffix - Random Turn-On Version  
 \*\* .06-25 in forced air, Heat Sink 85°C max., .06-10 natural convection, free air @ 25°C ambient



### SERIES CTX 4 x 2.5 Amp • 120/240Vac • AC SIP Package

Fast Fax No. 110

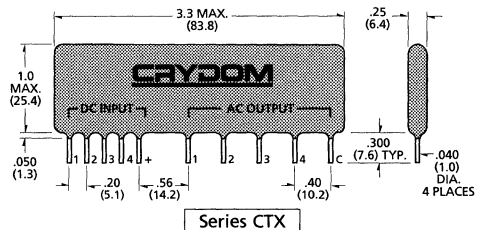
The CTX240D3Q offers four independently controlled SSRs in one compact PCB mount package. Based on the Series CX line, offers ultra-high surge rating, extra low leakage and 4-10 Vdc logic compatible input.

- ▶ **4 AC Relays in One Compact PCB Package**
- ▶ **TRIAC Output**



Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 10 ms (Apk)
CTX240D3Q	24-280	0.1-6.0**	4-10	120
CTX240D3QR	24-280	0.1-6.0**	4-10	120

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vrms): 2500  
 \*\*1 Section On: 0.1-6.0, 2 Sections On: 0.1-4.0, 3 Sections On: 0.1-3.0, 4 Sections On: 0.1-2.5



### SERIES D2W 2-3.5 Amp • 120/240Vac • AC SIP Package

Fast Fax No. 116

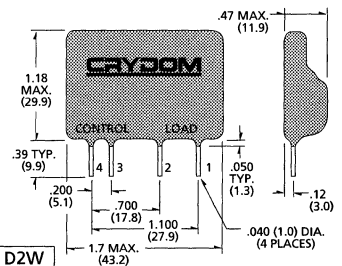
The D2W Series features an epoxy-coated package that provides exceptional environmental protection. Pinouts are compatible with Series 6 and OAC type I/O modules.

- ▶ **DC Control, AC Output**
- ▶ **TRIAC Output**



Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
D2W202F	24-280	.06-2.0	3-32	28
D2W203F	24-280	.06-3.0	3-32	70
D2W203F-11	24-280	.06-3.5	3-32	80

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vrms): 2500





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## PCB Mount SSRs

### SERIES MP

3-4 Amp • 120/240Vac • AC Output

Fast Fax No. 111, 112

Available in 3Arms and 4Arms ratings, all are SPST-NO PC-mount relays that provide greater packaging density and compatibility with pin out of Series 6 and OAC output modules. Internal snubber included.

- ▶ Opto-Isolated 4000Vrms
- ▶ Compatible with 5, 15 & 24V Logic Systems

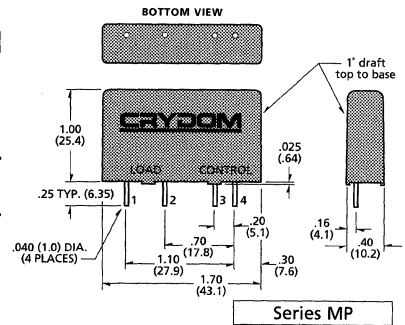


AC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 10 ms (Apk)
MP120D3	12-140	.02-3.0	3-32	90
MP240D3	24-280	.02-3.0	3-32	90
MP240D4	24-280	.02-4.0	3-32	130

DC CONTROL Type	Line Voltage Range (Vdc)	Load Current Range (Adc)	Control Voltage Range (Vdc)	Surge Current 1 s (A)
MPDCD3	3-60	.02-3.0	3-32	5.0

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vrms): 4000  
 \* R suffix - Random Turn-On Version  
 PX models available in the MP package (See Series MP).  
 Use 'M' Prefix, Example: **MPX240D5**



## Panel Mount SSRs

### SERIES 1

10-125 Amp • 120/240Vac • AC Output

Fast Fax No. 151, 152

Featuring state-of-the-art Surface Mount Technology, these SPST-NO relays deliver proven reliability in the most demanding applications. Output consists of an SCR AC switch with internal snubber and is available in zero-cross, random turn-on (phase controllable) versions with either AC or DC input (coil) control.

- ▶ AC or DC Control, SCR AC Output
- ▶ Zero Voltage & Random Turn-On Switching

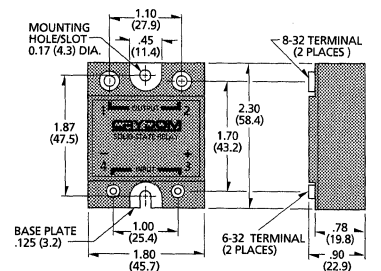


DC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
D1202	24-140	.04-2.5	3-32	22.5
D1210	24-140	.04-10	3-32	120
D1225	24-140	.04-25	3-32	250
D1240	24-140	.04-40	3-32	625
D2410	24-280	.04-10	3-32	120
D2425	24-280	.04-25	3-32	250
D2440	24-280	.04-40	3-32	625
D2450	24-280	.04-50	3-32	625
D2475	24-280	.04-75	3-32	1000
D2490	24-280	.04-90	3-32	1200
D24110	24-280	.04-110	3-32	1500
D24110-10	24-280	.04-110	3-32	1500
D24125	24-280	.04-125	3-32	1750
D24125-10	24-280	.04-125	3-32	1750
D4812	80-530	.04-12	3-32	140
D4825	80-530	.04-25	3-32	250
D4840	80-530	.04-40	3-32	625
D4850	80-530	.04-50	3-32	625
D4875	80-530	.04-75	3-32	1000
D4890	80-530	.04-90	3-32	1200

AC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vac)	Surge Current 1-Cycle (Apk)
A1210	24-140	.04-10	3-32	120
A1225	24-140	.04-25	3-32	250
A1240	24-140	.04-40	3-32	625
A2402	24-280	.04-2.5	3-32	22.5
A2410	24-280	.04-10	3-32	120
A2425	24-280	.04-25	3-32	250
A2440	24-280	.04-40	3-32	625
A2450	24-280	.04-50	3-32	625
A2475	24-280	.04-75	3-32	1000
A2490	24-280	.04-90	3-32	1200
A24110	24-280	.04-110	3-32	1500
A24110-10	24-280	.04-110	3-32	1500
A24125	24-280	.04-125	3-32	1750
A24125-10	24-280	.04-125	3-32	1750
A4812	80-530	.04-12	3-32	140
A4825	80-530	.04-25	3-32	250
A4840	80-530	.04-40	3-32	625
A4850	80-530	.04-50	3-32	625
A4875	80-530	.04-75	3-32	1000
A4890	80-530	.04-90	3-32	1200

- Series 1 AVAILABLE OPTIONS:  
 -10 Non-Zero Cross, Phase Controllable  
 -B Normally Closed (Form B)  
 4D 400 Hz Operation  
 E 24 VAC Input (18-36 Vac)  
 F Faston terminal (see data sheet)

Operating Temp Range: -30°C to 80°C  
Isolation Voltage (Vrms): 4000



Series 1, HA/HD, HA60/HD60

### SERIES HA/HD, HA60/HD60

12-125 Amp • 480, 600Vac • AC Output

Fast Fax No. 158, 159

Crydom's HA (AC control) and HD (DC control) relays incorporate the same proven technologies as our Series 1. All models come with 1200 V blocking as standard and are available in either zero-cross or random turn-on and phase controllable (-10) switching versions.

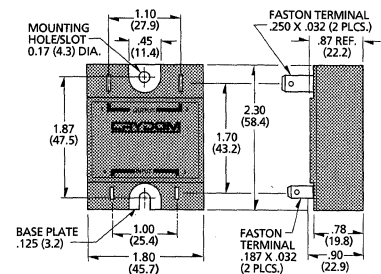
- ▶ AC or DC Control, 1200 Volt Blocking
- ▶ Zero Voltage & Random Turn-On Switching



DC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
HD4812	48-530	.04-12	3-32	140
HD4825	48-530	.04-25	3-32	250
HD4850	48-530	.04-50	3-32	625
HD4875	48-530	.04-75	3-32	1000
HD4890	48-530	.04-90	3-32	1200
HD48110	48-530	.04-110	3-32	1500
HD48125	48-530	.04-125	3-32	1750
HD6025*	48-660	.04-25	3-32	250
HD6050*	48-660	.04-50	3-32	625
HD6090*	48-660	.04-90	3-32	1200
HD60125*	48-660	.04-125	3-32	1750

AC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vac)	Surge Current 1-Cycle (Apk)
HA4812	48-530	.04-12	90-280	140
HA4825	48-530	.04-25	90-280	250
HA4850	48-530	.04-50	90-280	625
HA4875	48-530	.04-75	90-280	1000
HA4890	48-530	.04-90	90-280	1200
HA48110	48-530	.04-110	90-280	1500
HA48125	48-530	.04-125	90-280	1750
HA6025*	48-660	.04-25	90-280	250
HA6050*	48-660	.04-50	90-280	625
HA6090*	48-660	.04-90	90-280	1200
HA60125*	48-660	.04-125	90-280	1750

\* Output marked with nominal 600Vac Line Voltage Rating, as preferred in Canada



Series 1, HA/HD, HA60/HD60 with Faston

Series HA/HD, HA60/HD60 AVAILABLE OPTIONS:

- 10 Non-Zero Cross, Phase Controllable
- E 24 VAC Input (18-36 Vac)
- F Faston terminal (see data sheet)

Operating Temp Range: -30°C to 80°C  
Isolation Voltage (Vrms): 4000





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## Panel Mount SSRs

### SERIES CS

10-90 Amp • 120/240Vac • AC Output

Fast Fax No. 162

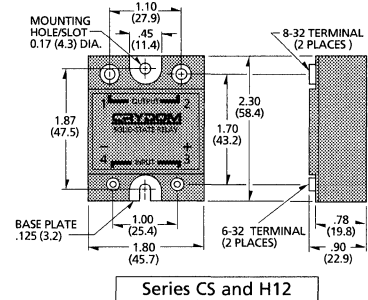
The Series CS has an SCR AC switch output featuring low off-state leakage (1mA, snubberless), zero-voltage switching and a broadened operating range (24-280Vac). This wide range permits optimum performance at both 120Vac and 240Vac line voltages.

- ▶ DC Control, SCR AC Output
- ▶ Low Leakage, Zero Voltage Switching



DC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
CSD2410	24-280	.15-10	3.5-15	120
CSD2425	24-280	.15-25	3.5-15	250
CSD2440	24-280	.15-40	3.5-15	625
CSD2450	24-280	.15-50	3.5-15	625
CSD2475	24-280	.25-75	3.5-15	1000
CSE2410	24-280	.15-10	15-32	120
CSE2425	24-280	.15-25	15-32	250
CSE2440	24-280	.15-40	15-32	625
CSE2450	24-280	.15-50	15-32	625
CSE2475	24-280	.25-75	15-32	1000
CSE2490	24-280	.25-90	15-32	1200
CTD2410	24-280	.15-10	3.5-15	120
CTD2425	24-280	.15-25	3.5-15	250

Operating Temp Range: -40°C to 80°C Isolation Voltage (Vrms): 4000



### SERIES H12

25-90 Amp • 480, 600Vac • AC Output

Fast Fax No. 157

High voltage relays use IC driven circuits for switching loads up to 660 VAC. All models come with 1200 Volts blocking standard and are available with either AC or DC input (coil) control. Types CA, CD and WD are snubberless.

- ▶ 1200 Volt Blocking
- ▶ Up to 660Vac

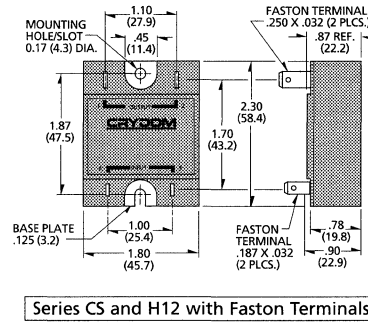


DC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
H12CD4850	48-660	.15-50	4-8	625
H12CD4890	48-660	.15-90	4-8	1200
H12WD4850	48-660	.15-50	4-32	625
H12WD4890	48-660	.15-90	4-32	1200
H12D4825	48-530	.15-25	4-32	250
H12D4850	48-530	.15-50	4-32	625
H12D4875	48-530	.15-75	4-32	1000
H12D4890	48-530	.15-90	4-32	1200

AC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vac)	Surge Current 1-Cycle (Apk)
H12CA4850	48-660	.15-50	90-140	625
H12CA4890	48-660	.15-90	90-140	1200

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vrms): 4000



### SERIES NTD/NTA

10-25 Amp • 120/240Vac • AC Output

Fast Fax No. 176

Featuring zero-voltage or random switching and a broadband operating range (24-280Vac). This wide range permits optimum performance at both 120Vac and 240Vac line voltages.

- ▶ AC or DC Control, Cost Effective
- ▶ Zero Voltage or Random Turn-On Switching

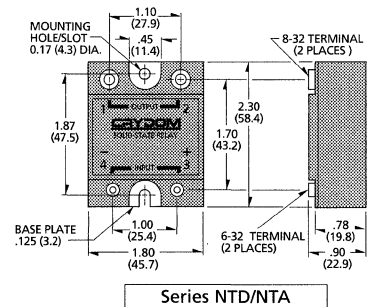


DC CONTROL Type	Line Voltage Range (Vrms)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
NTD2405	24-480	.15-5	4-15	40
NTD2410	24-480	.15-10	3-32	120
NTD2425	24-480	.15-25	3-32	250

AC CONTROL Type	Line Voltage Range (Vrms)	Load Current Range (Arms)	Control Voltage Range (Vrms)	Surge Current 1-Cycle (Apk)
NTA2410	24-480	.15-10	90-140	120
NTA2425	24-480	.15-25	90-140	250

AVAILABLE OPTIONS:  
-10 Random Turn-On, Phase Controllable  
F Faston Terminal  
Operating Temp Range: -30°C to 80°C Isolation Voltage (Vac): 4000



### SERIES 53TP

25-50 Amp • 240/480 • 3 Phase

Fast Fax No. 161

Three-phase solid state relays switch up to 530 Vrms directly to loads such as motors, transformers, heating elements, etc. Available with either AC or DC input (coil) control in zero-voltage or random turn-on switching versions.

- ▶ SCR Output
- ▶ LED Status Indicator

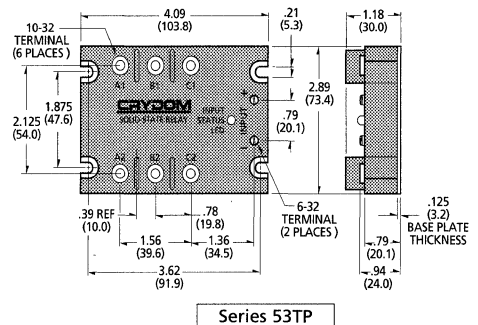


DC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
D53TP25D	48-530	.05-25	3-32	250
D53TP50D	48-530	.05-50	3-32	625

AC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vac)	Surge Current 1-Cycle (Apk)
A53TP25D	48-530	.05-25	90-280	250
A53TP50D	48-530	.05-50	90-280	625

AVAILABLE OPTIONS:  
-10 Non-Zero Cross, Instantaneous Turn-On  
DP 2 Controlled, 1 Linked (C1-C2)  
Operating Temp Range: -40°C to 80°C Isolation Voltage (Vrms): 4000





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## Panel Mount SSRs

### SERIES SMR 25-90 Amp • 120/240Vac • AC Output

Fast Fax No. 154

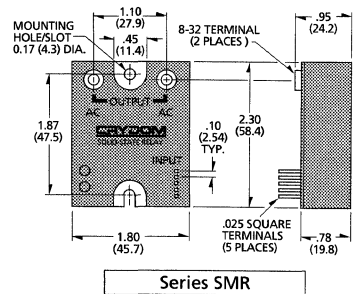
The SMR Series of System Monitoring Relays offer the user a number of fault condition alarms. Loss of voltage, open circuit load, damaged relay output and loss of DC supply current are constantly monitored by this unique Solid State Relay.

- System Monitoring SSR
- Alarm Output, LED Status Indicators



DC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
SMR2425	48-280	.04-25	8-32	250
SMR2450	48-280	.04-50	8-32	625
SMR2490	48-280	.04-90	8-32	1200
SMR2425-6	48-280	.04-25	8-32	250
SMR2450-6	48-280	.04-50	8-32	625
SMR2490-6	48-280	.04-90	8-32	1200

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vrms): 4000  
Note: 6 pin version provides invert/non invert control, input and alarm output



### SERIES EZ 12-18 Amp • 120/240, 480Vac • AC Output

Fast Fax No. 160

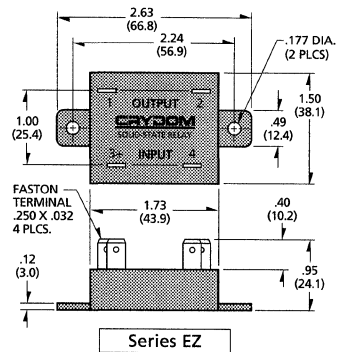
The Series EZ SPST-NO AC relays offer a low profile package with convenient quick-connect terminals and is the preferred choice for replacement of 120V and 240V Electro-mechanical relays.

- AC or DC Control, SCR AC Output
- Low Leakage



DC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
EZ240D12	24-280	.15-12	3-15	150
EZ240D18	24-280	.15-18	3-15	200
EZ480D12	48-660	.15-12	4-15	150
EZ480D18	48-660	.15-18	4-15	200
EZE240D12	24-280	.15-12	15-32	150
EZE240D18	24-280	.15-18	15-32	200
EZE480D12	48-660	.15-12	15-32	150
EZE480D18	48-660	.15-18	15-32	200

AVAILABLE OPTIONS: S Internal Snubber R Random Turn-On Switching  
Operating Temp Range: -30°C to 80°C Isolation Voltage (Vrms): 4000 (240V, DC Control)



### DUAL Relays 25-40 Amp • 120/240, 480Vac

Fast Fax No. 165

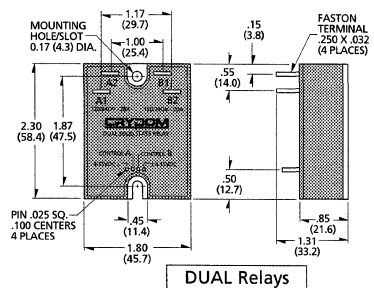
Two totally independent AC output relays come in a single standard panel-mount package. Utilizing an AC switch output with internal snubber, relays provide greater protection against false triggering. Model choices include zero-voltage or random turn-on (phase controllable) switching.

- Zero Voltage & Random Turn-On Switching
- SCR Output, Industry Standard Package



DC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
D2425D	24-280	.15-25	4-15	250
D2440D	24-280	.15-40	4-15	625
H12D2425D	48-530	.15-25	4-15	250
H12D2440D	48-530	.15-40	4-15	625

AVAILABLE OPTIONS: -10 Non-Zero Cross, Instantaneous Turn-On  
Operating Temp Range: -40°C to 80°C Isolation Voltage (Vrms): 4000  
For 480Vac models see data sheet



### QUAD Relays 20 Amp • 120/240 Vac • AC Output

Fast Fax No. 166

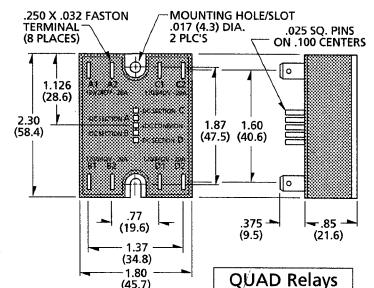
Four independent AC output relays come in a single standard panel-mount package. Utilizing an AC switch output with internal snubber, relays provide greater protection against false triggering. Model choices include zero-voltage or random turn-on (phase controllable) switching.

- Zero Voltage & Random Turn-On Switching
- Triac Output, Industry Standard Package



DC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
TD2420Q	24-280	.15-20	4-15	250

AVAILABLE OPTIONS: -10 Non-Zero Cross, Instantaneous Turn-On  
Operating Temp Range: -40°C to 80°C Isolation Voltage (Vrms): 2500





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## Panel Mount SSRs

### SERIES CMD/CMA 25-125 Amp • 240, 480, 600 Vac • AC Output

Fast Fax No. 170

Featuring state-of-the-art Surface Mount Technology, this SPST-NO relay delivers proven reliability in the most demanding applications. Output consists of an SCR AC switch and is available in zero-cross and random turn-on versions.

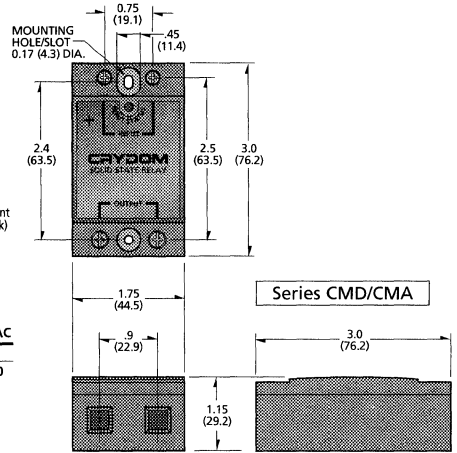
- ▶ AC or DC Control with Status Indicating Display
- ▶ Zero Voltage & Random Turn-On Switching



DC/AC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc/Vrms)	Surge Current 16.6ms (Apk)
CMD/CMA2425	24-280	0.15-25	3-32/90-140	250
CMD/CMA2450	24-280	0.15-50	3-32/90-140	625
CMD/CMA2475	24-280	0.25-75	3-32/90-140	1000
CMD/CMA2490	24-280	0.25-90	3-32/90-140	1200
CMD/CMA24110	24-280	0.25-110	3-32/90-140	1500
CMD/CMA24125	24-280	0.25-25	3-32/90-140	1750
CMD/CMA4825	48-530	0.15-25	3-32/90-140	250
CMD/CMA4850	48-530	0.15-50	3-32/90-140	625
CMD/CMA4875	48-530	0.25-75	3-32/90-140	1000
CMD/CMA4890	48-530	0.25-90	3-32/90-140	1200
CMD/CMA48110	48-530	0.25-110	3-32/90-140	1500
CMD/CMA48125	48-530	0.25-25	3-32/90-140	1750

DC/AC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc/Vrms)	Surge Current 16.6ms (Apk)
CMD/CMA6025	48-660	0.15-25	3-32/90-140	250
CMD/CMA6050	48-660	0.15-50	3-32/90-140	625
CMD/CMA6075	48-660	0.25-75	3-32/90-140	1000
CMD/CMA6090	48-660	0.25-90	3-32/90-140	1200
CMD/CMA60110	48-660	0.25-110	3-32/90-140	1500
CMD/CMA60125	48-660	0.25-25	3-32/90-140	1750AC

AVAILABLE OPTIONS: -10 Random Turn-On, Phase Controllable  
Operating Temp Range: -30°C to 80°C Isolation Voltage (Vac): 4000



### SERIES DC60 3-7 Amp • 60Vdc • DC Output

Fast Fax No. 163

Bipolar transistor outputs are available in 3, 5 and 7 amp ratings. Cost-effective relays offer 4000 Volt isolation and come in Crydom's standard panel-mount package.

- ▶ AC or DC Control, Cost Effective
- ▶ Industry Standard Package

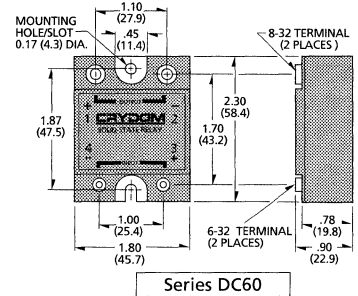


DC CONTROL Type	Line Voltage Range (Vdc)	Load Current Range (Adc)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
DC60S3	3-60	.02-3	3.5-32	6
DC60S5	3-60	.02-5	3.5-32	10
DC60S7	3-60	.02-7	3.5-32	14

AC CONTROL Type	Line Voltage Range (Vdc)	Load Current Range (Adc)	Control Voltage Range (Vac)	Surge Current 1-Cycle (Apk)
DC60SA3	3-60	.02-3	90-280	6
DC60SA5	3-60	.02-5	90-280	10
DC60SA7	3-60	.02-7	90-280	14

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vac): 4000



### SERIES 1-DC 7-40 Amp • 0-500Vdc • DC Output

Fast Fax No. 164

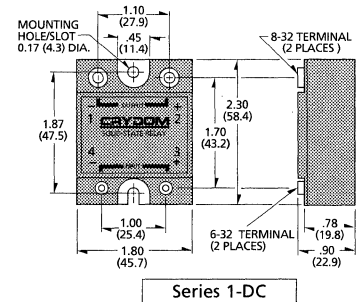
DC output relays feature MOSFET technology for low on-state resistance, assuring easy paralleling and switching capabilities to 40 amps at 100 Vdc. Lower current models are also available to 500 Vdc. All models come in Crydom's standard panel-mount package.

- ▶ MOSFET Output, Low On-State Resistance
- ▶ Paralleling Capability for Higher Currents



DC CONTROL Type	Line Voltage Range (Vdc)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
D1D07	0-100	0-7	3.5-32	15
D1D12	0-100	0-12	3.5-32	28
D1D20	0-100	0-20	3.5-32	42
D1D40	0-100	0-40	3.5-32	106
D2D07	0-200	0-7	3.5-32	22
D2D12	0-200	0-12	3.5-32	27
D4D07	0-400	0-7	3.5-32	17
D4D12	0-400	0-12	3.5-32	36
D5D07	0-500	0-7	3.5-32	19
D5D10	0-500	0-12	3.5-32	29

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vac): 2500  
\*UL Approval on 100V Models Only



### SERIES PRG 150 Amp • 120/240, 480Vac • AC Output

Fast Fax No. 153

Featuring state-of-the-art Surface Mount Technology, this SPST-NO relay delivers proven reliability in the most demanding applications. Output consists of an SCR AC switch with internal snubber and is available in zero-cross and random turn-on (phase controllable) versions.

- ▶ Extra High Steady-State Current
- ▶ Zero Voltage & Random Turn-On Switching

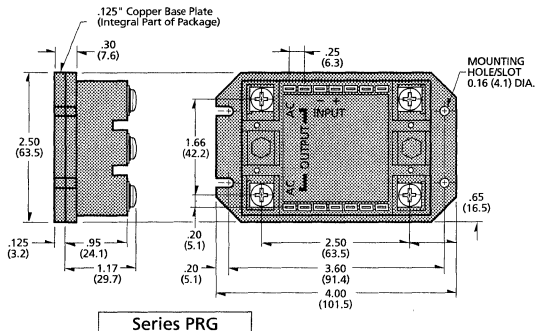


DC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
PRGD24150	24-280	.15-150	3-32	1750

AC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vac)	Surge Current 1-Cycle (Apk)
PRGA24150	24-280	.15-150	90-140	1750

AVAILABLE OPTIONS: -10 Non-Zero Cross, Phase Controllable  
Operating Temp Range: -30°C to 80°C Isolation Voltage (Vac): 4000





Your reliable source for

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For Complete Product Specifications:

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**www.crydom.com** - view and download specifications

9525 Chesapeake Drive, San Diego, CA 92123  
 Tel: (619) 715-7200 • Fax: (619) 715-7280  
 Toll-Free **800-8 CRYDOM (827-9366)**



## DIN Rail Panel Mount SSRs

### SERIES CMRD/CMRA

35-65 Amp • 240, 480, 600 Vac • AC Output

Fast Fax No. 171

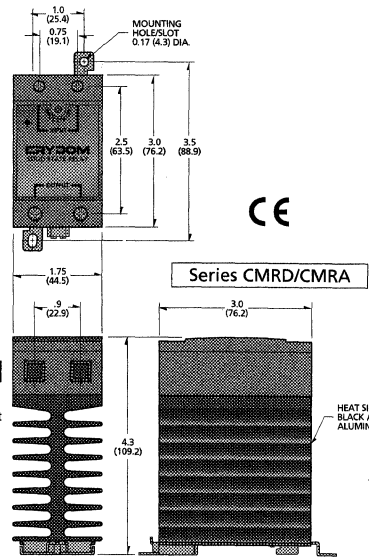
Featuring state-of-the-art Surface Mount Technology, this SPST-NO relay delivers proven reliability in the most demanding applications. Output consists of an SCR AC switch and is available in zero-cross and random turn-on versions.

- ▶ AC or DC Control with Status Indicating Display
- ▶ Zero Voltage & Random Turn-On Switching

DC/AC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc/Vrms)	Surge Current 16.6ms (Apk)
CMRD/CMRA4825	48-530	0.15-35	3-32/90-140	250
CMRD/CMRA4850	48-530	0.15-45	3-32/90-140	625
CMRD/CMRA4875	48-530	0.25-55	3-32/90-140	1000
CMRD/CMRA4890	48-530	0.25-65	3-32/90-140	1200
CMRD/CMRA4895	48-660	0.15-35	3-32/90-140	250
CMRD/CMRA6050	48-660	0.15-45	3-32/90-140	625
CMRD/CMRA6075	48-660	0.25-55	3-32/90-140	1000
CMRD/CMRA6090	48-660	0.25-65	3-32/90-140	1200

DC/AC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc/Vrms)	Surge Current 16.6ms (Apk)
CMRD/CMRA4825	48-530	0.15-35	3-32/90-140	250
CMRD/CMRA4850	48-530	0.15-45	3-32/90-140	625
CMRD/CMRA4875	48-530	0.25-55	3-32/90-140	1000
CMRD/CMRA4890	48-530	0.25-65	3-32/90-140	1200
CMRD/CMRA4895	48-660	0.15-35	3-32/90-140	250
CMRD/CMRA6050	48-660	0.15-45	3-32/90-140	625
CMRD/CMRA6075	48-660	0.25-55	3-32/90-140	1000
CMRD/CMRA6090	48-660	0.25-65	3-32/90-140	1200

AVAILABLE OPTIONS:  
 -10 Random Turn-On, Phase Controllable  
 Operating Temp Range: -30°C to 80°C Isolation Voltage (Vac): 4000



### SERIES HPF

20, 30 Amp • 120/240, 480Vac • AC Output

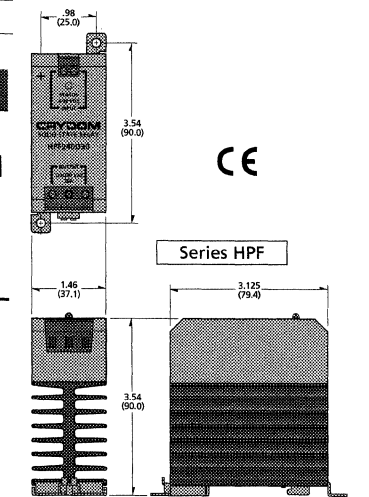
Fast Fax No. 155

The Series HPF Solid State Relays utilize Crydom's proprietary thermal management technology providing a compact and efficient design. Built-in DIN Rail attachment, easy-to-use cage type terminals and integral heat sinking complete the package. This compact new design offers up to 30Arms in ambient temperatures of 25°C.

- ▶ DIN Rail Mount, Integral Heat Sink
- ▶ Zero Voltage & Random Turn-On Switching

DC CONTROL Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
HPF240D20	12-280	.15-20	4-32	250
HPF240D30	12-280	.15-30	4-32	625
HPF240D20R*	12-280	.15-20	4-32	250
HPF240D30R*	12-280	.15-30	4-32	625
HPF480D20	12-480	.15-20	5-32	250
HPF480D30	12-480	.15-30	5-32	625
HPF480D20R*	12-480	.15-20	5-32	250
HPF480D30R*	12-480	.15-30	5-32	625

AVAILABLE OPTIONS:  
 \* R Random Turn-On Version S Internal Snubber  
 Operating Temp Range: -30°C to 80°C Isolation Voltage (Vrms): 4000



## Panel Mount SSR Accessories

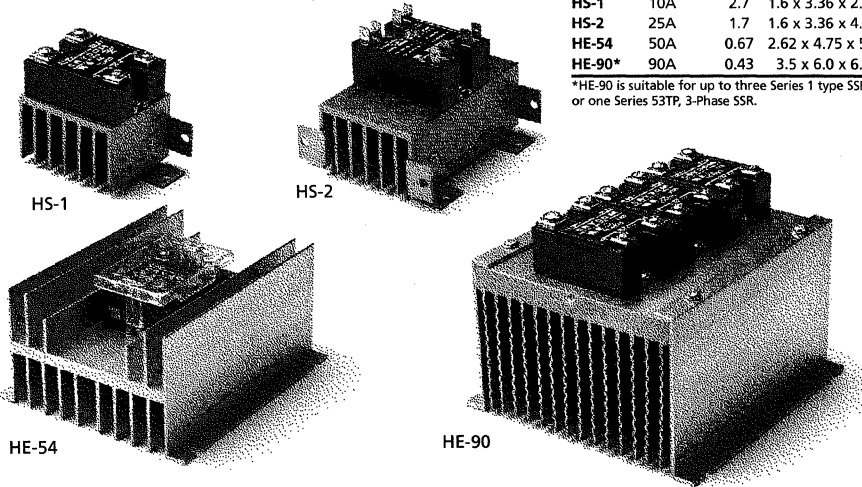
### Heat Sinks

For Panel Mount SSRs

Fast Fax No. 168

Type	Usage Rating (Max.)	Deg°C/W @ Max. Curr.	HxWxD (Inches)
HS-1	10A	2.7	1.6 x 3.36 x 2.06
HS-2	25A	1.7	1.6 x 3.36 x 4.12
HE-54	50A	0.67	2.62 x 4.75 x 5.5
HE-90*	90A	0.43	3.5 x 6.0 x 6.0

\*HE-90 is suitable for up to three Series 1 type SSRs, or one Series 53TP, 3-Phase SSR.



### SSR Protective Covers

For Panel Mount SSRs

Type  
 KS100 - Cover for Series 1 Type SSR package  
 KS300 - Cover for Series 53TP, Three-Phase SSR package

### Solid State Relay Handbook

A Comprehensive Tutorial and SSR Resource Guide

- ▶ Over 200 pages, written by Anthony Bishop
- ▶ Detailed reference on SSR applications

Type HDBK-899



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Fax-On-Demand, call **888-267-9191** for instant specs on your fax  
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Toll-Free **800-8 CRYDOM (827-9366)**



## Auxiliary Function Modules

### SERIES RPC (SOLID STATE PROPORTIONAL CONTROLLER) 15-40 Amp • 120/240, 480Vac • AC Output

Fast Fax No. 205

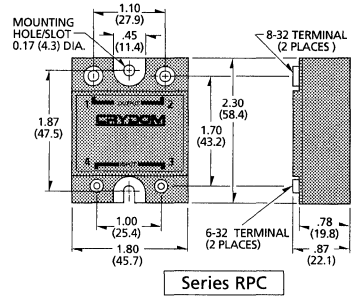
The RPC series proportional controllers provide a cost effective method of controlling power in many applications such as heaters or incandescent lamps. A customer provided potentiometer is all that is required for control.

- ▶ Standard Package, Protective Cover Included
- ▶ Uses Potentiometer for Economical Power Control



Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Off-State Leakage (mA)	Surge Current 1-Cycle (Apk)
RPC1215	90-130	.07-15	10	150
RPC1225	90-130	.08-25	10	250
RPC1240	90-130	.09-40	10	625
RPC2415	200-240	.07-15	7	150
RPC2425	200-240	.08-25	7	250
RPC2440	200-240	.09-40	7	625
RPC4815	400-480	.07-15	3	150
RPC4825	400-480	.08-25	3	250
RPC4840	400-480	.09-40	3	625

Operating Temp Range: -30°C to 80°C  
Isolation Voltage (Vrms): 2500 (load to base plate only)  
WARNING: Control to load is not isolated, exercise care in handling this product to avoid the risk of electric shock.



### SERIES PCV (ANALOG INPUT POWER CONTROLLER) 15-90 Amp • 120/240, 480Vac • AC Output

Fast Fax No. 204

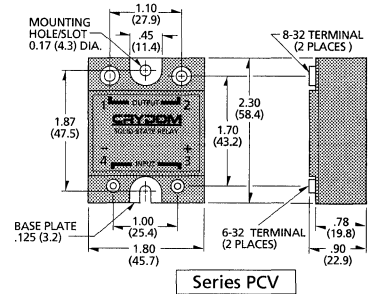
The PCV Series proportional controllers are self contained power control modules integrating a complete phase fired logic control system and a solid state relay in the same standard package. Typical applications include heaters, vibratory feeders and tungsten lamps.

- ▶ 0-100% Control Range, Operates at 60 & 50Hz
- ▶ Internal Snubber, Industry Standard Package



Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Voltage Range (Vdc)	Surge Current 1-Cycle (Apk)
10PCV2415	100-240	.15-15	2-10	150
10PCV2425	100-240	.15-25	2-10	250
10PCV2450	100-240	.15-50	2-10	625
10PCV2475	100-240	.15-75	2-10	1000
10PCV2490	100-240	.15-90	2-10	1200

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vrms): 2500



### SERIES LPCV (LINEAR PROPORTIONAL LOAD CONTROLLER) 15-110 Amp • 120/240, 480Vac • AC Output

Fast Fax No. 207

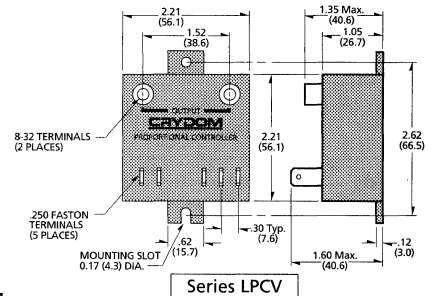
The LPCV linear proportional controllers control loads up to 110 amps. Changes in the input signal linearly vary the firing angle of the thyristor load control device. Control circuitry and power switch are in a single package.

- ▶ Back-to-Back SCR Output
- ▶ Precise Proportional Load Controller



Type	Line Voltage Range (Vac)	Load Current Range (Arms)	Control Range	Surge Current 1-Cycle (Apk)
5LPCV2415	20-300	.10-15	0-5 Vdc	150
5LPCV2425	20-300	.10-25	0-5 Vdc	250
5LPCV2440	20-300	.10-40	0-5 Vdc	625
5LPCV2475	20-300	.15-75	0-5 Vdc	1000
5LPCV24110	20-300	.20-110	0-5 Vdc	1500
10LPCV2415	20-300	.10-15	0-10 Vdc	150
10LPCV2425	20-300	.10-25	0-10 Vdc	250
10LPCV2440	20-300	.10-40	0-10 Vdc	625
10LPCV2475	20-300	.15-75	0-10 Vdc	1000
10LPCV24110	20-300	.20-110	0-10 Vdc	1500
20LPCV2415	20-300	.10-15	4-20 mA	150
20LPCV2425	20-300	.10-25	4-20 mA	250
20LPCV2440	20-300	.10-40	4-20 mA	625
20LPCV2475	20-300	.15-75	4-20 mA	1000
20LPCV24110	20-300	.20-110	4-20 mA	1500

Operating Temp Range: -30°C to 80°C Isolation Voltage (Vrms): 2500

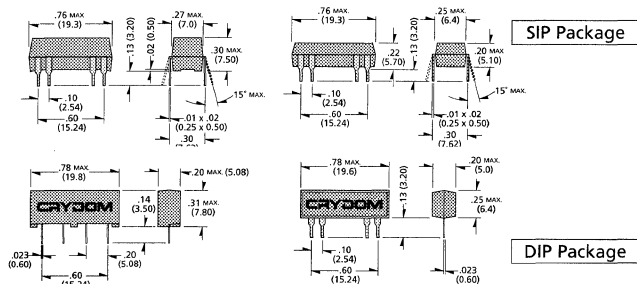


## REED Relays SIP and DIP Packages

Fast Fax No. 403, 404

Crydom's SIP and DIP Reed relays provide a comprehensive range of products developed for high density PCB applications. Epoxy molded for complete resistance to automatic wave soldering, harsh cleaning fluids and severe industrial conditions. These relays are available with (D suffix) or without (L suffix) an internally fitted coil suppression diode.

- ▶ Epoxy Molder Package & Pin Configurations
- ▶ Optional Coil Suppression Diode



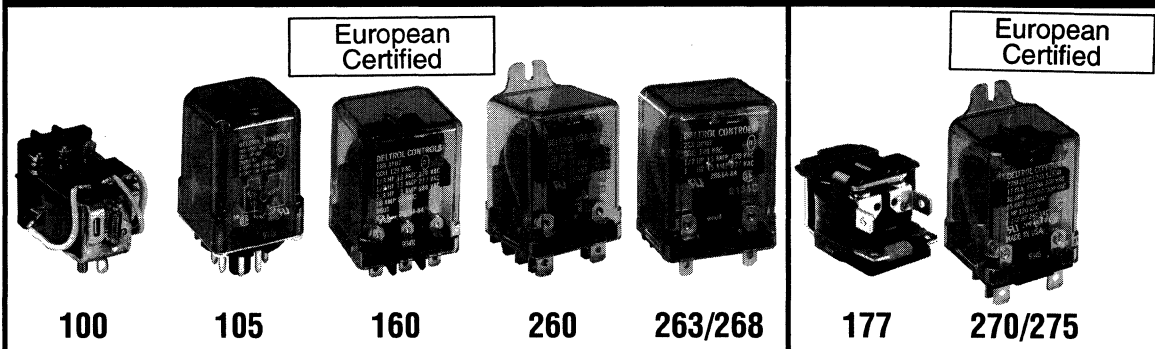
Type	Arrangement	Contact Ratings	Vdc	Ohms
D05-1A01-01L			5	500
D12-1A01-01L	14 Pin Dip		12	1000
D24-1A01-01L	1 Form A	10W, 200Vdc, 0.5A	24	2000
D05-1A01-01D	SPST-NO (Fig.1)	250Vdc Holdoff	5	500
D12-1A01-01D			12	1000
D05-1B01-03L	14 Pin Dip		5	500
D12-1B01-03L	1 Form B	10W, 200Vdc, 0.5A	12	1000
D05-1B01-03D	SPST-NC (Fig.2)	250Vdc Holdoff	5	500
D05-2A01-04L	14 Pin Dip		5	200
D12-2A01-04L	2 Form A	10W, 200Vdc, 0.5A	12	500
D05-2A01-04D	DPST-NO (Fig.3)	250Vdc Holdoff	5	200
D05-1C20-05L	14 Pin Dip		5	200
D12-1C20-05L	1 Form C	3W, 175Vdc, 0.25A	12	500
D05-1C20-05D	SPDT-CO (Fig. 4)	200Vdc Holdoff	5	200
S05-1A02-01L			5	500
S12-1A02-01L	SIP		12	1000
S24-1A02-01L	1 Form A	15W, 200Vdc, 1A	24	2000
S05-1A02-01D	SPST-NO (Fig.5)	250Vdc Holdoff	5	500
S12-1A02-01D			12	1000
S05-1A05-02L	SIP - 1 Form A	10W, 500Vdc, 0.5A	5	500
	SPST-NO (Fig. 6)	1500Vdc Holdoff		

# DELTRON

*controls* /  DIVISION OF DELTRON CORP.

## General Purpose Relays 5 to 15 Amp

## Power Relays



Series	100	105	160	260	263/268	177	270/275
<b>Contact Rating</b>	5 or 10 Amp	5 or 10 Amp	5 or 13 Amp	5, 10, or 15 Amp	15 Amp	15 or 30 Amp	30 or 35 Amp
<b>Features</b>	<ul style="list-style-type: none"> <li>- Armature Stop Maintains Adjustment</li> <li>- Replacement Relay for Many Devices</li> <li>- RF Radio Frequency Version Available</li> </ul>	<ul style="list-style-type: none"> <li>- Eight or Eleven Pin Plug-In</li> <li>- Polycarbonate Plastic Cover</li> <li>- Gusseted Frame Maintains Alignment</li> </ul>	<ul style="list-style-type: none"> <li>- Low Cost Plug-In Design</li> <li>- Coil Terminals Molded in Coil</li> <li>- .187 QC or PC Terminals</li> <li>- Wide Variety of Mountings</li> <li>- Gusseted Frame Maintains Alignment</li> </ul>	<ul style="list-style-type: none"> <li>- Low Cost Plug-In Design</li> <li>- Coil Terminals Molded in Coil</li> <li>- .250 QC Terminals</li> <li>- Wide Variety of Mountings</li> <li>- Gusseted Frame Maintains Alignment</li> </ul>	<ul style="list-style-type: none"> <li>- Low Cost Plug-In Design</li> <li>- Coil Terminals Molded in Coil</li> <li>- .187 QC or PC Terminals</li> <li>- Wide Variety of Mountings</li> </ul>	<ul style="list-style-type: none"> <li>- Heavy Duty 1/4" Dia. Contacts</li> <li>- Compact Size</li> <li>- Up-Stop for Contact Protection on SPST-NO-DM</li> </ul>	<ul style="list-style-type: none"> <li>- High Power Switching in a Compact Size</li> <li>- Can Often Replace Small Contactors</li> <li>- 35 Amps on 1X or 1Y</li> <li>- 25 or 35 Amp Rating By Semko For Use In Europe</li> </ul>
<b>Size in Inches</b>	1.76 x 1.25 x 1.22	1.38 x 1.38 x 2.00	1.50 x 1.38 x 2.20	1.50 x 1.38 x 2.25	1.50 x 1.38 x 2.25	1.88 x 1.63 x 1.25	1.50 x 1.38 x 2.15
<b>Contact Configuration</b>	Thru 3PDT	Thru 3PDT	Thru 3PDT	Thru 3PDT	Thru 3PDT	Thru SPDT SPST-NO-DM	Thru DPDT
<b>Coil Insulation Class</b>	Class F Molded Rynite®	Class F Molded Rynite®	Class F Molded Rynite®	Class F Molded Rynite®	Class F Molded Rynite®	Class F Molded Rynite®	Class F Molded Rynite®
<b>Mounting Options</b>	Panel Mount Bracket Mount	Socket Mount	Socket Mount Panel Mount PC Terminal	Socket Mount Panel Mount	Socket Mount Panel Mount	Panel Mount	Panel Mount PC Terminal
<b>Sockets</b>	N/A	Screw Terminal DIN Rail Mtg.	Screw Terminal DIN Rail Mtg. Back Connecting - PC Terminal - QC Terminal - Solder Tab	N/A	N/A	N/A	N/A
<b>Typical Applications</b>	Lighting Control, Time Delay Controls	Common Replacement Relay for Many Types of Existing Equipment	Industrial Machine Control, Energy Management Systems Control Panels	Industrial Machine Control, Lighting Control	Industrial Machine Control, Fork Lifts, Energy Management, HVAC	Motor Control Lighting Control Surge Protection	Electric Heat, Motor Control, HVAC, Laundry Equipment, Welding Equipment

# DELTRON

*controls* /  DIVISION OF DELTRON CORP.

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 Milwaukee, WI 53215  
 Tel: 414-671-6800 • Fax: 414-671-6809  
 E-Mail: sales@deltrol.com  
 Web: http://www.deltrol.com

### Deltrol Relay Features\*

- Class F (155°C) encapsulated coils cope with elevated ambient temperatures
- "skeined" wire process assures coil integrity on fine wire gauges
- precision contacts utilizing the latest metallurgic improvements in silver alloys

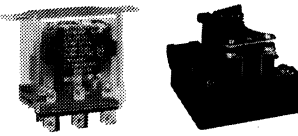
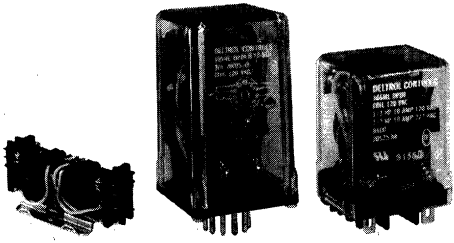

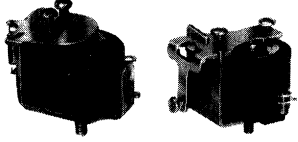


• made in the USA (most models)



Model 275  
 Model 165/166/F,P,T

SEE SECTION 4550 FOR SOLENOIDS

15 to 50 Amp		Latching Relays 5 to 10 Amp			Buzzer	Clappers	
<div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>CE Marked</b>  <b>3 pole 25 Amp</b> </div>							
							
<b>375</b>	<b>900</b>	<b>100ML</b>	<b>105ML</b>	<b>165/166ML</b>	<b>BZ</b>	<b>100C</b>	<b>900C</b>
<b>30 Amp</b>	<b>30 or 50 Amp</b>	<b>5 or 10 Amp</b>	<b>5 or 10 Amp</b>	<b>5 or 10 Amp</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
<ul style="list-style-type: none"> <li>- High Power Switching in a 3-pole design.</li> <li>- CE Marked for use in Europe</li> <li>- "Dual Flag" terminal option allows serial connections.</li> <li>- PPS engineering thermoplastic panel provides superior electrical and mechanical characteristics.</li> </ul>	<ul style="list-style-type: none"> <li>- High Power Switching for Motors, Heaters, etc.</li> <li>- Rugged, Easy Access Construction</li> <li>- Screw Terminal Connections</li> </ul>	<ul style="list-style-type: none"> <li>- Permanent Magnet Locks Armature in Place</li> <li>- Maintains Status Without Coil Power</li> <li>- Pulse Activated</li> </ul>	<ul style="list-style-type: none"> <li>- Permanent Magnet Locks Armature in Place</li> <li>- Maintains Status without Coil Power</li> <li>- Pulse Activated</li> <li>- 8, 11, or 20 Pin Octal Type Base</li> </ul>	<ul style="list-style-type: none"> <li>- Low Cost Design</li> <li>- Maintains Status without Power</li> <li>- Single and Dual Coil Designs</li> </ul>	<ul style="list-style-type: none"> <li>- AC Buzzer</li> <li>- Easy Screw Mount</li> <li>- Compact Size</li> <li>- Molded Coil</li> </ul>	<ul style="list-style-type: none"> <li>- Medium Duty Mechanical Actuator</li> <li>- Tapped Holes in Armature for Attachment of Moving Load</li> </ul>	<ul style="list-style-type: none"> <li>- Heavy Duty Mechanical Actuator</li> <li>- Tapped Holes in Armature for Attachment of Moving Load</li> <li>- Adjustable Armature Stop</li> </ul>
2.13 x 1.40 x 2.2	2.5 x 2.5 x 2.2 Short Base 2.5 x 3.3 x 2.2 Long Base	1.69 x 1.38 x 3.38	1.94 x 1.94 x 3.25	1.50 x 1.38 x 2.20	1.06 x 1.26 x 1.0	1.5 x 1.26 x 1.25	2 x 2.23 x 1.25
3PST-NO 3PST-NC 3PDT	Thru DPDT	Thru 6PDT	Thru 5PDT	Thru 3PDT	N/A	N/A	N/A
Class F Molded Rynite®	Class F Molded Rynite®	Class F Molded Rynite®	Class F Molded Rynite®	Class F Molded Rynite®	Class F Molded Rynite®	Class F Molded Rynite®	Class F Molded Rynite®
Panel Mount PC versions available	Panel Mount	Panel Mount	Socket Mount	Panel Mount Socket Mount	Screw Mount	Screw Mount	Screw Mount
N/A	N/A	N/A	Screw Terminal DIN Rail Mtg.	Screw Terminal DIN Rail Mtg. Back Connecting - PC Terminals - QC Terminals - Solder Tab	N/A	N/A	N/A
3 phase motor control, resistive heating, HVAC and refrigeration controls.	Motor Control, Control Panel Switching, Spa Controls	Railroads, Public Transit Pump Controllers	Railroads, Public Transit	Laundry & Textile Equipment, HVAC	Commercial Appliances, Laundry Equipment	Automation Systems, Sorting Equipment	Automation Systems, Sorting Equipment

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**DELTROL**  
*controls* |  DIVISION OF DELTROL CORP

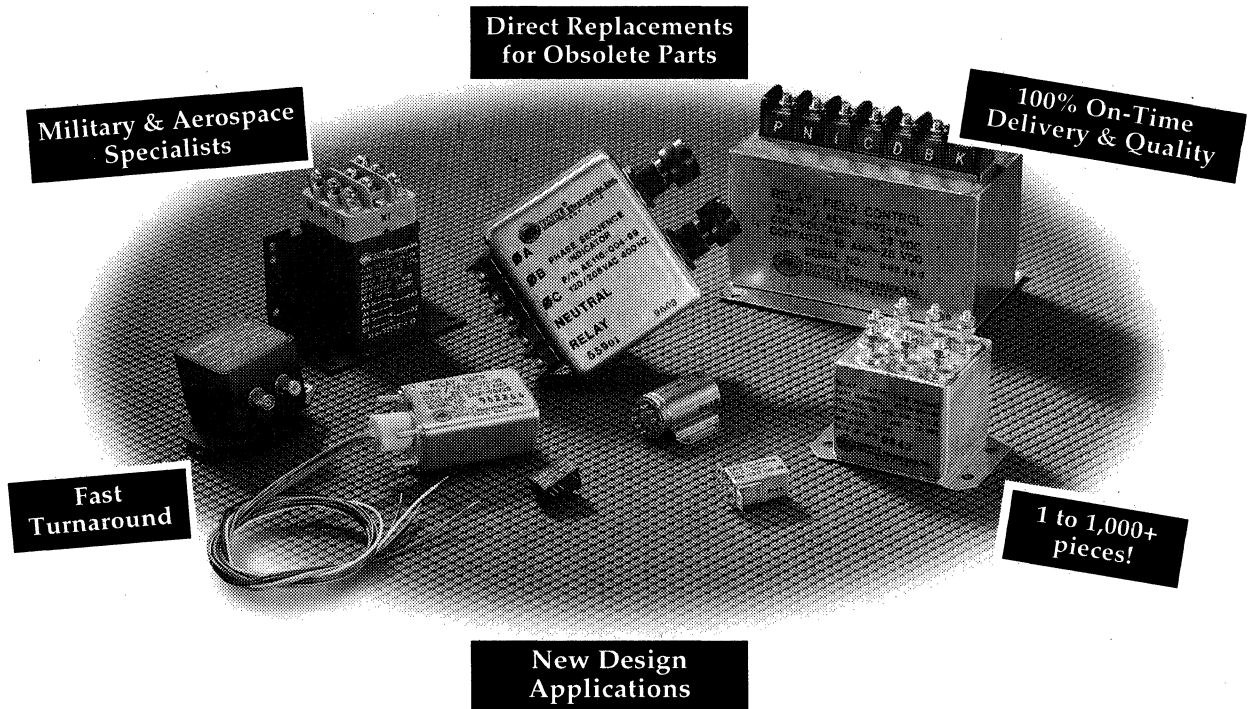
2740 S. 20th Street  
 Milwaukee, WI 53215  
 Tel: 414-671-6800 • Fax: 414-671-6809  
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**DARE<sup>®</sup> Electronics, Inc.**

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Phone: (937) 335-0031 FAX: (937) 339-6948

## Custom Manufacturers of Electronic Sensing & Control Devices



### VOLTAGE SENSORS

- Monitor and protect voltage sensitive equipment from motors, transformers, generators, and power lines.
- Overvoltage, Undervoltage, and Bandwidth Sensing Models
- Single or Three Phase, AC & DC
- 60 or 400 Hz, Delta or Wye
- Millivolts to Hundreds of Volts

### PHASE SENSORS

- Monitor and protect three phase equipment for correct phase sequence, phase reversal, phase loss, open or grounded phase.
- SPST to 4 PDT, dry circuit to 25 amps
- 40-440 Hz
- 90-150 VAC line-neutral
- 156-260VAC line-line

### FREQUENCY SENSORS

- Monitor and protect frequency sensitive equipment from power sources, AC motors, AC to DC converters, and generators.
- Overfrequency, Underfrequency, Band Pass (Fixed or Adjustable)
- Built-in Hysteresis
- 60 or 400 Hz  $\pm 1\%$  Trip Point Accuracy

### POWER MONITORS

- Combine voltage, frequency, and phase sensor functions in one product with or without time delay feature.
- 60 or 400 Hz - Single or Three Phase - Built-in Hysteresis
- Three Phase Averaging or High/Low Sensing
- Solid State or Electromechanical Outputs
- SPST to 4PDT to 25 amps

### TIME DELAY RELAYS

- Delay on pull-in; drop-out, or both, repeat cycle timers and interval timers
- Direct replacements for motor driven or thermal timers
- Fixed or adjustable timing/milliseconds to hours
- Delay tolerances  $\pm 1, \pm 5, \pm 10\%$  available
- Units qualified to MIL-R-83726

### SOLID STATE RELAYS

- Hybrid microelectronic design
- Optical or transformer input to output isolation
- Zero voltage/current Turn-on/ Turn-off
- Low level to 50 amps/ Up to 500 Volts
- AC or DC Inputs and Outputs

### FLASHERS/RECYCLE TIMERS

- Control and activate navigation, position, warning or indicator lights or alarm device
- AC and DC input voltage
- Solid State or Electromechanical Outputs
- Units qualified to MIL-F-26301

### SPECIAL PRODUCTS

- Pitot Heat Current Sensor monitors anti-icing tube heaters on UH-60
- Frequency Sensing Relay monitors turbine speed during F/A-18 engine start-up
- Signal Clearing Device monitors firing rate and counts rounds on 20MM automatic gun system.

Contact our sales department with your specifications at 1-800-FON-DARE  
Let us show you why DARE should be your source for High Quality Relays



# ED DUAL-INLINE RELAYS ED

## SHORT FORM CATALOG\*

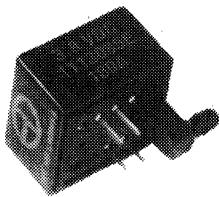
**Introducing** the growing family of ELECTRODYNE RELAYS... Electrodyne, the first to design an electro-mechanical, rotary balanced armature relay, housed in a sealed dual-inline package, offers a choice of three different coil drives, sensitive, magnetic latch and a new

"exclusive OR" function. These relays are designed for applications with either demanding space limitations or operating requirements that are unobtainable with reed or conventional relays. May be inserted in IC sockets or flow soldered.

### Standard Features:

- Low coil drive power: CMOS Direct Drive (9 MA max, at 5VDC).
- Environmentally sealed: excludes dust and circuit board cleaning materials.
- Contacts: choice of 1 or 2 Form C, rated from dry circuit to 2 Amp (60 VA max), 1 MV to 300 VDC.
- Mechanical life: 10<sup>8</sup> ops. min.
- Terminals: .1" x .3" grid spacing, .020" dia. x .160" L.
- Terminals: .1" x .3" grid spacing, .020" dia. x .160" L.
- Capacitance: 0.3 PF max.
- Breakdown: 750 VDC min.
- New "exclusive OR" function: two relays mechanically interlocked 18 series.

Description	Schematics	Model No.	Nom. VDC	Resis. Ohms @ 25° C	Max. Pickup VDC @ 25° C	Approx. Pickup Pwr. M.W. @ 25° C
<b>10 SERIES:</b> Non polarized, <b>DPDT</b> , nonlatching relay, T <sup>2</sup> L compatible bifilar windings. Applications include data processing, telecommunication, logic circuitry and control circuits. Weight, 5 grams max. Max. size: .64" L x .64" W x .405" H.		1030570	5	570	4.1	30
		1055300	5	300	4.1	55
		1020085	5	85	4.1	200
		10200450	12	450	9.5	200
		10200675	15	675	11.5	200
		10201850	24	1850	19.2	200
<b>11 SERIES:</b> Low cost, nonpolarized, <b>SPDT</b> , nonlatching relay, T <sup>2</sup> L compatible. Can switch certain capacitance and lamp loads that would normally weld the contacts of reed relays. Weight, 5 grams max. Max. size: .64" L x .64" W x .405" H.		1130570	5	570	4.1	30
		1120085	5	85	4.1	200
		1120050	12	450	9.5	200
		11200675	15	675	11.5	200
		112001850	24	1850	19.2	200
		<b>15 SERIES:</b> Dual coil, <b>DPDT</b> , magnetic latching relay, T <sup>2</sup> L compatible. Operates by pulsing each coil alternately (observing polarity), or connecting the coils in series from a reversing polarized source. Remains latched, without coil power and is not position sensitive. Weight, 5 grams max. Max. size: .64" L x .64" w x .405" H.		1530570	5	570
1555300	5			300	4.1	55
1520085	5			85	4.1	200
15200450	12			450	9.5	200
15200675	15			675	11.5	200
152001850	24			1850	19.2	200
<b>18 SERIES:</b> Dual coil, nonpolarized, <b>2 SPDT</b> , nonlatching, "EXCLUSIVE OR" relay, T <sup>2</sup> L compatible. Each coil operates 1 SPDT contact set independently from the other. Both contact sets cannot operate at the same time (mechanically interlocked). May replace 2 conventional SPDT relays. Weight, 5 grams max. Max. size: .64" L x .64" W x .405" H.		1830570	5	570	4.1	30
		1855300	5	300	4.1	55
		1820085	5	85	4.1	200
		18200450	12	450	9.5	200
		18200675	15	675	11.5	200
		182001850	24	1850	19.2	200
<b>1001 Series:</b> Used to sense small signal currents used in communication networks and indicate change of state conditions. The relay incorporates two balanced windings which are inserted one in each side of the line maintaining longitudinal balance. The must operate current is 19 mA. Max. size: .64" L x .64" W x .405" H.		1001A25	15	1.5	25	10
		1001A25A	15	1.5	25	10
		1001A25C	15	1.5	25	10
		1001A25E	15	1.5	25	10
		1001A25D	15	1.5	25	10



**AIR VALVES:** Electrodyne is the first to integrate rotary balanced armature technology with air valve control technology, providing low cost high quality miniature air valves. Electrodyne has developed a line of air valves for applications with either demanding space limitations or operating requirements that are unobtainable with conventional solenoid valve technology. Electrodyne air valves exceed the leak rate requirements of the JIS (Japan Industry Standard) and provide high reliability. Custom manifolds incorporating any of the Electrodyne air valves with pressure transducers or limit switches can be readily achieved while maintaining Electrodyne quality. We invite your inquiries on the standard air valve or any other variation to fit your specific needs.

\*Please phone or write for specific series catalog sheet, price and delivery information.

**SPECIAL FEATURES:** 3 pole contracts, Form A, B or C or in combination. Internal suppression diodes available. Wide selection of operating voltages, 1 through 48 VDC.

## ED ELECTRODYNE, INC

11200 21st Street ■ Milwaukie, Oregon 97222

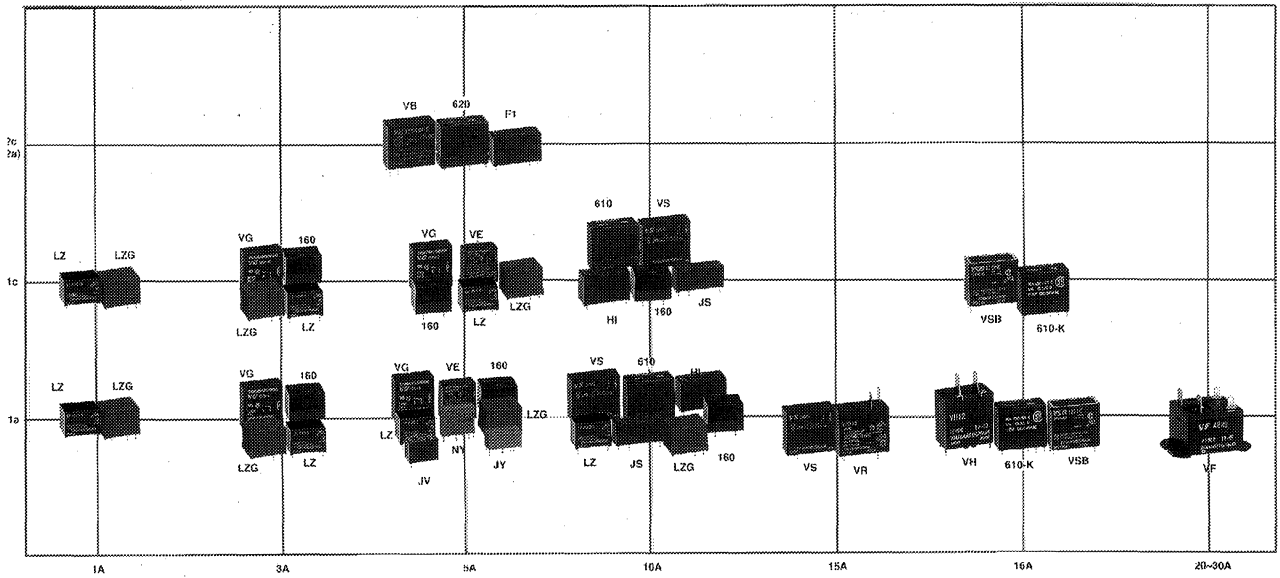
Tel: 503-654-0711 ■ Fax: 503-654-1959

Internet: [www.electrodyne-nw.com](http://www.electrodyne-nw.com)

**RELAY APPLICATIONS**

Classification	Power Relays																			
	JS	JV	JY	160	LZ	LZG	NY	VE	VG	H1	H2	610	610-K	620	F1	F2	F3	VR	VH	VF
Home Appliance & Consumer Goods	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•		•
Telecommunications																				
Business Machines	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			•	•	
Industrial & Commercial Equipment	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			•	•	
Automotive				•																

**Power Relays**

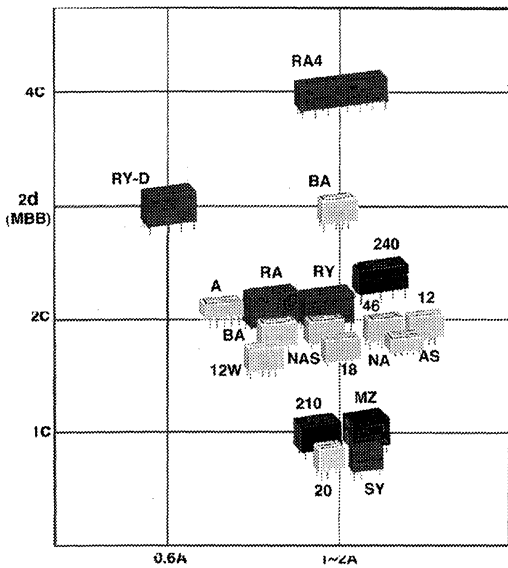




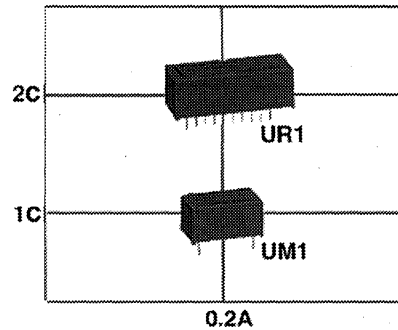
# RELAY APPLICATIONS

Classifications	Signal Relays													High Freq.		Automotive										SSR	I/O										
	Type of Relay	20	210	A	AS	12	18	12W	18W	46				240	UMI	URI	P1	161 166	51 52	510 520	P2	P3	P4	56 57	560 570			580	270					SJ	SE	SN	
Home Appliance & Consumer Goods	●	●	●	●	●																															●	
Telecommunications	●	●	●	●	●	●	●	●	●	●	●	●	●	●												●											
Business Machines		●	●	●	●	●	●	●	●	●	●	●	●	●											●	●	●										
Industrial & Commercial Equipment		●	●	●																																	
Automotive				●													●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	

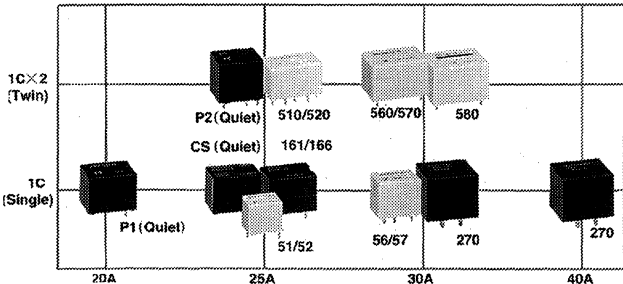
**■ Signal Relays**



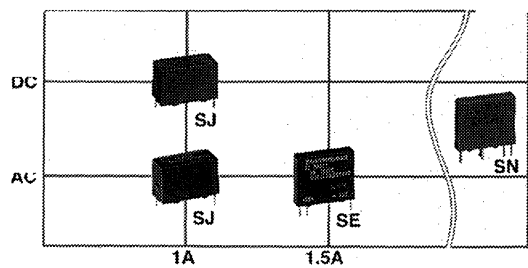
**■ High Frequency Relays**



**■ Auto-motive Relays**



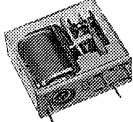



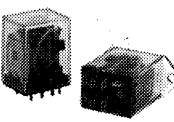

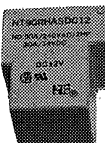
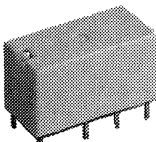
**■ Solid State Relays**



# Greenwich Electronics

## Electromechanical Relays

1 - 8 8 8 - 5 5 4 - 5 5 6 1

Model	Application	Available Contact	Available Coil	Size in mm (Approx.)	Approval	Extra Features
 CH	Appliances Photo Copiers Vending Equip. Temp. Controls	SPST SPDT 10, 16 Amps DPST DPDT 5 Amps	DC Coils 3, 6, 5, 12, 24, 48, 100 AC Coils 6, 12, 24, 50, 110, 220	29 L 13 W 26 H	UL cUL TUV FIMKO SEMCO	High Current Standard Footprint Low Cost
 CQ	Automotive Sound Systems Security Process Control	SPST SPDT 10, 16 Amps	DC Coils 5, 12, 24, 48, 100	22 L 16 W 11 H	cUL	Small Size Sealed Package Low Power Consumption
 CP	Process Control Communication Equipment General	DPDT 2 Amps	DC Coils 5, 12	14 L 9 W 6 H	UL CSA	Bifurcated Gold Contacts
 HG 4185/4191	Automotive Lights Horns Motors	HG4185 SPST 40A SPDT 40A HG4191 SPST 70A	DC Coils 6, 12, 24	28 L 28 W 25 H	Options: Resistor Diode	Available With or Without Plastic Mounting Bracket or Removable Metal
 KMH	Office, Vending, Coin Operated Machines Control Equipmt.	DPDT, 3PDT 5 Amps 4PDT 3 Amps	DC Coils 6, 12, 24, 48, 110 AC Coils 6, 12, 24, 50, 110, 220	25 L 20 W 21 H	cUL	Top Mounting Available LED, Plug in or PCB Terminals
 NT 73	Automation Appliances Security	SPST NO SPST NC SPDT 5, 10, 12 Amps	DC Coils 5, 12, 24, 48	19 L 16 W 17 H	UL CSA	Common Footprint Compact Design Sealed
 NT 90	Heaters Appliances Power Switching	SPST NO SPST NC SPDT 15 Amps 30 Amps	DC Coils 5, 6, 9, 12, 24, 48	32 L 27 W 20 H	UL CSA	Panel Mount, PC Mount, PC Mount With Top Terminals
 FRT2	Telecom Modems General Purpose	DPDT 2 AMPS	DC Coils 5, 6, 9, 12, 24, 48	21 L 10 W 12 H	UL CSA	Standard Footprint

Greenwich Electronics • 5 Division Street, East Greenwich, RI 02818

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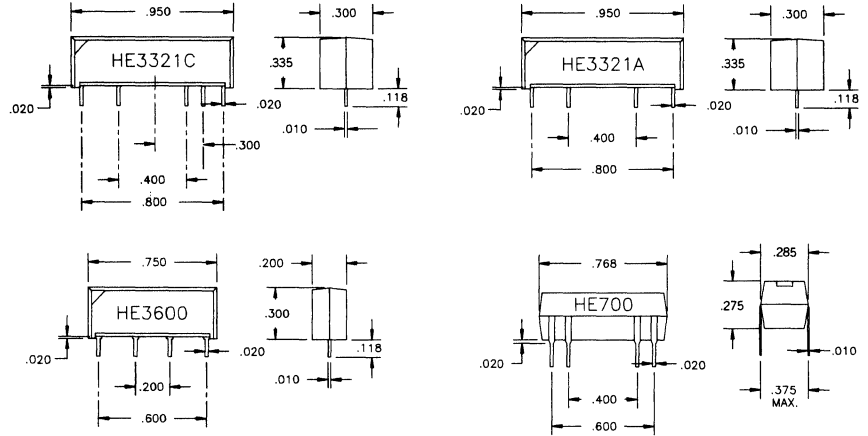
**REED RELAYS**  
**HAMLIN**  
 A BREED Technologies Company



612 East Lake Street, Lake Mills, WI 53551 USA  
 Phone 920/648-3000 FAX 920/648-3001  
 e-mail: info@hamlin.com  
 Internet: www.hamlin.com

Relays are molded construction and compatible with automatic insertion and board washing. All contacts are run-in one million operations prior to testing.  
 Operating temperature: -40 to +85 Deg. C. ,  
 Immune to 50G shock and 20G vibration 10-2000Hz.  
 Maximum contact resistance is 200 milli-ohms.

Hamlin 721, 3321 and 3621 series of reed relay's are available with optional form B contacts and external magnetic shielding. Consult factory for coil/contact configurations available.



MODEL NUMBER	CONTACTS		COIL		Diode	TOP VIEW 2.54mm, 0.10in. Grid (numbers do not appear on Relay)
	TYPE	RATINGS	Vdc	Ohms		
HE721A0500 HE721A0510 HE721A1200 HE721A1210 HE721A2400 HE721A2410	14 PIN DIP 1 Form A SPST-NO UL E47528	10W, 200Vdc, .5A 250Vdc Holdoff	5 5 12 12 24 24	500 500 1000 1000 2150 2150	No Yes No Yes No Yes	
HE721C0500 HE721C0510 HE721C1200 HE721C1210 HE721C2400 HE721C2410	14 PIN DIP 1 Form C SPDT-CO UL E47528	5W, 175Vdc, .25A 200Vdc Holdoff	5 5 12 12 24 24	200 200 500 500 2000 2000	No Yes No Yes No Yes	
HE722A0600 HE722A0610 HE722A1200 HE722A1210 HE722A2400 HE722A2410	14 PIN DIP 2 Form A DPST-NO UL E47528	10W, 200Vdc, .5A 250Vdc Holdoff	5 5 12 12 24 24	150 150 500 500 2150 2150	No Yes No Yes No Yes	
HE3321A0400 HE3321A1200 HE3321A2400  HE3351A0500 HE3351A1200 HE3351A2400	242 SIP 1 Form A SPST-NO UL E47258  10W, 250Vdc, .5A 600Vdc Holdoff	10W, 200Vdc, .5A 250Vdc Holdoff  10W, 250Vdc, .5A 600Vdc Holdoff	5 12 24  5 12 24	500 500 2000  125 500 2000	No No No  No No No	
HE3321C0500 HE3321C0500 HE3321C1200 HE3321C2400	242 SIP 1 Form C SPDT-CO UL E47258	5W, 175Vdc, .25A 200Vdc Holdoff	5 5 12 24	125 125 500 2000	No No No No	
HE3621A0500 HE3621A0510 HE3621A1200 HE3621A1210 HE3621A2400 HE3621A2410	222 SIP 1 Form A SPST-NO UL E47258	10W, 200Vdc, .5A 250Vdc Holdoff	5 5 12 12 24 24	500 500 1000 1000 2150 2150	No Yes No Yes No Yes	



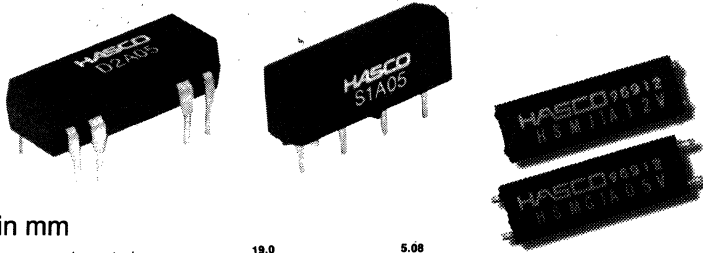
# REED RELAYS

\* SINCE 1976 \*

SIP/DIP REED RELAYS LOW COST D & S SERIES

**NEW SMT AVAILABLE**

- Molded epoxy body.
- FCC Part 68



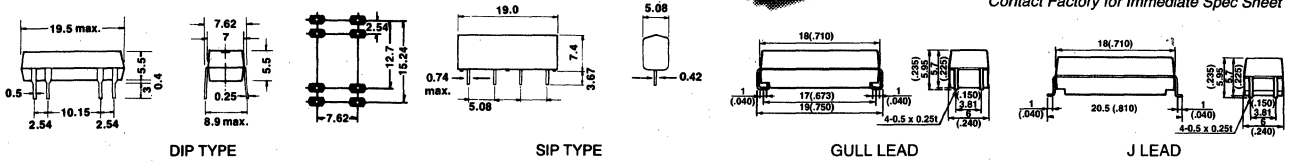
**ORDERING INFORMATION**

HSM 1A \* 05V  
HSM 1A \* 12V

\* J = J Lead  
G = Gull Lead

Contact Factory for Immediate Spec Sheet

DIMENSIONS: unit in mm



Contact Form	Part Number	Nominal Voltage (VDC)	Coil Resistance ±10%	Must Operate (VDC)	Must Release (VDC)	Rated Current (mA)	Continuous Voltage (max)	Circuit Schematic
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**DIP SPECIFICATIONS COIL RATINGS (20°C)**

1A	D1A05(D)	5	500	3.75	1.0	10	10	
	D1A12(D)	12	1000	9.00	1.2	12	20	
	D1A24(D)	24	2150	18.00	2.4	11.1	28	
1B	D1B05(D)	5	500	3.75	1.0	10	7	
	D1B12(D)	12	1000	9.00	1.2	12	15	
	D1B24(D)	24	2150	18.00	2.4	11.1	28	
2A	D2A05(D)	5	140	3.75	1.0	35.7	10	
	D2A12(D)	12	500	9.00	1.2	24	20	
	D2A24(D)	24	2150	18.00	2.4	11.1	28	
1C	D1C05(D)	5	200	3.75	1.0	25	10	
	D1C12(D)	12	500	9.00	1.2	24	20	
	D1C24(D)	24	2150	18.00	2.4	11.1	28	

(D): Clamp diode optional

**SIP SPECIFICATIONS COIL RATINGS (20°C)**

1A	S1A05(D)	5	500	3.75	1.0	10	10	
	S1A12(D)	12	1000	9.00	1.2	12	20	
	S1A24(D)	24	2000	18.00	2.4	12	28	

(D): Clamp diode optional

**SURFACE MOUNT SPECIFICATIONS COIL RATINGS (20°C)**

1A	HSM1A*05V	5	500	3.8	0.5			
	HSM1A*12V	12	1000	9.0	1.0			

1 Form B Available

\* J= J Lead, G = Gull Lead

Contact Factory for Immediate Spec Sheet

Form C & B Available. Call or Fax for Specifications.

**CHARACTERISTICS**

Item	Contact Form	2A, 1A, 1B	1C
Contact resistance		100mΩ max. (initial)	150mΩ max. (initial)
Operate time		0.5msec max.	1.0msec max.
Bounce time		0.5msec max.	2.0msec max.
Release time		0.2msec max.	0.2msec max.
Insulation resistance		10 <sup>11</sup> (min)	10 <sup>11</sup> (min)
Contact Material		Rhodium	Rhodium
Power		10VA max.	3VA max.
Switching Voltage		200VDCmax.	100VDCmax.
Switching Current		0.5Amps max.	0.25Amps max.
Carry Current		1.0Amps max.	0.5Amps max.
Life expectancy		10 <sup>8</sup> (signal level)	5 x 10 <sup>7</sup> (signal level)
Breakdown Voltage		DC250V across open contact DC500V between coil and contact	DC200V across open contact DC500V between coil and contact
Operating temp		- 40 ~ 85°C	- 40 ~ 85°C
Storage temp		- 50 ~ 125°C	- 50 ~ 125°C
Minimum permissible load		100mVDC 10μA	100mVDC 10μA
Vibration		20g (10 ~ 2000Hz)	20g (10 ~ 2000Hz)
Resonant frequency		3.5 KHz	3.5KHz

HASCO COMPONENTS INT'L., CORP. / 247-40 JERICO TPKE., BELLEROSE VILLAGE, NY 11001 / (516) 328-9292 FAX: 516-326-9125



# RELAYS

\* SINCE 1976 \*

Hasco Relay Type	700 SIP	UJ SERIES	BAS-111																																																																																																																																																		
<b>Features</b> <ul style="list-style-type: none"> <li>• Economical</li> <li>• Epoxy Molded</li> <li>• Low Price</li> <li>• Std. Heavy Duty or Hi-Voltage</li> <li>• FCC Pt 68</li> <li>• Complete Spec Sheet Faxed in 5 Min.</li> </ul>	<ul style="list-style-type: none"> <li>• High Switching Capacity</li> <li>• Long Life</li> <li>• PC Board Mount</li> <li>• Socket Mount</li> </ul>	<ul style="list-style-type: none"> <li>• 2A, 5A Switching</li> <li>• Small Size</li> <li>• Meets FCC Pt68</li> <li>• Same Day Sample Service</li> <li>• Complete Spec Faxed in 5 Minutes</li> </ul>																																																																																																																																																			
<b>Form</b>	1A, & 1C	1A, 1C, 2A, 2C	1C																																																																																																																																																		
<b>Contact Material</b>	De-activated Rhodium	Ag Cdo	Ag, Ag Cdo, AgPdAu																																																																																																																																																		
<b>Contact Rating</b>	TYPE: 711: 10VA Max, 100V DC Max, 1A 712: 70VA Max, 200V DC Max, 2.5A 713: 50VA Max, 350V DC Max, 2.5A 703: Form C SIP	UJ 1C 15A 120VAC, 24VDC UJ 2C 10A 120VAC, 24VDC Max. operating voltage 250VAC, 120VDC	BAS-111 = 2 AMP BAS-511 = 5 AMP HAS-111 = 1 AMP																																																																																																																																																		
<b>Coil Voltages</b>	5, 12, 24	DC + AC 6, 12, 24, 48, 110V	120, 220 (AC) 3, 5, 6, 9, 12, 24, 48V Standard and Sensitive																																																																																																																																																		
<b>Dielectric Strength</b>	250V-600V across contacts 2500V contacts to coil	1,000V AC (60Hz) for 1 minute between open contacts 1,500V AC (60Hz) for 1 minute between coil and contacts	Between open contacts: 1000VAC Contact to coil: 1500V RMS																																																																																																																																																		
<b>Internal Connections and Mounting Holes</b>	<b>GENERAL PURPOSE</b> <table border="1"> <thead> <tr> <th>Part Number</th> <th>Nominal Voltage (V)</th> <th>Must Operate (V)</th> <th>Must Release (V)</th> <th>Coil Resistance (Ohms)</th> </tr> </thead> <tbody> <tr> <td>711-5</td> <td>5</td> <td>3.75</td> <td>0.5</td> <td>500</td> </tr> <tr> <td>711-12</td> <td>12</td> <td>9.0</td> <td>1.2</td> <td>1000</td> </tr> <tr> <td>711-24</td> <td>24</td> <td>18.0</td> <td>2.4</td> <td>2000</td> </tr> </tbody> </table>	Part Number	Nominal Voltage (V)	Must Operate (V)	Must Release (V)	Coil Resistance (Ohms)	711-5	5	3.75	0.5	500	711-12	12	9.0	1.2	1000	711-24	24	18.0	2.4	2000	<b>SPECIFICATIONS COIL RATINGS</b> <table border="1"> <thead> <tr> <th>Rated Voltage</th> <th>Resistance (±10% at 20°C)</th> <th>Rated Current</th> <th>Pick-up Voltage (Max.)</th> <th>Drop-out Voltage (Min.)</th> <th>Allowable Voltage (Max.)</th> </tr> </thead> <tbody> <tr> <td>6V DC</td> <td>40Ω</td> <td>150 mA</td> <td>4.8 V DC</td> <td>0.6 V DC</td> <td>6.6 V DC</td> </tr> <tr> <td>12V DC</td> <td>160Ω</td> <td>75 mA</td> <td>9.6 V DC</td> <td>1.2 V DC</td> <td>13.2 V DC</td> </tr> <tr> <td>24V DC</td> <td>650Ω</td> <td>37 mA</td> <td>19.2 V DC</td> <td>2.4 V DC</td> <td>26.4 V DC</td> </tr> <tr> <td>48V DC</td> <td>1,260Ω</td> <td>18.5 mA</td> <td>38.4 V DC</td> <td>4.8 V DC</td> <td>52.8 V DC</td> </tr> <tr> <td>100V DC</td> <td>11,000Ω</td> <td>9.1 mA</td> <td>80 V DC</td> <td>10 V DC</td> <td>110 V DC</td> </tr> <tr> <td>6V AC</td> <td>10.5Ω</td> <td>183 mA</td> <td>4.8 V AC</td> <td>1.8 V AC</td> <td>6.6 V AC</td> </tr> <tr> <td>12V AC</td> <td>43 Ω</td> <td>95 mA</td> <td>9.6 V AC</td> <td>3.6 V AC</td> <td>13.2 V AC</td> </tr> <tr> <td>24V AC</td> <td>160 Ω</td> <td>56 mA</td> <td>19.2 V AC</td> <td>7.2 V AC</td> <td>26.4 V AC</td> </tr> <tr> <td>48V AC</td> <td>668 Ω</td> <td>26 mA</td> <td>38.4 V AC</td> <td>14.4 V AC</td> <td>52.8 V AC</td> </tr> <tr> <td>110V AC</td> <td>3530 Ω</td> <td>11 mA</td> <td>88 V AC</td> <td>33 V AC</td> <td>121 V AC</td> </tr> <tr> <td>120V AC</td> <td>4560 Ω</td> <td>10 mA</td> <td>96 V AC</td> <td>36 V AC</td> <td>132 V AC</td> </tr> <tr> <td>220V AC</td> <td>13920 Ω</td> <td>6.8 mA</td> <td>176 V AC</td> <td>66 V AC</td> <td>242 V AC</td> </tr> </tbody> </table>	Rated Voltage	Resistance (±10% at 20°C)	Rated Current	Pick-up Voltage (Max.)	Drop-out Voltage (Min.)	Allowable Voltage (Max.)	6V DC	40Ω	150 mA	4.8 V DC	0.6 V DC	6.6 V DC	12V DC	160Ω	75 mA	9.6 V DC	1.2 V DC	13.2 V DC	24V DC	650Ω	37 mA	19.2 V DC	2.4 V DC	26.4 V DC	48V DC	1,260Ω	18.5 mA	38.4 V DC	4.8 V DC	52.8 V DC	100V DC	11,000Ω	9.1 mA	80 V DC	10 V DC	110 V DC	6V AC	10.5Ω	183 mA	4.8 V AC	1.8 V AC	6.6 V AC	12V AC	43 Ω	95 mA	9.6 V AC	3.6 V AC	13.2 V AC	24V AC	160 Ω	56 mA	19.2 V AC	7.2 V AC	26.4 V AC	48V AC	668 Ω	26 mA	38.4 V AC	14.4 V AC	52.8 V AC	110V AC	3530 Ω	11 mA	88 V AC	33 V AC	121 V AC	120V AC	4560 Ω	10 mA	96 V AC	36 V AC	132 V AC	220V AC	13920 Ω	6.8 mA	176 V AC	66 V AC	242 V AC	<b>COIL RATINGS FOR STANDARD MODEL BAS 111</b> Nominal Power (W) Consumption Approximately 0.45 <table border="1"> <thead> <tr> <th>Relay Code</th> <th>Coil Resist. (Ω ±10%)</th> <th>Nom. Curr. (mA)</th> <th>Pick-Up Volt. (V)</th> <th>Drop-Out Volt. (V)</th> <th>Max. Volt. (V)*</th> </tr> </thead> <tbody> <tr><td>111-3V</td><td>20</td><td>150</td><td>2.1</td><td>0.3</td><td>3.3</td></tr> <tr><td>111-5V</td><td>56</td><td>89.3</td><td>3.5</td><td>0.5</td><td>5.5</td></tr> <tr><td>111-6V</td><td>80</td><td>75</td><td>4.2</td><td>0.6</td><td>6.6</td></tr> <tr><td>111-9V</td><td>180</td><td>50</td><td>6.3</td><td>0.9</td><td>9.9</td></tr> <tr><td>111-12V</td><td>320</td><td>37.5</td><td>8.4</td><td>1.2</td><td>13.2</td></tr> <tr><td>111-24V</td><td>1280</td><td>18.8</td><td>16.8</td><td>2.4</td><td>26.4</td></tr> <tr><td>111-48V</td><td>5120</td><td>9.4</td><td>33.6</td><td>4.8</td><td>52.8</td></tr> </tbody> </table>	Relay Code	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (V)	Drop-Out Volt. (V)	Max. Volt. (V)*	111-3V	20	150	2.1	0.3	3.3	111-5V	56	89.3	3.5	0.5	5.5	111-6V	80	75	4.2	0.6	6.6	111-9V	180	50	6.3	0.9	9.9	111-12V	320	37.5	8.4	1.2	13.2	111-24V	1280	18.8	16.8	2.4	26.4	111-48V	5120	9.4	33.6	4.8	52.8
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HASCO COMPONENTS INT'L., CORP. / 247-40 JERICHO TPKE., BELLEROSE VILLAGE, NY 11001 / (516) 328-9292 FAX: 516-326-9125



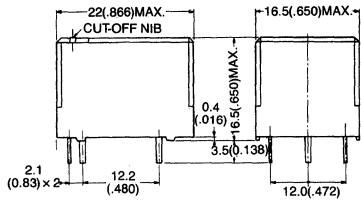
# RELAYS

\* SINCE 1976 \*

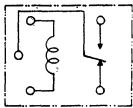
## KLT MINIATURE POWER RELAYS SPDT 3, 6, 12 & 15 AMP



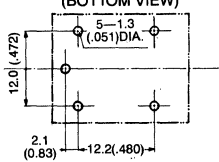
DIMENSIONS/UNIT mm (inch)



TERMINAL ARRANGEMENT (BOTTOM VIEW)



MOUNTING HOLES (BOTTOM VIEW)



### SPECIFICATIONS

#### ELECTRICAL RATINGS

- 3 Amp: 3A at 120VAC or 28VDC resistive
- 6 Amp: 6A at 120VAC or 28VDC; 6A at 240VAC general purpose; 1/4 hp at 120VAC
- 12 & 15 Amp: 12A at 120VAC or 28VDC; 12A at 240VAC general purpose; 7A at 277VAC general purpose; 1/4 hp at 120VAC; 15A at 120VAC resistive
- Pilot duty: 40A in-rush, 4A steady state at 125VAC
- 10A in-rush, 1A steady state at 240VAC
- N.O. only, Single Pole:
- 10A at 12VDC Tungsten; 15A at 120VAC Tungsten
- 1/2 hp at 120VAC; 5.4A at 277 VAC Ballast

#### GENERAL DATA

- Contact resistance: 50mΩ Max.
- Operate Time: 8ms Max. (at nominal voltage)
- Operate Bounce Time: 3 ms Max.
- Release Time: 5 ms Max.
- Release Bounce Time: 8 ms Max.
- Max. Switching Voltage: 277VAC & 125VDC
- Min. Permissible Load (reference value):
- 3 Amp: 5VDC at 1mA
- 6, 12 & 15 Amp: 5VDC at 100mA
- Insulation Rating: Class B, Class F Available
- Insulation Resistance: more than 100MΩ at 500VDC
- Dielectric Strength: 750VAC (50/60Hz), between open contacts
- 1500VAC (50/60Hz), between coil & contact
- Vibration: 1.5mm double amplitude, 10 to 50Hz
- Shock: 100 m/sec<sup>2</sup> (approx. 10G's)
- Operation Frequency: Mechanical: 18,000 operations/hour
- Electrical: 1,800 operations/hour (under rated load)
- Service Life: Mechanical: 10 million operations
- Electrical: 100,000 operations min. at rated resistive load
- Temperature Range: -30°C to 85°C
- Temperature Rise: Less than 35 degrees
- Humidity: 45% - 85% RH
- Approximate Weight: 12 grams



#### COIL RATINGS

Nominal Coil Voltage	Coil Resistance in Ohms ± 10% at 20°C	Must Operate Voltage at 20°C	Must Release Voltage at 20°C	Maximum Voltage
3VDC	25	75% max. of nominal voltage	10% min. of nominal voltage	130% of nominal voltage
5VDC	70			
6VDC	100	75% max. of nominal voltage	10% min. of nominal voltage	130% of nominal voltage
9VDC	225			
12VDC	400	75% max. of nominal voltage	10% min. of nominal voltage	130% of nominal voltage
18VDC	900			
24VDC	1600	75% max. of nominal voltage	10% min. of nominal voltage	130% of nominal voltage
48VDC	6400			

#### ORDERING INFORMATION

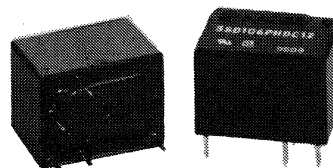
Model No. \_\_\_\_\_ KLT 1C 12 DC12

Contact Arrangement: \_\_\_\_\_  
 A = 1 Form A (SPST-NO) B = 1 Form B (SPST-NC) C = 1 Form C (SPDT)

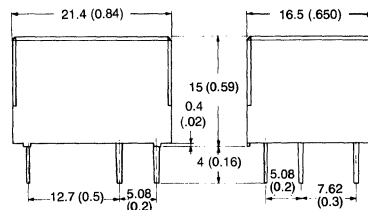
Contact Material & Rating: \_\_\_\_\_  
 3 Amp = Silver, gold flash  
 6 Amp = Silver cadmium oxide  
 12 & 15 Amp = Silver cadmium oxide

Nominal Voltage: \_\_\_\_\_  
 3 = 3VDC; 5 = 5VDC; 6 = 6VDC;  
 9 = 9VDC; 12 = 12VDC; 24 = 24VDC; 48 = 48VDC

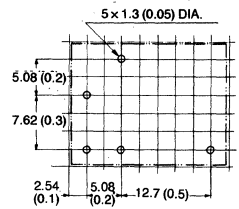
## SSD SERIES/3, 6 OR 10 AMP SPDT RELAY



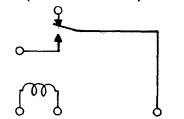
DIMENSIONS/UNIT mm (inch)



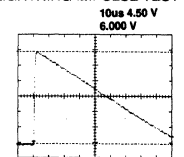
MOUNTING HOLES (BOTTOM VIEW)



TERMINAL ARRANGEMENT (BOTTOM VIEW)



LIGHTNING IMPULSE TEST



### SPECIFICATIONS

#### CONTACT DATA

- Arrangement: 1 Form C (SPDT), 1 Form A (SPDT-NO), 1 Form B (SPST-NC)
- Material & Rating: Silver, gold flash: 3A at 24 VDC or 120V AC, 1.5A at 240V AC, resistive
- Silver Cadmium oxide: 6A at 24 VDC or 120V DC, 3A at 240V AC, resistive
- Silver Cadmium oxide: 10A at 24 VDC or 120V AC, 5A at 240V AC, resistive 6A, 300VAC and 1/8hp. 120/240VAC
- Max. Operating Voltage: 250V AC & 125VDC
- Min. permissible load (reference value): Silver contact: 5VDC, 1mA
- Other contact: 5VDC, 100mA
- Life: Mechanical: 10 million operations
- Electrical: 100,000 operations min at rated resistive load.

#### GENERAL DATA

- Contact Resistance: 50m Ω Max.
- Operate time: Approx. 6ms (at nominal voltage)
- Operate bounce time: Approx. 2ms
- Release time: Approx. 2ms/Release bounce time: Approx. 4ms
- Insulation resistance: More than 100M Ω at DC 500V
- Dielectric strength: 750V AC (50/60 Hz), between open contact; 3000V AC (50/60 Hz), between coil & contact, 4000V AC (50/60 Hz), available
- Vibration: 1.5mm double amplitude, 10 to 50 Hz
- Shock: 100m/sec<sup>2</sup> (approx. 10G's)
- Operation frequency: Mechanical: 18,000 operations/hour
- Electrical: 1,800 operations/hour (under rated load)
- Temperature range: -45°C to 85°C
- Temperature rise: Less than 35 degrees/Humidity: 45%-85% RH

NOTE: The data shown above are of initial value.

#### COIL RATINGS

Nominal Coil Voltage	Coil Resistance in Ohms ± 10% at 20°C	Must Operate Voltage at 20°C	Must Release Voltage at 20°C	Maximum Voltage
3VDC	20	75% max. of nominal voltage	10% min. of nominal voltage	130% of nominal voltage
5VDC	56			
6VDC	80	75% max. of nominal voltage	10% min. of nominal voltage	130% of nominal voltage
9VDC	180			
12VDC	320	75% max. of nominal voltage	10% min. of nominal voltage	130% of nominal voltage
24VDC	1150			

#### ORDERING INFORMATION

Model No. \_\_\_\_\_ SSD 106PH DC12

Contact Material & Rating: \_\_\_\_\_  
 103 = Silver, gold flash, 3A  
 106 = Silver Cadmium oxide, 6A  
 110 = Silver Cadmium oxide, 10A

Nominal Voltage: \_\_\_\_\_  
 3 = 3VDC; 5 = 5VDC; 6 = 6VDC;  
 9 = 9VDC; 12 = 12VDC; 24 = 24VDC; 48 = 48VDC

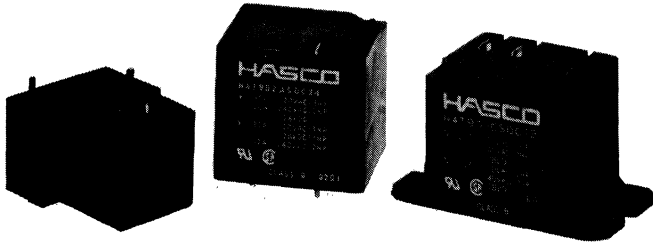




# RELAYS

\* SINCE 1976 \*

## HAT-900 SERIES HEAVY DUTY



### GENERAL SPECIFICATIONS

Contact Material: silver cadmium oxide with copper base  
 Max. continuous rated voltage: 110% of nominal voltage.  
 Pull-In voltage: 75% of nominal voltage. Max @ 25°C.  
 Drop-Out voltage: 10% of nominal voltage. Min @ 25°C.  
 Contact Resistance: 20 mΩ max. (Initial value)  
 Operating Temp: Class B: -20°C to 85°C  
 Class F: -20°C to 105°C  
 Insulation Resist: DC 500V 10 MΩ min.  
 Dielectric Strength: AC 1500V between contact and coil, frame and contact, coil and frame one minute. AC 2500V between contacts one minute.  
 Operate Time: approx. 15 ms.  
 Release Time: approx. 10 ms.  
 Electrical Life: 10 x 10<sup>4</sup> operation min. for rated resistive load (N.O.)  
 Mechanical Life: 10 x 10<sup>6</sup> operation min.

### COIL SPECIFICATIONS

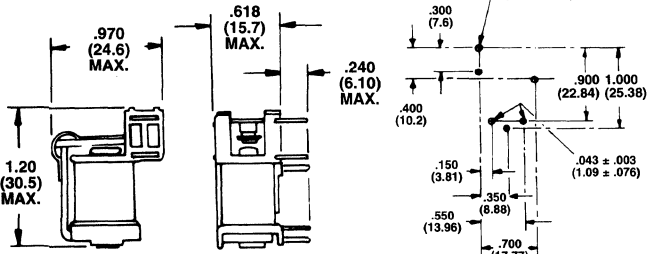
(AC Coil Available)

Nominal Voltage (VDC)	DC Resistance ±10% @ 25°C (Ohms)	Coil Power @ 25°C (Watts)
5	27	.93
6	40	.90
9	97	.84
12	155	.93
15	256	.88
18	380	.85
22	640	.76
24	660	.87
48	2560	.88
110	13400	.90

File E75887 LR49291

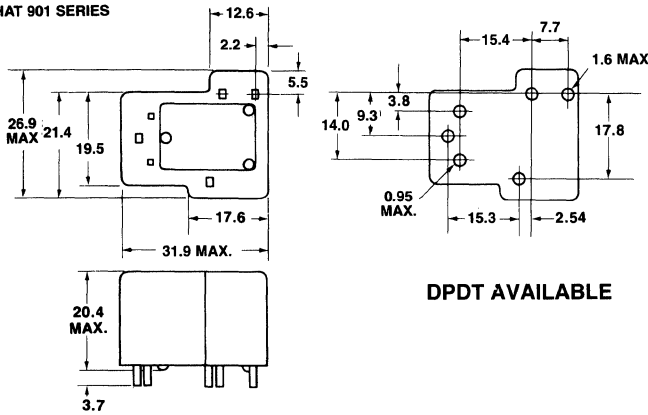
### MECHANICAL SPECIFICATIONS

HAT 900 SERIES



PC BOARD LAYOUT VIEWED TOWARD TERMINALS

HAT 901 SERIES



DPDT AVAILABLE

### MAXIMUM LOAD SPECIFICATIONS

Voltage	Load Type	SPNC	SPNO
AC	Resistive	30A 277VAC	30A 277VAC
		1HP 120VAC 2HP 277VAC	1HP 120 VAC 2HP 277VAC
	General Purpose	30A 277VAC	30A 277VAC
	Ballast	10A 120VAC	30A 120VAC
		10A 277VAC	20A 277VAC
	Tungsten	2A 120VAC	10A 120VAC
DC	Resistive	30A 28VDC	30A 28VDC

Shock Operational - 10g for 11ms w/no contact opening  
 Shock Destructive - 100g

### ORDERING INFORMATION



Temp. Class	Type	Form	Style	Coil	Coil Voltage	Option
Nil:	901: PC Pins Only	A: SPST-NO	Nil: Open	AC or DC	See Table	Pin 6 is Omitted UL 840
Class B	902: PC Pins & Quick Connects	B: SPST-NC	C: Cover, not sealed			
Class F	903: Quick Connects Only - Flange Mount	C: SPDT	S: Cover, sealed			

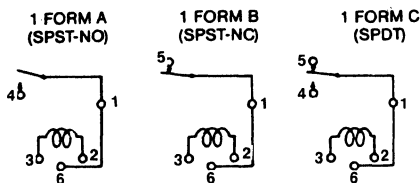
\*Note: 902 relays do not have pin 6.

DPDT AVAILABLE - Call for Specifications

### QUICK CONNECT

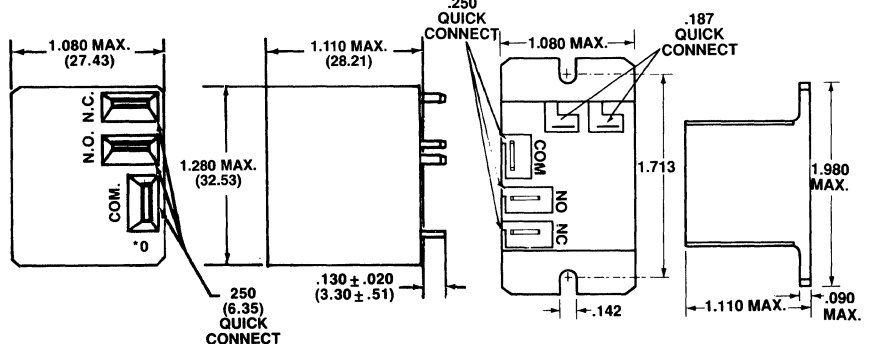
### WIRING DIAGRAMS

PIN VIEW



HAT 902 SERIES

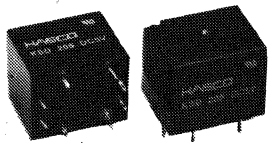
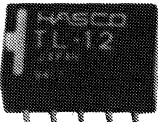
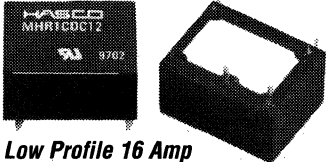
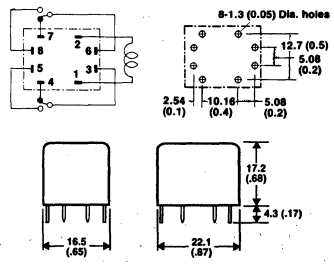
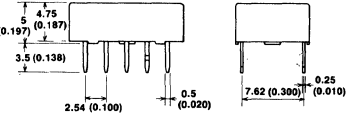
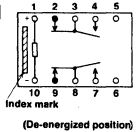
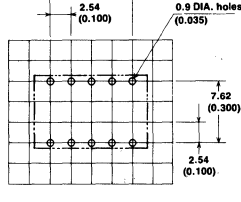
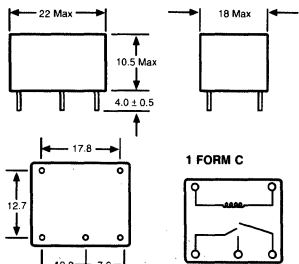
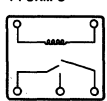
HAT 903 SERIES





# RELAYS

\* SINCE 1976 \*

<p><b>Hasco Relay Type</b></p>	<p><b>KSD-DPDT 5 AMP</b></p>  <p><b>Only .68" H</b></p>	<p><b>T SERIES</b></p>  <p><b>SMT &amp; Through hole</b></p>	<p><b>MHR SERIES</b></p>  <p><b>Low Profile 16 Amp</b></p>																																																																																																																														
<p><b>Features</b></p> <ul style="list-style-type: none"> <li>• Miniature Two Pole Relay</li> <li>• High Reliability</li> <li>• 5 Amp Switching</li> <li>• Fully sealed</li> <li>• Low Cost</li> <li>• Complete Spec Sheet Faxed in 5 Min.</li> </ul>		<ul style="list-style-type: none"> <li>• Subminiature Size</li> <li>• Meets FCC Pt68</li> <li>• Latching Available</li> <li>• SMT Available</li> </ul>	<ul style="list-style-type: none"> <li>• Subminiature Light Weight Relay</li> <li>• High Sensitivity</li> <li>• Switching Capacity Up to 16 Amp</li> <li>• P.C. Board Mounting, Direct Pitch Terminal</li> </ul>																																																																																																																														
<p><b>Form</b></p>	<p>2C</p>	<p>2C, 2C latch</p>	<p>1A, 1C</p>																																																																																																																														
<p><b>Contact Material</b></p>	<p>AgCd-Au plated</p>	<p>Movable Contact: AgPd Alloy Stationary Contact: Au clad AgPd Alloy</p>	<p>AGDCO, AGSnO<sub>2</sub>InO<sub>2</sub></p>																																																																																																																														
<p><b>Contact Rating</b></p>	<p>120 VAC/24 VDC-Load 250 VAC/125 VDC-Max Oper. Voltage</p>	<p>1A 30 VDC. 0.5A 125 VAC</p>	<p>1 Form A: "H" Type: 16A/125, 250VAC Standard: 10A/125, 250VAC 10A/30VDC, 1/10 HP 125, 277VAC 1 Form C: 10A/125VAC, 5A/250VAC, 3VDC 1/10HP125, 277VAC</p>																																																																																																																														
<p><b>Coil Voltages</b></p>	<p>3, 5, 6, 9, 12, 24VDC</p>	<p>3, 5, 6, 9, 12 &amp; 24V Standard and Latching</p>	<p>5, 6, 9, 12, 24VDC</p>																																																																																																																														
<p><b>Dielectric Strength</b></p>	<p>1,500 VAC, 50/60 Hz for 1 minute between coil and contact, dissimilar pole 750 VAC, 50/60 Hz for 1 minute between non-continuous contacts of same pole</p>	<p>BETWEEN open contacts 1000VAC SURGE 1500V Between coil &amp; contacts 1000VAC 1500V Between contact poles 1000VAC 1500V</p>	<p>1000V/ms, 1 minute between open contact 1500V/ms, 1 minute between coil &amp; contact</p>																																																																																																																														
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24	2880	1280																																																																																																																															
<p><b>Internal Connections and Mounting Holes</b></p> 	<p><b>DIMENSIONS</b> T-relay (Thru-hole type)</p>  <p><b>WIRING DIAGRAM</b> Single side stable</p>  <p><b>MOUNTING LAYOUT</b> Mounting hole layout for T-relay</p>  <p>Tolerance: ±0.1 (±0.004)</p>		<p><b>MOUNTING LAYOUT</b> Mounting hole layout for MHR Series</p>  <p>1 FORM C</p> 																																																																																																																														

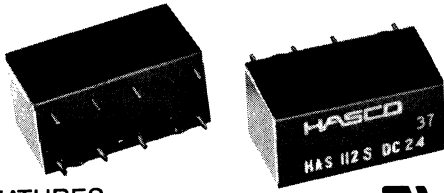
HASCO COMPONENTS INT'L., CORP. / 247-40 JERICO TPKE., BELLEROSE VILLAGE, NY 11001 / (516) 328-9292 FAX: 516-326-9125



# RELAYS

\* SINCE 1976 \*

DPDT—DIP PC STANDARD or SENSITIVE 2.00 AMP BIFURCATED CONTACT RELAY



### FEATURES

- FCC Pt 68.
- Sensitive available.
- Nitrogen sealing available.
- In stock!

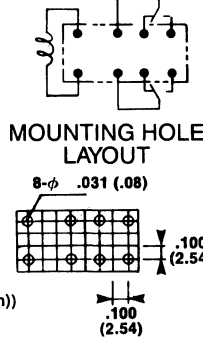


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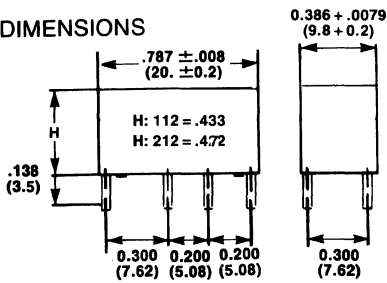


File LR49291

### SCHEMATIC Bottom view

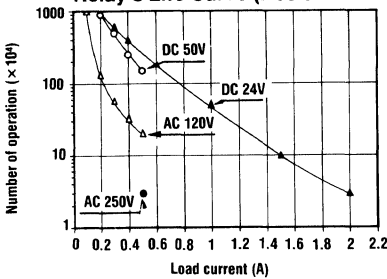


### DIMENSIONS

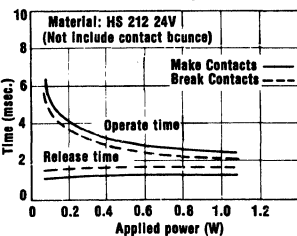


(Unit: inch (mm))

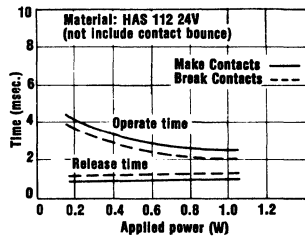
### HS212-HAS112 Relay's Life Curve (Resistive Load)



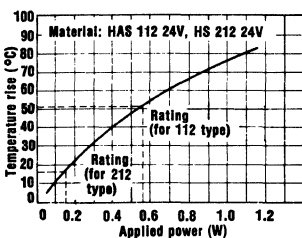
### Operate and Release Time For 212 24V Relays



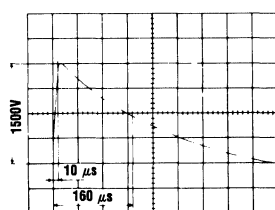
### Operate and Release Time For HAS 112 24V Relays



### Temperature Rise Of Coil



### FCC 1500V Surge Test Wave Form



### COIL RATINGS FOR STANDARD HAS 112

Relay Code (V)	Contact Arrangement	Nom. Volt. (VDC)	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (VDC)	Drop-Out Volt. (VDC)	Max. Volt. (VDC)	Nom. Pwr (W) Cons'p-tion
HAS-112-5	DPDT (2 Form C)	5	45	111.0	3.5	0.5	7.0	Approx. 0.56
HAS-112-6		6	66	90.9	4.2	0.6	8.4	
HAS-112-9		9	140	64.3	6.3	0.9	12.6	
HAS-112-12		12	280	42.9	8.4	1.2	16.8	
HAS-112-24		24	1070	22.4	16.8	2.4	33.6	
HAS-112-48		48	3900	12.3	33.6	4.8	67.2	

Data Measured at 20°C.

### COIL RATINGS FOR SENSITIVE HS 212

Relay Code (V)	Contact Arrangement	Nom. Volt. (VDC)	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (VDC)	Drop-Out Volt. (VDC)	Max. Volt. (VDC)	Nom. Pwr (W) Cons'p-tion
HS-212-5	DPDT (2 Form C)	5	167	29.9	3.5	0.5	12.5	0.15
HS-212-6		6	240	25.0	4.2	0.6	15.0	0.15
HS-212-9		9	540	16.7	6.3	0.9	22.5	0.15
HS-212-12		12	960	12.5	8.4	1.2	30.0	0.15
HS-212-24		24	2,880	8.3	16.8	2.4	51.6	0.2
HS-212-48		48	7,680	6.3	32.6	4.8	84.0	0.3
HS-212A-48		48	9,800	5.0	33.0	4.8	96.0	0.3
HS-212B-48		48	11,500	4.2	33.6	4.8	117.5	0.2
HS-212C-48		48	5,760	8.3	33.6	4.8	83.1	0.4

As for the resistance value, pull-in voltage and drop-out voltage, they show the value at ambient temperature, 20°C, and the tolerance is ±10%.

### RATING PERFORMANCE

		Specifications	Note
Contact	Contact Arrangement	DPDT, 2 Form C	
	Contact Material	Gold-clad, Ag-Pd alloy	
1.25 Amp	Contact Resistance	100 mΩ	at initial value
	Max. Switching Power	DC 60W AC 60 VA	HAS 112/212
	Max. Switching Voltage	220VDC 250VAC	
Max. Switching Current	2.0ADC / AC 0.6A / 110VDC 2.5A @ 12V		
2 Amp	Max. Switching Power	DC 60W AC 125 VA	HAS 114/115
	Max. Switching Voltage	220VDC 250VAC	
	Max. Switching Current	0.6A / 125VAC 0.6A / 110VDC 2A/30VDC	
Time	Operate Time (Type HS)	Approx. 4.5 msec.	at Nominal Voltage
	Release Time (Type HS)	Approx. 2.5 msec.	
	Bounce Time (Operating)	Approx. 1.5 msec.	
	Bounce Time (Releasing)	Approx. 0.5 to 2 msec.	
		Approx. 0.5 to 3.5 msec.	
Insulation Resistance	1000 MΩ	at 500 VAC, 25°C, 50% relative humidity	
Dielectric Strength	2250VAC Between coil and contacts 2000VAC Between open contacts		
FCC Surge Strength	1500V Between coil and contacts Between Adjacent contacts		
Vibration Resistance	1.5 mm DA. 10 - 55 Hz.		
Temperature	-40°C ~ +90°C -40°C ~ +80°C -40°C ~ +65°C	HS212-5-24V HS212-48 HAS112-5	
Life	Mechanical Life	10 x 10 <sup>7</sup> times	
	Electrical Life	5 x 10 <sup>6</sup> times	at 24 VDC, 1A, resistive load
Weight	5 g		



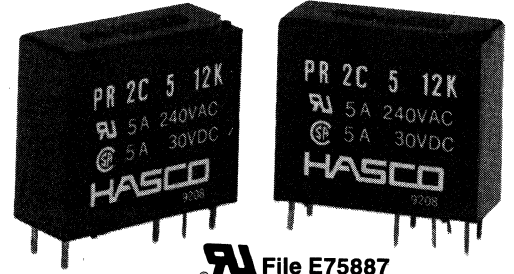
# RELAYS

\* SINCE 1976 \*

**PR SERIES**  
**COMPACT POWER RELAYS 1C (16A, 10A), 2C (5A)**  
 High breakdown voltage (4,000V AC between coil and contact)

**COIL RATINGS**

Rated Voltage	Resistance (±10% at 20°C)	Rated Current (±10% at 20°C)	Pick-up Voltage (Max.)	Drop-Out Voltage (Min.)	Allowable Voltage (Max.)	Rated operating power
5V DC	47Ω	106.4 mA	4 V DC	0.5V DC	6 V DC	Approx 0.7W
6V DC	68Ω	88.2 mA	4.8V DC	0.6V DC	7.2V DC	
9V DC	155Ω	58.1 mA	7.2V DC	0.9V DC	10.8V DC	
12V DC	275Ω	43.6 mA	9.6V DC	1.2V DC	14.4V DC	
24V DC	1,100Ω	21.8 mA	19.2V DC	2.4V DC	28.8V DC	
48V DC	4,170Ω	11.5 mA	38.4V DC	4.8V DC	57.6V DC	



File E75887



\* Coil resistance varies ± 0.4% for each ± 1°C change in coil temperature

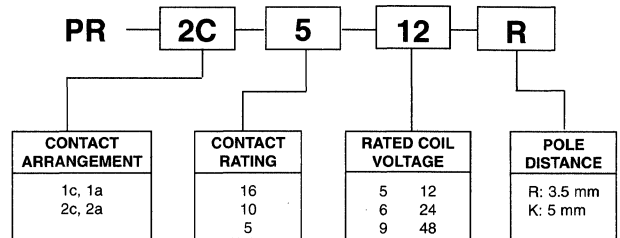
**CONTACT RATINGS**

Type & Arrangement	PR-1 (1a, 1c)		PR-1 (1a, 1c)		PR-2 (2a, 2c)	
	R load (p.f. = 1)	L load (p.f. = 0.7)	R load (p.f. = 1)	L load (p.f. = 0.7)	R load (p.f. = 1)	L load (p.f. = 0.7)
Rated load	16A 240V AC 16A 30V DC	8A 240V AC 8A 30V DC	10A 240V AC 10A 30V DC	5A 240V AC 5A 30V DC	5A 240V AC 5A 30V DC	2.5A 240V AC 2.5A 30V DC
Carry current	1/2 hp 120VAC 16A		1/4 hp 120VAC 10A		1/8 hp 120VAC 5A	
Max. operating voltage			380V AC, 120V DC			
Max. operating current	16A/3A Tungsten		10A/3A Tungsten		5A	
Max. switching capacity	3,520VA, 480W	1,760VA, 240W	2,200VA, 300W	1,100VA, 150W	1,100VA, 150W	550VA, 75W
Material	AgCdO					
Contact resistance	Less than 50mΩ (initial value)					

**SPECIFICATIONS**

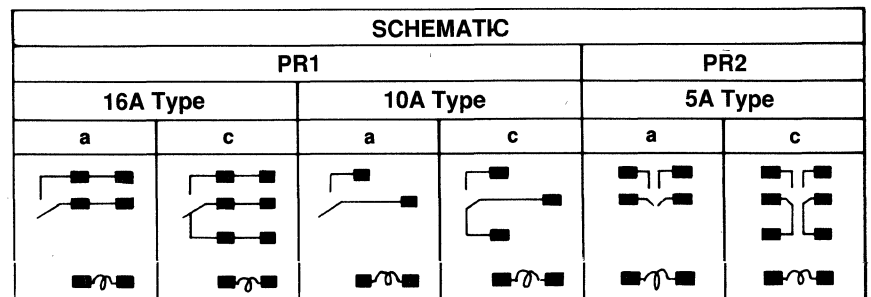
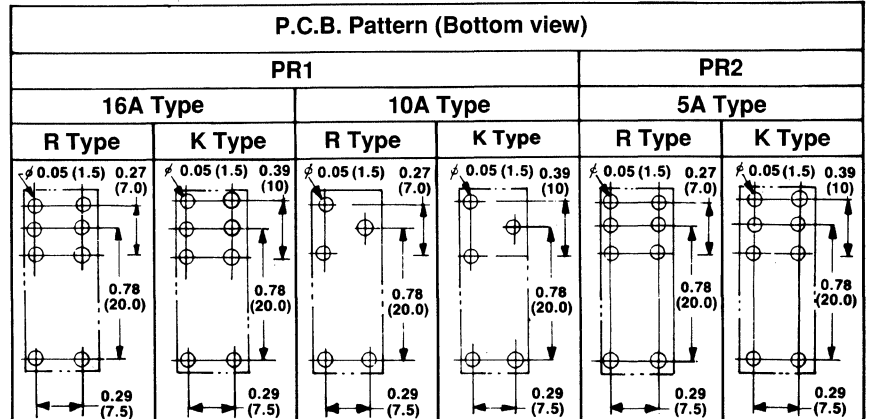
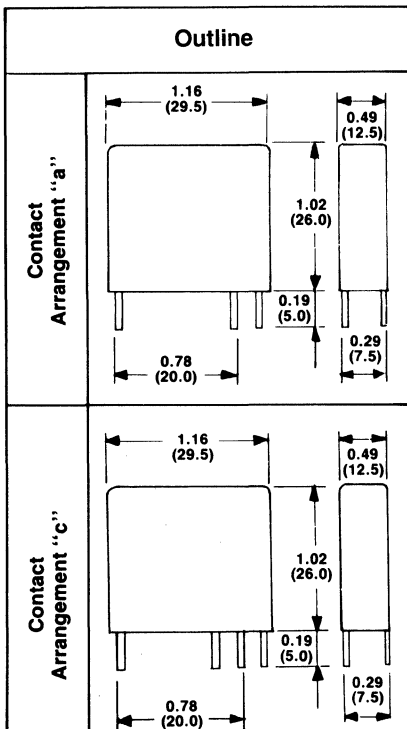
Operate time	15m sec. max.	
Release time	10m sec. max.	
Breakdown voltage	1,000V AC (60Hz) for 1 minute between open contacts 4,000V AC (60Hz) for 1 minute between coil and contacts	
Insulation resistance	More than 1,000 MΩ at 500V DC	
Vibration resistance	10 ~ 55 Hz at double amplitude of 1.5 mm	
Shock resistance	10G min.	
Ambient temperature range	-40°C ~ +65°C	
Operating speed	1,800 operations/hour	
Life	Mechanical	Over 10,000,000 operations
	Electrical (R load)	Over 100,000 operations
Weight	Approx. 17 grs (PR-1), Approx. 22 grs (PR-2)	

**ORDERING INFORMATION**



**Dimensions and Schematics PR**

Unit: inch (mm)



HASCO COMPONENTS INT'L., CORP. / 247-40 JERICHO TPKE., BELLEROSE VILLAGE, NY 11001 / (516) 328-9292 FAX: 516-326-9125

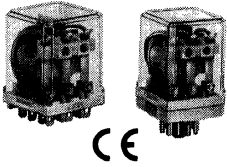


# IDEC Selection Guide Relays, Sockets & Time Delay Relays

IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211

Telephone: (408) 747-0550, Fax: (408) 744-9055, Catalog Requests: 800 262-IDEC  
In Canada: (604) 946-1271, Fax: (604) 946-0368

## RR Series

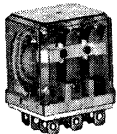


**Contacts**  
Form: 1C, 2C, 3C  
**Current:** 10A  
**Rating:** 10A, 240V AC (Resist.)  
1/3 HP @ 240V  
1/4 HP @ 120V  
10A/30V DC (Resist.)  
**Material:** Silver  
**Resistance:** 30mΩ, max.

**Nominal Operating Voltages  
And Coil Resistance (Ω)**  
6V AC: 4.9      6V DC: 25  
12V AC: 18      12V DC: 100  
24V AC: 79      24V DC: 400  
120V AC: 2100      48V DC: 1600  
240V AC: 8330      110V DC: 8460  
**Power Consumption:** 2.5VA

**Operating Temperature**  
-30° C to +70° C  
**Life Expectancy**  
Mechanical: 10,000,000  
Electrical: 500,000  
**Terminals**  
Pin & Blade/Plug-In  
**Compatible IDEC Socket**  
SR Series

## RH Series



**Contacts**  
Form: 1C, 2C, 3C, 4C  
**Current:** 10A  
**Rating:** 10A, 240V AC (Resist.)  
1/3 HP @ 240V  
1/6 HP @ 120V  
10A/30V DC (Resist.)  
**Material:** Silver Cadmium Oxide  
**Resistance:** 50mΩ, max.

**\*Nominal Operating Voltages  
And Coil Resistance (Ω)**  
6V AC: 9.4      6V DC: 40  
12V AC: 39.3      12V DC: 160  
24V AC: 153      24V DC: 650  
120V AC: 4170      48V DC: 2600  
240V AC: 15210      110V DC: 12100  
\*Specification for 2C version.  
**Power Consumption:** 1.2VA

**Operating Temperature**  
-30° C to +70° C  
**Life Expectancy**  
Mechanical: 50,000,000  
Electrical: 500,000  
**Terminals**  
Blade/Plug-In  
P.C. Mount  
**Compatible IDEC Socket**  
SH Series

## RY Series

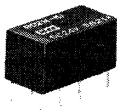


**Contacts**  
Form: 2C, 4C  
**Current:** 5A  
**Rating:** 5A, 240V AC (Resist.)  
5A/30V DC (Resist.)  
**Material:** Silver (Gold Plated)  
**Resistance:** 50mΩ, max.

**\*Nominal Operating Voltages  
And Coil Resistance (Ω)**  
6V AC: 9.4      6V DC: 40  
12V AC: 39.3      12V DC: 160  
24V AC: 153      24V DC: 650  
120V AC: 4170      48V DC: 2600  
240V AC: 15210      110V DC: 12100  
\*Specifications for 4C version.  
**Power Consumption:** 1.2VA

**Operating Temperatures**  
-30° C to +70° C  
**Life Expectancy**  
Mechanical: 50,000,000  
Electrical: 200,000  
**Terminals**  
Solder/Plug-In  
P.C. Mount  
**Compatible IDEC Socket**  
SY Series

## RD Series

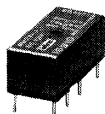


**Contacts**  
Form: 2C  
**Current:** 1.25A, max.  
**Material:** Silver (Gold-Clad)  
**Resistance:** 100mΩ, max.  
**Surge Withstand Voltage:** 1500V (FCC)

**Nominal Operating Voltages  
And DC Coil Resistance (Ω)**  
3V DC: 22.5  
5V DC: 62.5  
6V DC: 90  
12V DC: 360  
24V DC: 1440  
48V DC: 4000  
**Power Consumption:** 400mW, 510mW (48V DC)

**Operating Temperature**  
-30° C to +70° C  
**Life Expectancy**  
Mechanical: 50,000,000  
Electrical: 500,000  
**Terminals**  
P.C. Mount

## RW Series



**Contacts**  
Form: 2C  
**Current:** 2A, max.  
**Material:** Silver (Gold-Clad)  
**Resistance:** 50mΩ, max.  
**Surge Withstand Voltage:** 1500V (FCC)

**Nominal Operating Voltages  
And DC Coil Resistance (Ω)**  
1.5V DC: 11.3  
3V DC: 45  
5V DC: 125  
6V DC: 180  
12V DC: 720  
24V DC: 2880  
**Power Consumption:** 200mW

**Operating Temperature**  
-30° C to +70° C  
**Life Expectancy**  
Mechanical: 100,000,000  
Electrical: 500,000  
**Terminals**  
P.C. Mount

## Rss Series



**Input: (DC)**  
Voltage Range: 4-32V DC  
Turn-On/Turn-Off Voltage: 4/1V DC  
Isolation Voltage: 4000V AC (Input to Output)

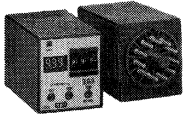
**Output: (AC)**  
Current Ratings: 10A, 25A, 50A, 75A, 90A  
1 Cycle Surge Peak: 100A, 250A, 750A, 1000A  
Voltage Range: 48-660V AC  
Voltage Drop-Out @ Rated Current: 1.6v max.  
Over Voltage Rating: 1200PIV

**Input: (AC)**  
Voltage Range: 90-280V AC  
Turn-On/Turn-Off Voltage: 90/10V AC  
Isolation Voltage: 4000V AC (Input to Output)

**Output: (AC)**  
Current Ratings: 10A, 25A, 50A, 75A, 90A  
1 Cycle Surge Peak: 100A, 250A, 750A, 1000A  
Voltage Range: 48-660V AC  
Voltage Drop-Out @ Rated Current: 1.6v max.  
Over Voltage Rating: 1200PIV

**For Complete Information On IDEC Relays, Sockets, & Time Delays, See Catalog U900.**

**GT3D Series**

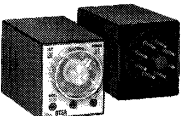


**Contacts**  
**Form:** Delayed SPDT  
 Delayed SPDT +  
 Instantaneous SPDT  
 Delayed DPDT  
**Output:** 250V AC, 5A  
 30V DC, 5A  
**Operating Voltages:**  
 100-240V AC  
 12V AC/DC  
 24V AC/DC

**Operation Modes**  
 • ON-Delay, Interval, Cycle, Cycle-ON  
 • ON-Delay (2 types), Cycle (2 types),  
 Signal ON/OFF Delay (3 types),  
 Interval (2 types), One-Shot (2 types),  
 Signal OFF Delay (2 types), Cycle-ON,  
 One-Shot ON-Delay, One-Shot Cycle  
 (w/input)  
 • ON-Delay 1, ON-Delay 2,  
 Cycle (One-shot output)  
 (w/input)

**Timing**  
**Time Range:** 0.01 sec to 99.9 hrs  
**Repeat Accuracy:** 0.3%  
**Reset Time:** 60 msec, max.  
**Terminals:** 8-/11-Pin, Plug-In  
**Compatible IDEC Socket**  
 SR Series  
 (Optional panel mount adaptor  
 available.)

**GT3A Series**



**Contacts**  
**Form:** Delayed SPDT  
 Delayed SPDT +  
 Instantaneous SPDT  
 Delayed DPDT  
**Output:** 250V AC, 5A  
 30V DC, 5A  
**Operating Voltages:**  
 100-240V AC  
 12V AC/DC  
 24V AC/DC

**Operation Modes**  
 Multi-Mode  
 • ON-Delay, Interval, Cycle, Cycle ON  
 • ON-Delay, Cycle, Signal ON/OFF, OFFDelay  
 (w/Input)  
 • Interval ON, Single-Shot Cycle,  
 Signal ON/OFF Delay, Signal OFF Delay  
 (w/Input)  
 • Single-Shot, Single-Shot ON Delay,  
 Single-Shot, Signal ON/OFF Delay  
 (w/Input)

**Timing**  
**Time Range:** 0.05 sec to 180 hrs  
**Repeat Accuracy:** 0.2%  
**Reset Time:** 60 msec, max.  
**Terminals:** 8-/11-Pin, Plug-In  
**Compatible IDEC Socket**  
 SR Series  
 (Optional panel mount adaptor  
 available.)

**GT3F Series**

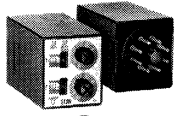


**Contacts**  
**Forms:** Delayed SPDT  
 Delayed DPDT  
**Output:** 250V AC, 5A  
 30V DC, 5A  
**Operating Voltages:**  
 100-120V AC  
 200-240V AC  
 24V DC

**Operation Modes**  
 • Power OFF Delay  
 • Power OFF Delay (w/Reset Input)  
**Timing**  
**Time Range:** 0.05 sec to 180 sec.  
 6 sec to 10 min  
**Repeat Accuracy:** 0.2%

**Terminals:** 8-/11-Pin, Plug-In  
**Compatible IDEC Socket**  
 SR Series  
 (Optional panel mount adaptor  
 available.)

**GT3W Series**

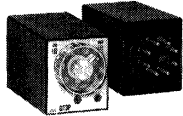


**Contacts**  
**Form:** Delayed SPDT+  
 Delayed SPDT  
**Output:** 250V AC, 5A  
 30V DC, 5A  
**Operating Voltages:**  
 100-240V AC  
 24V AC/DC

**Operation Mode**  
 • Recycle  
 (Dual Timing Adjustment)  
**Timing**  
**Time Range:** 0.1 sec to 1 hr  
 0.6 sec to 6 hrs  
**Repeat Accuracy:** 0.2%  
**Repeat Time:** 0.1 sec, max.

**Terminals:** 8-/11-Pin, Plug-In  
**Compatible IDEC Socket**  
 SR Series  
 (Optional panel mount adaptor  
 available.)

**GT3P Series**



**Contacts**  
**Form:** Triac One Circuit (AC)  
 Transistor  
 One Circuit (DC)  
**Output:** 250V AC, 0.6A  
 28V DC, 100mA  
**Operating Voltages:**  
 100-240V AC  
 24 V AC/DC

**Operation Modes**  
 • Sequence  
 (Variable Ratio Duty)  
**Timing**  
**Time Range:** 0.01 sec to 10 min  
**Duty Ratio:** 0 to 100% variable  
**Repeat Accuracy:** 0.2%  
**Reset Time:** 60 msec, max.

**Terminals:** 8-/11-Pin, Plug-In  
**Compatible IDEC Socket**  
 SR Series  
 (Optional panel mount adaptor  
 available.)

**RTE Series**



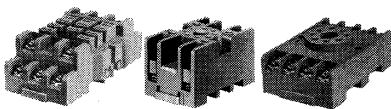
**Contacts**  
**Form:** DPDT  
**Output:** 240V AC, 10A  
 30V DC, 10A  
**Operating Voltages:**  
 120V AC  
 12V AC/DC  
 24V AC/DC

**Operation Modes**  
 • ON Delay, Interval  
 • OFF Delay, Single Shot Timing  
**Time Range:** 1 sec to 10 hrs  
**Repeat Accuracy:** 0.2%  
**Reset Time:** 0.1 sec, max.

**Terminals:** 8-Pin/Blade, Plug-In  
 11-Pin/Blade, Plug-In  
**Compatible IDEC Socket**  
 SR Series  
 (Optional panel mount adaptor  
 available.)

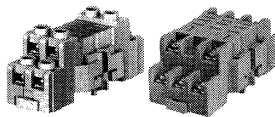
**DIN Rail Mount Sockets** (IDEC offers a complete line of "Finger-Safe" DIN rail mount sockets, panel and PC mount sockets)

**SR Series**



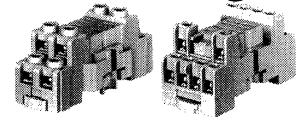
**Type:** 2-Pole, 8-Pin Plug-In  
 3-Pole, 11-Pin Plug-In  
**Ratings:** 10A/300V, 15A/300V

**SH Series**



**Type:** 1-4 Pole, Blade, Plug-In  
**Ratings:** 10A/300V

**SY Series**



**Type:** 2 & 4-Pole, Solder, Plug-In  
**Ratings:** 7A/300V

**For Complete Information On IDEC Relays, Sockets & Time Delay Relays See Catalog No. U900.**

INSTRUMENTATION &amp; CONTROL SYSTEMS, INC.

**ICS**

INSTRUMENTATION &amp; CONTROL SYSTEMS, INC.

520 Interstate Road

Addison, IL 60101

Phone: 630.543.6200

FAX: 630.543.6244

**SOLID STATE DELAY TIMERS**

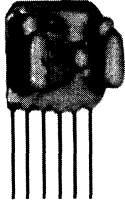
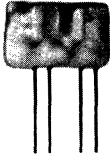
KH 2

**KH Series Timing Module/PC Mount****Thick Film Hybrid Circuit, Miniature Size, Thick Conformal Coating, Printed Circuit Mounting, Time Ranges from .1 to 300 sec\*, External Adjustable or Fixed Times.****OUTPUT CURRENT RATING:** Action 1:10 ma. min,100 max. Actions 2&3:10 ma. min. 500 ma .max.**REPEAT ACCURACY:** Fixed conditions = ± 3 %, OVERALL ±10 % over -10° to 70° C.**SIZE:** Action 1 = 1.25"L x .6"W x .3" Thick. Action 2 & 3 = 1.25"L x 1.0" W x .5" Thick.**Ordering Code:**

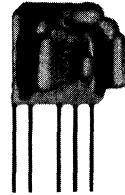
KH

**Timing Actions:**ON Delay (1).  
OFF Delay (2).  
INTERVAL Delay (3)  
N/A in all voltages.**Timing Ranges:**Standard:  
.1 to 1 sec. (1).  
.5 to 5 sec. (2).  
3 to 30 sec. (7).  
30 to 300 sec. (4).  
Non-standard:  
1 to 10 sec. (5).  
5 to 50 sec. (3).  
6 to 60 sec. (8).  
12 to 120 sec. (6).  
\*Special time. (0).**Input Voltages:**Standard: Non-standard:  
24 VAC (2). 12 VAC (7).  
120 VAC (1). 240 VAC (5).  
12 VDC (8). 48 VDC (6).  
24 VDC (4). 110 VDC (3).

KH 1



KH 3



KD 2

**KD Series Digital Countdown Timer/PC Mount****Digital Countdown Circuit, Miniature PC Board, Thick Conformal Coating, Printed Circuit Mounting, Time Ranges from .1 sec. to 10 hr.\*, External Adjustable or Fixed Times.****OUTPUT CURRENT RATING:** 20 ma. min, 500 max.**REPEAT ACCURACY:** Fixed conditions = ± .5 %, OVERALL ± 3 % over -10° to 70° C.**SIZE:** Action 1 = 1.25" L x 1.0" W x .5" Thick Action 2, 3, 5 = 1.38" sq. x .5" Thick.

Action 6 = 2.0" L x 1.38" W x .5" Thick.

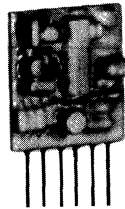
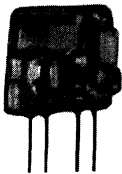
**Ordering Code:**

KD

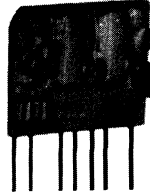
Action 6 "ON" time is inserted here.

**Timing Actions:**ON Delay (1).  
OFF Delay (2).  
INTERVAL Delay (3).  
RECYCLE Timer (5)  
(OFF & ON times are  
equal; single adjustment).  
RECYCLE Timer (6) (OFF & ON times independently adjustable).**Timing Ranges:**Standard:  
.1 to 10 sec. (1).  
1 to 60 sec. (4).  
10 to 600 sec. (2).  
1 to 60 min. (5).  
Non-standard:  
10 - 600 min. (3).  
\*Special time (0).**Input Voltages:**Standard: Non standard:  
24 VAC (2). 12 VAC (7).  
120 VAC (1). 240 VAC (5).  
12 VDC (8). 48 VDC (6).  
24 VDC (4). 110 VDC (3).

KD 1

KD 3  
KD 5

KD 6

**Custom Engineered Electronic Controls and Sensors****INFRARED SENSOR CONTROL**

Our Infrared Proximity Sensor is one of the latest developments where hygiene is a vital issue, such as in restaurants, hospitals, and public washrooms. When the IR beam detects an object it turns on a device. A preset timer turns off the device. This design provides the engineer with a myriad range of new product development possibilities. The touchless concept is currently being extended to include hand dryers, soap dispensers, automatic water-flow control, and closet flushers.

**MODULAR TIMER ASSEMBLY**

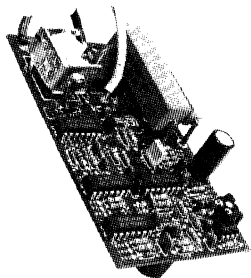
A PC Board using the standard ICS, Inc. timing modules may be designed to fit a customer's logic controls criteria.

**SOLID STATE SEQUENCE CONTROL**

A custom designed sequence control is used to overcome the critical problem of occluded surfaces in industrial dust collection cyclones. Another type of sequencer designed and manufactured by ICS, Inc. controls the crucial directional strobe lights used at airports.

**SOLID STATE SENSORS AND TIMING CONTROLS**

Current Sensing Relays &amp; Monitors, Voltage Sensors, Motor Speed Controls, Machine Controls, Timing Controls, True Off Delay TDR, Flashers, Vending Controls, Garbage Compactor, Incinerator, and Dispensing Controls.

**MICROPROCESSOR CONTROLS****PROVEN RELIABILITY FOR 30 YEARS**

**HEXFET® Power MOSFET Photo Voltaic Relays**

International Rectifier 2nd Generation Photo Voltaic Relays utilize proprietary HEXFET® power MOSFETs, or IGBTs as the output switch, driven by an integrated circuit photo-voltaic generator of novel construction. The output switch is controlled by radiation from a GAAIAs light emitting diode (LED) which is optically isolated from the photovoltaic generator.

These series include specialized telecom and instrumentation relays as well as general purpose relays. They offer

solid-state replacement for miniature electromechanical and reed relays. They feature high sensitivity, miniaturization, no contact bounce, long operational life, insensitivity to external magnetic fields, shock and vibration, and high reliability inherent with solid state technology.

The relays are housed in a variety of plastic DIP packages, including small outline packages available on several models and are available with thru-hole and SMT (gull-wing) leads, in standard plastic shipping tubes or on tape-and-reel.

Contact Configuration	Part Number	Operating Voltage Range V(Pk)	Max. On-State Res. @ 25°C Ohms		Max. Load Current @ 40°C mA		Nom. Control Current mA (DC)	Min. Off-State Res. Ohms	Outline Drawing	FOD Document No.
			AC	DC	AC	DC				
1 FORM A	PVAZ172N	±60	0.5	0.5	1000	1000	10	10 <sup>8</sup>	Fig. 2	1.040
	PVDZ172N	+60		0.25		1500	10	10 <sup>8</sup>		1.039
	PVG612	±60	0.5	0.15	1000	2000	5	10 <sup>8</sup>	Fig. 4	1.035
	PVN012	±20	0.1	0.04	2500	4500	5	0.16 x 10 <sup>8</sup>		1.034
	PVT312	±250	10	3	190	320	5	2.5 X 10 <sup>8</sup>		1.038
	PVT312L	±250	15	4.25	170	300	5	2.5 X 10 <sup>8</sup>		1.038
	PVT412	±400	27	7	140	210	5	4.0 X 10 <sup>8</sup>		6.040
	PVT412L	±400	35	9	120	200	5	4.0 X 10 <sup>8</sup>		6.040
	PVU414	±400	27	7	140	210	5	10 <sup>10</sup>		1.031
PVX6012	±400	N/A	N/A	1000	1000	5	4.0 X 10 <sup>7</sup>	Fig.1	1.046	
1 FORM B	PVT442	±400	16	7	170	300	5	4.0 X 10 <sup>8</sup>	Fig. 4	1.047
2 FORM A	PVT322	±250	10	10	170	170	5	2.5 X 10 <sup>8</sup>	Fig. 5	1.042
	PVT322A	±250	8	8	170	170	5	2.5 X 10 <sup>8</sup>		1.044
	PVT422	±400	35	35	120	120	5	3.2 X 10 <sup>8</sup>		1.037
	PVT422P	±400	35	35	120	120	5	3.2 X 10 <sup>8</sup>	Fig. 6	1.043
1 FORM A	PVO402P	±400	35	35	120	120	5	4.0 X 10 <sup>8</sup>	Fig. 6	1.036
& Ring Detector	PVO402AP	±400	22	22	150	150	5	4.0 X 10 <sup>8</sup>		1.045

**Notes:**

"L" suffix denotes load current limiting capacity designed to protect against current transients of lightning surges.  
"P" suffix denotes small outline "Thin-Pak" package designed for type II PCMCIA card applications.

General Characteristics	Values	Units
Isolation Input/Output	4000 (3750 for "P" suffix)	V <sub>RMS</sub>
Min. Insulation Resistance Input/Output	10 <sup>12</sup>	Ohm
Max. Capacitance Input/Output	1.0	pF
Max. Pin Soldering Temp. (10 sec. max.)	+260	°C
Ambient Temp. Range: Operating	-40 to +85	°C
Storage	-40 to +100	°C

International Rectifier  
233 Kansas Street, El Segundo, CA 90245 (310) 252-7105  
Europe: Hurst Green, Oxted, Surrey RH8 9BB, England

Fax-on-Demand (North America): 310-252-7100  
Internet: www.irf.com  
Fax-on-Demand (United Kingdom): 01883-733420



**BOSFET® PhotoVoltaic Relays**

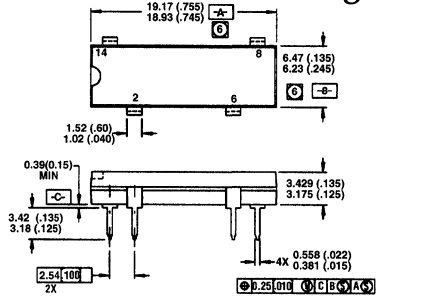
International Rectifier Photo-Voltaic Relays utilize a unique power integrated circuit termed a BOSFET to form a solid state replacement for signal level electromechanical relays. They feature high speed, zero offset voltage, low pick-up power, miniaturization, and are widely applied in instrumentation, multiplexing, automatic test equipment, thermocouple switching and general purpose switching of AC/DC analog and digital signals. The PVI isolators provide a DC output with a 2500VAC isolation level for driving MOSFETs, IGBTs and serving as an isolated DC bias.

Contact Configuration	Part Number	Operating Voltage Range V(Pk)	Maximum On-State Res. @25°C Ohms		Max. Load Current @40°C (DC)	Nom. Control Current (DC) mA	Min. Off-State Res. Ohms	Outline Drawing	FOD Document No.
			AC	DC					
<b>PVR</b> 2 FORM A	PVR1300	±100	5.0	1.5	700	10	10 <sup>8</sup>	Figure 3	1.027
	PVR1301	±100	5.0	1.5	700				1.027
	PVR2300	±200	24	6.0	260				1.028
	PVR3300	±300	24	6.0	260				1.028
	PVR3301	±300	24	6.0	260				1.028
<b>PVA</b> 1 FORM A	PVA1052	±100	35	35	70	5.0	10 <sup>8</sup>	Figure 2	1.019
	PVA1054	±100	35	35	70	5.0	10 <sup>10</sup>		1.019
	PVA1352	±100	5.0	5.0	315	5.0	10 <sup>8</sup>		1.020
	PVA1354	±100	5.0	5.0	315	5.0	10 <sup>10</sup>		1.020
	PVA2352	±200	24	24	130	5.0	10 <sup>8</sup>		1.020
	PVA3054	±300	160	160	40	5.0	10 <sup>10</sup>		1.030
	PVA3055	±300	160	160	40	5.0	10 <sup>11</sup>		1.030
	PVA3324	±300	24	24	130	2.0	10 <sup>10</sup>		1.021
PVA3354	±300	24	24	130	5.0	10 <sup>10</sup>	1.021		
<b>PVD</b> 1 FORM A	PVD1052	+100		8.0	160	5.0	10 <sup>8</sup>	Figure 2	1.023
	PVD1054	+100		8.0	160	5.0	10 <sup>10</sup>		1.023
	PVD1352	+100		1.5	500	5.0	10 <sup>8</sup>		1.024
	PVD1354	+100		1.5	500	5.0	10 <sup>10</sup>		1.024
	PVD2352	+200		6.0	220	5.0	10 <sup>8</sup>		1.025
PVD3354	+300		6.0	220	5.0	10 <sup>10</sup>	1.025		
<b>PVI</b>	<b>PHOTOVOLTAIC ISOLATOR</b>								
		Number Outputs	Output Volts (DC)	Short Circuit Current (µA)	Outline Drawing	FOD Document No.			
	PVI1050	2	5.0/10	10/5.0	Figure 2	1.029			
	PVI5080	1	5.0	8.0	Figure 2				
	PVI5050	1	5.0	5.0	Figure 2				
PVI15013R	2	5.0/10	2/1	Figure 5	1.041				

GENERAL CHARACTERISTICS	PVR	PVA	PVD	PVI	UNITS
Dielectric Strength Input/Output	1500	1500 and 2500		2500*	VRMS
Min. off state dv/dt @ rated V 25°C		1000		-	V/µ sec
Max. thermal offset voltage		0.2		-	µV
Output	AC or DC			DC	-
Ambient operating temperature	-40 to +85				°C

\* 4000 VRMS for PVI15013R

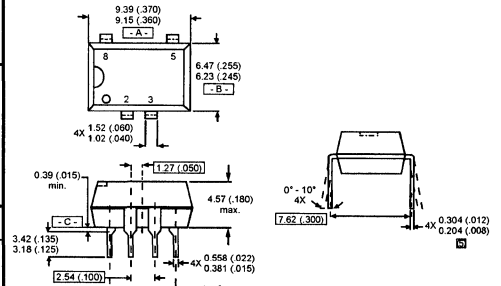
**Dimension Drawings**



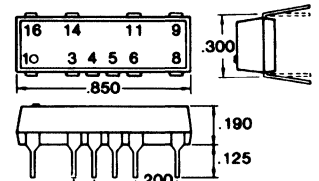
- NOTES:  
 1. DIMENSIONING & TOLERANCE PER ANSI Y14.5M-1982.  
 2. CONTROLLING DIMENSION: INCH.  
 3. DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).  
 4. OUTLINE CONFORMS TO JDEC OUTLINE MS-001AA.

- ⑤ MEASURED WITH THE LEADS CONSTRAINED TO BE PERPENDICULAR TO DATUM PLANE C.  
 ⑥ DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS SHALL NOT EXCEED 0.25 (.010).

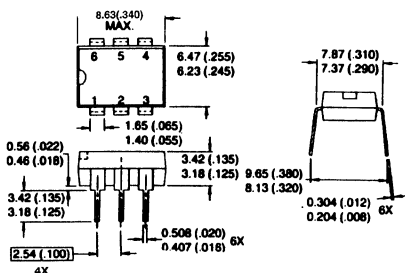
**Figure 1**



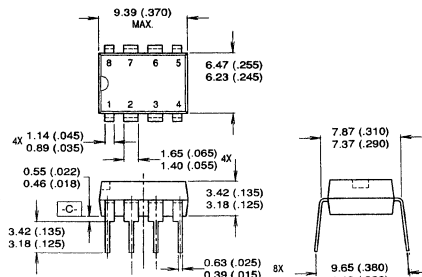
**Figure 2**



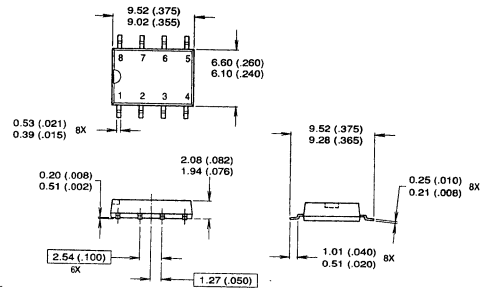
**Figure 3**



**Figure 4**



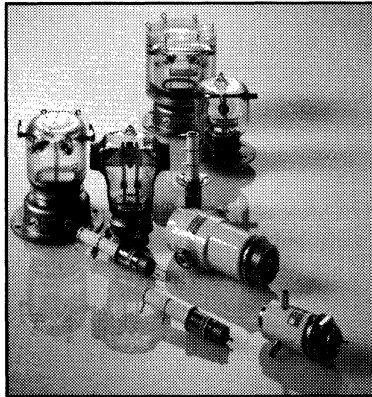
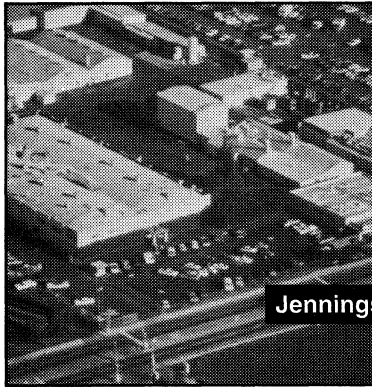
**Figure 5**



**Figure 6**

International Rectifier  
 233 Kansas Street, El Segundo, CA 90245 (310) 252-7105  
 Europe: Hurst Green, Oxted, Surrey RH8 9BB, England

Fax-on-Demand (North America): 310-252-7100  
 Internet: www.irf.com  
 Fax-on-Demand (United Kingdom): 01883-733420



Jennings operates test facilities to provide all environmental, high voltage, and radio frequency (RF) test parameters. All relays are individually tested prior to shipment for pull-in and drop-out voltage, timing characteristics, contact resistance, and dielectric strength. Vibration, shock, humidity, salt spray, temperature effects, current load, mechanical life and reliability tests are regularly performed on a sampling basis. The equipment used in testing mechanical life only passes relays which cycle with proper sequences of contact operation. Some relay types have been checked to more than 10<sup>6</sup> operations. Please write or call for our comprehensive relay catalog.

**Jennings Technology Corporation**  
 970 McLaughlin Ave.  
 San Jose, CA 95122, U.S.A.  
 Phone: (408) 292-4025  
 Fax: (408) 286-1789  
 URL: <http://www.jenningstech.com>

# JENNINGS

## Vacuum & Gas Filled Relays

Jennings...The leader in high power vacuum technology

	Peak Test Voltage kV	Work. Voltage kV DC	Model Number	Cont. Current A (RMS) DC/60 Hz	Max. Capac. Between Contacts to Ground, pF	Contact Configuration	Contact Resistance Milli-ohms	Operate Time ms.	Release Time ms.	Coil * Resistance X 10 <sup>3</sup>	Expect. Mech. Life X 10 <sup>6</sup>	Available Connectors	Nominal Weight oz.
SPST VACUUM FILLED RELAYS	4	3.6	RF41 & RF42	12	1.6	N/C	20	10	10	290	1	Solder	1
	4	3.6	RF44	12	1.6	LATCH	12	4	N/A	80	1	Solder	1
	8	7.5	RF5A	12	1.6	N/C	50	8	8	920	10	Solder	1
	8	7.5	RF6A	12	1.6	N/O	50	8	8	920	10	Solder	1
	9	7.0	RF43	12	1.6	LATCH	20	10	N/A	47	1	Solder	1
	10	8.0	RF47	35	1.6	LATCH	4	4	N/A	80	1	Solder	1
	10	8.0	RF4A	30	4.0	N/C	15	18	18	156	1	Solder	2
	10	8.0	RF4B	30	4.0	LATCH	15	18	18	156	1	Solder	2
	10	8.0	RF72	35	1.6	LATCH	4	4	4	80	1	Solder	1
	12	10	RF50 & RF51	12	1.6	N/C	20	15	15	290	40	Solder	1
	12	12	RJ5A	15	1.0	N/C	30	10	10	180	1	All options	3
	14	12	RF73	35	1.2	Latch	5	4	4	47	5	Solder	1.5
	15	12	RD5A & RD5B	15	1.0	N/O	10	18	8	265	1	All options	3
	17.5	12	RF83	15	0.8	Latch	20	5	5	47	1	Solder	1
	SPDT VACUUM FILLED RELAYS	30	12	RD6A & RD6B	15	1.0	N/C	10	18	8	265	1	All options
33		28	RS8 & RS10	75	1.5	N/O	3	30	10	120	2	Threaded	7
33		28	RJ8A	110	1.3	N/O	3	18	8	120	2	Threaded	10
4		28	RJ10A	110	1.3	N/C	3	18	8	120	10	Threaded	10
4		2.0	RF1D & RF1E	8	2.0	SPDT	50	8	8	920	1	Solder	1
5		3.6	RF60	12	2.0	LATCH	20	10	N/A	47	1	Solder	1
5		3.6	RF61	12	2.0	SPDT	20	10	N/A	47	2	Solder	1
5		3.5	RJ1A	18	2.5	SPDT	10	8	8	335	1	Solder	1
9		2.5	RJ1H	3	N/A	SPDT	30	6	6	335	1	Solder	1
9		7.0	RF62	12	1.6	SPDT	20	10	10	290	1	Solder	1
9		7.0	RF63	12	1.6	LATCH	20	10	10	290	1	Solder	1
15		12	RB1H & RB1J	15	1.0	SPDT	12	18	9	265	1	All options	3
15		12	RJ2B & RJ2C	50	1.0	SPDT	12	18	9	270	1	Solder	3
15		12	RJ4B	50	1.0	SPDT	12	18	9	270	1	Solder	3
SPDT GAS FILLED RELAYS		18	12	RB1D & RB1E	15	1.0	SPDT	12	18	8	265	.1	All options
	20	15	RF10B	75	1.8	SPDT	12	30	10	225	1	Solder	16
	30	25	RE6B	25	2.5	SPDT	12	25	10	120	1	All options	7
	9	7.0	RB7A & RB7B	14	2.0	DPDT	20	15	5	270	1	All options	2
	15/8 (a)	12/6 (a)	RB3	30	2.5	DPDT	10	20	8	120	1	All options	6
	22	20	RB2A	20	2.5	DPDT	10	20	10	225	.1	All options	8
	17	15	RB4	15	2.5	4PDT	10	45	10	131	2	All options	16
	10	8.0	RG1H	12	N/A	SPDT	500 **	6	6	335	.1	Solder	1
	10	6.5	RG1HG	10	N/A	SPDT	100 **	6	6	17 (b,c)	2	Fly or wire	1
	12	10	RGF62A	10	N/A	SPDT	1000 **	10	10	290	.1 (d)	Fly or wire	3
	14	7.5	RGD6	30	N/A	DPDT	1000 **	20	20	18 (b,c)	.1 (d)	Fly or wire	11
	20	18	RGD1	N/A	N/A	DPDT	1000 **	17	17	52 (b)	1	Solder	16
	50	40	RGH5	10	N/A	SPDT	1000 **	20	15	167	5	Fly or wire	12
	70	70	RGH3	15	N/A	N/C	1000 **	N/A	15	24 (b)		Sol./screw	16

Note: (a) = lower contacts (b) = intermittent duty (c) = 12 VDC coil (d) = rated load life

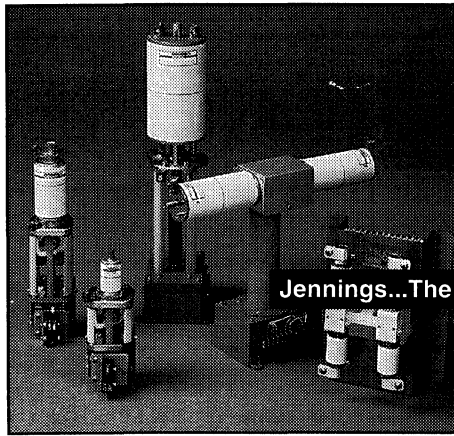
\* 26.5 VDC operate at 25° (other coil voltages available) \*\* 28 VDC, 1 Amp

**Connector Options**

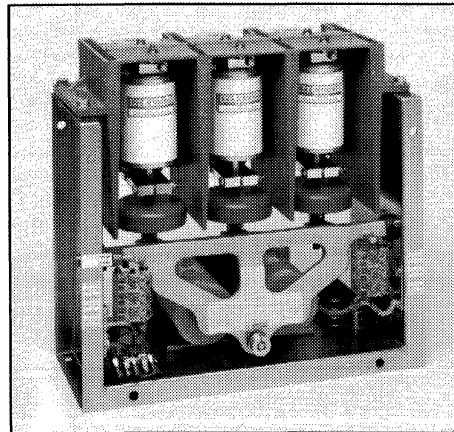
S  
 N300  
 N400

**Connector Description**

Standard - no contact hardware.  
 Nickel tabs are optional on all glass body relays.  
 Heavy duty screw type connectors are optional in place of N300 connectors.



Jennings...The leader in high power vacuum technology



# JENNINGS

## Vacuum Contactors

GENERAL PURPOSE CONTACTORS

Model Number	Operate Voltage Peak kV	Cont. Current Amps	Max. Interrupt AC Current Amps RMS	Capacitor Discharge Decaying to 0 in 200 Microsec. KA Peak	Contact Configuration	Actuator Voltage Volts	Close Time ms.	Break Time ms.	Approx. Weight Lbs.
RP101F4903D21B20	30	200 DC	N/A	50	N/O	115	60	50	15
RP101F4904D21B20					N/C	60 Hz			
RP101F4304D26B20	30	200 DC	N/A	50	N/C	100 DC	55	42	10
RP103F4304D26B20		200 RMS	2000						
RP103F4903D21B20	30	200 RMS	2000	50	N/O	115	60	50	10
RP103F4904D21B20					N/C	60 Hz	30	60	
RP901K4903D21B30	50	400 DC	N/A	100	N/O	115	60	50	20
RP901K4904D21B30					N/C	60 Hz	30	60	
RP900K4601D26B30	50	400 DC	4000	100	N/O	100 DC	34	11	15
RP900K4602D26B30					N/C		27	17	
RP900K4903D21B30	50	400 RMS	4000 at 13 kV	100	N/O	115	60	50	20
RP900K4904D21B30					N/C	60 Hz	50	60	
RT1G4201C22A10	20	100	500	1	N/O	230 AC	60	25	4
RT1G4202C21A10					N/C	115 VAC 50/60	60	30	
RT5C4202A21A10	15	30	100	0.5	N/C	115 AC	60	30	3

RF CONTACTORS

Model Number	Peak Operate Voltage 32 MHz	Cont. Current 32 MHz RMS	Contact Resistance Ohms Max.	Contact Capacitance pF	Contact Inductance Nh	Contact Configuration	Open Time ms.	Close Time ms.	Actualing Voltage or Air Pressure	Aux. Contacts Rating Volt & Current RMS	Expected Mech. Life	Approximate Weight Lbs.
RT224070A31NB Solenoid Operated	5*	25	.0005	2.5	N/A	Latch	<300	<300	230 VAC	Form C 230/15	2.5 X 10 <sup>6</sup>	12
RP233D1585 Air Operated	25	35	.0005	2	25	N/O	<200	<200	40 ± 5 psig	N/A	1 X 10 <sup>6</sup>	13 oz.
RF22-D2488 Air Operated	20	45	.0007	3	25	N/O	50	100	20 ± 10 psig	N/A	10 X 10 <sup>6</sup>	15 oz.
RF20B1586	20	100	.0004	10	2.5	N/O	<200	<200	35 ± 5 psig	N/A	1 X 10 <sup>6</sup>	2

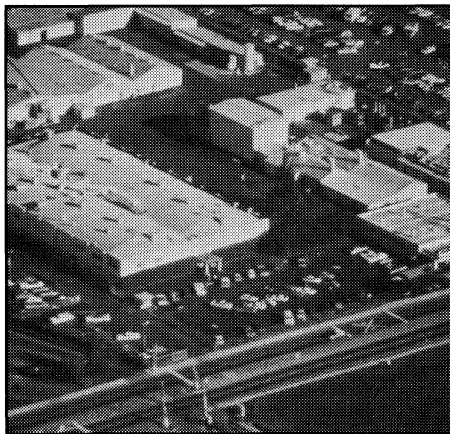
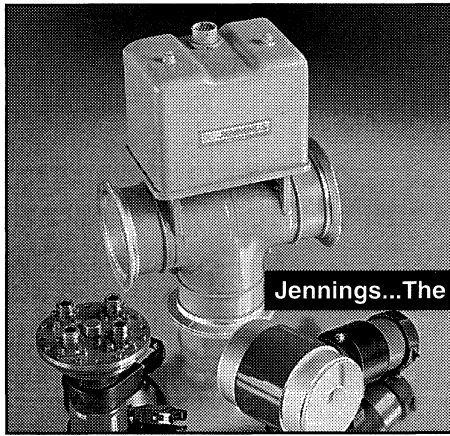
3-PHASE CONTACTORS

Model Number	Operate Voltage Volts RMS	Cont. Current 60 Hz	Interrupt Current A RMS	Expected Mech. Life Min.	Actuator Voltage	Interrupt Time	Aux. Contacts	Approx. Weight Lbs.
RP151B4541X44R20	600	250	2000	2.5 X 10 <sup>6</sup>	26.5 VDC	Less than 2 cycles	DPDT 115/230 VAC	16
RP151B4541X46R20					100 VDC			
RP173-2310-00	7200	450	6000	1 X 10 <sup>6</sup>	115 VAC 50/60 110 VDC	Less than 2 cycles	3 N/O 2 N/C	67
RP173-2311-00	7200	450	6000	1 X 10 <sup>6</sup>	230 VAC 220 VDC	Less than 2 cycles	3 N/O 2 N/C	67
RP133-2332-00	1500	450	4500	1 X 10 <sup>6</sup>	115 VAC 50/60 110 VDC	Less than 2 cycles	3 N/O 2 N/C	30

\* Higher voltage ratings are available at lower frequencies.

Vacuum Contactors are used to control large amounts of DC power and RF currents with ratings up to 50 kV and currents up to 600 amperes continuous. These contactors are recommended wherever high voltage capability, small size, and high speed operation with a long and low maintenance life are important. Applications include primary control of power supplies, industrial motors, and induction heating equipment. RF system tap changing, and fault protection of high power transmitters. The 18 page catalog provides complete specifications with a variety of specific applications for 3-pole, high voltage AC and DC, RF contactors actuated by solenoid, air or motor drives. Please write or call for our comprehensive contactor catalog that details our complete line.

**Jennings Technology Corporation**  
 970 McLaughlin Ave.  
 San Jose, CA 95122, U.S.A.  
 Phone: (408) 292-4025  
 Fax: (408) 286-1789  
 URL: <http://www.jenningstech.com>



Applications for these units include high speed switching from omnidirectional to directional antennas, transmit-receive switching, and switching between transmitters for standby control. Other applications include crossbar matrices and switching trees, CCTV, CATV, and microwave telemetry and data acquisition links, as well as general coaxial instrumentation. Jennings vacuum coaxial relays have a recorded history of dependable, maintenance free operation. Because of this they were chosen for ground and airborne applications for the tracking network of the Apollo program and the Atlantic Missile Range Communications. Please write or call for our comprehensive coaxial relay catalog that details our complete line.

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# JENNINGS

## Vacuum Coaxial Relays

Jennings...The leader in high power vacuum technology

Model Number	50 Ohms Impedance		Cross-talk db Isolation	Insertion Loss db Max.	Coil* Resist. Ohms ± 10%	Contact Configuration	Con- nector Size	Aux. Contact Position Indicator	Operate Time*** ms. Max.	Wt. Lbs. Nom.	
	Power Rating CW in KW	Fre- quency Range									
<b>GENERAL TRANSMITTER/RECEIVER SWITCH</b>											
RC41E6000K440	3	0-500	1.1:1	30 @ 300 MHz	.1	265	SPDT	C	None	25	0.9
RC43E6050H440	5	0-500	1.1:1	30 @ 300 MHz	.1	265	SPDT	LC	None	25	3.3
<b>CROSS OVER TYPE / 4-PORT: 2 INPUT, 2 OUTPUT</b>											
RC53A6300K24B	2.25 connector limited	0-600	1.1:1	75 @ 300 MHz	.1	19 ± 15%	Transfer	N	DPDT	30	2.8
RC54A6325H24B	7.5	0-400	1.1:1	53 @ 300 MHz	.1	19 ± 15%	Transfer	LC	DPDT	30	6.4
<b>1 5/8" LINE SIZE</b>											
RC5A5101A24B	25	0-100	1.05:1	70 @ 60 MHz	.02	Open 19.9 Close 18.7	SPST	1 5/8"	DPDT	30	1.8
RC6A5126F14B	25	0-400	1.1:1	65 @ 150 MHz	.01	15.4	SPDT (Latch)	1 5/8"	DPDT	50	8.0
<b>3 1/8" LINE SIZE</b>											
RC10C5227A24B	90	0-100	1.05:1	65 @ 60 MHz	.02	Open 20.3 Close 18.7	SPST	3 1/8"	DPDT	30	3.8
RC21A5500F14B	90	0-500	1.1:1	60 @ 400 MHz	.01	4.8	SPDT (Latch)	3 1/8"	DPDT	40	14
<b>SWITCH ASSEMBLY</b>											
RC265552G24F	90 2 MW Peak** Special order	0-600	1.1:1	60 @ 400 MHz	.01	19	SPDT (Latch)	3 1/8"	DPDT	50	14
<b>ATTENUATOR</b>											
RC275576G24F	90 2 MW Peak** Special order	0-600	1.1:1	60 @ 400 MHz	.01	19	SPST (Latch)	3 1/8"	DPDT	50	13

\* 26.5 VDC Actuating Voltage  
 \*\* Power rating applies when connecting line pressurized 45 PSIA Dry Air or 31 PSIA Dry Nitrogen.  
 \*\*\* Faster operate times can be obtained on most units by coil pulse circuits. Information available from factory.

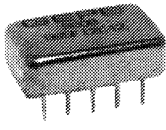
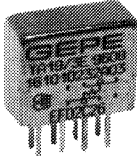
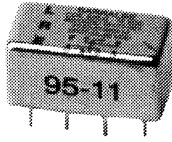

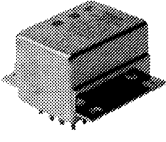
Note: This power rating is for the frequency at which the relay is most commonly used. The power rating for any point in the frequency range of the unit other than that shown may be obtained by consulting factory.

# LEACH INTERNATIONAL CORPORATION

## Quick Reference Guide

Leach products have been setting the standards in both technology and reliability for more than 70 years. Our products are aboard virtually every major U.S. airborne and commercial program involving aircraft, missiles, satellites and space launch vehicles as well as submarines, ship, tanks and ground vehicles. This guide describes our relay product line ranging from 5 amp dry circuit sub-miniatures to 400 amp power contractors, time delay and solid state relays.

### SUBMINIATURE RELAYS

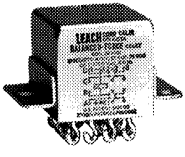



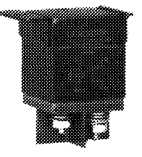
<b>LEACH® INTERNATIONAL</b> NORTH AMERICA 6900 Orangethorpe Ave. P.O. Box 5032 Buena Park, CA 90622-5032 (714) 739-0770 FAX (714) 670-1145					
LEACH SERIES:	<b>065*D, 065*1</b> 0.5 Amp 2 PDT Non-Latch & Latch	<b>D, E</b> 1 Amp 2 PDT Non-Latch & Latch	<b>F250, GP5, GP2</b> 2 Amp 2 PDT Non-Latch & Latch	<b>GP52, GP4</b> 2 Amp 4 PDT Non-Latch & Latch	<b>F600</b> Low level to 10 Amp 6 PDT Non-Latch
MEET THE REQUIREMENTS OF:	MIL-R-39016/48 MIL-R-39016/47 CECC16101/025 CECC16101/026	MIL-R-39016/34 CECC16101/023 SCC3601/012 SCC3602/019	MIL-R-39016/6 CECC16205 SCC3601/003 SCC3602/003	MIL-R-39016 CECC16101/033	MIL-R-6106/8 CECC16101/020
<b>ELECTRICAL DATA</b>					
Nominal Contact Voltage	28 VDC	28 VDC	28 VDC    115 VAC 60-400 Hz	28 VDC    115 VAC 60-400 Hz	28 VDC    115 VAC 400 Hz
Contact Rating in Amps					
Load					
Resistive	0.5	1	2    0.3	2    0.3	10    10
Inductive	0.1	0.2	0.75    N/A	0.5    N/A	8    8
Motor	N/A	N/A	N/A    N/A	N/A    N/A	4    4
Lamp	N/A	N/A	N/A    N/A	N/A    N/A	2    2
Coil Voltage	5 to 28 VDC	5 to 28 VDC	5 to 60 VDC	6 to 48 VDC	6 to 110 VDC
Operate Time (MS)	6	5-6	4	6	15
<b>ENVIRONMENTAL DATA</b>					
Sinusoidal Vibration, G	30 70-3000 Hz	30 70-3000 Hz	30 70-3000 Hz  20 70-3000 Hz	30 75-3000 Hz	30 75-3000 Hz
Shock, G	10 / 6 MS	100 / 6 MS	100 / 6 MS	100 / 6 MS	50 / 6 MS
<b>MECHANICAL DATA</b>					
Weight, oz./grams, Max.	<0.64 oz. (2 g.)	<0.129 oz. (4 g.)	<0.354 oz. (11 g.)	<0.56 oz. (16 g.)	<3.054 oz. (95 g.)
Dimensions, in., Max.	0.346 x 0.575 x 0.169	0.236 x 0.504 x 0.409	0.413 x 0.811 x 0.409	0.807 x 0.807 x 0.409	1.484 x 1.024 x 1.012
Sockets Available:					S600
NOTES:	2 terminal types surface mounting	4 mounting styles 4 terminal types; space qualified	8 mounting styles 3 terminal types; GP5 & GP2 space qualified	3 mounting styles 3 terminal types	4 mounting styles 4 terminal types

# LEACH INTERNATIONAL CORPORATION

SUBMINIATURE RELAYS					
<b>LEACH® INTERNATIONAL</b> NORTH AMERICA 6900 Orangethorpe Ave. P.O. Box 5032 Buena Park, CA 90622-5032 (714) 739-0770 FAX (714) 670-1145					
LEACH SERIES:	<b>X, XL, XA</b> SERIES III DESIGN Low level to 5 Amp 2 PDT Non-Latch & Latch	<b>Y, YL, YA</b> SERIES III DESIGN Low level to 5 Amp 4 PDT Non-Latch & Latch	<b>XC, XCL</b> SERIES III DESIGN Low level to 10 Amp 1 PDT Non-Latch & Latch	<b>YC, YCL, YCA</b> SERIES III DESIGN Low level to 10 Amp 3 PDT Non-Latch & Latch	<b>J, JA, JL</b> BALANCED FORCE DESIGN Low level to 12 Amp 2 PDT Non-Latch & Latch
DESIGNED TO: APPLICABLE MS NUMBER(S):	MIL-R-83536 M83536/1, 2, 3, 4	MIL-R-83536 M83536/5, 6, 7, 8	MIL-R-6106 N/A	MIL-R-83536 M83536/21, 22, 23, 24	MIL-R-83536 M83536/9, 10, 11, 12, 13
ELECTRICAL DATA					
Contact Rating (Amps): 28 VDC: Resistive Inductive Motor Lamp 115/220 VAC, 400 Hz, 3Ø, (Case Grounded)	5 3 2 1 Same as DC except inductive is 5 amp and motor is 3 amp	5 3 2 1 Same as DC except inductive is 5 amp and motor is 3 amp	10 6 4 2 Same as DC except inductive is 10 amp	10 6 4 2 Same as DC except inductive is 8 amp	12 8 4 2 Same as DC rating except resistive is 10 amp
Nominal Coil Voltage(s): DC Non-Latch DC Latch AC Coil	6/12/28/48 VDC 6/12/28 VDC 28, 115/200 VAC 50-400 Hz	6/12/28/48 VDC 6/12/28 VDC 28, 115/200 VAC 50-400 Hz	6/12/28/48 VDC 6/12/28 VDC	6/12/28/48 VDC 6/12/28 VDC 28, 115/200 VAC 50-400 Hz	6/12/28/48 VDC 6/12/28/48 VDC 28, 115/200 VAC 50-400 Hz
Coil Resistance(s) Ohms: DC Non-Latch DC Latch AC Coil, Current, I Max.	30/125/500/1600 43/182/730 .100/.040/.024	25/100/400/1275 37/148/600 .120/.040/.028	25/125/500/1600 730	25/100/400/1275 600 .120/.040/.028	20/80/320/1000 38/150/600/1600 .240/.040/.024
Operate Time, Max. (MS): DC Non-Latch DC Latch AC Coil	4 4 4	6 6 5	6 6 N/A	6 15 15	10 10 15
Release Time, Max. (MS): DC Non-Latch DC Latch AC Coil	4 N/A 4	6 N/A 25	6 N/A N/A	6 N/A 25	10 N/A 50
Bounce Time, Max. (MS)	0.5	0.5	1.0	1.0	1.0
ENVIRONMENTAL DATA					
Sinusoidal Vibration, G	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz
Shock, G	200	200	200	200	200
MECHANICAL DATA					
Weight, oz./grams, Max.	.56 oz. (16 g.)	1.06 oz. (30 g.)	.56 oz. (16 g.)	1.09 oz. (31 g.)	1.40 oz. (40 g.)
Dimensions, in., Max. L x W x H	0.810 x 0.410 x 0.640	0.810 x 0.810 x 0.640	0.810 x 0.410 x 0.640	0.810 x 0.810 x 0.640	DC: 1.025 x 0.525 x 1.010 AC: 1.025 x 0.525 x 1.125
Sockets Available: Non-Latch DC Coil Latch DC Coil Non-Latch AC Coil 28 VAC Coil	SO-1064-001 SO-1064-003 SO-1064-10444 SO-1064-10445	SO-1066-001 SO-1066-003 SO-1066-10385 SO-1066-10386	SO-1064-10425 SO-1064-10534 N/A N/A	SO-1065-001 SO-1065-003 SO-1065-10392 SO-1065-10393	SO-1049-8309 SO-1055-8690 SO-1049-8772 SO-1055-8774
NOTES:	5 mounting styles 4 terminal types	5 mounting styles 3 terminal types	5 mounting styles 4 terminal types	5 mounting styles 3 terminal types	5 mounting styles 4 terminal types

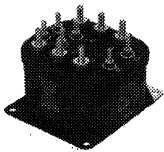
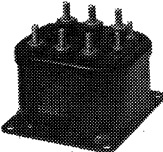
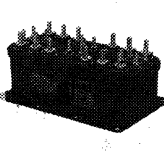
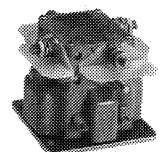
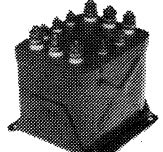
# LEACH INTERNATIONAL CORPORATION

## SUBMINIATURE RELAYS

<b>LEACH® INTERNATIONAL</b> NORTH AMERICA 6900 Orangethorpe Ave. P.O. Box 5032 Buena Park, CA 90622-5032 (714) 739-0770 FAX (714) 670-1145					
<b>LEACH SERIES:</b>	<b>K, KA, KL BALANCED FORCE DESIGN</b> Low level to 12 Amp 4 PDT Non-Latch & Latch	<b>JC, JCA, JCL; JS, JSA [1]</b> <b>BALANCED FORCE DESIGN</b> Low level to 25 Amp 1 PDT Non-Latch & Latch	<b>KC, KCA, KCL BALANCED FORCE DESIGN</b> Low level to 25 Amp 3 PDT Non-Latch & Latch	<b>KD, KDA, KDL BALANCED FORCE DESIGN</b> Low level to 25 Amp 3 PST/NO, 2 amp 1 PDT Aux Non-Latch & Latch	<b>KM BALANCED FORCE DESIGN</b> 50 Amp 1 PST/DB Non-Latch & Latch
<b>DESIGNED TO:</b> <b>APPLICABLE MS NUMBER(S):</b>	MIL-R-83536 M83536/15, 16, 17, 18, 19	MIL-R-6106 Non-Latch: M6106/19 Latch: M6106/20	MIL-R-6106 Non-Latch: MS27743 Latch: MS27742	MIL-R-6106 Non-Latch: M6106/13 Latch: M6106/12	MIL-R-6106 N/A
<b>ELECTRICAL DATA</b>					
<b>Contact Rating (Amps):</b> 28 VDC: Resistive Inductive Motor Lamp 115/220 VAC, 400 Hz, 3Ø, (Case Grounded)	12 8 4 2 Same as DC rating except resistive is 10 amp	JC, JCA, JCL [1] JS, JSA [2] 25 10 12 10 10 4 5 4 Same as DC rating N/A See Note [2]	25 12 10 5 Same as DC except inductive is 15 amp	25 12 10 5 Same as DC except inductive is 15 amp	50 15 30 15 N/A (see notes)
<b>Nominal Coil Voltage(s):</b> DC Non-Latch DC Latch AC Coil	6/12/28/48 VDC 6/12/28/48 VDC 28, 115/200 VAC 50-400 Hz	6/12/28/48 VDC 6/12/28/48 VDC 28, 115/200 VAC 50-400 Hz	6/12/28/48 VDC 6/12/28/48 VDC 28, 115/200 VAC 50-400 Hz	6/12/28/48 VDC 6/12/28/48 VDC 28, 115/200 VAC 50-400 Hz	6/12/28 VDC 6/12/28 VDC N/A
<b>Coil Resistance(s) Ohms:</b> DC Non-Latch DC Latch AC Coil, Current, I Max.	18/70/290/890 28/112/450/1500 .120/.040/.028	20/80/320/1000 38/150/600/1600 .100/.040/.024	18/70/290/890 28/112/450/1500 .120/.040/.028	18/70/290/890 28/112/450/1500 .120/.040/.028	18/70/290 28/112/450 N/A
<b>Operate Time, Max. (MS):</b> DC Non-Latch DC Latch AC Coil	15 15 20	10 10 15	15 15 20	15 15 20	15 15 N/A
<b>Release Time, Max. (MS):</b> DC Non-Latch DC Latch AC Coil	15 N/A 50	10 N/A 50	15 N/A 50	15 N/A 50	15 N/A N/A
<b>Bounce Time, Max. (MS)</b>	1.0	1.0	1.0	1.0 (Aux 4)	1.0
<b>ENVIRONMENTAL DATA</b>					
<b>Sinusoidal Vibration, G</b>	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz	30 70 to 3000 Hz
<b>Shock, G</b>	200	200	200	200	50
<b>MECHANICAL DATA</b>					
<b>Weight, oz./grams, Max.</b>	DC: 2.5 oz. (71 g.) AC: 2.7 oz. (77 g.)	1.6 oz. (45 g.)	3.0 oz. (85 g.)	3.0 oz. (85 g.)	3.0 oz. (85 g.)
<b>Dimensions, in., Max. L x W x H</b>	1.025 x 1.025 x 1.010	DC: 1.015 x 0.515 x 1.000 AC: 1.015 x 0.515 x 1.125	1.025 x 1.025 x 1.010	1.025 x 1.025 x 1.010	
<b>Sockets Available:</b> Non-Latch DC Coil Latch DC Coil Non-Latch AC Coil 28 VAC Coil	SO-1048-8308 SO-1056-8691 SO-1048-8776 SO-1048-8779	SO-1063-9033 SO-1063-9036 SO-1063-9034 N/A	SO-1057-8912 SO-1058-8913 SO-1062-8917 N/A	SO-1059-8914 SO-1060-8915 SO-1061-8916 N/A	N/A N/A N/A N/A
<b>NOTES:</b>	5 mounting styles 3 terminal types	4 mounting styles 4 terminal types Special models available. [1] JS, JCA & JCL @ 50 ADC & 80 amp 400 Hz over load. [2] JS/JSA only designed to switch 115 VAC, 60 Hz case grounded; JS has 20 amp overload capabilities	5 mounting styles 3 terminal types	5 mounting styles 3 terminal types Same design as KC series with added auxiliary pole	Special models available; contact factory for auxiliary contacts and additional information

# LEACH INTERNATIONAL CORPORATION

## POWER CONTACTORS

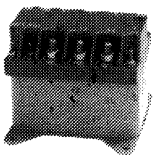
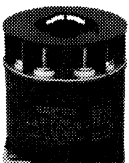


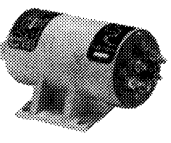
<b>LEACH® INTERNATIONAL</b> <b>NORTH AMERICA</b> 6900 Orangethorpe Ave. P.O. Box 5032 Buena Park, CA 90622-5032 (714) 739-0770 FAX (714) 670-1145					
LEACH SERIES:	<b>9123</b> 25 Amp 3 PST/NO DB	<b>9124</b> 50 Amp 3 PST/NO DB	<b>9125</b> 50 Amp 3 PDT-CO DB 6 PST/NO DB	<b>9207</b> 25 to 100 Amp 3 PST/NO DB, 4 PST/NO DB, 2 P/NO, 2 P/NC DB	<b>9213</b> 25 to 100 Amp 3 PST/NO, 4 PST/NO, 2 P/NO, 2 P/NC DB
DESIGNED TO:	MIL-R-6106	MIL-R-6106	MIL-R-6106	MIL-R-6106	MIL-R-6106
APPLICABLE MS NUMBER(S):	MS27997	MS27222		DESC Spec 84192	
ELECTRICAL DATA					
Contact Rating (Amps): 28 VDC: Resistive Inductive Motor Lamp 115 VAC, 400 Hz, 3Ø: Resistive Inductive Motor Lamp 115 VAC, 50/60 Hz, 3Ø: Resistive Inductive Motor Lamp	25 25 25 N/A 25 25 25 N/A 15 15 7 N/A [1]	50 50 50 N/A 50 50 50 N/A 30 30 15 N/A 50 [1]	50 50 50 N/A 50 50 50 N/A 30 30 15 N/A [1]	25-100 25-100 25-100 N/A 25-100 25-100 25-100 N/A 50 50 50 N/A [1]	25-100 25-100 25-100 N/A 25-100 25-100 25-100 N/A 50 50 50 N/A [1]
Resistance, Ohms ±10% @ 25°C for 28 VDC	50Ω	50Ω	50Ω	44.5Ω	44.5Ω
Nominal Coil Voltage(s)	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz
Operate Time, Max. (MS): AC Coils DC Coils	30 25	30 25	30 25	40 30	40 30
Release Time, Max. (MS): AC Coils DC Coils	50 10	50 10	50 10	50 20	60 20
Bounce Time, Max. (MS)	2	2	2	10	10
ENVIRONMENTAL DATA					
Sinusoidal Vibration, G	15 G 15 to 1500 Hz	15 G 55 to 1500 Hz	15 G 70 to 1500 Hz	10 G 55 to 500 Hz	10 G 55 to 1500 Hz
Shock, G	50	50	50	50	50
MECHANICAL DATA					
Weight, oz., Max. Dimensions, in., Max. L x W x H	20 oz. 3.73 x 3.305 x 2.50	20 oz. 3.73 x 3.305 x 2.50	46.4 oz. 6.21 x 3.80 x 2.70	28 oz. 3.63 x 3.62 x 2.875	44.8 oz. 4.22 x 4.23 x 4.53
NOTES:	Auxiliary 5 amp contacts available. [1] 440 Vac 60 Hz delta ratings available	Auxiliary 5 amp contacts available. [1] 440 Vac 60 Hz delta ratings available	Auxiliary 5 amp contacts available. [1] 440 Vac delta 60 Hz ratings available	Unsealed rotary, 1, 2, 3 and 4 pole; auxiliary contacts from 5 to 25 amps available [1] 440 Vac 60 Hz wye/delta rated	Sealed rotary, 1, 2, 3 and 4 pole; auxiliary contacts from 5 to 25 amps available [1] 440 Vac 60 Hz wye/delta rated



# LEACH INTERNATIONAL

## CORPORATION

### POWER CONTACTORS

<b>LEACH® INTERNATIONAL</b> NORTH AMERICA 6900 Orangethorpe Ave. P.O. Box 5032 Buena Park, CA 90622-5032 (714) 739-0770 FAX (714) 670-1145					
LEACH SERIES:	<b>5030 TO 5120 SERIES</b> 30 to 120 Amp. 3 PST/NO DB	<b>H, HT SERIES</b> 60 Amp 3 PST, 3 PDT, 1 PDT-DB Magnetic Latch	<b>HC, CENTER-OFF SERIES</b> 50 Amp 3 PDT-NO 1 PDT-NO DB	<b>HL, HLT</b> 60 Amp 3 PST, 3 PDT, 1 PDT-DB	<b>79 THRU 509 SERIES</b> 80 to 500 Amp 1 PST/NO DB Permanent duty
DESIGNED TO: APPLICABLE MS NUMBER(S):	AIR 7304 AIR 8456 B	MIL-R-6106 MS27751 M6106/26 and 43	MIL-R-6106 MS27750	MIL-R-6106 MS27749	MIL-R-6106 AIR 7304 AIR 8456 B

### ELECTRICAL DATA

Contact Rating (Amps): 28 VDC: Resistive Inductive Motor Lamp 115 VAC, 400 Hz, 3Ø: Resistive Inductive Motor Lamp 115 VAC, 50/60 Hz, Δ: Resistive Inductive Motor Lamp	30-120	50 20 20 10	25 15 15 10	50 20 20 10	80-500  40-250
Resistance, Ohms ±10% @ 25°C for 28 VDC	7/112 to 4/82	6 VDC, 12Ω; 12 VDC, 50Ω; 28 VDC, 200Ω; 115 VAC, .090 Amp	6 VDC, 12Ω; 12 VDC, 50Ω; 28 VDC, 200Ω <sup>1</sup> 115 VAC, .100 Amps	6 VDC, 12Ω; 12 VDC, 50Ω; 28 VDC, 200Ω	7.2/280 to 5/200
Nominal Coil Voltage(s)	28 VDC	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	28 VDC
Operate Time, Max. (MS): AC Coils DC Coils	20	50 50	35 35	35 35	30
Release Time, Max. (MS): AC Coils DC Coils	20	80 25	80 25	— —	20
Bounce Time, Max. (MS)	N/A	3	3	3	N/A

### ENVIRONMENTAL DATA

Sinusoidal Vibration, G	10 G 5 to 2000 Hz	10 G 70 to 2000 Hz	10 G 70 to 2000 Hz	10 G 70 to 2000 Hz	10 G 5 to 2000 Hz
Shock, G	30/11 MS	50	50	50	30/11 MS

### MECHANICAL DATA

Weight, oz., Max.	16 to 35 oz.	14 oz.	15 oz.	15 oz.	7.2 to 38 oz.
Dimensions, in., Max. L x W x H	3.15 x 3 x 2.54 to 4.1 x 4 x 3.4	2.5 diameter x 3.13	2.50 diameter x 3.13	2.50 diameter x 3.13	3.26 x 1.9 x 1.42 to 4.76 x 2.75 x 2.46

NOTES:	1NO + 1NC Auxiliary 5 amp contacts available; dust proof enclosure	HT (power transfer model); auxiliary 5 amp contacts and gasket sealed models available	Gasket sealed models available <sup>1</sup> 30 amps for AC coil <sup>2</sup> ±20% @ 25°C	HLT (power transfer model); auxiliary 5 amp contacts and gasket sealed models available	1NO + 1NC Auxiliary 5 amp contacts available; dust proof enclosure
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# LEACH INTERNATIONAL CORPORATION

## POWER CONTACTORS

<b>LEACH® INTERNATIONAL</b> NORTH AMERICA 6900 Orangethorpe Ave. P.O. Box 5032 Buena Park, CA 90622-5032 (714) 739-0770 FAX (714) 670-1145					
LEACH SERIES:	<b>ZC, CENTER-OFF</b> 100 Amp 3 PDT-NO, 1 PDT/NO DB	<b>Z, ZG, ZJ SERIES</b> 120-200 Amp 3 PDT, 3 PST/NO, SPDT-DB SPST/NO-DB, SPST/NC-DB	<b>ZL SERIES</b> 120 to 200 Amp 3 PST, 3 PDT, 1 PDT-DB Magnetic Latch	<b>CC0202P SERIES</b> 200 Amp 1 PST/NO DB Permanent duty bus bar mounting	<b>W, WC, WL SERIES</b> <sup>1</sup> 250 to 275 Amp 1 PDT-DB, 3 PST/NO 1 PST/NO-DB, 1 PST/NC-DB
DESIGNED TO: APPLICABLE MS NUMBER(S):	MIL-R-6106	MIL-R-6106	MIL-R-6106	MIL-R-6106 AIR 7304 AIR 8456 B	MIL-R-6106

### ELECTRICAL DATA

Contact Rating (Amps): 28 VDC: Resistive 50 Inductive 30 Motor 30 Lamp N/A 115 VAC, 400 Hz, 3Ø: Resistive 100 Inductive 100 Motor 60 Lamp N/A 115 VAC, 50/60 Hz, Δ: Resistive 60 Inductive 60 Motor 40 Lamp N/A	50 30 30 N/A 100 100 60 N/A 60 60 40 N/A	50 30 30 N/A 120-200 120-200 80-120 N/A 60 60 60 N/A	50 30 30 N/A 120 120 80 N/A 60 60 60 N/A	200 100	125 75 75 N/A 275 275 175 N/A N/A N/A N/A N/A
Resistance, Ohms ±10% @ 25°C for 28 VDC	6 VDC, 9.3Ω; 12 VDC, 38Ω; 28 VDC, 150Ω <sup>1</sup> ; 115 VAC, 0.9 Amp	6 VDC, 7Ω; 12 VDC, 28Ω; 28 VDC, 113Ω; 115 VAC, .12 Amp	6 VDC, 10Ω; 12 VDC, 40Ω; 28 VDC, 163Ω <sup>1</sup>	7.2/200	(W) 90Ω; (WL) 9.8Ω; (WC) 100Ω <sup>2</sup>
Nominal Coil Voltage(s)	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	28 VAC	28 VDC 115 VAC, 400 Hz (W/WC) 28 VDC Suppressed (W/WC)
Operate Time, Max. (MS): AC Coils DC Coils	60 60	60 60	60 60	30	60 60
Release Time, Max. (MS): AC Coils DC Coils	80 40	40 40	N/A N/A	20	125 40
Bounce Time, Max. (MS)	4	4	4	N/A	4

### ENVIRONMENTAL DATA

Sinusoidal Vibration, G	5 G 70 to 500 Hz	10 G 55 to 1000 Hz	10 G 55 to 500 Hz	10 G 5 to 2000 Hz	5 G 60 to 2000 Hz
Shock, G	15	50	15	30/11 MS	20

### MECHANICAL DATA

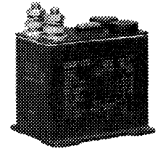
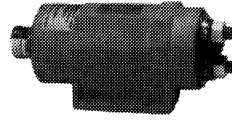
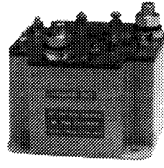
Weight, oz./lbs., Max. Dimensions, in., Max. L x W x H	32 oz. to 43.2 oz. 3.65 diameter x 4.28	32 oz. to 43.2 oz. 3.65 diameter x 4.28	2.0 to 2.75 lbs. 3.65 diameter x 4.28	9 oz. 3.1 x 1.42 x 3.13	4.5 lbs. 4.625 x 5.56 x 4.10
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NOTES:	Gasket sealed and magnetically latched versions available <sup>1</sup> ±20% @ 25°C	Auxiliary 5 amp contacts and other configurations available; gasket sealed models available	<sup>1</sup> ±20% @ 25°C. Auxiliary 5 amp contacts available	2NO + 2NC Auxiliary 2 amp and low level contacts available; dust proof enclosure. May be associated with a Hall current sensor	Auxiliary 8 amp contacts available <sup>1</sup> WL Magnetic Latch, WC Center-Off versions <sup>2</sup> ±20% @ 25°C
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# LEACH INTERNATIONAL CORPORATION

## POWER CONTACTORS

**LEACH<sup>®</sup> INTERNATIONAL**  
**NORTH AMERICA**  
 6900 Orangethorpe Ave.  
 P.O. Box 5032  
 Buena Park, CA 90622-5032  
 (714) 739-0770  
 FAX (714) 670-1145



LEACH SERIES:	<b>A, AJ SERIES</b> 300 to 400 Amp 1 PST/NO DB	<b>52040 M4 SERIES</b> 400 Amp 1 PST/NO DB Remote circuit breaker contactor	<b>1009-1 SERIES</b> 1000 Amp 1 PST/NO DB Intermittent duty starter contactor	<b>REHL SERIES</b> <span style="border: 1px solid black; padding: 2px;">1</span> 15 to 65 Amp 1 PST-DB, 3 PST, 3 PDT
DESIGNED TO: APPLICABLE MS NUMBER(S):	MIL-R-6106 MIL-R-6106/33	MIL-R-6106 AIR 7304 AIR 8456 B	MIL-R-6106	MIL-R-6106/MIL-C-83883

### ELECTRICAL DATA

Contact Rating (Amps):	28 VDC:				
	Resistive	300/400	400	1000	15-50
	Inductive	100/150			12-50
	Motor	250/250		500	5-20
	Lamp	N/A			N/A
115 VAC, 400 Hz, 3Ø:	Resistive	N/A			15-65
	Inductive	N/A			15-60
	Motor	N/A			15-40
	Lamp	N/A			N/A
115 VAC, 50/60 Hz, Δ:	Resistive	N/A			30
	Inductive	N/A			30
	Motor	N/A			30
	Lamp	N/A			N/A
Resistance, Ohms ±10% @ 25°C for 28 VDC	6 VDC, 4Ω; 12 VDC, 15Ω; 28 VDC, 60Ω	3.5/60	8	N/A	
Nominal Coil Voltage(s)	6, 12, 28 VDC	28 VDC	28 VDC	28 VAC 115 VAC, 400 Hz	
Operate Time, Max. (MS):	AC Coils	N/A			N/A
	DC Coils	35	30	30	N/A
Release Time, Max. (MS):	AC Coils	N/A			N/A
	DC Coils	15	see note	20	N/A
Bounce Time, Max. (MS)	4	N/A	N/A	4	

### ENVIRONMENTAL DATA

Sinusoidal Vibration, G	10 G, 70 to 500 Hz 5 G, 500 to 2000 Hz	10 G 5 to 2000 Hz	10 G 5 to 2000 Hz	10 G 55 to 2000 Hz
Shock, G	25	30/11 MS	30/11 MS	25

### MECHANICAL DATA

Weight, oz./lbs., Max.	1.75 lbs.	39 oz.	49 oz.	2.0 lbs.
Dimensions, in., Max. L x W x H	3.90 x 3.64 x 2.80	4.1 x 4.1 x 3.66	5.28 x 3.15 x 2.45	3.69 x 3.25 x 4.26

NOTES:	Auxiliary 5 amp contacts available	I <sup>2</sup> t trip curve according to customer requirement	1NO + 1NC Auxiliary 5 amp contacts available; dust proof enclosure	Auxiliary 5 amp contacts available. <span style="border: 1px solid black; padding: 2px;">1</span> Current sensing with remote control capability
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# LEACH INTERNATIONAL CORPORATION

## TIME DELAY RELAYS

6900 ORANGETHORPE AVE., P.O. BOX 5032, BUENA PARK, CA 90622-5032 • (714) 739-0770 • TWX 910-596-2867 • FAX (714) 739-1713

### SPECIFYING A FIXED TIME DELAY PERIOD

LEACH and the Military identify the time delay period in the same manner. A four-digit dash number specifies the delay period in milliseconds. The first three numbers are significant figures while the fourth indicates the number of zeroes to follow the first three.

Examples: -1001 = 1,000 milliseconds (1 second)  
 -2502 = 25,000 milliseconds (25 seconds)  
 -5000 = 500 milliseconds (0.5 seconds)

In the case of a repeat cycle timer (flasher), a similar method is used. The dash number indicates the length of each cycle. (Note: each cycle is 50% on, 50% off).

Examples: -2500 = 250 milliseconds cycle or 4 cycles/sec.  
 -1001 = 1,000 milliseconds cycle or 1 cycle/sec.  
 -6002 = 60,000 milliseconds cycle or 1 cycle/min.

### USE AND SELECTION OF ADJUSTABLE TIMERS

Adjustable timers are useful in system prototyping or breadboard circuits where the precise time delay period is unknown. By the use of an external resistor, these devices are adjustable over a specific DECADE RANGE. Although any decade range within the overall timing range can be supplied, the following ranges are offered as standards:

0.1 to 1 seconds (Specify -1001)  
 1.0 to 10 seconds (Specify -1002)  
 5 to 50 seconds (Specify -5002)  
 50 to 500 seconds (Specify -5003)

Note from the above that in specifying a decade range, the four-digit dash number indicates the high or upper limit of the desired decade range. The formula below provides the proper resistance value to achieve the desired time delay:

$$R_{ext} = \left( \frac{T_1}{T_0} - 1 \right) 100,000 \text{ Ohms}$$

Where:  $R_{ext}$  = External resistance value (Ohms)  
 $T_1$  = Desired time in seconds  
 $T_0$  = Minimum time (low end of the decade range) in seconds

As an example, if using a 5 to 50 second adjustable timer and a 30 second delay is desired, the calculation is:

$$R_{ext} = \left( \frac{30}{5} - 1 \right) 100,000 \text{ or } R_{ext} = 500 \text{ K Ohms}$$

Recommended resistors IAW MIL-R-55182 1/2 WATT, 1% (RNC60HXXXXFS).

### QPL CROSS REFERENCE — MILITARY P/N TO LEACH P/N

Military P/N	Leach P/N	Operation Mode	Output	Timing Range (seconds)
M83726/3 <sup>Ⓛ</sup>	TD-1150/1151	Delay On Operate - Fixed Time	10A, 2PDT	0.1 to 300
M83726/4 <sup>Ⓛ</sup>	TD-1160/1161	Delay On Release - Fixed Time	10A, 2PDT	0.1 to 300
M83726/12	TD-1369	Delay On Release - Fixed Time	10A, 4PDT	0.1 to 300
M83726/14	TD-1370	Delay On Operate - Fixed Time	10A, 4PDT	0.1 to 300
M83726/20	TD-1435	Delay On Operate - Fixed Time	250MA, SPST	0.05 to 500
M83726/21	TD-1436	Delay On Operate - Adjustable <sup>Ⓜ</sup>	250MA, SPST	0.05 to 500
M83726/22	TD-1412	Repeat Cycle Timer (Flasher)	250MA, SPST	1-600 cycles/min. <sup>Ⓜ</sup>
M83726/23	TD-1505	"True" Delay On Release - Fixed <sup>Ⓛ</sup>	10A, 4PDT	0.1 to 75
M83726/24	TDH-1609	Delay On Operate - Fixed Time	150MA, SPST	0.05 to 500
M83726/25	TDH-1610	Delay On Release - Fixed Time	150MA, SPST	0.05 to 500
M83726/28	TDH-8050/8051	Delay On Operate - Fixed Time	10A, 2PDT	0.1 to 600 <sup>Ⓜ</sup>
M83726/29	TDH-8070/8071	Delay On Release - Fixed Time	10A, 2PDT	0.1 to 600 <sup>Ⓜ</sup>
M83726/30	TDH-8060/8061	Delay On Operate - Adjustable	10A, 2PDT	0.1 to 600 <sup>Ⓜ</sup>
M83726/31	TDH-8080/8081	Delay On Release - Adjustable	10A, 2PDT	0.1 to 600 <sup>Ⓜ</sup>

<sup>Ⓛ</sup> Slash sheets 1, 2, 3 & 4 to MIL-R-83726 have been officially cancelled. DLA specified replacements: /28 replaces /1 and /3 and /29 replaces /2 and /4. Replacement units are smaller and lighter but are electrically and physically compatible with inactivated units.

<sup>Ⓜ</sup> All adjustable timers use external resistor (not supplied) to adjust timing range.

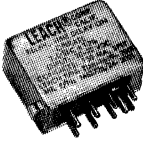
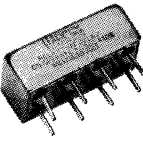
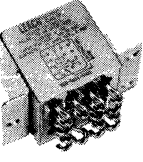

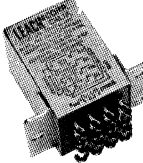


<sup>Ⓜ</sup> Each cycle 50% on, 50% off.

<sup>Ⓛ</sup> "True" time delay on release requires no external power during timing period.

<sup>Ⓜ</sup> Timing ranges above 500 seconds not MIL qualified.

# LEACH INTERNATIONAL CORPORATION

## TIME DELAY RELAYS

P.O. Box 5032 6900 Orangethorpe Ave. Buena Park, CA 90622-5032 (714) 739-0770 FAX: (714) 739-1713 ■ TWX: 910-596-2867	CONTACT RATING—AMPS	OUTPUT CONFIGURATION	METHOD OF TIMING				TIMING RANGE IN SECONDS	DIMENSIONS (L×W×H)	WEIGHT MAX OZ.
			ON OPERATE FIXED TIME	ON OPERATE ADJUSTABLE	ON RELEASE FIXED TIME	ON RELEASE ADJUSTABLE			
	TDH-1609	.150	SPST	✓			.05 TO 500	.810 × .410 × .640 0.56 oz.	
	TDH-1610					✓			
	TD-1435	.250	SPST	✓			.05 TO 500	.810 × .410 × .310 0.5 oz.	
	TD-1436				✓				
	TD-1412			REPEAT CYCLE (FLASHER)					1 TO 600 CYCLES/MIN
	TDH-8050	10	2PDT	✓			0.1 TO 600	1.025 × 1.025 × 1.010 2.5 oz.	
	TDH-8060				✓				
	TDH-8070					✓			
	TDH-8080					✓			
	TDH-6050	10	2PDT	✓			0.1 TO 600	1.025 × .525 × 1.520 1.9 oz.	
	TDH-6060				✓				
	TDH-6070					✓			
	TDH-7050	10	4PDT	✓			0.1 TO 600	1.025 × 1.025 × 1.500 3.0 oz.	
	TDH-7060				✓				
	TDH-7070					✓			
	TD-1370	10	4PDT	✓			0.1 TO 300	1.531 × 1.531 × 2.340 10.0 oz.	
	TD-1369					✓			
	TD-1505	10	4PDT				0.1 TO 75	2.062 × 2.062 × 1.810 12.0 oz.	

# LINE ELECTRIC PRODUCTS

TOLL FREE  
800 331-1137

PO BOX 127 ■ GLASTONBURY, CT 06073 ■ TELEPHONE 860 659-3573 ■ FAX 860 659-3576

## RELAYS

	OPEN GEN. PURPOSE	OCTAL	PLUG-IN	HERMETICALLY SEALED	OCTAL LATCHING	30 AMP POWER	AUTOMOTIVE APPLIANCE	P.C. BOARD POWER	P.C. BOARD
<b>BASIC RELAY TYPE</b>									
<b>TYPICAL DIMENSIONS</b>	W = 1.03 in. H = 1.22 in. L = 1.80 in.	W = 1.38 in. H = 2.16 in. L = 1.38 in. PINS	W = 1.52 in. H = 1.89 in. L = 1.40 in. PINS	W = 1.38 in. H = 2.19 in. L = 1.38 in. PINS	W = 1.75 in. H = 1.75 in. L = 2.75 in. OPEN	W = 2.50 in. H = 2.03 in. L = 2.31 in.	W = 1.02 in. H = 1.28 in. L = 1.02 in.	W = 0.75 in. H = 1.19 in. L = 0.91 in.	W = 0.51 in. H = 1.00 in. L = 1.14 in.
<b>CONTACT ARRANGEMENT</b>	SPST THRU 3PDT	SPST THRU 3PDT	SPST THRU 3PDT	SPST THRU 3PDT	SPST THRU 6PDT	SPDT DPDT THRU SPST-NO-DM DPDT (2 AUX.)	SPST SPDT	SPDT SPST-NO SPST-NC	SPST THRU DPDT
<b>CONT. RATING AVAILABLE (RESISTIVE)</b>	5A 240VAC 10A 120VAC	5A 240VAC 10A 120VAC	10A 240VAC THRU 30 AMP	5A 240VAC 10A 240VAC	15A TUNGSTEN 30A 120VAC 5A 120VAC 10A 120VAC	30A 277VAC 1.5 H.P.	40A RESISTIVE	10 @ 240VAC THRU 30A @ 240VAC	5A @ 250VAC/ 30VDC THRU 20A @ 250VAC/ 30VDC
<b>COIL VOLTAGE</b>	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-480 (DC) 6-110	6-24VDC	5-110VDC	3-100VDC

## RELAYS

	RELAYS	SENSITIVE DC COIL
	P.C. BOARD	MKF & MKC
<b>BASIC RELAY TYPE</b>		
<b>TYPICAL DIMENSIONS</b>	W = .65 in. H = .80 in. L = .89 in.	W = 1.38 in. H = 2.16 in. L = 1.38 in.
<b>CONTACT ARRANGEMENT</b>	SPDT SPST-NO SPST-NC	SPST THRU 3PDT
<b>CONT. RATING AVAILABLE (RESISTIVE)</b>	15A @ 125VAC 10A @ 250VAC	PILOT DUTY RATINGS 5A 240VAC 10A 240VAC
<b>COIL VOLTAGE</b>	3-60VDC	1PDT-125mw 2PDT-250mw 3PDT-375mw

## SOLENOIDS AND ACTUATORS

	D.C. OPERATED	U-FRAME	U-FRAME	U-FRAME	ACTUATOR	ACTUATOR	MINIATURE IMPULSE DUTY
	EL	DS	BR	KL	RC	RM	TO-5
<b>BASIC SOLENOID TYPE</b>							
<b>OPERATING VOLTAGES</b>	6, 12, 24, 48, AND 110VDC OTHERS AVAILABLE	ANY TO 110VDC ANY TO 240VAC	ANY TO 110VDC ANY TO 240VAC	ANY TO 110VDC ANY TO 240VAC	ANY TO 110VDC ANY TO 240VAC	ANY TO 110VDC ANY TO 240VAC	ANY TO 24VDC
<b>DUTY</b>							
Continuous	YES	X	X	X	X	X	X
Intermittent	YES	X	X	X	X	X	X
Pulse	YES	X	X	X			X
<b>DIMENSIONS IN INCHES</b>	L = 1.813 D = 0.484	W = 0.750 H = 1.406 D = 1.563	W = 1.000 H = 1.656 D = 1.563	W = 1.375 H = 2.063 D = 1.563	W = 0.859 H = 1.563 D = 1.375	W = 1.188 H = 1.563 D = 2.438	L = 0.500 D = 0.359
<b>ACTION</b>							
Push	X	X	X	X			X
Pull	X	X	X	X	X	X	X

## BUZZERS

	BUZZERS	
	MD	MC
<b>BASIC RELAY TYPE</b>		
<b>TYPICAL DIMENSIONS</b>	W = .88 in. H = .88 in. L = 1.66 in.	W = 2.84 in. H = 1.56 in. L = 3.47 in.
<b>COIL VOLTAGE</b>	6-240VAC	6-240VAC

## REPLACEMENT RELAYS AND CUSTOM COILS

Line Electric specializes in hard to find relays that were manufactured by Potter & Brumfield, Magnecraft, Deltrol, Struthers-Dunn and others. We can supply relays and solenoids with various types of wiring diagrams, terminals, coils, and contacts. No inquiry is too small.


**LOGITEK**<sup>INC.</sup><sup>TM</sup>

101 CHRISTOPHER STREET,  
 RONKONKOMA, NY 11779  
 PHONE (516) 467-4200 \* FAX: (516) 467-4090  
 E MAIL: SALES@LOGITEKINC.COM  
 HTTP://EEMONLINE.COM/LOGITEK

## POWER MONITOR & POWER CONVERSION PRODUCTS

**AC Power Monitors**  
**AC and DC Voltage Monitors**  
**Frequency Monitors**  
**Phase Monitors**  
**Time Delay Relays**  
**Flashers**

**AC/DC Power Supplies**  
**DC/DC Power Supplies**  
**DC/DC Converters**

**See Pages D•1666-1672,  
 Section 4000  
 And Pages D•2005-2008,  
 Section 4025**

### ***Power, Voltage, Frequency & Phase Monitors***

When the voltage (Voltage Monitors) or frequency (Frequency Monitors) or phase rotation (Phase Monitors) or all three (Power Monitors) of the input signal are within prescribed high and low limits, and the phase rotation is ABC, the output relay will energize after the specified "pick-up" time delay. If the high or low voltage limits of any phase are exceeded for a time greater than the specified "drop-out" time delay, the relay de-energizes and remains de-energized until all phase voltages return within limits and remain at normal levels for longer than the specified "pick-up" time delay. If the input frequency exceeds the high or low frequency limits for a time exceeding the "drop-out" time delay, the relay de-energizes and remains de-energized until the frequency returns within limits and remains at normal levels for longer than the "pick-up" time delay. The output relay will not energize if the phase rotation is other than ABC or if any phase is disconnected. When the output relay is energized, loss of any phase will cause the relay to drop out immediately, overriding the time delay circuits.

### ***Time Delays, Solid State Flashers***

The design of complex electrical distribution systems often requires certain operations be delayed or sustained for a precise interval of time. Combinations of various timing devices can be used for sequential start-up or shutdown, load transfer or shedding, or delayed transfer to avoid race conditions. In addition, pulsers, interval timers, and flashers are used in applications, such as operating instrument panel warning lights or other annunciation devices, landing gear, door open indicators and navigation lights.

### ***Quality Assurance***

Logitek's products are designed and manufactured in accordance with MIL-STD-454, MIL-STD-2000 & MIL-I-45208. Standard 100% factory burn-in contributes to reliable, long term performance, as demonstrated by an incredibly low 0.1% field reject rate.

### ***Switch Mode Power Supplies***

Logitek's AC/DC & DC/DC Series is a family of high density, compact, Full-Mil, Mil Spec and Industrial switch mode power supplies. These advanced design power supplies accept a wide range of inputs, and are available in multiple output configurations. The AC/DC Series is ideally suitable for airborne, shipboard, ground mobile, distributed power and telecommunications applications. Logitek's power supplies have been designed and qualified to the most stringent performance and environmental requirements.

### ***Custom & Special Applications***

Logitek's engineering department is available to discuss your applications of our products or to design special equipment to satisfy your system requirements.



# LOGITEK INC.™

101 CHRISTOPHER STREET, RONKONKOMA, NY 11779  
 (516) 467-4200 Fax: (516) 467-4090 E MAIL: sales@LogitekInc.com  
 http://eemonline.com/logitek

## Phase Monitors



### Operation:

Phase monitors are used to monitor the phase characteristics of three phase power lines for both proper sequencing and phase loss allowing normal operation of system loads when these characteristics are normal. In the event of a loss of phase or improper sequence the control relay will de-energize and may be used to operate alarm indicators.

### Military Grade

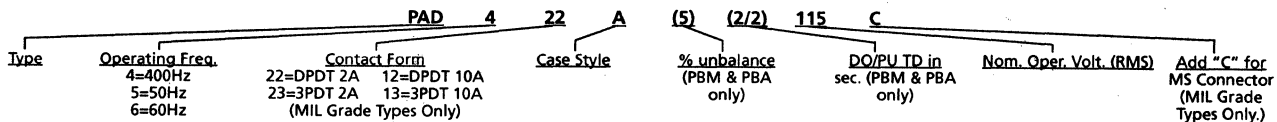
Type	Function	Input	Sense Band	Accuracy	PU/DO Delay	Temp.
PAA*	Relay energizes if all phases are present & ABC. De-energizes on loss or reversal of phase.	115/220 VRMS ±20% 4 wire wye, 50/60/400Hz.	115/220 VRMS ±20% 4 wire wye, 50/60/400Hz. 50/60/400Hz	N/A	N/A	1
PLA						3
PAD		28 vdc ±15%	1			
PLD			3			
PVA*	Relay energizes if all phases are present, ABC & voltage levels are above preset limits. De-energizes on loss, reversal or low voltage phase.	115/220 VRMS ±20% 4 wire wye, 50/60/400Hz.	80-100 VRMS	±5%	N/A	1
PBM	Relay energizes if all phases are within % unbalance for >PU TD. If unbalance occurs for >DO TD relay de-energizes.	115/230/480 VRMS ±20% 4 wire wye, 50/60/400Hz.	5% to 10% unbalance	±1%	250ms to 10sec.	

### Industrial Grade

LPS-1†	Relay energizes if all phases are present & ABC. De-energizes on loss or reversal of phase. Consult factory for P/N specification.	115/208 VRMS ±20% Delta, 50/60Hz.	120 ±5 deg. max	N/A	N/A	5
PHA†		115/220/400 VRMS ±20% 4 wire wye or Delta, 50/60/400Hz.				4
PBA†	Relay energizes if phases are within % unbalance for >PU TD. If unbalance occurs for >DO TD relay de-energizes.		3% to 12% unbalance	±1%	250ms to 10sec.	5

\*NSN # Assigned †10A Contacts Only

### Ordering Information: Ex: PAA423A115C



### Operation:

Frequency monitors are used to monitor the frequency characteristics of single or three phase power lines (AC types) or of AC buses (DC types) allowing normal operation of system loads when these characteristics are within predetermined limits. In the event of an out of limit condition the control relay will de-energize and may be used to operate alarm indicators or system shutdown contactors.

## Frequency Monitors

### Military Grade

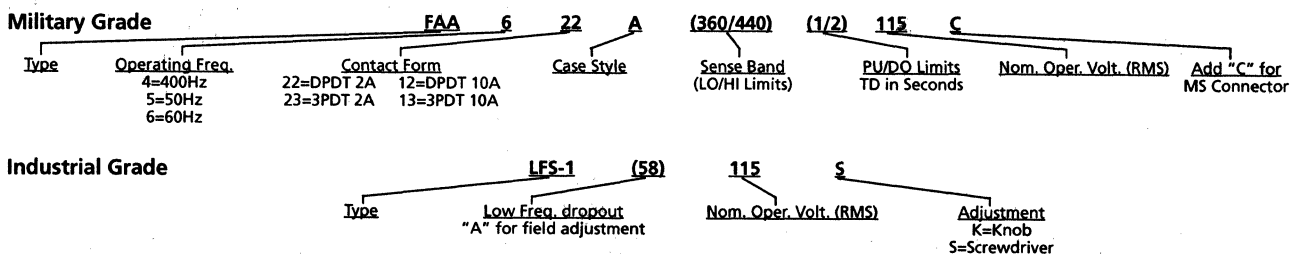
Type	Function	Input	Sense Band	Accuracy	Hyst	PU/DO Delay	Temp.
FAD	Monitor line frequency of input power. Output relay energizes, de-energizes after PU/DO time delay upon any deviation from preset limits.	28 vdc ±15%	±20% of nominal sense frequency	±1% incl set point	0.5% max.	250ms to 10sec	1
FQD				±0.5%			3
FAA*	PU/DO time delay upon any deviation from preset limits.	115/220VRMS ±20% 4 wire wye, 50/60/400Hz.					1
FQA							3

\*NSN # Assigned

### Industrial Grade

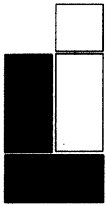
LFS-1	Monitors line frequency of input power. Output relay energizes, de-energizes upon any deviation from preset limit.	115VRMS ±20%	45-65Hz	±2%	N/A	N/A	7
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### Ordering Information: Ex: FQA612D(58/63)(.25/2)115



See Page B-1380 for STANDARD SPECIFICATIONS. Pages B-1381-1382 for case sizes, dimensions & wiring diagrams.



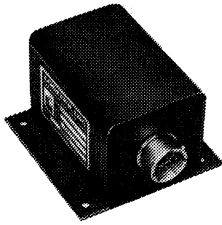


# LOGITEK<sup>INC.</sup>

101 CHRISTOPHER STREET, RONKONKOMA, NY 11779  
 (516) 467-4200 Fax: (516) 467-4090 E MAIL: sales@LogitekInc.com  
<http://eemonline.com/logitek>

## AC/DC Voltage Monitors

### Monitor Input Voltage for conformance to system requirements



- Time Delayed PUIDO upon out of spec conditions
- ±1% Sense Accuracy
- Hi/Lo Sense band
- AC/DC Operation
- NAV MAT P-4855 48 Hr Burn-In/Vibration/Derating
- 3 Year Warranty

#### Operation:

Voltage monitors are used to monitor the voltage characteristics of single or three phase power lines (AC types) or of DC buses (DC types) allowing normal operation of system loads when these characteristics are within predetermined limits. In the event of an out of limit condition the control relay will de-energize and may be used to operate alarm indicators or system shutdown contactors.

#### AC Voltage Monitors - Military Grade

Type	Function	Input	Sense Band	Accuracy	Hyst	DO/PU Delay	Temp.
VAA**	Monitor voltage (1 or 3 phase) of input power. Output relay energizes/de-energizes after DO/PU time delay upon any deviation from preset limits.	115/220VRMS, ±20%	Nominal ±20%	±1% inc. set point	±0.25% max.	250ms to 10sec.	1
VQA†		4 wire wye, 50/60/400 Hz		±5% inc. set pt.			3
VSA		115/220/440VRMS, Delta, ±20%, 50/60/400 Hz	Nominal ±20% Field Adjustable	±1% inc. set pt.	0.5% max.	250ms to 10sec.	1
VMA†				±0.5% inc. set pt.			
DAA†		28 vdc ±15%	Nominal ±20%	±1% inc. set pt.	N/A		3
DMA†				±5% inc. set pt.			
VAD							
VQD							
VMD†							
VSD							

#### AC Voltage Monitors - Industrial Grade

407*	Monitor voltage (1 or 3 phase), of input power. Output relay energizes/de-energizes after PU/DO time delay upon any deviation from preset limits. 10A contacts.	115/220VRMS ±20%	Nominal ±20%	±3% set accuracy ±1% repeatability	N/A	50ms to 10sec.	4
408		4 wire wye, 50/60/400Hz.					
EAA*		115/208, 220/440, 50/60/400Hz.		±1% incl. set point	250ms to 10sec.		

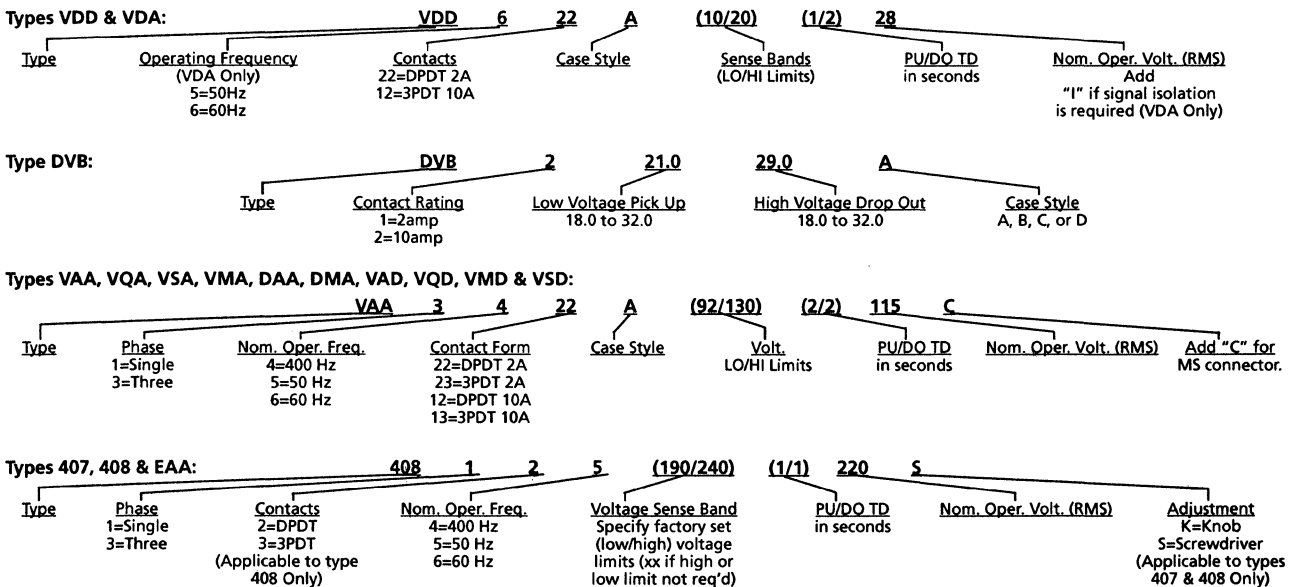
#### DC Voltage Monitors - Military Grade

DVB*	Monitor DC power lines. HI/LO limits.	0-35 vdc	18-32 vdc PU/DO	±0.6 vdc	0.5 ±0.2 vdc	none	1
VDD*		28 ±15% vdc			N/A		
VDA*		115VRMS ±20%	4-200 vdc	±5%		250ms to 10sec.	

†10A Contacts Only

\*NSN# Assigned

#### Ordering Information:



See Page B•1380 for STANDARD SPECIFICATIONS. Pages B•1381-1382 for case sizes, dimensions & wiring diagrams.

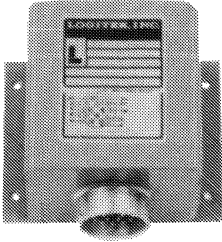


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## AC Power Monitors

### Monitor Voltage, Frequency & Phase of Input Power for conformance to system requirements



**Featuring:**

- Time Delayed PU & DO for out of spec conditions.
- ±1% Sense Accuracy
- Inner/Outer Sense Band available
- AC/DC Operation
- NAV MAT P-4855 48 Hr Burn-In/Vibration/Derating
- 3 Year Warranty

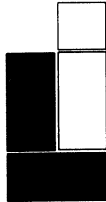
**Operation:**

When the voltage and frequency of the input signals are within prescribed high and low limits, and the phase rotation is ABC, the output relay will energize after the specified "pick-up" time delay. If the high or low voltage limits of any phase are exceeded for a time greater than the specified "drop-out" time delay, the relay de-energizes and remains de-energized until all phase voltages return within limits and remain at normal levels for longer than the specified "pick-up" time delay. If the input frequency exceeds the high or low frequency limits for a time exceeding the "drop-out" time delay, the relay de-energizes and remains de-energized until the frequency returns within limits and remains at normal levels for longer than the "pick-up" time delay. The output relay will not energize if the phase rotation is other than ABC or if any phase is disconnected. When the output relay is energized, loss of any phase will cause the relay to drop out immediately, overriding the time delay circuits.

**Military Grade**

Type	Function	Input	Sense Band	Accuracy	Hyst	PU/DO Delay	Temp. Range	
PMA*	Monitor voltage (1 or 3Φ), frequency & phase of input power. Output relay energizes/de-energizes after PU/DO time delay upon deviation from preset limits	115/220VRMS ±20% 4 wire wye, 50/60/400 Hz	Nominal ±20%	±1% incl. set pt.	1% max.	250ms to 10sec.	1	
PQA*							3	
YMA		115/220/440VRMS ±20% Delta, 50/60/400 Hz	Nominal ±20%	±5% incl. set pt.	2% max.	50ms to 10sec.	1	
YQA*			Field Adjustable				3	
PCM		28 vdc ±15%	Nominal ±20%	±1% incl. set pt.	1% max.	250ms to 10sec.	3	
PQA-D 3Φ only								
PMD								1
PQD								3
YMD								1
YQD			3					
100-210-3A	Per M24021-3 QPL-24021-17	113-118 v/phase, 393-407Hz	Per M24021-3					
100-211-5A	Per M24021-5 QPL-2402-17		Per M24021-5					
108	Monitor input voltage (1 or 3 phase) frequency & phase of input power. 2 control circuits monitor inner/outer band limits of voltage, frequency & time delay which are independently set. Set long DO delay for small & short delay for large deviations	115VRMS ±20% 4 wire wye, 50/60/400Hz	Inner window Nominal ±20% Outer window Nominal ±30%	±1% incl. set pt.	1% max.	250ms to 10sec.	3	
109	Monitor voltage (1 or 3 phase) frequency & phase of input power. 3 output relays, 1 per characteristic energizes/de-energizes after the associated PU/DO time delay upon any deviation of the associated characteristic from preset limits.	115/220VRMS ±20% 4 wire wye, 50/60/400Hz	Nominal ±20%					

See Page B•1380 for STANDARD SPECIFICATIONS. Pages B•1381-1382 for case sizes, dimensions & wiring diagrams.



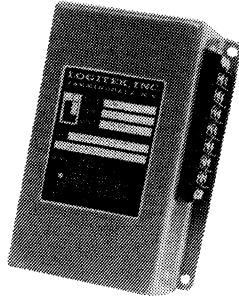
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# AC Power Monitors

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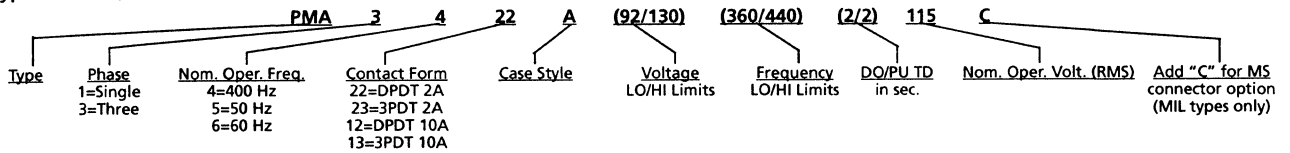
### Industrial Grade

Type	Function	Input	Sense Band	Accuracy	PU/DO Delay	Temp. Range
WMA	Monitor voltage (1 or 3 phase) frequency & phase of input power. Output relay energizes/de-energizes	115/220/440VRMS wye. ±20% 50/60/400Hz	Nominal ±20%	±1% incl. set pt.	250ms to 10sec.	5
WMA-D 3φ Only	after PU/DO time delay upon any deviation from preset limits.	115/220/440VRMS Delta				

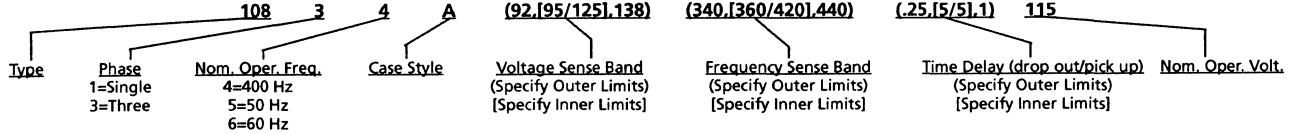


### Ordering Information:

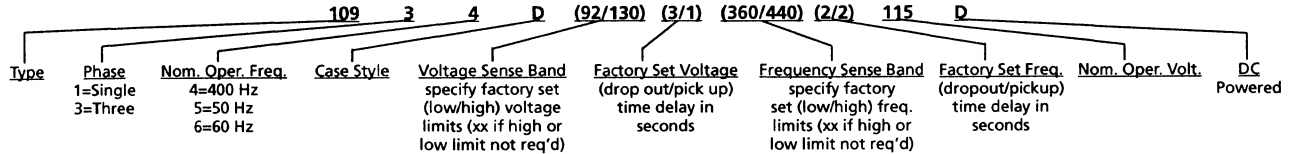
Types PMA, PQA, YMA, YQA, PCM, PQA-D, WMA\*, WMA-D\*, YMD, YQD:



Type 108:



Type 109:

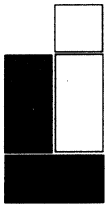


\* For type WMA, delete Contact Form and Case Style. For type WMA-D delete Phase, Contact Form, and Case Style. Add "D" (Delta) or "E" (Edison Connection) to end of P/N.

### Input Filter Response Time

Change (ΔV)	Set Pt. %	Typical 50/60/400 Hz Filter Response msec.
+20	+5	60
+20	+10	110
+20	+15	175
+10	+5	100
-10	-5	90
-20	-5	80
-20	-10	110
-20	-15	210

See Page B•1380 for STANDARD SPECIFICATIONS. Pages B•1381-1382 for case sizes, dimensions & wiring diagrams.



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## Standard Specifications

### Power Monitors, AC/DC Voltage Monitors & Phase Monitors

#### Electrical

<i>Input (operating)</i>	
Voltage (nominal)	115,220 <sup>(3)</sup> VRMS ±20% 4 wire wye
Frequency (nominal)	50/60/400Hz ±20%
Voltage Transients	MIL-STD-704
<i>Input (sense)</i>	
Voltage Band	As required*
Frequency Band	As required*
Accuracy <sup>(1)</sup>	±1%
Hysteresis	1% maximum
Phase Sequence	ABC
Time Delay (pick-up) <sup>(2)</sup>	250ms to 10sec.*
Time Delay (drop-out) <sup>(2)</sup>	250ms to 10sec.*

#### Output Contacts

<i>Contact Form</i>	DPDT or 3PDT
<i>Contact Rating (@28 vdc)</i>	2A Res. 10A Res. 0.75A Ind. 6A Ind.
<i>Contact Life</i>	50,000 operations min.
<i>Contact Resistance</i>	.075 ohms max.
<i>Dielectric Strength</i>	1000VRMS @60Hz, all terminals to case
<i>Insulation Resistance</i>	100 megohms @500 vdc, all terminals to case
<i>Power Dissipation</i>	6 watts maximum

\* Specify in Part Number

<sup>(1)</sup> Defined as maximum difference between factory set points and specified set point including temperature drift and repetitive operations.

#### Environmental

<i>Temperature</i>	Per MIL-STD-810C, Methods 501.1, 502.2
<i>Operating</i>	<i>Storage</i>
1 -55°C to +125°C	-65°C to +150°C
2 -55°C to +85°C	-65°C to +150°C
3 -40°C to +85°C	-65°C to +150°C
4 -30°C to +70°C	
5 -10°C to +70°C	
6 -55°C to +71°C	-62°C to +71°C
7 -10°C to +50°C	
<i>Vibration</i>	Per MIL-STD-810C, Method 514.2 Procedure I, 10-2000Hz 20g's
<i>Acceleration</i>	Per MIL-STD-810C, Method 513.2 Procedure I and II, ±10g's
<i>Shock</i>	Per MIL-STD-810C, Method 516.2 Procedure I, 50g's 11 ±1ms any axis
<i>Humidity</i>	Per MIL-STD-810C, Method 507.1 Procedure II
<i>Altitude</i>	Per MIL-STD-810C, Method 504.1 Category 6 Equipment, Sea level to 70,000 ft.
<i>Physical</i>	
<i>Finish</i>	Gloss blue #15177, FED-STD-595 In Accordance with MIL-F-14072
<i>Connector</i>	Glass-to-metal seal, solder hooks or MS 3113H-20-16PN type connector (optional)
<i>Marking</i>	Model number, date code, operating voltage and wiring diagram
<i>Enclosure</i>	Hermetically sealed and encapsulated
<i>Weight</i>	16 oz. maximum

<sup>(2)</sup> Specified time delay does not include input filter response time. Consult factory for the typical delay which must be added to the specified time delay to account for input filter response.

<sup>(3)</sup> 220V only available in 10A size can. See "case dimensions."

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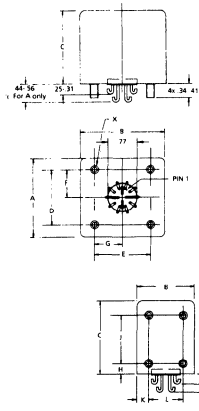
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## Case Styles & Dimensions Voltage, Frequency, Phase and Power Monitors

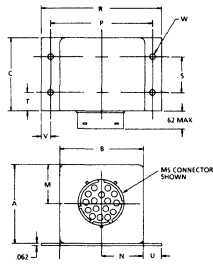
### Case Style Selection

Type	A	A1	B	C	D	D1	J	Type	A	A1	B	C	D	D1	J	Type	A	A1	B	C	D	D1	J
108	X	X			X	X		PCM	X	X			X	X		VDA	X	X			X	X	
109	X	X			X	X		PLA	X	X			X	X		VDD	X	X			X	X	
DAA	X	X			X	X		PLD	X	X			X	X		VMA	X	X			X	X	
DMA	X	X			X	X		PMA	X	X			X	X		VMD	X	X			X	X	
DVB	X	X			X	X		PMD	X	X			X	X		VSA	X	X			X	X	
FAA	X	X			X	X		PQA	X	X			X	X		VSD	X	X			X	X	
FAD	X	X			X	X		PQA-D	X	X			X	X		VQD	X	X			X	X	
FQA	X	X			X	X		PQD	X	X			X	X		YMA	X	X			X	X	
FQD	X	X			X	X		PVA	X	X			X	X		YMD	X	X			X	X	
PAA	X	X			X	X		VAA	X	X			X	X		YQA	X	X			X	X	
PAD	X	X			X	X		VAD	X	X			X	X		YQD	X	X			X	X	
PBM	X	X			X	X																	

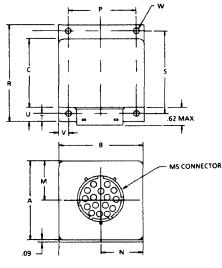
Style A & A1



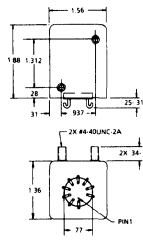
Style D



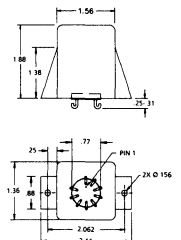
Style D1



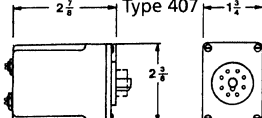
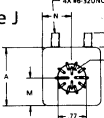
Style B



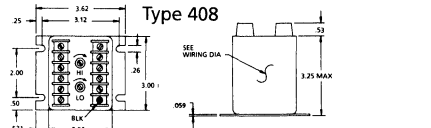
Style C



Style J



Type 408



### Case Dimensions

Symbol	Type 108	Type 109	Type YMD/YQD, YMA/YQA	Type PMA/PQA, PLM/PLD/POD				Type PAD/PLD		Type PVA/PLM, PVA/PLD, PVA/PLQ	Type PBM 10A	Type PVA 10A, 60HZ, 10A, 400HZ	Type VDA	Type VDD	Type DMA 10A	Type PQA-D 10A	Symbol
				2A, 60HZ, 2A, 400HZ, 10A, 400HZ	10A, 60HZ, 115V	2A, 60HZ, 2A, 400HZ	10A, 60HZ, 10A, 400HZ	2A, 60HZ, 2A, 400HZ	10A, 60HZ, 10A, 400HZ								
A	2.759	2.75	2.56	2.14	2.56	2.00	2.14	2.00	2.56	2.14	2.00	1.36	3.50	3.50	A		
B	4.383	4.38	2.94	2.27	2.94	2.00	2.27	2.00	2.94	2.27	2.00	1.56	4.38	4.38	B		
C	3.753	3.75	3.17	3.19	3.17	2.50	2.75	2.50	3.17	2.75	2.50	2.375	4.00	4.00	C		
D	2.000	2.000	1.875	1.625	1.875	1.437	1.625	1.437	1.875	1.625	1.437	1.000	—	—	D		
E	3.625	3.625	2.250	1.750	2.250	1.437	1.750	1.437	2.250	1.750	1.437	1.000	—	—	E		
F	0.720	0.72	0.656	0.812	0.656	0.718	0.812	0.718	0.656	0.812	0.718	0.468	—	—	F		
G	1.810	1.81	1.125	0.875	1.125	0.718	0.875	0.718	1.125	0.875	0.718	0.500	—	—	G		
H	0.39	—	0.39	0.41	0.39	0.31	0.41	0.31	0.39	0.41	0.31	0.28	0.62	0.62	H		
J	2.375	—	2.375	2.375	2.375	1.875	1.938	1.875	2.375	1.938	1.875	1.812	2.750	2.750	J		
K	0.39	—	0.39	0.32	0.39	0.38	0.32	0.38	0.39	0.32	0.38	0.31	0.50	0.50	K		
L	2.156	—	2.156	1.625	2.156	1.250	1.625	1.250	2.156	1.625	1.250	0.937	3.375	3.375	L		
M	1.111	—	1.00	1.07	1.00	1.00	1.07	1.00	1.00	1.07	1.00	0.68	1.22	1.22	M		
N	2.182	—	1.47	1.13	1.47	1.00	1.13	1.00	1.47	1.13	1.00	0.78	1.41	1.41	N		
P	4.877	4.875	3.437	2.765	3.437	2.500	2.765	2.500	3.437	2.765	2.500	2.062	3.500	3.500	P		
R	5.376	5.375	3.94	3.27	3.94	3.00	3.27	3.00	3.94	3.27	3.00	2.56	5.00	5.00	R		
S	2.747	2.750	2.171	2.187	2.171	1.500	1.750	1.500	2.171	1.750	1.500	1.875	4.500	4.500	S		
T	—	—	—	—	0.50	—	—	—	—	—	—	—	—	—	T		
U	—	—	—	—	0.50	—	—	—	—	—	—	—	—	—	U		
V	—	—	—	—	0.25	—	—	—	—	—	—	—	—	—	V		
W	—	—	—	—	—	—	4X Ø.146-166	—	—	—	—	—	0.44	0.44	W		
X	4X 6-32UNC-2A	4X 8-32UNC-2A	—	—	—	—	4X 6-32UNC-2A	—	—	—	—	—	4X 10-32UNC-2A	—	X		

Tolerances: .XX±.03; .XXX±.010

Symbol	Type VAD/YQD 2A, 60HZ	Type VAD/VDD FAA/FQA		Type VAD/YQD 10A, 400HZ	Type DAA/YMA/ YMD	Type FAA/FQA/PA/PLA			Type FAD/FQD		Type DVB, 10A DVZ, 2A	Type VSA/VSD 2A, 10A, 60HZ 2A, 10A, 400HZ	Type VAA/VQA			Symbol			
		10A, 60HZ 115V	2A, 400HZ			2A, 60HZ	10A, 400HZ	10A, 60HZ 220V	2A, 60HZ	10A, 60HZ			2A, 60HZ	10A, 60HZ 115V	2A, 400HZ		10A, 400HZ	10A, 60HZ 220V	
A	2.14	2.56	2.00	2.14	2.56	2.14	2.14	2.56	2.00	2.14	1.36	2.13	2.14	2.56	2.00	2.14	2.56	A	
B	2.27	2.94	2.00	2.27	2.94	2.27	2.27	2.94	2.00	2.27	1.56	2.13	2.27	2.94	2.00	2.27	2.94	B	
C	2.75	2.75	2.50	2.75	3.17	2.75	2.75	3.17	2.50	2.75	1.88	2.69	2.75	3.18	2.50	2.75	3.18	C	
D	1.625	1.875	1.437	1.625	1.875	1.625	1.625	1.875	1.437	1.625	0.937	1.625	1.625	1.875	1.437	1.625	1.875	D	
E	1.750	2.250	1.437	1.750	2.250	1.750	1.750	2.250	1.437	1.750	1.000	1.625	1.750	2.250	1.437	1.750	2.250	E	
F	0.812	0.656	0.718	0.375	0.656	0.375	0.375	0.656	0.718	0.812	0.21	0.812	0.375	0.656	0.718	0.375	0.656	F	
G	0.875	1.125	0.718	0.875	1.125	0.875	0.875	1.125	0.718	0.875	0.28	0.812	0.875	1.125	0.718	0.875	1.125	G	
H	0.41	0.41	0.32	0.41	0.39	0.41	0.41	0.41	0.32	0.41	0.28	—	0.41	0.41	0.31	0.41	0.39	H	
J	1.938	1.938	1.875	1.938	2.375	1.938	1.938	1.938	1.875	1.938	1.312	—	1.938	1.938	1.875	1.938	2.375	J	
K	0.32	0.39	0.38	0.32	0.39	0.32	0.39	0.32	0.39	0.38	0.32	—	0.32	0.39	0.38	0.32	0.39	K	
L	1.625	2.156	1.250	1.625	2.156	1.625	1.625	2.156	1.250	1.625	0.937	—	1.625	2.156	1.250	1.625	2.156	L	
M	1.07	1.00	1.00	1.10	1.00	0.63	0.63	0.868	1.00	1.07	0.68	—	1.07	1.00	1.00	1.07	1.00	M	
N	1.13	1.47	1.00	1.13	1.47	1.13	1.13	1.336	1.00	1.13	0.78	—	1.13	1.47	1.00	1.13	1.47	N	
P	2.765	3.437	2.500	2.765	3.437	2.765	2.765	3.437	2.500	2.765	2.062	2.812	2.765	3.437	2.500	2.765	3.437	P	
R	3.27	3.94	3.00	3.27	3.94	3.27	3.27	3.94	3.00	3.27	2.56	3.38	3.27	3.94	3.00	3.27	3.94	R	
S	1.750	1.750	1.500	1.750	2.171	1.750	1.750	2.171	1.500	1.750	1.375	1.562	1.750	2.162	1.500	1.750	2.162	S	
T	—	—	—	—	0.50	—	—	—	—	—	0.25	—	—	—	—	—	—	—	T
U	—	—	—	—	0.50	—	—	—	—	—	—	—	—	—	—	—	—	—	U
V	—	—	—	—	0.25	—	—	—	—	—	—	—	—	—	—	—	—	—	V
W	—	—	—	—	—	—	4X Ø.146-166	—	—	—	—	—	4X Ø.170-190	—	—	4X Ø.146-166	—	—	W
X	—	—	—	—	—	—	4X 6-32UNC-2A	—	—	—	—	—	4X 40UNC-2A	4X 8-32UNC-2A	—	4X 6-32UNC-2A	—	—	X

Tolerances: .XX±.03; .XXX±.010

Specifications subject to change without notice

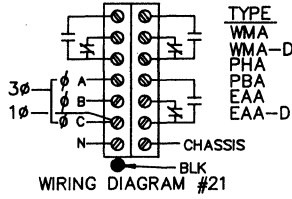


# LOGITEK<sup>INC</sup>

## Wiring Diagrams Voltage, Frequency, Phase and Power Monitors

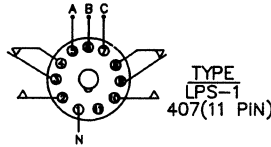
101 CHRISTOPHER STREET, RONKONKOMA, NY 11779  
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http://eemonline.com/logitek

### TERMINAL BLOCK



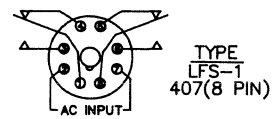
WIRING DIAGRAM #21

### 11 PIN HEADER



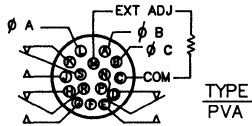
WIRING DIAGRAM #22

### 8 PIN HEADER



WIRING DIAGRAM #23

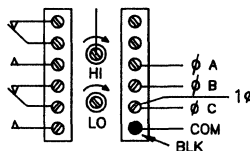
### MS CONNECTOR



WIRING DIAGRAM #17

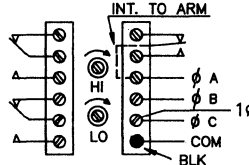
FOR SINGLE PHASE OPERATION USE PINS B & C  
NOT APPLICABLE ON PBM  
FOR DPDT OPERATION DELETE PINS D, E & N

### TYPE 408 DPDT 1φ, 3φ



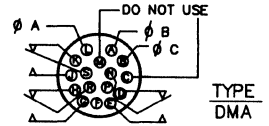
WIRING DIAGRAM #18

### TYPE 408 3PDT 1φ, 3φ



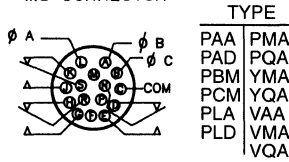
WIRING DIAGRAM #19

### MS CONNECTOR



WIRING DIAGRAM #20  
FOR DPDT OPERATION DELETE PINS D, E & N

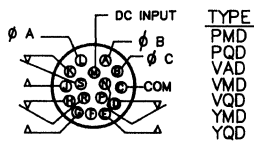
### MS CONNECTOR



WIRING DIAGRAM #13

FOR SINGLE PHASE OPERATION USE PINS B & C  
NOT APPLICABLE ON PBM  
FOR DPDT OPERATION DELETE PINS D, E & N

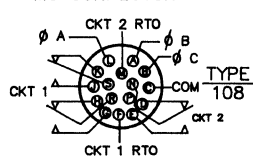
### MS CONNECTOR



WIRING DIAGRAM #14

FOR SINGLE PHASE OPERATION USE PINS B & C  
FOR DPDT OPERATION DELETE PINS D, E & N

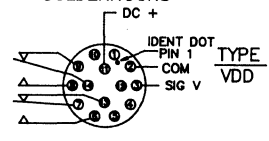
### MS CONNECTOR



WIRING DIAGRAM #15

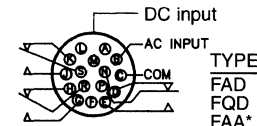
FOR SINGLE PHASE OPERATION USE PINS B & C  
CT 1 CONTACTS ARE INNER WINDOW  
CT 2 CONTACTS ARE OUTER WINDOW

### SOLDERHOOKS



WIRING DIAGRAM #16

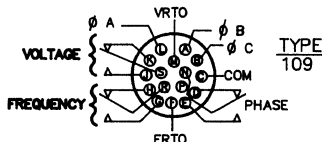
### MS CONNECTOR



WIRING DIAGRAM #9

FOR SINGLE PHASE OPERATION USE PINS B & C  
FOR DPDT OPERATION DELETE PINS D, E & N  
\* DC input N/A

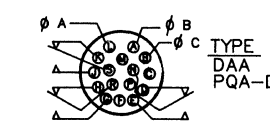
### MS CONNECTOR



WIRING DIAGRAM #10

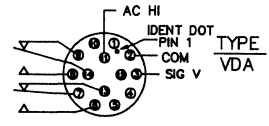
FOR SINGLE PHASE OPERATION USE PINS B & C  
FOR DPDT OPERATION DELETE PINS D, E & N  
FOR DC OPERATION USE PIN P, DC RETURN IS PIN C.

### MS CONNECTOR



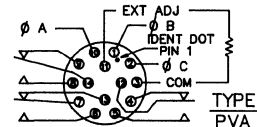
WIRING DIAGRAM #11  
FOR DPDT OPERATION DELETE PINS D, E & N

### SOLDERHOOKS



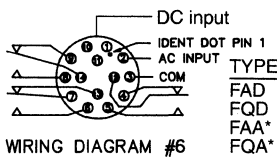
WIRING DIAGRAM #12  
NON-ISOLATED UNITS

### SOLDERHOOKS



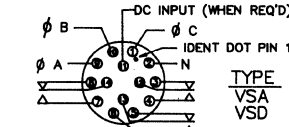
WIRING DIAGRAM #5  
FOR SINGLE PHASE OPERATION USE PINS 2 & 3  
FOR DPDT OPERATION DELETE PINS 4, 5 & 12

### SOLDERHOOKS



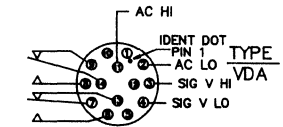
WIRING DIAGRAM #6  
FOR SINGLE PHASE OPERATION USE PINS 2 & 3  
FOR DPDT OPERATION DELETE PINS 4, 5 & 12  
\* DC input N/A

### SOLDERHOOKS



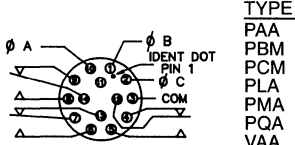
WIRING DIAGRAM #7 (3PDT)

### SOLDERHOOKS



WIRING DIAGRAM #8  
ISOLATED UNITS

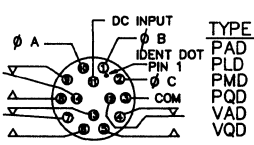
### SOLDERHOOKS



WIRING DIAGRAM #1

FOR SINGLE PHASE OPERATION USE PINS 2 & 3  
NOT APPLICABLE ON PBM  
FOR DPDT OPERATION DELETE PINS 4, 5 & 12

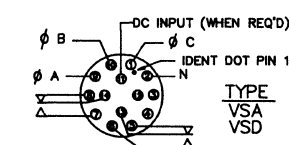
### SOLDERHOOKS



WIRING DIAGRAM #2

FOR SINGLE PHASE OPERATION USE PINS 2 & 3  
FOR DPDT OPERATION DELETE PINS 4, 5 & 12

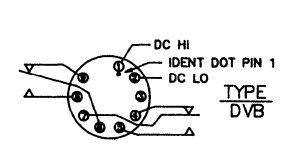
### SOLDERHOOKS



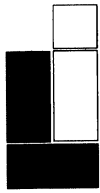
WIRING DIAGRAM #3 (2PDT)

FOR SINGLE PHASE OPERATION DELETE PINS 1 & 10

### SOLDERHOOKS



WIRING DIAGRAM #4



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## Time Delay Relays

### GENERAL:

LOGITEK time delay relays and interval timers utilize CMOS digital technology and are designed for surface mount assembly (SMT) in order to achieve the highest degree of electrical and mechanical integrity and reliability possible. All units are 100% burned in at the factory achieving a field reject rate of less than 0.1%.

### Time Delay Relay Selection Chart

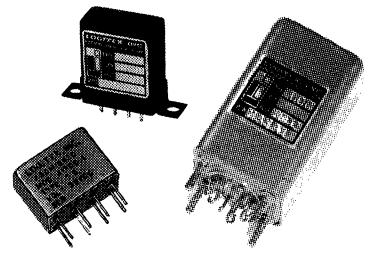
Model	Function	Input	Output	Timing Range
DMN1	Delay on Make	18-31 vdc Per MIL-STD-704	DPDT 2A Res.	50ms-200sec
DMO	Delay on Break			
DMN2	Delay on Make		DPDT 2A Res. DPDT 10A Res.	
DI	Delay on Make			
DO	Delay on Break			
DOC	Delay on Break	115VRMS ±20% 50,60,400Hz	DPDT 2A Res.	50ms-300sec
DOT	Delay on Break		DPDT 2A Res. DPDT 10A Res.	
DIA	Delay on Make			
DAO	Delay on Break			
PTR	Repeat Cycle	18-31 vdc	SPST 50ma max	50ms-200sec

### Specifications

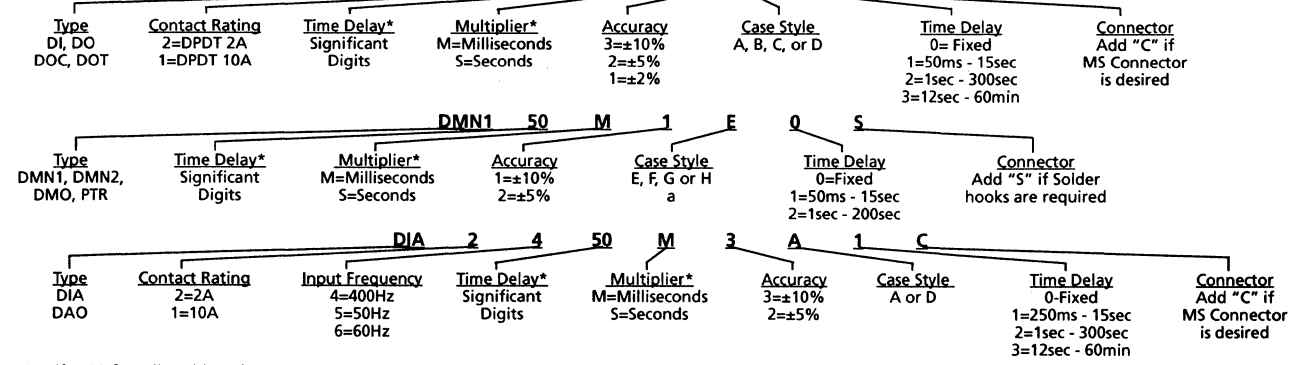
Electrical	DI,DO	DIA, DOA	DOC	DOT	DMN1, DMO	DMN2	PTR
Input Voltage	28 vdc nom. (18-31 vdc) MIL-STD-704 LIMITS 1 & 3	115VRMS ±20% 50/60/400 Hz ±20%	28 vdc nom. (18-31 vdc) MIL-STD-704 LIMITS 1 & 3	28 vdc nom. (18-31 vdc) MIL-STD-704 LIMITS 1 & 3 20ms min	28 vdc nom. (18-31 vdc) MIL-STD-704 LIMIT 1	28 vdc nom. (18-31 vdc) MIL-STD-704 LIMIT 1	28 vdc nom. (18-31 vdc) MIL-STD-704 LIMIT 1
Time Delay	50ms - 60min	250ms - 60min	50ms - 60min	50ms - 300sec	50ms - 200sec	50ms - 200sec	50ms - 200sec
Accuracy (1)	±10%, ±5%	±10%, ±5%	±10%, ±5%, ±2%	±10%, ±5%	±10%, ±5%	±10%, ±5%	±10%, ±5%
Repeatability (2)	±0.5%	±0.5%	±0.5%	±2%	±1%	±1%	±1%
Reset Time (3)	5ms max	100ms max	—	±2%	5ms max	5ms max	—
Recycle Time (4)	1ms typical	—	1-5 ms typ.	20ms min	1% of TD or 10ms	1% of TD or 10ms	—
Insulation Resistance	100 megohms@500 vdc	100 megohms@500 vdc	100 megohms@500 vdc	100 megohms@500 vdc	100 megohms@500 vdc	100 megohms@500 vdc	100 megohms@500 vdc
Dielectric Strength	1000VRMS @ 60Hz (0.5 ma leakage max)	1000VRMS @ 60Hz (0.5 ma leakage max)	1000VRMS @ 60Hz (0.5 ma leakage max)	1000VRMS @ 60Hz (0.5 ma leakage max)	500VRMS @ 60Hz all term. to case	500VRMS @ 60Hz all term. to case	500VRMS @ 60Hz all term. to case
Inverse Voltage	600 volts	600 volts	600 volts	600 volts	600 volts	600 volts	600 volts
Transient Protection	MIL-STD-704 ±600V, 500Usec	MIL-STD-704 ±600V	MIL-STD-704 ±600V, 500Usec	MIL-STD-704 ±600V, 500Usec	MIL-STD-704 LIMIT 1	MIL-STD-704 LIMIT 1	MIL-STD-704 LIMIT 1
Contacts:							
Form	2 Form C (DPDT)	2 Form C (DPDT)	2 Form C (DPDT)	2 Form C (DPDT)	2 Form C (DPDT)	Sink "ON" 0.4V @ 50ma	Sink "ON" 0.4V @ 50ma
Rating (@ 28 vdc)	2A Res. .075 A Ind. 10A Res. 6A Ind.	2A Res. .075 A Ind. 10A Res. 6A Ind.	2A Res. .075 A Ind. 10A Res. 6A Ind.	2A Res. .075 A Ind. 10A Res. 6A Ind.	2A Res. .075 A Ind. 10A Res. 6A Ind.	"OFF" open collector Leakage .1 Uamp	"OFF" open collector Leakage .1 Uamp
Resistance	75 milliohms max	75 milliohms max	75 milliohms max	75 milliohms max	75 milliohms max	—	—
Life	50,000 ops min	50,000 ops min	50,000 ops min	50,000 ops min	50,000 ops min	50,000 ops min	50,000 ops min
Current:	2A 10A	2A 10A	2A 10A	2A 10A	2A 10A	N/A	N/A
During Timing	5ma typ. 5ma typ.	1.6W typ. 1.6W typ.	75ma 125ma	150ma, 20ms	5ma max	6ma typ.	6ma typ.
After Timing	50ma typ. 100ma typ.	2W typ. 2.5W typ.	30ua 30ua	50ma max	25ma max	7ma typ. load exclusive	7ma typ. load exclusive

- (1) Defines maximum deviation from specified time delay at any combination of specified operating voltage, temperature or other environmental conditions.
- (2) Defines maximum timing change due to repetitive cycles at any fixed voltage and ambient temperature within specified limits.
- (3) Defines maximum time required for relay contacts to return to "NO" position after power has been removed.
- (4) Defines power interruption required to achieve a new delay cycle within specified accuracy.

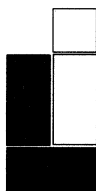
<b>ENVIRONMENTAL</b> Temperature Operating DI, DO, DOC, DOT, DIA, DOA -55°C to +125°C -55°C to +85°C DOC, DMN1, DMN2, DMO -65°C to +150°C Storage Vibration Per MIL-STD-810C, Method 514.2, Procedure I, 10-2000Hz, 20g's Shock Per MIL-STD-810C, Method 516.2, Procedure I, 50g's 11 ±1ms, any axis Acceleration Per MIL-STD-810C, Method 514.2, Procedure I&II, 10g's Humidity Per MIL-STD-810C, Method 507.1, Procedure I Altitude Per MIL-STD-810C, Method 504.1 Category 6 equipment, Sea level to 70,000 feet	<b>PHYSICAL</b> Finish In accordance with MIL-F14072 Gloss blue #15177, Glass-to-metal sealed solder hooks, MS 3113H-12-10P, connector on request Connector Model number, operating voltage, wiring diagram and date code Marking Steel case, hermetically sealed and potted DPDT 2A, 4 oz. maximum Enclosure DPDT 10A, 5 oz. maximum Weight
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### Ordering Information:



\* Specify "A" for adjustable units

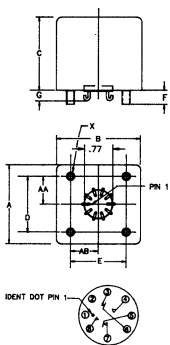


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 http://eemonline.com/logitek

## Time Delay Relay Case Styles, Dimensions & Wiring Diagrams

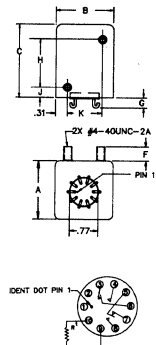
STYLE A & A1



WIRING DIAGRAM #1

TYPE  
 DI  
 DO  
 DOT

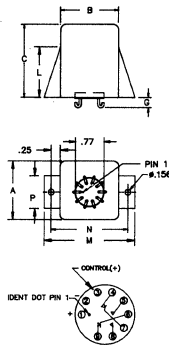
STYLE B



WIRING DIAGRAM #2  
 FOR FIELD ADJUSTABLE UNITS

TYPE  
 DI  
 DO  
 DOT

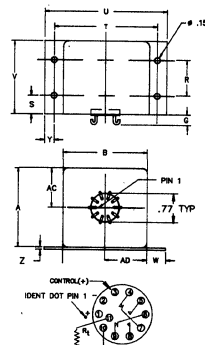
STYLE C



WIRING DIAGRAM #3

TYPE  
 DOC

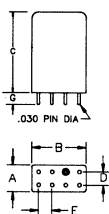
STYLE D



WIRING DIAGRAM #4  
 FOR FIELD ADJUSTABLE UNITS

TYPE  
 DOC

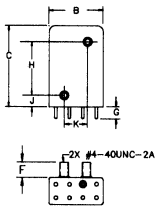
STYLE E



WIRING DIAGRAM #6  
 FOR FIXED DELAY UNITS

COLOR BEAD  
 TYPE  
 DMO  
 DMN1

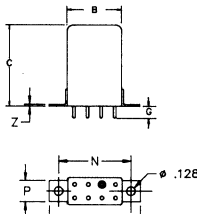
STYLE F



WIRING DIAGRAM #7  
 FOR FIELD ADJUSTABLE UNITS

RT COLOR BEAD  
 TYPE  
 DMO  
 DMN1

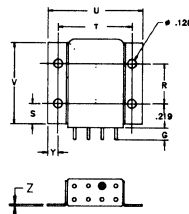
STYLE G



WIRING DIAGRAM #8  
 FOR FIXED DELAY UNITS

COLOR BEAD  
 TYPE  
 DMN2  
 PTR

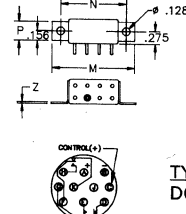
STYLE H



WIRING DIAGRAM #5  
 FOR MS3113H-12-10P  
 CONNECTOR

TYPE  
 DOC

STYLE H1



WIRING DIAGRAM #9  
 FOR FIELD ADJUSTABLE UNITS

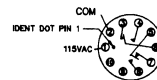
RT  
 TYPE  
 DMN2  
 PTR

### Case Dimensions

Symbol	Type DI		Type DO		Type DOC		Type DOT	Type DMN1, DMO	Type DMN2, PTR	Type DAO, DIA	Symbol		
	2A Relay	10A Relay	2A Relay	10A Relay	2A Relay	10A Relay	2A Relay	2A Relay	Solid State	2A & 10A Relay			
A	0.96	1.36	0.96	1.36	0.96	1.36	0.96	0.400 MAX	0.400 MAX	2.38	A		
B	1.23	1.56	1.23	1.56	1.23	1.56	1.23	0.800 MAX	0.800 MAX	2.75	B		
C	1.25	1.50	1.50	1.88	1.50	1.86	2.000	0.880 MAX	0.555 MAX	2.50	C		
D	0.625	0.937	0.625	0.937	0.625	0.937	0.625	0.200 TYP	0.200 TYP	1.887	D		
E	0.875	1.000	0.875	1.000	0.875	1.000	0.875	0.200 TYP	0.200 TYP	2.060	E		
F				0.41						0.38	F		
G				0.28				0.200	0.200	0.28	G		
H	0.667	0.937	0.938	0.937	1.436	1.312	1.438	0.430			H		
J				0.28				0.225			J		
K	0.625	0.937	0.625	0.937	0.625	0.937	0.625	0.350			K		
L	0.88	1.38	0.88	1.38	1.63	1.63	1.63				L		
M	2.11	2.56	2.11	2.56	2.16	2.56 MAX	2.11	1.320 MAX	1.320 MAX		M		
N	1.734	2.062	1.734	2.062	1.734	2.062	1.734	1.062	1.062		N		
P				0.88				0.312	0.312		P		
R	0.750	1.000	.750	1.375	1.000	1.375	1.500	0.437		2.000	R		
S				0.25				0.187		0.25	S		
T	1.734	2.062	1.734	2.062	1.734	2.062	1.734	1.062		3.250	T		
U	2.23	2.56	2.23	2.56	2.23	2.56	2.23	1.320 MAX		3.75	U		
V	1.25	1.50	1.25	1.50	1.50	1.88	2.00	0.81		2.50	V		
W				0.50						0.50	W		
X				4X 4-40UNC-2A							4X 8-32UNC-2A		X
Y				0.25				0.129		0.25	Y		
Z				0.063				0.025	0.025	0.063	Z		
AA										0.44	AA		
AB										1.030	AB		
AC										0.78	AC		
AD										1.37	AD		

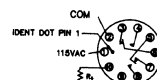
Tolerances: .XX=±.03; .XXX=±.010

Specifications subject to change without notice



WIRING DIAGRAM #10

TYPE  
 DAO  
 DIA



WIRING DIAGRAM #11  
 FOR FIELD ADJUSTABLE UNITS

TYPE  
 DAO  
 DIA

### Case Style Selection

Type	DAO	DI	DIA	DMN1	DMN2	DMO	DO	DOC	DOT	PTR
Style A	X	X	X	X	X	X	X	X	X	X
Style B	X	X	X	X	X	X	X	X	X	X
Style C	X	X	X	X	X	X	X	X	X	X
Style D	X	X	X	X	X	X	X	X	X	X
Style E	X	X	X	X	X	X	X	X	X	X
Style F	X	X	X	X	X	X	X	X	X	X
Style G	X	X	X	X	X	X	X	X	X	X
Style H	X	X	X	X	X	X	X	X	X	X
Style H1	X	X	X	X	X	X	X	X	X	X



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## Flashers & Interval Timers

### GENERAL:

LOGITEK flashers and interval timers are generally used to activate all types of indicator lights. Ruggedized design and construction insure rigid conformity to military specifications.

### Flashers

Model	Input	Output	Rate/Ratio	MIL Status	Temp. Range
F659	18-31 vdc	Input - 1.5 vdc max. @2.5A lamp load	60-120 PPM ratio, 1-2.5/1	NSN#5945-01-084-6397(80PPM) NSN#5945-01-165-3066 (45PPM)	1
F580		Input - 1.5 vdc max @500ma lamp load	80,120 PPM ratio, 1/1	NSN#5945-00-942-1311	
F945		4 channel sink @500ma ea. lamp load	30-200 PPM ratio, 1/1		2
F670		10 channel @ input-4% max. 2A lamp load ea.	120 PPM ratio, 1/1	NSN#5945-00-872-6793	
A915	17-29 vdc	1 channel @ input-4% max 5A lamp load	80 PPM ratio, 2,4/1	QPL MS24577-2A NSN#5945-00-752-5599 MIL-F-26301D	3
A738		Input-1.5 vdc max. 28 vdc @ 2.5A lamp load	85 PPM ratio, 2,4/1	QPL MS27710 NSN#5945-738-2254 MIL-F-26301D	
A915-8	105-	115Vac, 400Hz @4A max.	90 PPM ratio, 2/1	QPL MS25205-7	
A915-5	125 vac,	2 channel 115vac 400Hz ea. Ch. 2A Ind.	40 PPM ratio, 1/1	NSN#5845NC1063212HFG	
A915-6	400 Hz	2A Ind. @ 24 vdc, ±10%	40 PPM ratio, 1/1		

### Flasher Part Number Specification:

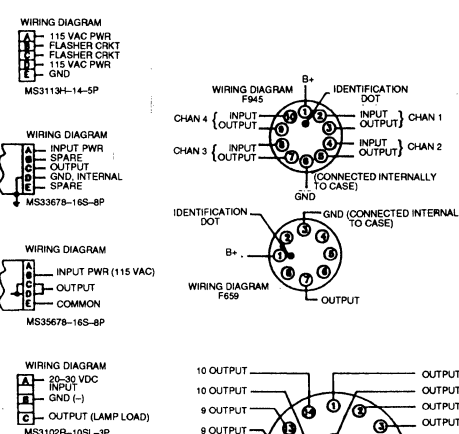
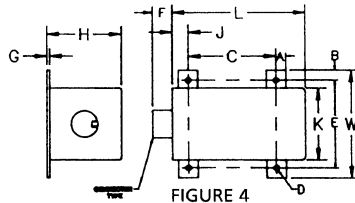
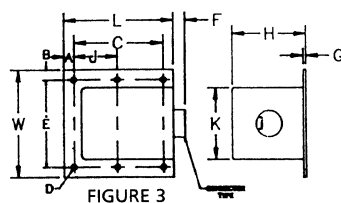
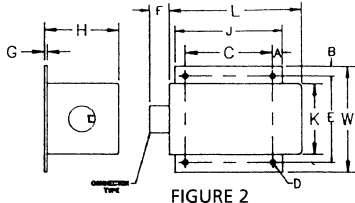
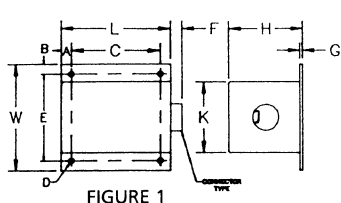
**Type** F659      **Flash Rate (PPM)** (80)      **Ratio** (2.5/1)

### Specifications

Dielectric Strength:	1000VRMS @ 60Hz, all terminals to case	Temperature:	Operating	Storage
Insulation Resistance:	100 megohms @ 500 vdc, all terminals to case		-55°C to +125°C	-65°C to +150°C
Environmental:	Per MIL-STD-810		-55°C to +85°C	-65°C to +150°C
Quality:	Per MIL-STD-454, MIL-STD-2000A, MIL-Q-9858A		-55°C to +71°C	-62°C to +71°C

### Dimensions/Connector

Type	Figure	A	B	C	D	E	F	G	L	W	H	J	K	Connector Type
F659	1	0.36	0.25	1.160	0.196	2.070	0.240	0.090	1.875	2.57	2.00	—	1.47	Solder Hooks
A738	1	0.40	0.17	1.750	0.190	2.312	0.625	0.040	2.562	2.66	1.925	—	1.63	MS3113H-10SL-3P
F945	1	0.28	0.28	2.438	0.154	2.438	0.31	0.060	3.00	3.00	2.08	—	2.00	Solder Hooks
A915	2	0.25	0.25	2.000	0.175	2.500	0.75	0.070	3.06	3.00	2.38	2.50	2.00	MS33678R-16S-8P
A915-5	2	0.30	0.30	2.50	0.166	3.20	NA	0.070	4.00	3.80	2.234	3.10	2.234	MS3113H-14-5P
A915-6	2	0.25	0.25	2.000	0.175	2.500	0.75	0.070	3.06	3.00	2.38	2.50	2.00	MS33678R-16S-8P
F670	3	0.25	0.25	3.625	0.180	3.750	0.31	0.093	4.13	4.25	2.98	1.812	3.00	Solder Hooks
A915-8	4	0.38	0.38	2.000	0.180	2.750	0.75	0.09	3.50	3.51	1.56	0.75	1.91	MS35678-16S-8P

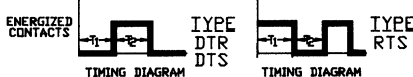
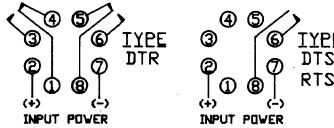
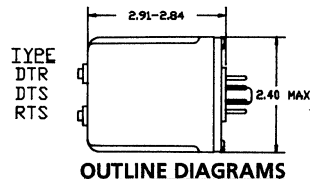


### Interval Timers

Model	Function	Input	Timing Range	Recycle Time	Temp. Range
DTR	Delayed Interval timer 10A DPDT Contacts	12, 24, 48, 115, 220V AC/DC ±20%	100 ms-1000 sec	50 ms	4
DTS	Delayed Interval timer 5A SPST Solid State Contacts				
RTS	Repeat Cycle Timer				

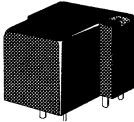
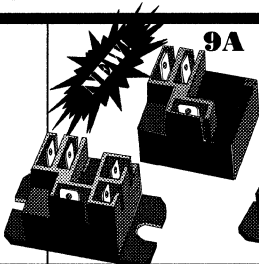
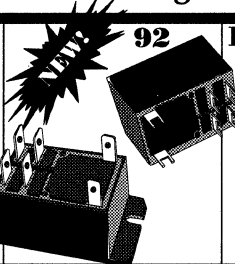
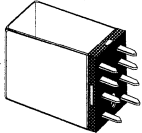
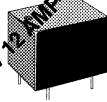





Interval Timer Part Type  
 Number Specification: DTR  
 (ex: DTR(2/4)K115A)

<b>Timing Range T1</b>	<b>Timing Range T2</b>	<b>K</b>	<b>115A</b>
1=50ms-1sec    4=3sec-60sec	1=50ms-1sec    4=3sec-60sec	K=Knob Adjust	Operating Voltage
2=200ms-4sec    5=12sec-250sec	2=200ms-4sec    5=12sec-250sec	S=Screwdriver Adjust	A=AC
3=.8sec-16sec    6=50sec-1000sec	3=.8sec-16sec    6=50sec-1000sec		D=DC



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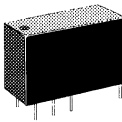
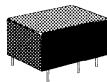
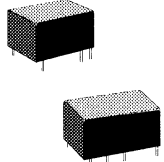

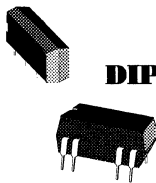
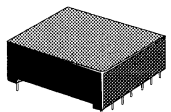




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RELAY SERIES	90			9A			92			1330 & 1335			178			
																
STYLE	PRINTED CIRCUIT			FLANGE or P.C.			FLANGE or P.C.			PRINTED CIRCUIT			PRINTED CIRCUIT			
DIMENSIONS (L x W x H) Max.	L	W	H	L	W	H	L	W	H	L	W	H	L	W	H	
	1.30 x 1.08 x .805			1.27 x 1.08 x 1.10			1.10 X 1.36 X 1.27			1.07 x .728 x .905			.890 x .650 x .620			
FEATURES	EPOXY SEALED IMMERSION CLEANABLE. STANDARD 0.1 GRID PATTERN. CLASS "B" OR "F" INSULATION SYSTEM. MEETS UL 508 & UL 873			EPOXY SEALED IMMERSION CLEANABLE. P.C BOARD OR FLANGED COVER 1/4" SPADE TERMINALS ACCEPT INSULATED 1/4" Q.C. CONNECTORS. CLASS "F" INSULATION SYSTEM. 6000 VOLT SURGE- UL APPLIED FOR.			EPOXY SEALED IMMERSION CLEANABLE WITH TAPE SEAL. PC BOARD OR FLANGE MOUNT STYLES. CLASS "F" INSULATION SYSTEM. 1/4" SPADE TERMINALS ACCEPT 1/4" Q.C. CONNECTORS.			MINIATURE 2 POLE ENCLOSED SEE THRU COVER. P.C. STYLE TERMINALS FOR DIRECT MOUNTING OR P.C. SOCKET. AC OR DC OPERATED COILS			MINIATURE EPOXY SEALED P.C. BOARD MOUNTING. CLASS "A" OR "B" INSULATION SYSTEM WITHSTANDS THE VAPOR SPRAY CLEANING OF MOST FLUXING SYSTEMS. SWITCHES UP TO 12 AMPS RESISTIVE LOAD			
CONTACT DATA	SPDT-NO		SPDT		SPDT-NO		SPDT		SPST-NO, DPDT		DPDT		SPDT		SPDT	
General Ratings:	30AMPS @ 240VAC		20AMPS @ 240VAC (NO) 15AMPS @ 240VAC (NC)		30A @ 240VAC 20A @ 30 VDC		20A @ 240VAC (NO) 15 A @ 240VAC (NC)		30A, 277 VAC 20A, 28 VDC (N.C.) 3A, 277 VAC 3A, 28 VDC		5 A @ 120VAC 5A @ 30 VDC 3A @ 120VAC INDUCTIVE		5 AMPS @ 240VAC		12 AMPS @ 120VAC	
Material:	Silver Cadmium Oxide			Silver Cadmium Oxide			Silver Cadmium Oxide			Silver Cadmium Oxide			Silver Cadmium Oxide			
COIL DATA	AC - Voltage: DC - Voltage VA, : (VAC) Watts, : (VDC)			AC - Voltage: DC - Voltage VA, : (VAC) Watts, : (VDC)			AC - Voltage: DC - Voltage VA, : (VAC) Watts, : (VDC)			AC - Voltage: DC - Voltage VA, : (VAC) Watts, : (VDC)			AC - Voltage: DC - Voltage VA, : (VAC) Watts, : (VDC)			
	Not Available 5, 12, 24 & 110 VDC N/A 0.93 Watts			Not Available 5, 12, 24, 48 & 110 DC N/A 1 Watts			24, 120 & 240 VAC 12, 24 48 & 110 VDC 4 VA 1.7 WATTS			24, 120 VAC 12, 24 VDC 1.2 VA 1.2 W			Not Available 5, 12, 24 VDC N/A 400 Milliwatts			
GENERAL DATA	Ambient Temp. Oper. Ambient Temp. Stor. Operate Time Max.: Release Time Max.: Life @ No Load Rated Load			Ambient Temp. Oper. Ambient Temp. Stor. Operate Time Max.: Release Time Max.: Life @ No Load Rated Load			Ambient Temp. Oper. Ambient Temp. Stor. Operate Time Max.: Release Time Max.: Life @ No Load Rated Load			Ambient Temp. Oper. Ambient Temp. Stor. Operate Time Max.: Release Time Max.: Life @ No Load Rated Load			Ambient Temp. Oper. Ambient Temp. Stor. Operate Time Max.: Release Time Max.: Life @ No Load Rated Load			
	-55°C to + 85°C -55°C to + 130°C 15 Milliseconds 10 Milliseconds 10 Million Operations 100,000 Operations			-55°C to + 85°C -55°C to + 130°C 15 Milliseconds 15 Milliseconds 10 Million Operations 100,000 Operations			-40°C to + 85°C, AC, +65°C 15 Milliseconds 10 Milliseconds 5 Million Operations 100,000 Operations			-45°C to + 70°C 20 Milliseconds 20 Milliseconds AC, 50 M Operations DC, 100 M Operations 100,000 Operations			-40°C to + 70°C 20 Milliseconds 10 Milliseconds 10 Million Operations 100,000 Operations			
INSULATION CHARACTERISTICS	Dielectric Withstand ing Voltage: Insulation Resistance: (Measured in Megohms)			Dielectric Withstand ing Voltage: Insulation Resistance: (Measured in Megohms)			Dielectric Withstand ing Voltage: Insulation Resistance: (Measured in Megohms)			Dielectric Withstand ing Voltage: Insulation Resistance: (Measured in Megohms)			Dielectric Withstand ing Voltage: Insulation Resistance: (Measured in Megohms)			
	1500 V rms 500 @ 500V			2500 V rms 500 @ 500V			2500 V rms 500 @ 500V			1500 V rms 1500 @ 500V			1500 V rms 100 @ 500V			
OPTIONS	Open style or dust covered available. Consult Factory for other special Features									Socket Available						
APPROVALS																

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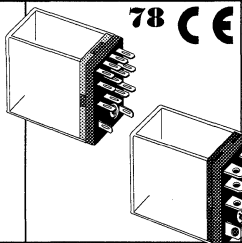
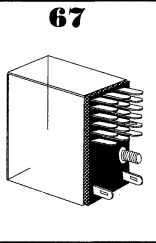
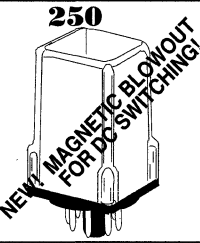

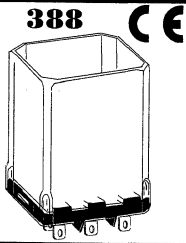







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<b>76</b>	<b>276</b>	<b>232 &amp; 272</b>	<b>7</b>	<b>SIP</b>	<b>193 REED</b>
				 <b>DIP</b>	
<b>PRINTED CIRCUIT</b> <b>L W H</b> 1.14 x .512 x .811	<b>PRINTED CIRCUIT</b> <b>L W H</b> .787 x 0.5 x .394	<b>PRINTED CIRCUIT</b> <b>L W H</b> .835 x .425 x .472	<b>PRINTED CIRCUIT</b> <b>L W H</b> .428 x .410 x .410	<b>PRINTED CIRCUIT</b> <b>L W H</b> .750 x .250 x .260 .750 x .300 x .275	<b>PRINTED CIRCUIT</b> <b>L W H</b> 1.15 x .4 to .7 x .355
EPOXY SEALED IMMERSION CLEANABLE. MEETS 8 mm SPACING COIL TO CONTACTS. 4 KV DIELECTRIC WITHSTANDING VOLTAGE UP TO 16 AMP SWITCHING.	EPOXY SEALED IMMERSION CLEANABLE. STANDARD 0.1 GRID PATTERN. SINGLE SIDE STABLE DESIGN. DTL COMPATIBLE MEETS INTERNATIONAL 4mm COIL TO CONTACT SPACING.	EPOXY SEALED IMMERSION CLEANABLE. STANDARD 0.1 GRID PATTERN FITS DIP SOCKETS. SENSITIVE COILS.	MICRO MINIATURE CONFORMS TO FCC PART 68.302, 1500V SURGE RESISTANCE. FCC, 68.304, 1000V DIELECTRIC. EXCELLENT RF SWITCH- ING CHARACTERISTICS. HIGH SHOCK AND VIBRATION RESISTANCE 94V-0 PLASTIC, EPOXY SEALED.	EPOXY MOLDED PC GRID SPACING 0.1" FAST OPERATE AND RELEASE TIME.. SWITCHING 10VA @ 100VDC. WAVE SOLDERABLE.	DUST COVERED PC BOARD MOUNTABLE. ON A 0.1 GRID PATTERN FAST OPERATE AND RELEASE TIME. SWITCHES 10VA @ 100 OR 200 VDC. EPOXY STYLE IS WAVE SOLDERABLE.
SPDT      DPDT	SPDT-NO    SPDT	SPDT OR DPDT	SPDT, DPDT	SPST-NO or NC DPST-NO, SPDT, DPDT	1, 2, 3 or 4 PDT 1, 2, 3 OR 4 PST-NO
10AMPS & 16 AMPS @ 250VAC/ 30VDC	5 AMPS @ 250VAC/ 30 VDC	10AMPS @ 250VAC/ 30 VDC	7 AMPS @ 240 VAC/ 30VDC	1 AMP @ 120 VAC, 24 VDC	50 uA @ 50 mV 2 AMPS @ 24 VDC 1 AMP @ 120 VAC
0.25 to 0.5AMP @ 100 VDC 4 to 10 VA	0.5AMPS @ 100 VDC Form "C" 200 VDC Form "A" 10VA	Rhodium or Mercury	Rhodium	Rhodium	Rhodium
Silver Cadmium Oxide	Silver Alloy	Silver Gold Clad	Gold Clad Silver Palladium Cross Bar	Rhodium or Mercury	Rhodium
See Options Below 5, 12, 24 & 48 VDC  600 Milliwatts	Not Available 5, 6, 12, 24 VDC N/A 200 Milliwatts	Not Available 3 to 48 VDC N/A 20 to 55 Milliwatts	Not Available 5, 12, 24 VDC N/A 370 Milliwatts	Not Available 5, 12, 24 VDC N/A 50 to 280 Milliwatts	Not Available 5, 12, 24 VDC N/A 50 to 1030 Milliwatts
-20°C to + 70°C  15 Milliseconds 10 Milliseconds 10 M Operations 20 M Operations 150,000 Operations	-40°C to + 70°C -40°C to + 80°C 10 Milliseconds 10 Milliseconds  50 Million Operations 100,000 Operations	-10°C to +40°C  6 Milliseconds 4 Milliseconds  10 Million Operations 100,000 Operations	-35°C to + 70°C  4.0 Milliseconds 5.0 Milliseconds  100 Million Operations 100,000 Operations	-40°C to + 85°C  2 Milliseconds Max 2 Milliseconds Max  20 Million Operations 5 Million Operations	-45°C to +85°C -60°C to +105°C 1 Millisecond 1 Millisecond  100 Million Operations 10 Million Operations
5000 V rms 1000 @ 500V	2000 V rms 1000 @ 500V	1500 V rms 100 @ 500V	500 V rms 1000 @ 500V	1500 V rms 1000 @ 500V	1000 V rms 1000 @ 500V
AC Voltages available on special order. DIN rail/surface mount Sockets/w screw terminals also available		Socket Available		Electrostatic Shield MIL-Spec Qualified Socket Available	.15 Grid spacing between pins available on special order.
					

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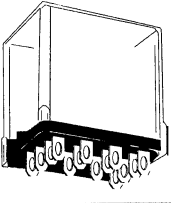
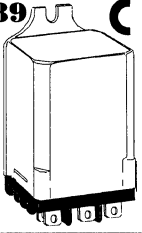
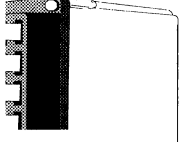
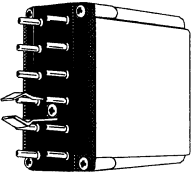
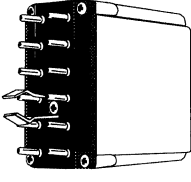
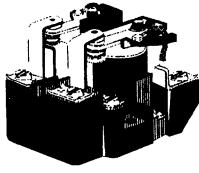

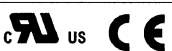




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RELAY SERIES	 78 CE	 67	 250 <i>NEW! MAGNETIC BLOWOUT FOR DC SWITCHING!</i>	 88HP	 388 CE
STYLE	PC/PLUG-IN	P.C./PLUG-IN	OCTAL PLUG-IN	OCTAL PLUG-IN	SOLDER/PLUG-IN
DIMENSIONS (L X W X H)	L W H 1.42 x .85 x 1.10	L W H 1.20 x .687 x .97 to 1.5	L W H 2.25 x 1.37 x 1.37	L W H 1.42 x .85 x 1.10	L W H 1.90 x 1.53 x 1.40
FEATURES	SEE THRU PLASTIC COVER. 1, 3, 5, 10 & 15 AMP RATINGS SOLDER/PLUG-IN OR P.C. MOUNTABLE. INDICATOR LAMPS & PUSH BUTTON	SEE THRU PLASTIC COVER. PLUG-IN OR PC BOARD MOUNTABLE. CROSS BAR OR BIFURCATED CONTACTS SENSITIVE COILS UP TO 8 POLES.	10 AMP 8 OR 11 PIN OCTAL PLUG-IN. INTERCHANGEABLE WITH OTHER GENERAL PURPOSE RELAYS OF THIS STYLE.	HERMETICALLY SEALED STEEL & PAINTED CASE. 8 OR 11 PIN OCTAL PLUG IN STYLE.	SQUARE BASE WITH SEE THRU PLASTIC COVER. OR FLANGE MOUNT COVER. 3/16" QC, SOLDER/PLUG-IN TERMINALS. OR PC STYLE TERMINALS. RATING TO 600V. VDE STYLES AVAILABLE.
CONTACT DATA	SPDT, DPDT, 4PDT	SPDT TO 8PDT	1, 2 & 3PDT	DPDT, 3PDT	SPDT, DPDT, 3PDT
General Ratings:	1 AMP, 4PDT 3 & 5 AMP, 4PDT 10 AMP, DPDT 15 AMP, SPDT @ 240VAC/28VDC	3 to 5AMPS @ 240VAC/28VDC	1 & 2 Pole, 12AMPS 3PDT, 10 AMPS @ 120/240VAC, 28VDC	10AMPS @ 120/240VAC/28VDC	SPDT, 13AMPS DPDT, 12 AMPS 3PDT, 11AMPS @120/240AC/28DC
Material:	Silver, Gold Flash, Silver Cadmium Oxide	Silver Gold Overlay	Silver Cadmium Oxide Gold Flashed	Silver Cadmium Oxide	Silver Cadmium Oxide Gold Flashed
COIL DATA	AC - Voltage: 6, 12, 24, 120, 240 AC DC - Voltage 6, 12, 24, 48, 110 VDC VA, : (VAC) 1.2VA Watts, : (VDC) 0.9 Watts	120VAC 5, 12, 24, 48, 115 VDC 2.5VA 0.5 to 1.5 Watts	24, 120 or 240VAC 12, 24VDC 2.75VA 1.2 Watts	120, 240 VAC 12, 24 VDC 3VA 1.5 Watts	24, 120, 240 VAC 12, 24VDC 2.75VA 1.2 Watts
GENERAL DATA	Ambient Temp. Oper. -40°C to + 70°C Ambient Temp. Oper.. Operate Time Max.: 25 Milliseconds Release Time Max.: 25 Milliseconds Life @ No Load 50 Million Operations Rated Load 200,000 Operations	-55°C to + 70°C 12 to 18 Milliseconds 8 Milliseconds 10 Million Operations 100,000 Operations	AC -10°C to + 50°C DC -10°C to + 60°C 25 Milliseconds 20 Milliseconds 10 Million Operations 100,000 Operations	-10°C to +50°C (AC) -10°C to +60°C (DC) 25 Milliseconds 20 Milliseconds 5 Million Operations 100,000 Operations	-30°C to + 50°C (AC) -30°C to + 65°C (DC) 15 Milliseconds 10 Milliseconds 10 Million Operations 100,000 Operations
INSULATION CHARACTERISTICS	Dielectric Withstand ing Voltage: 1500 V rms Insulation Resistance: 100 @ 500V	1500 V rms 1000 @ 500V	1500 V rms 1000 @ 500V	1500 V rms 100 @ 500V	2000 V rms 1000 @ 500V
OPTIONS	Sockets Available	.Other contact arrangements, sensitive coils, and Epoxy sealed available. Sockets Available.	Indicator Lamp, Manual Actuator, Blowout magnets for DC switching. Sockets Available	Special Wiring & Coil voltages. Sockets Available	Indicator Lamp, Manual Actuator, Tungsten contacts, Coil suppression, Magnetic Blowout. Sockets Available.
APPROVALS	 	 			 

MAGNECRAFT/STRUTHERS-DUNN 700 ORANGE STREET DARLINGTON, SC 29532-3739 - PHONE: 843/393-5778- FAX: 843/393-4123

# Magnecraft & Struthers-Dunn

**FAX ON DEMAND 1-800-891-2957      DIAL DOCUMENT 100**

<b>284</b>	<b>389</b>	<b>21</b>	<b>219</b>	<b>B255</b>	<b>199</b>
					
<b>PLUG-IN</b>	<b>SOLDER/Q.C.TERMINAL</b>	<b>PLUG-IN</b>	<b>PLUG-IN</b>	<b>PLUG-IN</b>	<b>PANEL MOUNT</b>
<b>L W H</b> .750 x .250 x .260	<b>L W H</b> 1.90 * x 1.53 x 1.40	<b>L W H</b> 2.84 x 1.85 x 2.47	<b>L W H</b> 3.06 x 1.46 x 3.40	<b>L W H</b> 4.56 x 1.46 x 2.62	<b>L W H</b> 3.12 x 3.62 x 2.75
RECTANGULAR BASE, SEE THRU PLASTIC COVER, 4PDT PLUG-IN. 0.187 (3/16") Q.C. TERMINALS FOR SOLDER/PLUG-IN OR QUICK CONNECTORS.	SQUARE BASE WITH SEE THRU PLASTIC COVER OR FLANGED COVER.. 1/4" QC, SOLDER TERMINALS. RATINGS TO 600V.  * Length does not include flange length.	SEE THRU PLASTIC COVER. SWITCHES TUNGSTEN LOADS UP TO 2400 WATT. MEETS NEMA STD. TS 2-1992, APPROVED BY D.O.T.	10 AMP MULTIPOLE TO 4 FORM "C" OR 6 FORM "A". PLUG-IN DESIGN WITH LOCKING CLIP FOR SOCKET. ENCAPSULATED COIL.	SEE THRU PLASTIC COVER. 2 COIL MECHANICAL LATCH. CONTINUOUS DUTY COIL. BOTH COILS MAY BE ENERGIZED SIMULTANEOUSLY WITH NO DAMAGE.	OPEN STYLE POWER RELAY. LOAD SWITCHING UP TO 50 AMPS. 6 & 8-32 SCREWS FOR ATTACHING WIRES. CLASS "B" INSULATION SYSTEM.
4PDT	SPDT, DPDT 3PDT SPST-DM, SPDT-DB-DM	DPDT	UP TO 4PDT OR 6PST	DPDT, 3PDT up to 4PST-NO or NC	SPDT, DPDT, 3PDT, SPST-NO OR NC(DM & DB)
10 AMPS @ 120/240VAC/ 28VDC	25 AMPS, 1, 2, 20 AMPS, 3PDT 30 AMPS, DM, DB 120/240AC/28DC	30AMPS @ 120/240VAC/28VDC 2.4 KW Tung. 120VAC	30AMPS @ 120/240VAC/28VDC	10 AMP @ 120/240VAC/28VDC	30 AMPS, 50 AMPS with Box Connectors @ 120/240 VAC/28VDC
Silver Cadmium Oxide Gold Flashed	Silver Cadmium Oxide Gold Flashed	Silver Alloy	Silver Cadmium Oxide Gold Diffused	Silver Cadmium Oxide Gold Diffused	Silver Cadmium Oxide Gold Flashed
6 to 240 VAC 6 to 125 VDC 3,4VAVA 1.2W(1.9W @ 125DC)	24, 120,240 VAC 12, 24 VDC 3.5 VA 1.5 Watts	120VAC N/A 4.0 to 8.0VA -	6 to 240 VAC 6 to 125 VDC(250V 5 VA with series resistor) 1.8W (2.5W @ 125DC)	6 to 240 VAC 6 to 125 VDC (250V with series resistor) 5VA Oper. 3VA Reset 1.8VA Oper. 1.4VA Reset	6, 12, 24, 120, 240 VAC 6, 12, 24, 110 VDC 10VA 2.0 Watts
AC -10°C to + 50°C DC -10°C to +70°C 15 Milliseconds 10 Milliseconds	-30°C to + 50°C (AC) -30°C to + 65°C (DC) 20 Milliseconds 20 Milliseconds	-40°C to +85°C 35 Milliseconds 35 Milliseconds	-10°C to + 60°C 25 Milliseconds 20 Milliseconds	-10°C to +60°C 25 Millisecond 20 Millisecond	AC -30°C to + 50°C DC -30°C to + 60°C 35 Milliseconds 30 Milliseconds
10 Million Operations 100,000 Operations	100 Million Operations 100,000 Operations	5 Million Operations 100,000 Operations	10 Million Operations 100,000 Operations	10 Million Operations 100,000 Operations	5 Million Operations 100,000 Operations
1500 V rms 1000 @ 500V	2000 V rms 1000 @ 500V	1500 V rms 100 @ 500V	1500 V rms 1000 @ 500V	1500 V rms 100 @ 500V	2200 V rms 100 @ 500V
Indicator Lamp Manual Actuator PC Terminals Gold diffused contacts Sockets Available	Plain cover with P.C. terminals.	Other coil voltages available on special order. Consult Factory Sockets Available.	Indicator Lamp Manual Actuator Bifurcated Contacts Coil suppression Magnetic Blowout Nuclear Qualified Sockets Available	Indicator Lamp Manual Actuator Coil suppression Magnetic Blowout Fine Silver Gold Diffused bifurcated contacts. Sockets Available	10 AMP Snap switches Other coil voltages
					

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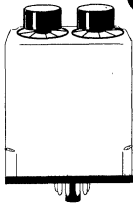

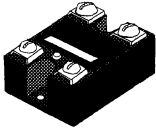
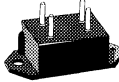
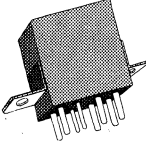
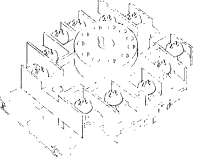





VISIT OUR WEB SITE AT [www.magnecraft.com](http://www.magnecraft.com)

RELAY SERIES	275	MDR	101, 102, 103	211 TDR	388 TDR
<b>STYLE</b>	<b>PANEL MOUNT</b>	<b>PANEL MOUNT</b>	<b>PANEL MOUNT</b>	<b>OCTAL PLUG-IN</b>	<b>FLANGE or PLUG-IN</b>
<b>DIMENSIONS</b> (L X W X H)	<b>L W H</b> 2.87 x .250 x .260	<b>L W H</b> 5.06 x 3.50 x 2.55	<b>L W H</b> 4.25 x 2.65 x 3.00	<b>L W H</b> 2.93 x 1.75 x .784	<b>L W H</b> 1.90 x 1.53 x 1.40
<b>FEATURES</b>	TWO COIL REVERSING CONTACTOR WITH MECHANICAL INTERLOCK. 6 PDT-DM-DB CONTACTS WITH UP TO 4 AUXILIARY MICRO SWITCHES. ENCAPSULATED COILS.	MERCURY DISPLACEMENT RELAY HAS RATINGS FROM 30 TO 100 AMPS. CONTACT TUBES ARE HERMETICALLY SEALED IN STEEL TUBES.  The size dimension above is for M60. M100 is slightly larger all others smaller.	HEAVY DUTY DC SOLENOID STYLE CONTACTOR. SWITCHING FROM 50 TO 200 AMPS. ENCLOSED CONTACTS. PANEL MOUNT BRACKET.	WHITE PLASTIC COVER. ±0.1 REPEATABILITY ADJUSTABLE TIMING. CHOICE OF STD. 211 OR PROGRAMMABLE 211 WITH 4 PROGRAM FUNCTIONS & 62 PROG. TIMING RANGES.	WHITE PLASTIC COVER. ±0.1 REPEATABILITY EXTERNAL ADJUSTABLE TIMING OR KNOB. PLUG-IN OR FLANGE COVER. SQUARE BASE WITH 3/16" SPADE TERMINALS
<b>CONTACT DATA</b> Contact Form:	6PDT-NO-NC-(DM-DB)	SPST-NO or NC	2 DM,NO &/or 1 NC 1 Form D, 1 DB-NC	DPDT	DPDT
General Ratings:	15 AMPS @120 VAC 10 AMPS @ 240 VAC 15 AMPS @ 30 VDC 5 AMPS @ 600 VAC	30 to 100AMPS @ 120/240/480VAC/28VDC	Up to 200 AMPS @ 120/240 VAC	10AMPS @ 120/240 VAC/28 VDC	12AMPS @ 120/240VAC/28VDC
Material:	Silver Cadmium Oxide	Mercury	Silver Cadmium Oxide	Silver Cadmium Oxide	Silver Cadmium Oxide
<b>COIL DATA</b> AC - Voltage: DC - Voltage VA, : (VAC) Watts, : (VDC)	24 to 600 VAC 12 to 120 VDC 16.7VA 4.5 Watts	120, 240 VAC 24 VDC 7 to 28 VA 9 Watts	Special Order 12, 28, 48 VDC - 10 to 14 Watts	120 VAC 24 VDC - -	120 VAC 24VDC - -
<b>GENERAL DATA</b> Ambient Temp. Oper. Ambient Temp. Stor. Operate Time Max.: Release Time Max.: <b>Life @</b> No Load Rated Load	AC -45°C to + 55°C DC -45°C to +70°C 50 Milliseconds 30Milliseconds  20 Million Operations 200,000 Operations	-35°C to +60°C 50 Milliseconds 80 Milliseconds  5 Million Operations 100,000 Operations	-45°C to + 65°C 60 Milliseconds 30 Milliseconds  500,000 Operations 100,000 Operations	-30°C to + 55°C -50°C to + 85°C .1-1 Sec. To 120 Minutes .1-1 Sec. To 120 Minutes  100 Million Operations 500,000 Operations	-30°C to + 55°C -55°C to + 85°C 0.1 to 180 Seconds 0.1 to 180 Seconds  10 Million Operations 100,000 Operations
<b>INSULATION CHARACTERISTICS</b> Dielectric Withstand ing Voltage: Insulation Resistance: (Measured in Megohms)	2500 V rms 100 @ 500V	2650 V rms 500 @ 500V	1500 V rms 1000 @ 500V	1500 V rms -	1500V rms -
<b>OPTIONS</b>	Up to 4 auxillary contact snap switches. Rectified Coi.l 30A contacts.	Combinations of NO & NC up to 3 poles.	Non standard DC coils Non standard contact arrangements. AC coil Voltage Consult Factory .	Other Voltages available on special order. Fixed timers Available Socket Available UL LISTED WITH SOCKET	Other Voltages available on special order. Fixed timers Available Socket Available
<b>APPROVALS</b>					

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FAX ON DEMAND 1-800-891-2957 DIAL DOCUMENT 100

222 TDR 	235 SENSOR 	6 SSR 	226 	FCA & FCB 	SOCKETS 
OCTAL PLUG-IN L W H 2.93 x 1.75 x 2.37	PLUG-IN L W H .750 x 1.53 x 1.40	NEW L.E.D. "ON" LAMP INDICATOR PANEL MOUNT L W H 1.87 x 1.75 x 0.87	SSR PANEL MOUNT L W H 1.50 x .670 x .600	MIL-SPEC SOLDER/PLUG-IN L W H 1.01 x 1.02 x 1.02	SOCKETS SOLDER/ PLUG-IN
REPEAT CYCLE TIMER WITH ADJUSTABLE ON TIME & OFF TIME. WHITE PLASTIC COVER. DUAL ON TIME AND OFF TIME KNOBS ± 0.1 REPEATABILITY	ADJUSTABLE CURRENT SENSOR. WHITE PLASTIC COVER. WITH KNOB ADJUSTMENT. 3/16" PLUG-IN OR 1/4" Q.C. TERMINALS FOR SOLDER OR QUICK CONNECTS.	SOLID STATE RELAY. INPUT VAC OR VDC OUTPUT CURRENT RANGES FROM 2 AMPS TO 75 AMPS. AC & DC OUTPUTS HIGH TRANSIENT CAPABILITY. SCREW TERMINALS TRIAC OR SCR OUTPUT	SOLID STATE RELAY INPUT 5 OR 12 VDC. OUTPUT CURRENT UP TO 7 AMPS. PC OR PUSH ON CONNECTOR VERSIONS COMPARABLE WITH TTL GATES. MOUNTS ON TO-3 TRANSISTOR HEAT SINKS FOR ADDED CURRENT RANGE.	HERMETICALLY SEALED, ALL WELDED CONSTRUCTION BALANCED FORCE PERMANENT MAGNET DRIVE CONTACTS RATED LOW LEVEL TO 25 AMPS COILS TO 50/60 & 400 HZ	WIDE CHOICE OF SOCKET STYLES FROM OCTAL TO SQUARE BASE SOCKET DESIGNS RANGE FROM CHASSIS, P.C., PANEL, DIN RAIL MOUNT AND SCREW TERMINALS. FINGER SAFE FEATURES AVAILABLE ON SOME MODELS.
DPDT	SPDT	SPST-N.O.	SPST-N.O.	SPDT TO 6PDT	1-8PDT
10AMPS @ 120/240 VAC/28 VDC	10AMPS @ 120VAC 6 AMPS @ 28 VDC	2 75 AMPS @ 140/280VAC	7 AMPS @ 260/380VAC	5 to 25 AMPS @ 120/200VAC 28 VDC	UP TO 20 AMPS @ 300 VOLTS
Silver Cadmium Oxide	Silver Cadmium Oxide	Triac/SCR or mosfet.	Triac	Silver Cadmium Oxide with Gold plating	
120 VAC Special Order VDC	120 VAC Not Available 1.7VA	120, 240VAC 3 to 32VDC 50 MA 50 MA	120/240 VAC 5, 12 VDC 13 to 15 MA	115VAC, 50/60 & 400Hz, 28 VDC	300VAC, 50/60
-30°C to + 55°C 0.1 to 30 Minutes 0.1 to 30 Minutes 50 Million Operations 500,000 Operations	-40°C to + 85°C 1.5 to 15 AMPS Sensing Range 10 Million Operations 100,000 Operations	-30°C to + 80°C Zero Voltage Switching	-40°C to + 65°C Zero Voltage Switching	-65°C to +125°C 4 to 10 Millisecond 1.5 - 7 Millisecond 50 Million Operations 100,000 Operations	
1500 V rms	2500 V rms	2500 V rms	2500 V rms	1000 V rms 100 @ 500V	
Special timing ranges and DC operated available on special order. Octal Sockets available	Custom Current ranges available on special order. Square Base Sockets available	Spade terminal kit. Heat sink. Finger Safe covers available			
				QPL APPROVED Meets MIL-R-83536	

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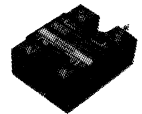
# MASTER ELECTRONIC CONTROLS

P.O. Box 25905 • Los Angeles, California 90025-0662 USA

Phone: (310) 452-1336 FAX: (310) 392-9585 Telex: 182041 MASTER SNM

- GENERAL PURPOSE RELAYS
- POWER RELAYS
- SOLID STATE RELAYS
- TIME DELAY RELAYS
- SOLID STATE TIMERS
- INPUT/OUTPUT MODULES
- SOCKETS
- SOLID STATE SWITCHMASTER®

## SOLID STATE RELAYS



### SS SERIES

SSA — SCR's back to back with A.C. control.  
SSD — SCR's back to back with D.C. control.

### ST SERIES:

STA — TRIAC with A.C. control.  
STD — TRIAC with D.C. control.

### SPECIFICATIONS

### ORDERING INFORMATION

1. Current Rating: 8 to 90 Amps.
2. Minimum load current: 50 ma.
3. Temperature Range:
  - a. Operating: -30°C to +80°C
  - b. Storage: -28°C to +100°C
4. Duty: Continuous
5. Contacts: 1 Form A (SPNO)
6. Input control: A.C. Models
  - a. Control voltage range: 90 — 280 VAC
  - b. Must operate voltage: 90 VAC Max.
  - c. Must release voltage: 10 VAC Min.
  - d. Input impedance: 40,000 OHMS Min.
  - e. Input current: 2mA max @ 120 VAC
7. Input control: D.C. Models
  - a. Control voltage range: 3-32 VDC
  - b. Must operate voltage: 3 VDC Max.
  - c. Must release voltage: 1 VDC Min.
  - d. Input impedance: 1,500 OHMS Min.
  - e. Input current: 4mA max @ 5 VDC
8. Standard: Zero voltage turn on.
9. UL listed and certified.

### SCR OUTPUT - SS SERIES

PART NUMBER		Line V ac (47-63 Hz)	Max. Load Current, Amps (RMS)	One-Cycle Surge, Amps (PK)
AC Input	DC Input			
SSA1210	SSD1210	24-140	10	120
SSA1225	SSD1225	24-140	25	250
SSA1240	SSD1240	24-140	40	625
SSA2410	SSD2410	48-280	10	120
SSA2425	SSD2425	48-280	25	250
SSA2440	SSD2440	48-280	40	625
SSA2450	SSD2450	48-280	50	625
SSA2475	SSD2475	48-280	75	1000
SSA4808	SSD4808	80-530	8	72
SSA4812	SSD4812	80-530	12	140
SSA4825	SSD4825	80-530	25	250
SSA4840	SSD4840	80-530	40	400
SSA4875	SSD4875	80-530	75	1000
SSA4890	SSD4890	80-530	90	1200

### TRIAC OUTPUT - ST SERIES

Part Number	Line V ac (47-63 Hz)	Max. Load Current, Amps (RMS)	One-Cycle Surge, Amps (PK)
STA1210	24-140	10	100
STA1225	24-140	25	250
STA2410	48-280	10	100
STA2425	48-280	25	250
STA4825	80-530	25	250



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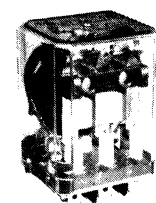















# MASTER ELECTRONIC CONTROLS

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## GENERAL PURPOSE RELAYS

					
SERIES	GV	GQ	GQ-F	GB	GF
<b>Features</b>	<ul style="list-style-type: none"> <li>• Exceptionally reliable power relay</li> <li>• Octal type plug-in terminations</li> <li>• AC &amp; DC coils</li> <li>• Optional indicator lamp</li> <li>•  </li> </ul>	<ul style="list-style-type: none"> <li>• Power relay for use in control panels</li> <li>• Optional indicator lamp and push-to-test button</li> <li>• High dielectric strength (2000VAC)</li> <li>•  </li> </ul>	<ul style="list-style-type: none"> <li>• GQ package with 15 amp rating</li> <li>• Plain or bracket mount dust cover</li> <li>• Ideally suited for many diverse applications</li> <li>•  </li> </ul>	<ul style="list-style-type: none"> <li>• Enclosed relay with magnetic blow outs</li> <li>• Switches DC currents</li> <li>• Optional flange-top case for panel mounting</li> <li>•  </li> </ul>	<ul style="list-style-type: none"> <li>• Magnetic latching relay</li> <li>• Single or dual coil input</li> <li>• Low power requirement</li> <li>• Good memory stability</li> <li>•  </li> </ul>
<b>Contact Arrangement</b>	SPDT DPDT TPDT	SPDT DPDT TPDT	1A, 1B, 1C, 2A, 2B, 2C, 3A, 3B, 3C, 1X, 1Y, 1Z	1X, 2A, 2C	SPDT DPDT
<b>Contact Rating</b>	10A @ 28 VDC or 230 VAC	10A @ 28 VDC or 240 VAC	15A @ 277 VAC 1/8 HP @ 120 VAC 1/2 HP @ 250-600 VAC 3A @ 600 VAC	(1X) 10A @ 150 VDC (2A) 5A @ 150 VDC (2C) 3A @ 150 VDC	10A @ 28 VDC or 240 VAC
<b>Contact Material</b>	Ag Cd O	Ag Cd O	Ag Cd O	Ag Cd O	Ag Cd O
<b>Coil Voltage</b>	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	5-110 VDC 6-277 VAC	6-110 VDC 6-277 VAC	6-110 VDC 6-240 VAC
<b>Nominal Coil Power</b>	(DC) 1.5W (AC) 2.3VA	(DC) 1.2-1.8W (AC) 2.0-2.75VA	(DC) 1.2W (AC) 2.74 VA	(DC) 1.2W (AC) 2.0VA	(DC single coil) 1.2W (DC dual coil) 2.4W
<b>Mechanical Life</b>	5,000,000 operations min.	10,000,000 operations	10,000,000 operations	10,000,000 operations	10,000,000 operations
<b>Approximate Dimensions (inches)</b>	2.07"Hx1.36"L x1.36"W	1.91"Hx1.53"L x1.41"W	1.91"Hx1.53"L x1.41"W	1.91"Hx1.53"L x1.41"W	2.16"Hx1.53"L x1.41"W
<b>Mounting</b>	Socket mount	Socket mount Panel mount P.C. mount	Socket mount Panel mount P.C. mount	Socket mount Panel mount P.C. mount	Socket mount Panel mount
<b>Sockets</b>	Screw terminal P.C. terminal	Screw terminal Solder terminal P.C. terminal Quick connect	Screw terminal Solder terminal P.C. terminal Quick connect	Screw terminal Solder terminal P.C. terminal Quick connect	Screw terminal Solder terminal P.C. terminal Quick connect



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GENERAL PURPOSE RELAYS				POWER RELAYS																													
IMMEDIATE DELIVERY																																	
	SERIES	GL	GM	GMH	GT	GH	GW																										
Features	<ul style="list-style-type: none"> <li>Compact general purpose relay</li> <li>Wide range of applications</li> <li>Optional indicator lamp and push-to-test button</li> <li>UL</li> </ul>	<ul style="list-style-type: none"> <li>Versatile relay</li> <li>Optional indicator lamp and push-to-test button</li> <li>Ideal for power and sequence control applications</li> <li>UL</li> </ul>	<ul style="list-style-type: none"> <li>Hermetically sealed steel case</li> <li>Excellent for adverse environments</li> <li>UL</li> </ul>	<ul style="list-style-type: none"> <li>20A and 30A switching</li> <li>Bracket mount package</li> <li>3,750 VRMS coil-to-contact breakdown</li> <li>UL</li> </ul>	<ul style="list-style-type: none"> <li>30 amp contact rating</li> <li>High inrush capacity</li> <li>Optional magnetic blowouts and auxiliary switch</li> <li>50A unit available</li> <li>UL</li> </ul>	<ul style="list-style-type: none"> <li>Mercury displacement relay</li> <li>35A and 60A switching</li> <li>Hermetically sealed</li> <li>Ideal for adverse environments</li> <li>UL</li> </ul>																											
Contact Arrangement	DPDT TPDT 4PDT	DPDT TPDT 4PDT	2C, 4C, 5C	SPDT DPDT	1A, 1B, 1C, 2A, 2B, 2C, 1X, 1Y	1A, 2A, 3A 1B, 2B, 3B																											
Contact Rating	10A @ 24 VDC or 110 VAC	<ul style="list-style-type: none"> <li>DPDT, TPDT 5A @ 24 VDC or 220 VAC</li> <li>4PDT 3A @ 24 VDC or 220 VAC</li> </ul>	Up to 5A @ 120 VAC/28 VDC	<ul style="list-style-type: none"> <li>SPDT 30A @ 120/240 VAC</li> <li>25A @ 28 VDC</li> <li>DPDT 20A @ 120/240 VAC or 28 VDC</li> </ul>	30 Amps @ 300 VAC	<ul style="list-style-type: none"> <li>35A model 35A @ 480 VAC</li> <li>60A model 60A @ 480 VAC</li> </ul>																											
Contact Material	Ag Cd O	<ul style="list-style-type: none"> <li>DPDT, TPDT Ag</li> <li>4PDT Ag (Au Flash)</li> </ul>	Ag or Ag Cd O	Ag Cd O	Ag or Ag Cd O	Liquid Mercury																											
Coil Voltage	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-120 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-220 VDC 6-480 VAC	5-250 VDC 6-480 VAC																											
Nominal Coil Power	<ul style="list-style-type: none"> <li>DPDT (DC) 0.9W (AC) 1.2VA</li> <li>TPDT, 4PDT (DC) 1.4W (AC) 1.6-2.5VA</li> </ul>	(DC) 0.9W (AC) 1.2VA	(DC) 0.90W (AC) 1.20VA	(DC) 1.2W (AC) 2.7VA	(DC) 2.0W (AC) 10.0VA	<table border="1"> <thead> <tr> <th></th> <th>N.O.</th> <th>N.C.</th> </tr> </thead> <tbody> <tr> <td>AC (VA)</td> <td></td> <td></td> </tr> <tr> <td>1 Pole</td> <td>8.0</td> <td>13.0</td> </tr> <tr> <td>2 Pole</td> <td>18.6</td> <td>20.5</td> </tr> <tr> <td>3 Pole</td> <td>33.0</td> <td>33.0</td> </tr> <tr> <td>DC (W)</td> <td></td> <td></td> </tr> <tr> <td>1 Pole</td> <td>6.5</td> <td>8.0</td> </tr> <tr> <td>2 Pole</td> <td>7.5</td> <td>10.5</td> </tr> <tr> <td>3 Pole</td> <td>12.0</td> <td>12.0</td> </tr> </tbody> </table>		N.O.	N.C.	AC (VA)			1 Pole	8.0	13.0	2 Pole	18.6	20.5	3 Pole	33.0	33.0	DC (W)			1 Pole	6.5	8.0	2 Pole	7.5	10.5	3 Pole	12.0	12.0
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3 Pole	12.0	12.0																															
Mechanical Life	AC-50,000,000 operations DC-100,000,000 operations	AC-50,000,000 operations DC-100,000,000 operations	10,000,000 operations	10,000,000 operations	3,000,000 operations	3,000,000 operations																											
Approximate Dimensions (inches)	1.40"H x 1.10"L x 0.85"W (DPDT Unit)	1.42"H x 1.10"L x 0.85"W	1.42"H x 1.10"L x 0.85"W	1.97"H x 1.53"L x 1.41"W	2.3"H x 3.125"L x 2.5"W (DPDT Unit)	5.06"H x 3.365"L x 3.125"W (TPDT Unit)																											
Mounting	Socket mount Panel mount P.C. mount	Socket mount Panel mount P.C. mount	Socket mount Panel mount P.C. mount	Panel mount Track mount	Screws	Box Collar																											
Sockets	Screw terminal Solder terminal P.C. terminal Quick connect	Screw terminal Solder terminal P.C. terminal Quick connect	Screw terminals Solder terminals P.C. terminals	—	—	—																											



## MASTER ELECTRONIC CONTROLS

P.O. Box 25905 • Los Angeles, California 90025-0662 USA






Phone: (310) 452-1336 FAX: (310) 392-9585 Telex: 182041 MASTER SNM



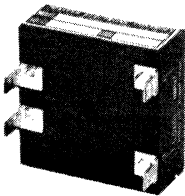
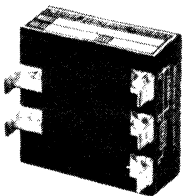
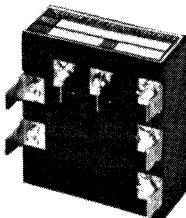
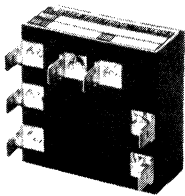
# MASTER ELECTRONIC CONTROLS

PHONE: (310) 452-1336

## TIME DELAY RELAYS

<b>IMMEDIATE DELIVERY</b>					
	<b>SERIES</b>	<b>DM</b>	<b>DI</b>	<b>DB</b>	<b>DS</b>
<b>Features</b>	<ul style="list-style-type: none"> <li>Reliable and accurate</li> <li>Indicator lamp available in all voltages</li> </ul>	<ul style="list-style-type: none"> <li>Precise timing cycles</li> <li>Indicator lamp available in all voltages</li> </ul>	<ul style="list-style-type: none"> <li>Wide range of industrial applications</li> <li>Indicator lamp available in all voltages</li> </ul>	<ul style="list-style-type: none"> <li>Reliable and accurate</li> <li>Indicator lamp available in all voltages</li> </ul>	<ul style="list-style-type: none"> <li>Independent on and off delays</li> <li>Indicator lamp available in all voltages</li> </ul>
<b>Mode of Operation</b>	Delay on make	Delay on interval	Delay on break	Delay on single-shot	Recycling timer
<b>Contact Arrangement</b>	DPDT TPDT	DPDT TPDT	SPDT DPDT	SPDT DPDT	DPDT TPDT
<b>Contact Rating</b>	10A @ 115 VAC	10A @ 115 VAC	10A @ 115 VAC	10A @ 115 VAC	10A @ 115 VAC
<b>Input Voltage</b>	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC
<b>Delay Time (in seconds)</b>	0.1-3600	0.1-3600	0.1-3600	0.1-3600	0.1-3600 on 0.1-3600 off
<b>Type of Control</b>	Fixed Knob Remote	Fixed Knob Remote	Fixed Knob Remote	Fixed Knob Remote	Knob Remote
<b>Maximum Repeatability</b>	±1%	±1%	±1%	±1%	±1%
<b>Mechanical Life</b>	10,000,000 Operations	10,000,000 Operations	10,000,000 Operations	10,000,000 Operations	10,000,000 Operations
<b>Approximate Dimensions (in.)</b>	2.75"H x 2.00"L x 1.56"W	2.75"H x 2.00"L x 1.56"W	2.75"H x 2.00"L x 1.56"W	2.75"H x 2.00"L x 1.56"W	2.75"H x 2.00"L x 1.56"W

## SOLID STATE TIMERS

<b>IMMEDIATE DELIVERY</b>				
	<b>SERIES</b>	<b>SDM</b>	<b>SDI</b>	<b>SDB</b>
<b>Features</b>	<ul style="list-style-type: none"> <li>Totally solid state output</li> <li>Fixed or remote adjustable delays</li> <li>Transient protected</li> <li>Completely encapsulated</li> <li>CSA, UL</li> </ul>	<ul style="list-style-type: none"> <li>Totally solid state output</li> <li>Fixed or remote adjustable delays</li> <li>Transient protected</li> <li>Completely encapsulated</li> <li>CSA, UL</li> </ul>	<ul style="list-style-type: none"> <li>Totally solid state output</li> <li>Fixed or remote adjustable delays</li> <li>Transient protected</li> <li>Completely encapsulated</li> <li>CSA, UL</li> </ul>	<ul style="list-style-type: none"> <li>Totally solid state output</li> <li>Fixed or remote adjustable delays</li> <li>Transient protected</li> <li>Completely encapsulated</li> <li>CSA, UL</li> </ul>
<b>Mode of Operation</b>	Delay on make	Delay on interval	Delay on break	Delay on single shot
<b>Output Type</b>	Solid state	Solid state	Solid state	Solid state
<b>Form</b>	Normally open	Closed during timing	Normally open	Normally open
<b>Rating: Steady State</b>	1 Amp	1 Amp	1 Amp	1 Amp
<b>Rating: Inrush</b>	10 Amps	10 Amps	10 Amps	10 Amps
<b>Input Voltage</b>	12, 24, 48, 120 VDC 24, 120, 230 VAC	12, 24 VDC 24, 120, 230 VAC	12, 24 VDC 24, 120, 230 VAC	12, 24 VDC 24, 120, 230 VAC
<b>Delay Time (in seconds)</b>	0.05-720	0.05-720	0.05-720	0.05-720
<b>Approximate Dimensions (in.)</b>	0.75"H x 2.0"L x 2.0"W	0.75"H x 2.0"L x 2.0"W	0.75"H x 2.0"L x 2.0"W	0.75"H x 2.0"L x 2.0"W
<b>Mounting</b>	Surface mount with #8 or #10 screw	Surface mount with #8 or #10 screw	Surface mount with #8 or #10 screw	Surface mount with #8 or #10 screw
<b>Termination</b>	.250" Male Quick connect terminals	.250" Male Quick connect terminals	.250" Male Quick connect terminals	.250" Male Quick connect terminals



# MASTER ELECTRONIC CONTROLS

P.O. Box 25905 • Los Angeles, California 90025-0662 USA

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# BRILL ELECTRONICS

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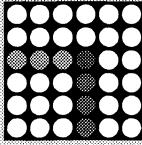


**Communications  
Instruments, Inc.**



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**MATRIX**  
SYSTEMS CORPORATION

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Calabasas, CA 91302

# Switching Systems

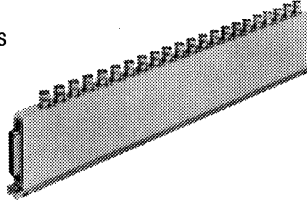
**We Specialize In Specials**

## Modular R.F. Digital and Video Switching Systems

Matrix Systems Programmable Relay Modules configure Matrices and Multiplexers and are housed in Model 11600 controller chassis.

### 70000 Series Coaxial Relay Modules

2 through 24 Positions  
DC-800MHz Scanners  
Dry or Mercury Reed Relays  
Self-terminating  
BNC, TNC, SMA connectors  
RS-232 & IEEE-488 Programmable



### 71000 Series R.F. Relay

72000 Series Self-terminating for Non-blocking H.F. & Video Matrices  
73000 Series for VHF, ECL & DS-3  
74000 Series for VHF & UHF  
75000 Series for High voltage  
76000 Series Self-terminating for Non-blocking H.F. & VHF Matrices  
77000 Series Mercury Wetted for High Current  
78000 Series Twinaxial for Balanced Audio, Kelvin & DS-1  
79000 Series Triaxial for 1553, T-1 & Low Leakage

700A00 Series Coaxial Relay Modules with internal R.F. Amplifier  
0.5-250MHz or internal Video Amplifier DC-200MHz for use in  
assembling Non-blocking Matrices



### Programmable:

#### R70000 Series Wide band Coaxial Relay Modules

2 through 10 Positions  
DC-1500MHz  
Dry contacts  
BNC, TNC, SMA connectors

Model 11919-24 Coaxial Solid State 8 x 24  
Non-blocking Matrix Module, DC-20MHz  
Configures Video Matrices up to 48 x 48  
in Model 11600 controller chassis.

#### Model 61057 Audio Relay Module

Four each 1 x 5 x 2 wire sections  
Dry or Mercury contacts  
Configures Audio Matrices up to 20 x 24

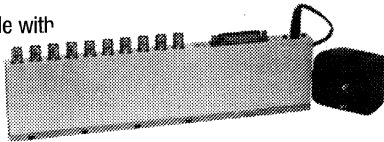
#### Model 61053A Coaxial/Audio Attenuator Module

DC-100MHz  
0-63.5dB Range, 0.5dB steps  
BNC connectors

## Switching Modules

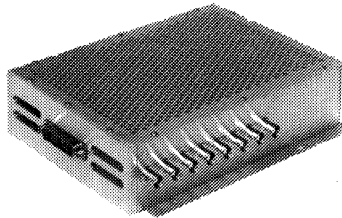
RS7000 Coaxial Relay Module with  
internal RS-232C Interfaces.

2 through 24 Positions  
DC-800MHz  
Dry or Mercury contacts  
Self-terminating  
BNC, TNC, SMA connectors



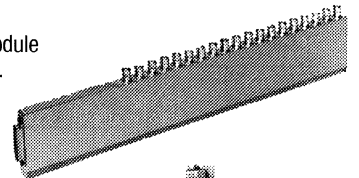
### Model B-4108 Matrix Module

8 x 8 Bi-directional  
DC-600MHz  
TTL Control  
BNC connectors



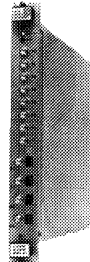
7000-TTL Coaxial Relay Module  
with internal TTL Interfaces.

2 through 24 Positions  
DC-800MHz  
Dry or Mercury contacts  
Self-terminating  
BNC, TNC, SMA connectors

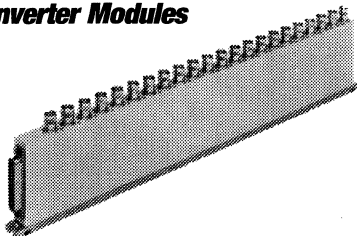


### Model 10081A VXI Matrix Module

4 x 8 Bi-directional  
DC-900MHz  
C Size  
SMA connectors



## Converter Modules



Model 12740-50-75  
Coaxial to Triaxial Converter  
9 converters in 1 module  
Unity, Gain  
Input impedance - 50 ohms  
Output impedance - 75 ohms  
DC-80MHz

Model 12741-75-50  
Triaxial to Coaxial Converter  
9 converters in 1 module  
Unity, Gain  
Input impedance - 75 ohms  
Output impedance - 50 ohms  
DC-80MHz

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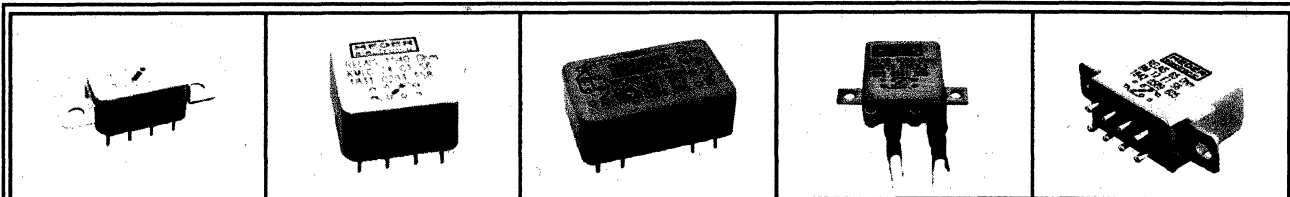


# CRYSTAL CAN RELAYS

**1 - 800 - 870 - 5385**

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For more information on Hermetically Sealed Crystal Can Relays not listed here call us 1-800-870-5385 or see our WEB PAGE: [www.meder.com](http://www.meder.com)



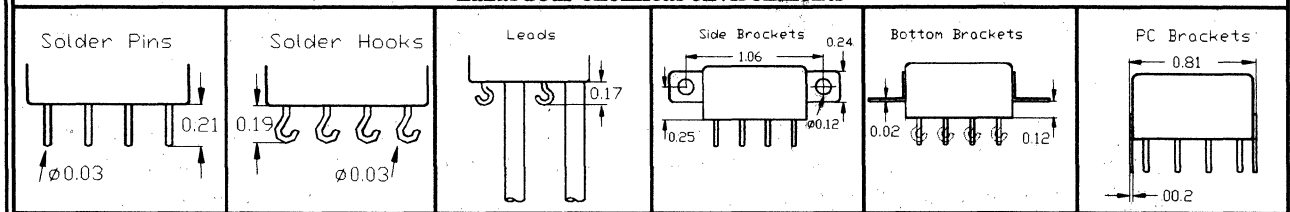
Special High Temperature coil with Teflon insulation.  
 Internal components are welded, prevents flux outgassing  
 Oxygen free internal atmosphere prevents contact contamination  
 Glass insulators improve isolation  
 Symmetrical design improves resistance to shock and vibration

Type	Contact		Coil Voltage	Terminal			Approval
	Form up to	Rating resistive		Solder Pin	Solder Hook	Lead	
SM	2C	2A/28VDC 0.3A/115VAC	6 to 32V	X	X		LN29882, MIL-R-5757, VG-95302
KMLC	2C	2A/28VDC 0.3A/115VAC	6 to 36V	X			MIL-R-5757, VG-95302
KM4L	4C	2A/28VDC 0.3A/115VAC	6 to 48V	X			MIL-R-5757, VG-95302
KMC	2C	2A/28VDC 0.3A/115VAC	6 to 48V	X	X		LN29882, MIL-R-5757, VG-95302
EM	2C	2A/28VDC 0.3A/115VAC	6 to 26V	X	X		LN29882, MIL-R-5757, VG-95302
KMLR	2C	5A/28VDC 1A/115VAC	6 to 48V	X			MIL-R-5757, VG-95302
KMR	2C	5A/28VDC 1A/115VAC	6 to 48V	X	X		LN29882, MIL-R-5757, VG-95302
EMR	2C	5A/28VDC 1A/115VAC	6 to 26V	X	X		LN29882, MIL-R-5757, VG-95302
BM	2C	10A/28VDC 4A/115VAC	6 to 28V	X	X		LN29882, MIL-R-5757, VG-95302

**HIGH FREQUENCY UP TO 1200 MHZ**

SMRF	2C RF	1A/28VDC 30W RF	6 to 32V	X			MIL-R-5757, VG-95302
EMRF...R3L3	1C 1C RF	2A/28VDC 50W RF	6 to 26V		X	X	MIL-R-5757, VG-95302
EMRF...R6	2C RF	2A/28VDC 50W RF	6 to 26V		X	X	MIL-R-5757, VG-95302

Applications requiring higher shock and vibration, military device, aviation and aerospace industry, hazardous chemical environments



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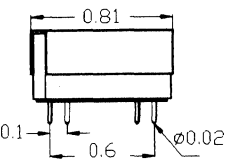

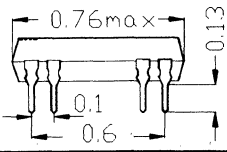

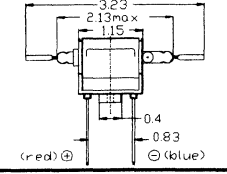
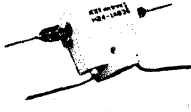
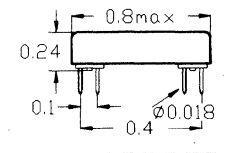

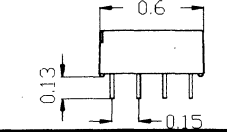

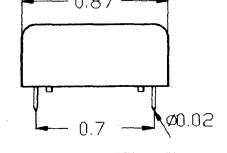

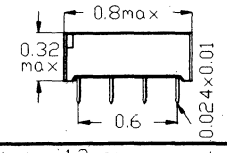

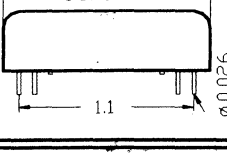

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## REED RELAYS

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USA and Canada

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Drawing Dimensions in Inch	Extra Features	Avail. Contact Forms up to	Available Coil	Application	Model
	Magnetic Shield avail. Up to 4.5kV Isolation avail. Standard 14 Pin Footprint	1A to 4A, 1C to 2C  Form A dry Up to 15W 500VDC HG 50W 1kVDC Form C dry 10W 100V	3 to 24 Volt Up to 10k Ohms 15 mA 4 Ohms To 18 Ohms Dual 4 Ohms	Telecom Modems General Purpose	 DIL-Relay
	Low Profile Standard I.C. Footprint 4.25 kV Isolation avail.	1A to 2A, 1B, 1C  Form A dry Up to 15W 500VDC HG 50W 1kVDC Form C dry 10W 100V	5 to 24 Volt  Up to 2k Ohms	Telecom Computer Alarm Test Equip.	 DIP-Relay
	Coil UL 94V-0 RF Switch avail. High IR Construction	1A, 1B  Up to 50W 15,000V	5 to 24 Volt	HV Testers 2 Way Radio	 H-Relay
	Magnetic Shield RF Screen Up to UHF Frequencies	1A, 1C  Form A dry Up to 15W 500VDC HG 50W 1kVDC Form C dry 10W 100V	5 Volt 12 Volt	Video + RF Switching	 LP-Relay
	Ultra small Magnetic Shield avail.	1 A  Up to 15W 200VDC	5 Volt 12 Volt	ATE Telecom Security Test Equip.	 MS-Relay
	Magnetic Shield avail. Small Size NEW : Plastic Case	1A to 2A, 1C  Up to 15W 500VDC HG 50W 1kVDC	3 to 24 Volt  15 mA 1 or 2 Coils	Alarm Telecom Computer Modems	 NP-Relay
	Small Size Magnetic Shield avail. Up to 4.25kV Isolation avail.	1A  Up to 15W 500 VDC	5 to 24 Volt  15 mA / 15 Ohm	Alarm Telecom Computer Test Equip.	 SIL-Relay
	Magnetic Shield avail. Very low Thermal EMF Bistable	1A to 5A, 1B to 2B, 1C  Form A dry Up to 15W 500VDC HG 50W 1kVDC Form C dry 10W 100V	5 to 24 Volt	Automatic Test Equip. General Purpose	 BE-Relay

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# National Controls Corporation

## Time Delay Relays & Cube Timers

Multi-Function Multi-Time Range Multi-Voltage (96M)	TMM-9999M-96M	KMM-9999M-96M	TMM-0999M Series			
	11 Pin Base, 10 Amp	KUP Base, 10 Amp	11 Pin Base, 10 Amp			
Delay on Make  <b>Logic Function Diagram:</b> Input Voltage: On, Off Relay Coil: On, Off Timing: [On]	AIM-0999 Series	TIK Series	KIK Series	ZI Series	QIT-34I Series	QIF Series
	8 Pin Base, 10 Amp	8 Pin Base, 10 Amp	KUP Base, 10 Amp	1/4" Spade, 10 Amp	1/4" Spade, 8Amp	1/4" Spade, 1 Amp
Interval  <b>Logic Function Diagram:</b> Input Voltage: On, Off Load: On, Off Timing: [On]	SIK Series	K4K Series	Z4 Series	QIT-34I Series	Q4F Series	
	8 Pin Base, 10 Amp	KUP Base, 10 Amp	1/4" Spade, 10 Amp	1/4" Spade, 8Amp	1/4" Spade, 1 Amp	
Delay on Break  <b>Logic Function Diagram:</b> Input Voltage: On, Off Start Switch: Closed, Open Load: On, Off Timing: [On]	T3M-0999M Series	T3K Series	K3K Series	Z3 Series	Q3T Series	Q3F Series
	11 Pin Base, 10 Amp	11 Pin Base, 10 Amp	KUP Base, 10 Amp	1/4" Spade, 10 Amp	1/4" Spade, 1 Amp	1/4" Spade, 1 Amp
Single Shot  <b>Logic Function Diagram:</b> Input Voltage: On, Off Start Switch: Closed, Open Timing: [On]	T2K Series	K2K Series	Q2T Series	Q2F Series		
	11 Pin Base, 10 Amp	KUP Base, 10 Amp	1/4" Spade, 1 Amp	1/4" Spade, 1 Amp		
Repeat Cycle  <b>Logic Function Diagram:</b> Input Voltage: On, Off Relay Coil: On, Off Timing: [On] Adj. 'On' Delay, [Off] Adj. 'Off' Delay	CKK Series	T7K Series	Z6 Series	Q6F Series	Q8F Series	
	8 Pin Base, 10 Amp	8 Pin Base, 10 Amp	1/4" Spade, 10 Amp	1/4" Spade, 1 Amp	1/4" Spade, 1 Amp	

## Liquid Level Sensors

Pump Down Logic	DLA Series	NS157	NS129	NS139	
	8 Pin Base, Dual Probe	1/4" Spade, Single Probe	Screw Term., Dual Probe	Screw Term., Dual Probe	
Pump Up Logic	DLB Series	05SLB Series	NS156	NS128	NS210
	8 Pin Base, Dual Probe	8 Pin Base, Single Probe	1/4" Spade, Single Probe	1/4" Spade, Dual Probe	1/4" Spade, Dual Probe

In addition to the products featured above, NCC offers:

- Temperature Controllers and Montiors
- Dust Collector Controls
- Solid State Relays and
- Voltage Monitors

NCC also provides a comprehensive custom control development program which is comprised of:

- Sales Support
- Engineering Support
- Manufacturing Support and
- Product Support

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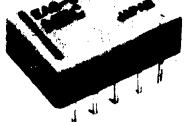
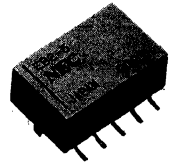
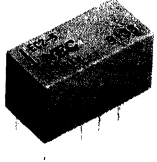
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# Miniature Relay— Signal

Type of relay	EA2	EB2	EC2
			
Features	<ul style="list-style-type: none"> <li>• low power consumption</li> <li>• low magnetic interference</li> <li>• 1500V FCC surge</li> <li>• 1000V AC FCC</li> <li>• compact, light weight</li> <li>• latching type available</li> </ul>	<ul style="list-style-type: none"> <li>• surface mount</li> <li>• low power consumption</li> <li>• low magnetic interference</li> <li>• 1500V FCC surge</li> <li>• 1000V AC FCC</li> <li>• compact, light weight</li> <li>• latching type available</li> </ul>	<ul style="list-style-type: none"> <li>• low power consumption</li> <li>• dual-inline leads (small mounting space)</li> <li>• 2500 V surge (2 x 10 μs*)</li> <li>• coil to contacts</li> <li>• latching type available</li> </ul>
Contact arrangement	2C		
Contact material (standard)	silver alloy with gold overlay		
Contact rating (resistive) (switching)	30W/62.5VA	30W/62.5VA	60W/125VA
3A			
2A			2.0A
1A	1.0A	1.0A	
Coil voltage	3, 4.5, 5, 6, 9, 12, 24 V. DC		
Nominal operating power	140mW (single coil latch type 100mW)		
Must operate voltage	75%		
Must release voltage	10%		
Operate time (typ.) (Excluding bounce)	2ms		
Release time (typ.) (Excluding bounce)	1ms		
Life (operations)	Electrical	2 x 10 <sup>5</sup> 30V. DC, 1A (resistive) 10 <sup>5</sup> 125V. AC, 0.5A (resistive)	
	Mechanical	10 <sup>8</sup>	
Break-down voltage	Between open contacts	1000V. AC	
	Between adjacent contacts	1000V. AC	
	Between contact and coil	1000V. AC	1500V. AC or 1000V. AC**
Surge withstand voltage	1500V FCC		1500V (FCC), 2500V*** (2 x 10 μs, coil to contact)
Safety standard	UL, CSA		
Option	latching type		
Height (mm)	5.4	7.5	9.8
Mounting space (mm)	9 x 14	9.3 x 14.3	7.5 x 15

\* 2 μs of rise time and 10 μs of decay time to half crest.

\*\* for double coil latch type


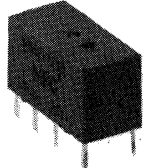

\*\*\* 1500V for double coil latch type

See NECEL's other products in Section 1500.

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## Miniature Relay— Signal

		EE2	MR62	MR62-Y
<b>Type of relay</b>				
<b>Features</b>		<ul style="list-style-type: none"> <li>• low power consumption</li> <li>• surface mount (reduced mounting space)</li> <li>• 2500V surge (2 x 10 μs*)</li> <li>• coil to contacts</li> <li>• latching type available</li> </ul>	<ul style="list-style-type: none"> <li>• DIP terminal</li> <li>• sealed package for flow soldering</li> <li>• stable contact resistance at high temperature</li> <li>• 1500V FCC surge</li> </ul>	<ul style="list-style-type: none"> <li>• DIP terminal</li> <li>• sealed package</li> <li>• low power consumption (400mW)</li> <li>• stable contact resistance at high temperature</li> <li>• 1500V FCC surge</li> </ul>
<b>Contact arrangement</b>		2C		
<b>Contact material (standard)</b>		silver alloy with gold overlay		
<b>Contact rating (resistive) (switching)</b>	3A	60W/125VA	60W/125VA	60W/125VA
	2A	2.0A	2.0A	2.0A
	1A			
<b>Coil voltage</b>		3, 4.5, 5, 6, 9, 12, 24 V. DC	5, 6, 9, 12, 24, 48 V. DC	
<b>Nominal operating power</b>		140mW (single coil latch type 100mW)	550mW	400mW
<b>Must operate voltage</b>		75%	62 to 72%	70%
<b>Must release voltage</b>		10%	5%	
<b>Operate time (typ.) (Excluding bounce)</b>		2ms	3ms	4ms
<b>Release time (typ.) (Excluding bounce)</b>		1ms	2ms	
<b>Life (operations)</b>	<b>Electrical</b>	2 x 10 <sup>5</sup> 30V. DC, 1A (resistive) 10 <sup>5</sup> 125V. AC, 0.5A (resistive)	10 <sup>6</sup> 24V. DC, 1A 3 x 10 <sup>6</sup> 24V. DC, 0.5A	10 <sup>7</sup> 24V. DC, 1A 3 x 10 <sup>6</sup> 24V. DC, 0.5A
	<b>Mechanical</b>	10 <sup>8</sup>	10 <sup>7</sup>	
<b>Break-down voltage</b>	Between open contacts	1000V. AC	500V. AC	
	Between adjacent contacts	1000V. AC		
	Between contact and coil	1500V. AC or 1000V. AC**	1000V. AC	
<b>Surge withstand voltage</b>		1500V (FCC), 2500V*** (2 x 10 μs, coil to contact)	1500V FCC #	
<b>Safety standard</b>		UL, CSA		
<b>Option</b>		latching type	—	
<b>Height (mm)</b>		11.5	11.4	
<b>Mounting space (mm)</b>		9.5 x 15	9.8 x 20.2	

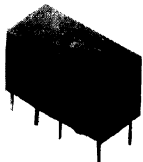
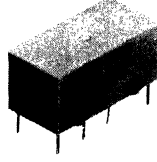
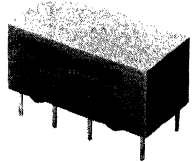
\* 2 μs of rise time and 10 μs of decay time to half crest. \*\*\* 1500V for double coil latch type #1500V FCC surge between coil and contacts and between adjacent contacts. \*\* for double coil latch type

See NECEL's other products in Section 1500.

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# Miniature Relay— Signal

		MR62-K	MR602	MR612
Type of relay				
Features		<ul style="list-style-type: none"> <li>• DIP terminal</li> <li>• sealed package for flow soldering</li> <li>• stable contact resistance at high temperature</li> <li>• 1500V FCC surge</li> </ul>	<ul style="list-style-type: none"> <li>• low power consumption</li> <li>• 1500V FCC surge</li> <li>• 1000V AC FCC breakdown voltage</li> <li>• latching type available</li> </ul>	<ul style="list-style-type: none"> <li>• low power consumption</li> <li>• 1500V FCC surge</li> <li>• 1000V AC FCC breakdown voltage</li> <li>• latching type available</li> </ul>
		Polarized Type		
Contact arrangement		2C	2C or 2D	
Contact material (standard)		silver alloy with gold overlay		
Contact rating (resistive) (switching)	3A	60W/125VA	60W/125VA	60W/125VA
	2A	2.0A	2.0A	2.0A
	1A			
Coil voltage		5, 6, 9, 12, 24, 48 V. DC	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48 V. DC	
Nominal operating power		400mW or 550mW	200mW (latching type-single wound coil 100mW)	400mW (latching type-single wound coil 200mW)
Must operate voltage		70% 48V...80%	70% (Form D type 80%)	70%
Must release voltage		5%	10%	
Operate time (typ.) (Excluding bounce)		3ms (KY type 4ms)	3.5ms	
Release time (typ.) (Excluding bounce)		2ms	1.5ms	2.0ms
Life (operations)	Electrical	10 <sup>6</sup> 24V. DC, 1A 3 x 10 <sup>6</sup> 24V. DC, 0.5A	1.5 x 10 <sup>6</sup> 24V. DC, 1A 3 x 10 <sup>6</sup> 24V. DC, 0.5A	
	Mechanical	10 <sup>7</sup>		
Break-down voltage	Between open contacts	1000V. AC	1000V. AC or 500V. AC*	
	Between adjacent contacts	1000V. AC		1500V. AC
	Between contact and coil	1000V. AC		1500V. AC
Surge withstand voltage		1500V FCC #	1500V FCC	
Safety standard		UL, CSA		
Option		—	latching type	
Height (mm)		11.4	10.1	
Mounting space (mm)		9.8 x 20.2	10.1 x 20.3	10.1 x 20.3

#1500V FCC surge between coil and contacts and between adjacent contacts.


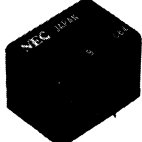

\* Form D type

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## Miniature Relay— Signal

		MR622	MR301	MR301-H
<b>Type of relay</b>				
<b>Features</b>		<ul style="list-style-type: none"> <li>• high-breakdown voltage</li> <li>• low power consumption</li> <li>• 1500V FCC surge</li> </ul>	<ul style="list-style-type: none"> <li>• low profile</li> <li>• specialty for automotive</li> <li>• flux tight</li> </ul>	<ul style="list-style-type: none"> <li>• low profile</li> <li>• high power switching</li> <li>• flux tight</li> <li>• specialty for automotive</li> </ul>
		Polarized Type		
<b>Contact arrangement</b>		2C or 2D	1C	
<b>Contact material (standard)</b>		silver alloy with gold overlay	silver nickel alloy	silver oxide complex alloy
<b>Contact rating (resistive) (switching)</b>		60W/125VA	150W/600VA	300W/1200VA
3A		-----	15A	-----
2A		-----	10A	-----
1A		-----	5A	-----
<b>Coil voltage</b>		1.5, 3, 4.5, 5, 6, 9, 12, 24, 48 V. DC	3, 5, 6, 9, 12, 24, 48 V. DC	
<b>Nominal operating power</b>		400mW	360mW	
<b>Must operate voltage</b>		70%		
<b>Must release voltage</b>		10%		
<b>Operate time (typ.) (Excluding bounce)</b>		3.5ms	10ms	
<b>Release time (typ.) (Excluding bounce)</b>		2.0ms	10ms	
<b>Life (operations)</b>	<b>Electrical</b>	1.5x10 <sup>6</sup> 24V. DC, 1A 3 x 10 <sup>6</sup> 24V. DC, 0.5A	10 <sup>5</sup> 120V. AC, 7A	
	<b>Mechanical</b>	10 <sup>7</sup>		
<b>Break-down voltage</b>	Between open contacts	1000V. AC or 500V. AC*	750V. AC	
	Between adjacent contacts	1500V. AC	—	
	Between contact and coil	4000V. AC	1500V. AC	
<b>Surge withstand voltage</b>		1500V FCC		
<b>Safety standard</b>		UL, CSA		
<b>Option</b>		—		
<b>Height (mm)</b>		10.1	17.0	
<b>Mounting space (mm)</b>		10.1 x 20.3	16.5 x 22.5	

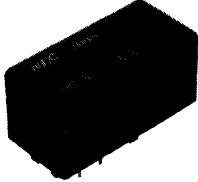


\* Y type (Form D type: 500V. AC)

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# Miniature Relay— Power

		EN2	EP2	EP1
<b>Type of relay</b>				
<b>Features</b>		<ul style="list-style-type: none"> <li>• twin relay</li> <li>• motor and solenoid reversible control</li> <li>• 30% less relay space than 2 conventional relays</li> <li>• symmetrical structure</li> <li>• flux tight housing</li> </ul>	<ul style="list-style-type: none"> <li>• twin relay</li> <li>• motor and solenoid reversible control</li> <li>• 50% less relay space than 2 conventional relays</li> <li>• symmetrical structure</li> <li>• flux tight housing</li> </ul>	<ul style="list-style-type: none"> <li>• low profile</li> <li>• high power switching</li> <li>• flux tight</li> </ul>
<b>Contact arrangement</b>		1C x 2		1C
<b>Contact material (standard)</b>		silver oxide complex alloy		
<b>Contact rating (resistive) (switching)</b>	30A			
	25A	35A	25A	25A
	20A			
	15A	(16V. DC)	(16V. DC)	(16V. DC)
	10A			
	5A			
<b>Coil voltage</b>		12 V. DC		
<b>Nominal operating power</b>		0.64W/0.8W/1.15W	0.48W/0.64W	0.48W/0.64W
<b>Must operate voltage</b>		6.5 to 8.5 V. DC		
<b>Must release voltage</b>		0.6 to 0.9 V.DC	0.9 V. DC	0.9 V.DC
<b>Operate time (max.) (Excluding bounce)</b>		10ms		
<b>Release time (max.) (Excluding bounce)</b>		10ms		
<b>Life (operations)</b>	<b>Electrical</b>	10 <sup>5</sup> motor load 14V. DC, 25A/7A	10 <sup>5</sup> motor load 14 V. DC, 20A/3A	
	<b>Mechanical</b>	10 <sup>6</sup>		
<b>Break-down voltage</b>	Between open contacts	500 V. DC		
	Between adjacent contacts	—		
	Between contact and coil	500 V. DC		
<b>Surge withstand voltage</b>		—		
<b>Safety standard</b>		—		
<b>Option</b>		Separate type		
<b>Height (mm)</b>		17.0	16.5	16.5
<b>Mounting space (mm)</b>		16.5 x 33.5	16.7 x 24.3	16.7 x 15.1

\* Y type (Form D type: 500V.AC)

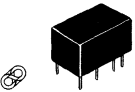


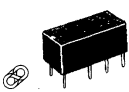
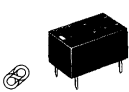
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## Low Signal Relays

Model	G5A	G5V-1, G5V-1F	G5V-2	G6A	G6E
					
Dimensions: mm (inch)	8.38 (.33)H x 16 (.63)L x 9.91 (.39)W	G5V-1: 9.91 (.39)H x 12.19 (.48)L x 7.37 (.29)W	11.43 (.45)H x 20.32 (.80)L x 9.91 (.39)W	8.13 (.32)H x 20.07 (.79)L x 9.91 (.39)W	8.38 (.33)H x 16 (.63)L x 9.91 (.39)W
<b>Features</b>	Subminiature relay ideal for office automation and test and measurement. Semi-sealed or fully-sealed.	Subminiature relay for interface applications. Fully-sealed construction. Low power consumption. Also available in surface mount.	Miniature relay for handling low signals in computer peripherals, telecommunications and security equipment. Fully-sealed construction.	Fully-sealed relay with high reliability, ideal for communication equipment. Latching type available.	Subminiature low signal switching relay has high sensitivity. Packed in a magazine for automatic insertion and soldering. Latching type available.
<b>Contact Ratings</b>					
Contact form	DPDT	SPDT	DPDT	DPDT 4PDT	SPDT
Contact type	Bifurcated crossbar	Single crossbar	Bifurcated crossbar	Bifurcated crossbar	Bifurcated crossbar
Contact material	Ag with Au clad	Ag with Au clad	Ag with Au clad	Ag with Au clad AgPd with Au clad	Ag with Au clad
Max. operating current under resistive load	1 A	1 A	2 A	2 A    2 A	3 A
Max. operating voltage	125 VAC, 125 VDC	125 VAC, 60 VDC	125 VAC, 125 VDC	250 VAC, 220 VDC	250 VAC, 220 VDC
Number of poles	2	1	2	2, 4	1
Max. switching capacity under resistive load	37.5 VA, 33 W	62.5 VA, 30 W	62.5 VA, 60 W	125 VA, 60 W	50 VA, 60 W
Minimum permissible load	10 µA, 10 mVDC	1 mA, 5 VDC	10 µA, 10 mVDC	10 µA, 10 mVDC	10 µA, 10 mVDC
Rated load (under resistive load)	0.5 A at 24 VAC 1 A at 24 VDC	0.5 A at 125 VAC 1 A at 24 VDC	0.5 A at 125 VAC 2 A at 30 VDC	0.5 A at 125 VAC, 2 A at 30 VDC 0.3 A at 125 VAC, 1 A at 30 VDC	0.4 A at 125 VAC 2 A at 30 VDC
<b>Coil Ratings</b>					
Rated voltage	3, 5, 6, 9, 12, 24, 48 VDC	5, 6, 9, 12, 24 VDC	3, 5, 6, 9, 12, 24, 48 VDC	3, 5, 6, 9, 12, 24, 48 VDC	3, 5, 6, 9, 12, 24, 48 VDC
Power consumption*	200 mW (standard and latching)	150 mW	500 mW (standard) 360 mW (high sensitivity) 150 mW (ultra-sensitive)	200 mW (DPDT std.) 180 mW (DPDT latch.) 360 mW (4PDT std.)	200 mW (standard) 400 mW (low sensitivity) standard and latching
<b>Dielectric Strength</b> (50/60 Hz for 1 minute)	1,000 VAC	1,000 VAC	1,000 VAC	1,000 VAC	1,500 VAC
<b>Electrical Service Life</b> (operations)	100,000 minimum	100,000 minimum	300,000 minimum	500,000 minimum	500,000 minimum (DC) 100,000 minimum (AC)
<b>Terminal Choices</b>	PCB terminal	PCB terminal, SMT gullwing	PCB terminal	PCB terminal	PCB terminal
<b>Approved Standards</b>	UL, CSA, FCC Part 68 available	UL, CSA	UL, CSA	UL, CSA, FCC Part 68	UL, CSA, FCC Part 68, CC I TT, Bellcore

NOTE: 1. Relay height includes standoffs.

2. All specifications subject to change without notice.

3. \* All specifications measured at 23°C, 65% RH unless indicated otherwise.

4.  Moving Loop Relay.

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Low Signal Relays					MOS FET Relay
Model	G6H/G6H-2F	G6K	G6S	G6Y	G3VM
Dimensions: mm (inch)	5.08 (.20)H x 13.97 (.55)L x 8.89 (.35)W	5.3 (.21)H x 10.2 (.40)L x 6.7 (.26)W	9.4 (.37)H x 15 (.59)L x 7.5 (.30)W	9 (.35)H x 20.5 (.81)L x 11.5 (.45)W	G3VM-2: 4.58 (.18)H x 6.4 (.25)L x 3.65 (.14)W
<b>Features</b>	Compact, extremely low-profile relay ideal for high-density mounting. Bifurcated contacts capable of switching 1A with very little power consumption. Fully-sealed construction. Available in surface mount (G6H-2F).	Space saving relay with special lead frame design. Available in SMT gullwing and "inside-L" leads as well as through-hole terminals.	Space-saving relay meets Bellcore 2.5 kV surge specification. Unique lead frame design emulates IC components for better solderability and solder joint reliability. Surface mount or through hole versions; latching and high-sensitivity models.	Small RF relay, fully sealed, with exceptional VSWR (1.5 max.), insertion loss (0.5 dB max.) and isolation (65 dB min.) characteristics at 900 MHz. Ideal for cable TV decoder boxes, TV sets and other RF applications.	Photo-MOS construction for continuous load current. Three versions: 100 mA, 100-120 mA and 120-200 mA. Compatible 4-pin model available for positioning 4-pin optocoupler.
<b>Contact Ratings</b>					
Contact form	DPDT	SPDT DPDT	DPDT	SPDT	1 Form A or 2 Form A
Contact type	Bifurcated crossbar	Bifurcated crossbar	Bifurcated crossbar	Twin	—
Contact material	Ag with Au clad	Ag with Au clad	Ag with Au clad	AuAg clad	—
Max. operating current under resistive load	1 A	1 A	2 A	0.5 A	10 mA (50 mA max.) LED forward current; 1 A (1% duty max., 100 µsec pulse width max.) repetitive peak LED forward current; 5V max. LED reverse voltage
Max. operating voltage	125 VAC, 110 VDC	125 VAC, 125 VDC	250 VAC, 220 VDC	30 VAC, 30 VDC	-350 to 350 VAC, -350 to 350 VDC
Number of poles	2	1, 2	2	1	—
Max. switching capacity under resistive load	62.5 VA, 33 W	37.5 VA, 30 W	62.5 VA, 60 W	1 VA, 1 W	—
Minimum permissible load	10 µA, 10 mVDC	10 µA, 10 mVDC	10 µA, 10 mVDC	10 mA, 10 m VDC	—
Rated load (under resistive load)	0.5 A at 125 VAC 1 A at 30 VDC	0.3 A at 125 VAC 1 A at 30 VDC	0.5 A at 125 VAC 2 A at 30 VDC	0.01 A at 30 VAC 0.01 A at 30 VDC 1 W at 900 MHz	—
<b>Coil Ratings</b>					
Rated voltage	3, 5, 6, 9, 12, 24, 48 VDC	3, 4.5, 5, 6, 9, 12, 24 VDC	3, 4.5, 5, 6, 9, 12, 24 VDC	4.5, 5, 9, 12, 24 VDC	—
Power consumption	140 mW (standard)*	80 mW (SPDT standard) 100 mW (DPDT standard)	140 mW (standard)	200 mW	—
<b>Dielectric Strength</b> (50/60 Hz for 1 minute)	1,000 VAC	1,500 VAC	2,000 VAC standard	1,000 VAC	2,500 VAC for 1 minute
<b>Electrical Service Life</b> (operations)	100,000 minimum	100,000 minimum	100,000 minimum	300,000 minimum	—
<b>Terminal Choices</b>	PCB terminal (G6H) "L" modified gullwing leads (G6H-2F)	Gullwing, inside "L", PCB terminal	Gullwing, inside "L", PCB terminal	PCB terminal	PCB, surface mount gull-wing
<b>Approved Standards</b>	UL, CSA	UL, CSA pending	UL, CSA, FCC Part 68, Bellcore	—	UL/CSA

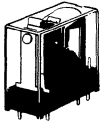

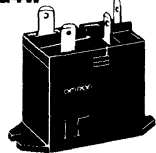


NOTE: 1. Relay height includes standoffs.  
2. All specifications subject to change without notice.  
3. \* All specifications measured at 23°C, 65% RH unless indicated otherwise.  
4. Moving Loop Relay/ Super Loop Relay

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**Power PCB Relays**

Model	G2R	G4X	G4W	G5B	G5LE
					
Dimensions: mm (inch)	25.4 (1)H x 28.96 (1.14)L x 12.95 (.51)W	25.5 (1.00)H x 29.0 (1.14)L x 13 (0.51)W	30.99 (1.22)H x 44.96 (1.77)L x 20.07 (.79)W	13.97 (.55)H x 22.1 (.87)L x 11.43 (.45)W	19 (.75)H x 22.5 (.89)L x 16.5 (.65)W
<b>Features</b>	Slim-styled power relay. 16 A high-capacity, bifurcated contacts, sealed, Class B insulation and latching types available.	Economical SPST-NO relay. Class B insulation, 10 A and 16 A switching capacities. Sealed and unsealed versions.	Offers high impulse withstand voltage and dielectric strength. Ideal for power switching. Sealed type and Class B insulation available.	Low-profile relay for switching up to 8 A. High-sensitivity coil available.	Compact, sugar cube 10 A relay with Class B insulation. Ideal for security equipment, home electrical appliances, audio equipment, remote control switched power. Flux protected or plastic sealed versions.
<b>Contact Ratings</b>					
Contact form	SPDT, SPST-NO, DPDT, DPST-NO	SPST-NO	SPST-NO, DPST-NO	SPST-NO	SPDT, SPST-NO
Contact type	Single and bifurcated button	Single button	Single button	Single button	Single button
Contact material	AgCdO or AgInSn	AgSnIn	AgCdO	AgCdO	AgCdO, AgSnO <sub>2</sub> , AgSnIn
Max. operating current under resistive load	16 A (high-capacity, 1-pole) 10 A (general-purpose, 1-pole) 5 A (general-purpose, 2-pole) 5 A (bifurcated, 1-pole) 5 A (high sensitivity, 1-pole) 3 A (high sensitivity, 2-pole)	16 A (high-capacity) 10 A (general-purpose)	15 A	3 A 8 A (high-capacity)	10 A
Max. operating voltage	380 VAC, 125 VDC	250 VAC, 24 VDC	250 VAC, 125 VDC	250 VAC, 30 VDC	250 VAC, 125 VDC
Number of poles	1    2	1	1    2	1	1
Max. switching capacity under resistive load	4,000 VA    1,250 VA 480 W    150 W	2,500 VA    4,000 VA 240 W    384 W	3,750 VA	750 VA, 90 W 2,000 VA, 240 W	1,200 VA, 240 W
Minimum permissible load	1 pole=100 mA, 5 VDC 2 pole=10 mA, 5 VDC	100 mA, 5 VDC	500 mA, 5 VDC	10 mA, 5 VDC	100 mA, 5 VDC
Rated load (under resistive load)	16 A at 250 VAC, 30 VDC 10 A at 250 VAC, 30 VDC 5 A at 250 VAC, 30 VDC	10 A at 250 VAC, 24 VDC 16 A at 250 VAC, 24 VDC	15 A at 250 VAC 15 A at 24 VDC	3 A at 125 VAC, 30 VDC 8 A at 125 VAC, 30 VDC	10 A at 120 VAC 8 A at 30 VDC
<b>Coil Ratings</b>					
Rated voltage	6, 12, 24, 50, 110, 120, 220, 240 VAC 3, 5, 6, 12, 24, 48, 100, 110 VDC	9, 12, 18, 24 VDC	12, 18, 24, 100 VDC	3, 5, 6, 12, 18, 24 VDC	3, 5, 6, 9, 12, 24, 48 VDC
Power consumption	0.9 VA, 530 mW 360 mW (high sensitivity)	530 mW	800 mW	360 mW	400 mW
<b>Dielectric Strength</b> (50/60 Hz for 1 minute)	5,000 VAC	5,000 VAC	4,000 VAC	2,000 VAC	2,000 VAC
<b>Electrical Service Life</b> (operations)	100,000 minimum	100,000 minimum (general purpose, unsealed version)	100,000 minimum	100,000 minimum	100,000 minimum
<b>Terminal Choices</b>	PCB terminal, plug-in and quick-connect	PCB terminals	PCB terminal, quick-connect, solder	PCB terminal	PCB terminal
<b>Approved Standards</b>	UL, CSA, SEV, SEMKO, VDE, TUV	UL, CSA, VDE	UL, CSA, VDE, SEMKO, SEV, TUV	UL, CSA, TUV	UL, CSA, TUV

NOTE: 1. Relay height includes standoffs.  
2. All specifications subject to change without notice.  
3. \* All specifications measured at 23°C, 65% RH unless indicated otherwise.

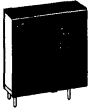
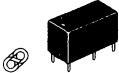
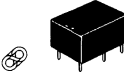

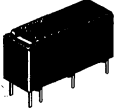
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**Power PCB Relays**

Model	G5P	G6B	G6C	G6D	G6RN
					
Dimensions: mm (inch)	25 (.98)H x 24 (.95)L x 10 (.39)W	9.91 (.39)H x 20.07 (.79)L x 9.91 (.39)W	9.91 (.39)H x 20.07 (.79)L x 14.99 (.59)W	12.5 (.49)H x 17.5 (.69)L x 6.5 (.26)W	15 (0.59)H x 28.5 (1.12)L x 10 (.39)W
<b>Features</b>	Slim-styled power relay for TV and audio equipment power supplies. High 10,000 V surge withstand. TV-5 rated and switches up to 5 A. Semi-sealed. High-sensitivity model available.	High-capacity, subminiature relay switches 8 A loads with SPST-NO and 5 A loads with standard type. Latching type available. Plastic sealed. Available with reverse coil polarity.	High-capacity, subminiature relay switches 10 A loads with SPST-NO and 8 A loads with SPST-NO and SPST-NC. Semi-sealed or plastic sealed. Latching type available.	Subminiature relay with reduced board space. Ideal for high-density mounting (45% smaller than surface area of G6B). Switches 5 A with SPST-NO and low power consumption.	Low-profile relay, switches 8 A with high (4,000 VAC) dielectric strength. Ideal for switching contactors, solenoids and motors.
<b>Contact Ratings</b>					
Contact form	SPST-NO	SPST-NO, SPST-NO + SPST-NC, DPST-NO, DPST-NC	SPST-NO, SPST-NO + SPST-NC	SPST-NO	SPST-NO, SPDT
Contact type	Single button	Single button	Single button	Single button	Single button
Contact material	AgSnO	AgCdO or AgInSn	AgCdO	Ag alloy	AgNi + Au plated
Max. operating current under resistive load	5 A	8 A    5 A	10 A, 8 A	5 A	8 A
Max. operating voltage	250 VAC, 30 VDC	380 VAC, 125 VDC	380 VAC, 125 VDC	250 VAC, 30 VDC	250 VAC, 125 VDC
Number of poles	1	1    2	1	1	1
Max. switching capacity under resistive load	1,250 VA, 150 W	2,000 VA, 240 W    1,250 VA, 150 W	2,500 VA, 300 W	1,250 VA, 150 W	2,000 VA, 150 W
Minimum permissible load	100 mA, 5 VDC	10 mA, 5 VDC	10 mA, 5 VDC	10 mA, 5 VDC	10 mA, 5 VDC
Rated load (under resistive load)	5 A at 250 VAC, 30 VDC	8 A at 250 VAC, 8 A at 30 VDC, 5 A at 250 VAC, 5 A at 30 VDC	10 A at 250 VAC, 10 A at 30 VDC, 8 A at 250 VAC, 8 A at 30 VDC	5 A at 250 VAC, 5 A at 30 VDC	8 A at 250 VAC, 5 A at 30 VDC
<b>Coil Ratings</b>					
Rated voltage	5, 6, 9, 12, 24, 48 VDC	5, 6, 12, 24 VDC	3, 5, 6, 12, 24 VDC	5, 12, 24 VDC	5, 6, 12, 24, 48 VDC
Power consumption	530 mW	200 mW standard and latching	200 mW standard and latching	200 mW	220 mW, 250 mW (48 VDC)
<b>Dielectric Strength</b> (50/60 Hz for 1 minute)	4,000 VAC	3,000 VAC	2,000 VAC	3,000 VAC	4,000 VAC
<b>Electrical Service Life</b> (operations)	100,000 minimum	100,000 minimum	100,000 minimum	100,000 minimum	100,000 minimum
<b>Terminal Choices</b>	PCB terminal	PCB terminal	PCB terminal	PCB terminal	PCB terminal
<b>Approved Standards</b>	UL, CSA, SEV, SEMKO, TUV	UL, CSA, FCC Part 68	UL, CSA, VDE	UL, CSA, TUV, SEV	UL, CSA, TUV, VDE, IEC

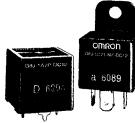

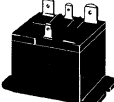
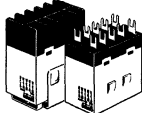
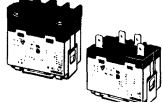
- NOTE: 1. Relay height includes standoffs.  
 2. All specifications subject to change without notice.  
 3. \* All specifications measured at 23°C, 65% RH unless indicated otherwise.  
 4.  Moving Loop Relay.

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**Power PCB Relays**                      **General Purpose Relays**

Model	G8J	G8P	G4B	G7J	G7L
					
Dimensions: mm (inch)	25 (.98)H x 28 (1.10)L x 28 (1.10)W	16.76 (.66)H x 30.48 (1.20)L x 24.13 (.95)W	28.96 (1.14)H x 50.8 (2)L x 32.51 (1.28)W	64 (2.52)H x 53.5 (2.11)L x 34.5 (1.36)W	49.02 (1.93)H x 68.58 (2.70)L x 34.54 (1.36)W
<b>Features</b>	General-purpose automotive relay switches 40 A, handles inrush current to 100 A. Fits standard ISO terminal footprint. Weatherproof cover and mounting bracket types available.	Power relay breaks up to 30 A load. Class B insulation, dust cover and sealed versions available. Optional footprint available.	Breaks 15 A, carries 20 A and withstands 55 A inrush. 25 A high-capacity and Class B insulation types available.	High-capacity power relay has double-break contact arrangement, and includes push-to-test button as a standard feature.	High-capacity power relay has double-break contact arrangement. Class B insulation is standard.
<b>Contact Ratings</b>					
Contact form	SPST-NO (PCB), SPDT (plug-in)	SPST-NO, SPST-NC, SPDT	SPST-NO, SPDT	4PST-NO, 3PST-NO/SPST-NC, DPST-NO/DPST-NC	SPST-NO-DM DPST-NO-DM
Contact type	Single button	Single button	Single button	Single button	Single button
Contact material	AgSnIn	AgCdO, AgInSn	AgCdO or AgInSn	AgCdO	AgCdO
Max. operating current under resistive load	40 A/20 A (NO/NC)	30 A (SPST-NO) 20 A SPDT (NO contact) 10 A SPDT (NC contact)	15 A 25 A (high-capacity)	25 A (NO contacts) 8 A (NC contacts)	30 A (SPST-NO) 25 A (DPST-NO)
Max. operating voltage	16 VDC	250 VAC, 28 VDC	250 VAC, 125 VDC	250 VAC, 125 VDC	250 VAC
Number of poles	1	1	1	4	1 2
Max. switching capacity under resistive load	480 W	7,500 VA, 560 W	3,300 VA/360 W 5,500 VA/600 W	5,500 VA (NO contacts) 1,760 VA (NC contacts)	6,600 VA 5,500 VA
Minimum permissible load	Consult factory	500 mA, 5 VDC	100 mA, 5 VDC	100 mA, 24 VDC at 120 operations/min.	100 mA, 5 VDC
Rated load (under resistive load)	40 A at 12 VDC	30 A at 250 VAC, 20 A at 28 VDC	15 A at 220 VAC, 24 VDC 25 A at 220 VAC, 24 VDC	25 A at 220 VAC (NO contacts), 8 A at 220 VAC (NC contacts)	30 A at 220 VAC 20 A at 220 VAC
<b>Coil Ratings</b>					
Rated voltage	12 VDC	6, 9, 12, 15, 18, 24, 48 VDC	6, 12, 24, 50, 100, 120 VAC 6, 12, 24, 48, 100, 110 VDC	100/120, 200/240 VAC 12, 24 VDC	6, 12, 24, 50, 100/120, 200/240 VAC 6, 12, 24, 48, 100 VDC
Power consumption	1.85 W	900 mW*	(At 60 Hz for AC) 1.3 VA, 1.2 W	(At 60 Hz for AC) 1.8 to 2.6 VA, 2.0 W	(At 60 Hz for AC) 1.7 to 2.5 VA, 1.9 W
<b>Dielectric Strength</b> (50/60 Hz for 1 minute)	800 VDC for 1 minute	1,500 VAC	2,000 VAC	4,000 VAC	4,000 VAC
<b>Electrical Service Life</b> (operations)	100,000 minimum	100,000 minimum	100,000 minimum	100,000 minimum	100,000 minimum
<b>Terminal Choices</b>	PCB/quick-connect	PCB terminal	Quick-connect, PCB terminal, combination PCB + QC	Screw terminals, PCB terminals	Quick-connect, plug-in screw, PCB terminal
<b>Approved Standards</b>	—	UL, CSA	UL, CSA	UL, CSA	UL, CSA, TUV, IEC, CE

NOTE: 1. Relay height includes standoffs.  
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3. \* All specifications measured at 23°C, 65% RH unless indicated otherwise.

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**General Purpose Relays**

Model	LY	MK	MY	H3RN	H3YN
Dimensions: mm (inch)	35.56 (1.40)H x 27.94 (1.10)L x 21.59 (.85)W	52.58 (2.07)H x 34.54 (1.36)L x 34.54 (1.36)W	36.07 (1.42)H x 27.94 (1.10)L x 21.59 (.85)W	31.20 (1.23)H x 47.40 (1.87)L x 12.80 (.50)W	28 (1.10)H x 56.60 (2.23)L x 21.50 (.85)W
<b>Features</b>	Compact, general-purpose relay suitable for a wide range of applications up to 15 A. LED indicator, push-to-test button versions.	Exceptionally reliable power relay plugs into convenient octal pin sockets. Mechanical indicator and test button are standard features.	Versatile relay, ideal for power and sequence control applications, meets many application needs. Latching and hermetically sealed versions available.	Ultra-slim timer offers ON-delay, Interval and Repeat Cycle timing functions and multiple time ranges. Short range (0.15-10 min.), long range (0.1 min.-10 hrs.) Self-resetting. Power and time up indicators standard.	Select ON delay, Interval or Repeat Cycle timing functions and multiple time ranges in one relay. Short range (0.15-10 min.), long range (0.1 min.-10 hrs.). Self-resetting. Power and time up indicators standard.
<b>Contact Ratings</b>					
Contact form	SPDT, DPDT, 3PDT, 4PDT	DPDT, 3PDT	DPDT, 3PDT, 4PDT	SPDT, DPST-NO	DPDT, 4PDT
Contact type	Single button, bifurcated button	Single button	Single button, bifurcated button	Single button	—
Contact material	AgCdO	Ag	Ag or AgCdO	AgCdO	AgCdO
Max. operating current under resistive load	15 A (SPDT) 10 A (DPDT, 3PDT, 4PDT) 5 A (bifurcated contacts, DPDT and 4PDT)	10 A	5 A (DPDT, 3PDT unsealed); 5 A (4PDT unsealed); 3 A (4PDT hermetically sealed); 1 A (4PDT sealed)	3 A	5 A (DPDT) 3 A (4PDT)
Max. operating voltage	250 VAC, 125 VDC	250 VAC, 250 VDC	250 VAC, 125 VDC	250 VAC	250 VAC
Number of poles	1, 2, 3, and 4	2, 3	2 and 3, 4	1, 2	2, 4
Max. switching capacity under resistive load	1,700 VA 360 W	2,500 VA 280 W	2,500 VA (NO)/ 1,250 VA (NC) 280 W	1,100 VA 120 W	750 VA 72 W
Minimum permissible load	Std: 100 mA, 5 VDC Bif: 10 mA, 5 VDC	10 mA, 1 VDC	Std: 1 mA, 5 VDC Bif: 100 µA, 1 VDC	10 mA, 5 VDC	1 mA, 5 VDC
Rated load (under resistive load)	15 A at 110 VAC, 24 VDC 10 A at 110 VAC, 24 VDC	10 A at 250 VAC, 28 VDC	10 A at 250 VAC (NO), 5 A at 250 VAC (NC), 10 A at 120 VAC, 10 A at 28 VDC	5 A at 220 VAC, 24 VDC 3 A at 220 VAC, 24 VDC	3 A, 250 VAC, 5 A at 250 VAC, 24 VDC 3 A at 250 VAC, 24 VDC
<b>Coil Ratings</b>					
Rated voltage	6, 12, 24, 50, 110/120, 220/240 VAC 6, 12, 24, 48, 100/110 VDC	6, 12, 24, 50, 110, 120, 220, 240 VAC 6, 12, 24, 48, 110 VDC	6, 12, 24, 50, 100/110, 110/120, 200/220, 220/240 VAC 6, 12, 24, 48, 100/110 VDC	24 VAC 12, 24 VDC	24, 100-120, 20-230 VAC 12, 24 VDC
Power consumption at 60 Hz for AC	1.1 VA 0.9 W	1.1 VA, 0.9 W (DPDT) 1.6 VA, 1.4 W (3PDT) 1.95 VA, 1.5 W (4PDT)	2.3 VA, 1.5 W	Approx. 1.1 VA, 0.9 W	0.8 VA, 24 VAC 0.4 W, 12 VDC 0.5 W, 24 VDC
<b>Dielectric Strength</b> (50/60 Hz for 1 minute)	2,000 VAC	2,000 VAC	2,000 VAC, unsealed 1,500 VAC, sealed	2,000 VAC	2,000 VAC
<b>Electrical Service Life</b> (operations)	200,000 minimum 500,000 minimum (2P)	100,000 minimum	500,000 minimum 200,000 minimum (4P)	100,000 minimum	500,000 minimum (DPDT) 200,000 minimum (4PDT)
<b>Terminal Choices</b>	PCB terminal, plug-in	Octal pin	PCB terminal, plug-in	Solder terminal, fits P2RF sockets	Socket for track, solder or wire-wrap terminal mounting
<b>Approved Standards</b>	UL, CSA, SEV, VDE, CE	UL, CSA, SEV, DEMKO, TUV	UL, CSA, SEV, CE	UL, CSA, CE (EMC and LV)	UL, CSA, CE (EMC and LV)





NOTE: 1. Relay height includes standoffs.  
2. All specifications subject to change without notice.  
3. \* All specifications measured at 23°C, 65% RH unless indicated otherwise.

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**Solid State Relays**

Model	G3MB	G3MC	G3NA	G3R
				
Dimensions: mm (inch)	20.5 (.72)H x 24.5 (.86)L x 5.5 (.19)W	13.5 (.48)H x 24.5 (.86)L x 4.5 (.16)W	27.0 (1.06)H x 58.0 (2.28)L x 43.0 (1.69)W	28.0 (.99)H x 29.0 (1.02)L x 13.0 (.46)W
<b>Features</b>	Multi-input solid state relay, space saving SIP design. Ideal for high-density PCB applications.	Multi-input solid state relay, compact, thin profile SSR. Ideal for close PCB mounting.	Multi-input solid state relay, industry standard "hockey puck" design. Operation indicator standard. Ideal for industrial controls.	Compact SSR with operation indicator offered. PCB or socket mount available. Interchangeable with G2R electromechanical relay.
<b>Available Operating Input</b>	4 - 6 VDC 9.6 - 14.4 VDC 19.2 - 28.8 VDC	4 - 6 VDC 9.6 - 14.4 VDC 19.2 - 28.8 VDC	4 - 32 VDC 75 - 132 VAC 150 - 264 VAC	4 - 6 VDC 9.6 - 14.4 VDC 19.2 - 28.8 VDC
<b>Available Outputs</b>				
Output voltage/Output load	75 - 132 VAC/2 A 75 - 264 VAC/2 A	75 - 132 VAC/1 A 75 - 264 VAC/1 A 75 - 264 VAC/2 A	5 - 200 VDC/10 A 24 - 240 VAC/5 A, 10 A, 20 A, 25 A, 40 A 200 - 480 VAC/10 A, 20 A, 25 A, 40 A	75 - 132 VAC/1 A 75 - 132 VAC/2 A 75 - 264 VAC/1 A 75 - 264 VAC/1 A 3 - 52.8 VDC/2 A 3 - 125 VDC/1.5 A
<b>Isolation</b>	Phototriac	Phototriac	Phototriac Photocoupler	Phototriac Photocoupler
<b>Zero Crossing Available</b>	Yes	Yes	Yes	Yes
<b>Snubber Circuit</b>	Yes	Yes	Yes	Yes
<b>Life</b>	MTTF 100,000 hours	MTTF 100,000 hours	MTTF 100,000 hours	MTTF 100,000 hours
<b>Mounting</b>	PCB mount	PCB mount	Panel mount	PCB/Socket mount
<b>Terminal</b>	PCB terminal	PCB terminal	Screw	PCB or Plug-in terminals
<b>Approvals</b>	UL, CSA	UL, CSA	UL, CSA, TÜV	UL, CSA

**For more information, call 1-800-55-OMRON.**

# HIGH VOLTAGE RELAYS

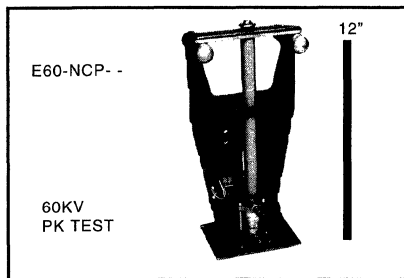
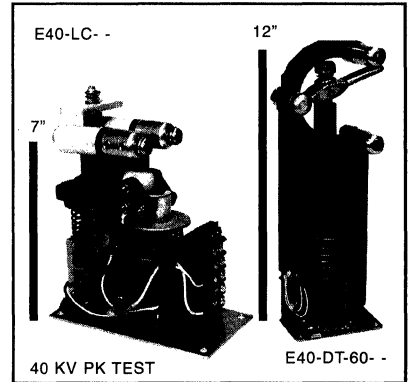
## 1KV TO 300KV PK TEST

### HV BASIC RELAYS TO 300KV PK TEST

For transfer, safety grounding, tap selection, polarity selection in the range of 1 KV to 200KV DC or PK AC with PK test voltages up to 300KV PK. Most high voltage contacts have full insulation above ground. A higher insulation level to ground is optional. Some units are spring return and can mount in any position, or with gravity return by mounting in the proper position. Also usable in oil or insulating gas with increased voltage ratings. Relays are available with replaceable tungsten alloy contacts for high current capacitor discharge use and with auxiliary contacts for holding, indicating or interlocking. See Solenoid-Saver™ for computer control.

### HV LATCHING RELAYS

Loss of control power will not cause an unwanted transfer. Power is not required to maintain position, reducing energy requirements and heat. Pulse actuation may be desirable in some applications.

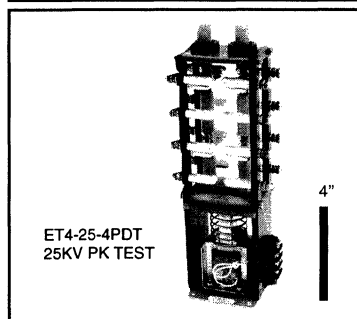
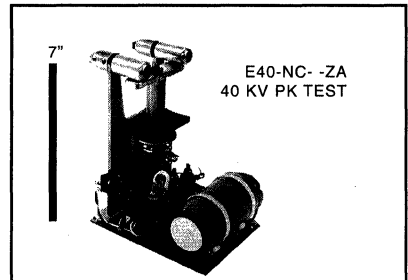


### HV AIR OPERATED RELAYS TO 300KV PK TEST

Air operated relays can be actuated with compressed air or other gas pressures of 80 to 120 PSI. Some can be operated at pressures as low as 30 PSI. Some units have spring return with loss of air. Auxiliary air valve type indicators can be provided in place of auxiliary electrical type contacts to provide complete isolation from high voltage, and provide answerback to indicate full open or closed, or other control. Units designed to be submerged in insulating fluid are also available with air exhaust outlets to exterior to avoid contaminating the insulating fluids.

### HV DELAYED OPENING AND CLOSING RELAYS TO 100KV PK

For some high voltage control and safety applications, a delayed action but positive automatic closing (normally closed) or opening (normally open) of high voltage relays upon accidental loss or normal shut down of control power is desirable if not mandatory. These relays are designed for safety shorting and for use with HV power supplies having stored energy which must not be discharged before other control relays operate, or current flow which must not be interrupted too soon. Delay can be initiated either when control voltage is turned on or turned off, or both.

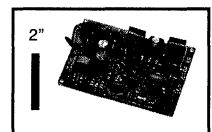


### HIGH VOLTAGE MULTI-POLE RELAYS TO 40KV PK TEST

The Multi-pole E series relays are designed for high voltage applications where 2 or more poles are required. These air insulated relays are constructed using fire retardant, moisture sealed anti-tracking epoxy glass laminate of the highest quality. Environmental resistant materials are standard throughout to assure long life and ruggedness. Applications for these relays include: 3 phase tap or load selection, transfer, polarity reversing, safety grounding, and shorting. These units can be used in air, oil, or other insulating mediums and are designed to be mounted base down. Contacts are available in normally open, normally closed and double throw configurations. Latching units are also available.

### SOLENOID-SAVER® SOLENOID DRIVER/CONTROLLER 24V TO 250V AC/DC

For AC 25 to 800Hz or DC high pull-in/low holding current Solenoids to prevent coil burnout, reduce coil temperature, eliminate AC Hum, & also, if specified, to allow low voltage, low current computer control, 4-10V, 5MA. Available also to delay deactivation on loss of power or to provide energy storage high speed activation by low power signals.



See our additional HV products in **Volume D, Instruments, Test & Measuring - Sect. 2900,**  
and **Control Systems & Components - Sect. 2200**

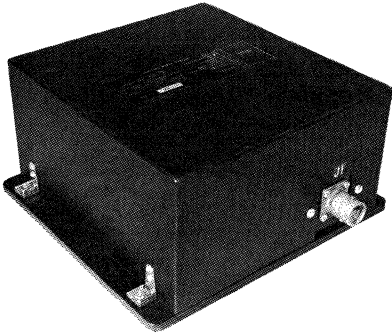
## ROSS ENGINEERING CORP.

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E-mail: rosseng@aol.com, URL: <http://home.navisoft.com/rossengineering/index.htm>



# SCIENTIFIC TECHNOLOGIES INCORPORATED

## ELECTRIC POWER MONITOR



### SPECIFICATIONS

**INPUT VOLTAGE:** 115 VRMS line to neutral  $\pm 5.8$  VRMS, 400 Hz  $\pm 20$  Hz, 3 phases plus neutral, phase sequence A-B-C (pins 1, 2, 3 & 8)

**NORMAL OUTPUT:** 28 VDC  $\pm 2.8$ V, 4.5 to 5.0 AMP max. (pin 5), voltage regulation and ripple: 10% and 1V peak-to-peak max.

**ALARM OUTPUT:** 28 VDC nominal, 1.8 to 2.0 AMP max. (pin 7)

**RESET SWITCH:** Customer will supply a momentary normally open switch to permit normal operation when the switch is activated providing none of the fault conditions exist and the input voltage is applied (switch across pins 6 & 4)

**MATERIAL AND FINISH:** Housing is aluminum with black anodized finish.

**OPERATING TEMP. RANGE:** 0°C to +85°C

**DIELECTRIC STRENGTH:** 1250V, 60 Hz between contacts and case and between isolated circuits

**VIBRATION:** 5 to 55 CPS with DA of .06 in along any axis.

**SHOCK:** 20G'S for 11 MS

**FAULT CONDITIONS:** The monitor will supply the alarm output when any of the following conditions exist:

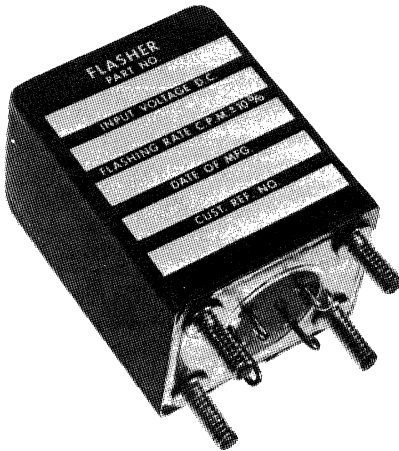
**OVER/UNDER VOLTAGE SENSOR:** Voltage is above 126.5 VAC  $\pm 1.5$ V or below 105.5 VAC  $\pm 1.5$ V across any one or more of the phases with respect to neutral.

**PHASE SENSOR:** Improper phase sequence (C-B-A) or if any one phase is open with the remaining phases closed.

**FREQUENCY SENSOR:** Frequency is above 420 Hz +0 Hz/-5 Hz or below 380 Hz +5 Hz/-0 Hz

**VOLTAGE DROP:** Any one or more of the phases drop to 95 VAC, the voltage regulation and ripple will be 10% and 1 volt peak-to-peak max. Any one or more of the phases drop to 80 VAC, the voltage regulation and ripple will be 30% and 3 volt peak-to-peak max. Any one phase is open while these conditions exist, the voltage regulation and ripple will be 30% and 6 volt peak-to-peak max.

## FLASHERS



### FEATURES:

- High reliability
- Rugged
- Hermetically sealed
- Compact and lightweight
- Solid state and relay outputs
- Long life

### SPECIFICATIONS

#### SOLID STATE FLASHER

**INPUT VOLTAGE:** 18 to 32 VDC

**POWER CONSUMPTION:** 3 Watts (Not Including Lamp Power)

**FLASHER OUTPUT:** 200 ma, 500 ma, 2 AMP, or 5 AMP Lamp or Relay Load.

**OUTPUT POLARITY:** Positive or Negative Types.

**NOT DAMAGED BY REVERSE POLARITY.**

**FLASHING RATES:** AS SPECIFIED.

**ON:OFF RATIOS ARE:** AS SPECIFIED

**OPERATING TEMPERATURE RANGE:**

-55 C to +71 C.

**OPERATING LIFE EXPECTANCY:** 10,000

Hours Min.

**SHOCK:** 100 G's for 11 Milliseconds

**VIBRATION:** 10 G's at 10 to 500 CPS.

**HERMETICALLY SEALED.**

**MOUNTING:** Stud or Flange.

**SOLDER HOOK TERMINALS.**

**WEIGHT:** 4 Ounces Nominal.

**VOLTAGE DROP:** 1.5 Volts Maximum.

### RELAY TYPE FLASHER

**INPUT VOLTAGE:** 18 to 32 VDC.

**POWER CONSUMPTION:** 4 watts (not including lamp power).

**FLASHER OUTPUT:** 500 ma, 2 AMP, 5 AMP, lamp or relay load.

**CONTACTS ARE S.P.S.T. normally open.**

**NOT DAMAGED BY REVERSE POLARITY.**

**FLASHING RATES:** AS SPECIFIED.

**ON: OFF RATIOS ARE:** AS SPECIFIED

**OPERATING TEMPERATURE RANGE:**

-55 C to +71 C.

**OPERATING LIFE EXPECTANCY:** 500,000

cycles

minimum at rated load.

**SHOCK:** 15 G's for 11 milliseconds.

**VIBRATION:** 10 G's at 10 to 500 CPS

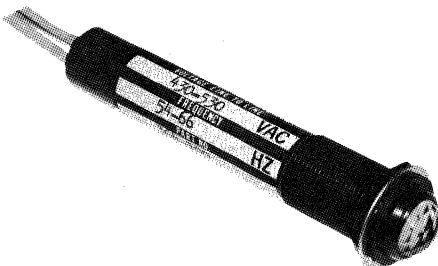
**UNIT:** Hermetically sealed.

**MOUNTING:** Studs or flange.

**SOLDER HOOK TERMINALS.**

**WEIGHT:** 8 ounces nominal.

## PHASE SEQUENCE INDICATORS



### DESCRIPTION

A unique passive element circuit within the housing allows the indicator to illuminate only when the phase sequence of power being monitored is A-B-C. The phase sequence indicator will not illuminate when any one or more of the power inputs are opened or if the phase sequence is C-B-A.

### SPECIFICATIONS

**POWER CONSUMPTION:** 2 watts

**OPERATING TEMPERATURE:** -55 to +125 C

**WEIGHT:** 2 ounces

**MOUNTING:** 5/8 inch dia. hole, panel thickness to 3/4 inch

**LEADS:** 18 inches long, teflon insulated

**HOUSING MATERIAL:** aluminum, black anodized

**FREQUENCY AND VOLTAGE:** per customer specifications

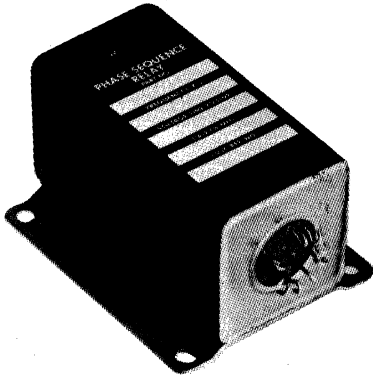
**INDICATOR:** lights up when all input leads are energized and phase sequence is A-B-C

The indicator will provide trouble-free instantaneous indication with no warm-up time required. The units are potted in an aluminum housing with no moving parts. Designed to meet severe environmental requirements of military applications.



# SCIENTIFIC TECHNOLOGIES INCORPORATED

## PHASE SEQUENCE RELAYS



### FEATURES

- Designed for use in severe environmental conditions
- Automatic monitoring of phase sequence
- Solid state sensing circuit
- Hermetically sealed
- Light weight, small size
- Many voltages and frequency combination available

### SPECIFICATIONS

Relay picks up when all input terminals are energized and phase sequence is A-B-C. Relay drops out if one or more power leads are grounded, opened or if the phase sequence is C-B-A.

**POWER CONSUMPTION:** 10 watts maximum.

**OPERATING TEMPERATURE:** -55 C + 71 C

**CONTACT RATINGS:** (Per MIL-C-5757)

28 VDC	Resistive (Form C)	Inductive
2 AMP	2.0 AMPS	1.0 AMPS
3 AMP	3.0 AMPS	1.0 AMPS
10 AMP	10.0 AMPS	5.0 AMPS

115 VAC	Resistive (Form A&B)	Resistive (Form C)
2 AMP	2.0 AMPS	0.2 AMPS
3 AMP	3.0 AMPS	0.2 AMPS
10 AMP	10.0 AMPS	2.0 AMPS

**VIBRATION:** 10 G's to 500 Hz.

**SHOCK:** 30 G's for 11 milliseconds stud mount.

100 G's for 11 milliseconds flange mount.

**SEAL:** Hermetically sealed.

**CONTACT RESISTANCE:** .08 ohm maximum.

**INSULATION RESISTANCE:** 100 megohms minimum between terminals and case, between open contacts.

**DIELECTRIC STRENGTH:** 1000 Vrms 60 Hz, between terminals and CASE; 500 Vrms 60 Hz, between open contacts.

**LIFE:** 100,000 operations minimum.

**WEIGHT:** 11 ounces maximum.

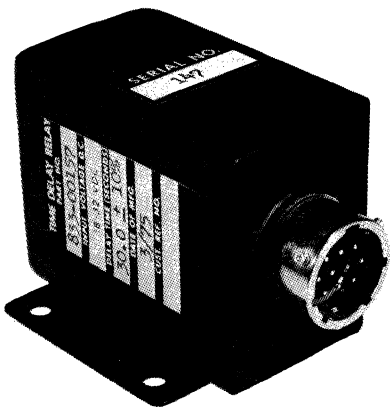
Relays per MIL-R-5757.

Environmental testing per MIL-E-5272.

Test methods per MIL-STD-202.

Marking per MIL-STD-130.

## TIME DELAY RELAYS



### FEATURES

- Solid state sensing circuit
- Transient protected
- 2 amp, 3 amp, and 10 amp relay contacts, dpdt.
- Hermetically sealed.
- Light weight (3.5 to 9 oz).
- Choice of 3 operating modes.
- Designed for use in severe environmental conditions.

### SPECIFICATIONS

**INPUT VOLTAGE:** 18 to 32 vdc

**POWER REQUIREMENTS AT 28 VDC:** 5 watts max, 2 amp relays  
6.5 watts max, 10 amp relays

**TEMPERATURE RANGE:** -65 F to + 185 F

**VIBRATION:** 20 G's, 10 to 2000 Hz

**SHOCK:** 100 G's for 11 milliseconds

**CONTACTS:** DPDT

**LIFE:** 100,000 cycles minimum at rated load

**DROP-OUT TIME:** 10 milliseconds max.

**DROP-OUT VOLTAGE:** 1 volt min.

**PULL-IN VOLTAGE:** 18 volts max.

**INSULATION RESISTANCE:** 100 megohms min.

**DIELECTRIC STRENGTH:** 500 volts 60 Hz case to terminals and across open contacts

**CONTACT RATING:**

2 amp & 3 amp unit: 2 amp & 3 amp resistive at 32 vdc  
1 amp inductive at 32 vdc

10 amp unit: 10 amp resistive at 28 vdc or 115 vac  
5 amp inductive at 28 vdc or 115 vac

**CONTACT RESISTANCE:** 0.050 ohms at rated current

**RESET-TIME:** 0.050 sec. max.

**TRANSIENT PROTECTION:** Will not be damaged by transients per Mil-Std-704

**INTERNAL RELAYS:** Per MIL-R-5757

**semitronics**

64 Commercial Street  
Freeport, NY 11520

For complete specifications, samples  
& technical assistance: Tel: (516) 623-9400  
Fax: (516) 623-6954 • Toll Free: 800-926-SEMI

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**SOLID STATE RELAYS**

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- Bi-Directional
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- DESC Approved

**HYBRIDS**

- Multichip Modules
- Chip & Wire
- Custom Military, Medical & Commercial Applications

**High Reliability screening available. Consult factory for details.**

# Solid State Relays

NAME OF DEVICE	ELECTRICAL CHARACTERISTICS	MAJOR APPLICATIONS	NOTES
CT-101 Bi-Directional 1.0 Amp 80 Volts  CT-102 Bi-Directional 0.6 Amp 180 Volts  CT-103 Bi-Directional 350 Ma 350 Volts	PIN CONNECTIONS  INPUTS 1, 2 OUTPUTS 4, 5, 6 CASE 3  	Instrumentation Automotive Automatic Test Equipment Medical Electronics Aircraft Programmable Controllers Process Control Robotics Battery Back Up	Bi-directional Power Mosfet output stage Extremely low output leakage Optical isolation Available MIL-R-28750C screening to W and Y QPL approved to DESC drawing #89116
CT-400 50V 2.0 AMP DPST Solid State Relay	INPUTS 1, 2, 3 OUTPUTS 4, 5, 6  	Instrumentation Process Control Robotics Programmable Controllers Automotive Automatic Test Equipment Battery Back Up	Low ON resistance 0.1 Ohm Optical Isolation 500V rms Compact size High current 2.0 Amps Custom options available Available to military Y level screening
CT-501 0.5 Amp 80V	INPUTS 1, 3 OUTPUTS 4, 5  	Optically isolated, High performance Solid State & Hybrid relays. 28VDC Military Systems Rated to MIL-STD 704 Y MIL-R 28750 Screening Custom variations	Short circuit protection in 28V systems Thermal shut down Operating temp -55C to +105C Options include Y level screening and custom variations

**semitronics**

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**EAST**  
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Freeport, NY 11520  
(516) 623-9400 • Fax: (516) 623-6954

**MID WEST**  
496 Windsor Park Drive  
Dayton, OH 45459  
(937) 435-6600 • Fax: (937) 435-1074

**WEST**  
2659 Townsgate Road - Suite 101  
Westlake Village, CA 91361  
(805) 373-6850 • Fax: (805) 379-3801



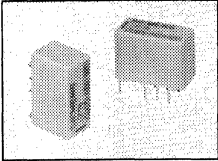
# SIEMENS

Siemens Electromechanical Components Inc.  
200 South Richland Creek Drive, Princeton, Indiana 47671-0001  
Tel: 812.386.1000 • Fax: 812.386.2072 • e-mail: info@sec.siemens.com

## Relays

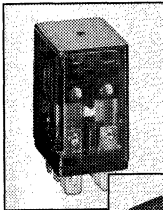


### P.C. Board Relays



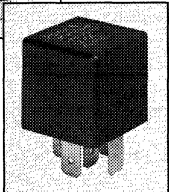
- Dry circuit to 30A ratings
- Up to 4PDT arrangements
- Open, dust cover and sealed units
- AC and DC coils
- Polarized types
- Latching models

### General Purpose Relays



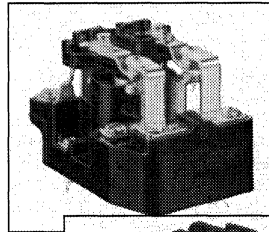
- Dry circuit to 30A ratings
- Up to 8PDT arrangements
- Open, dust cover and sealed units
- AC and DC coils
- P.C. board, socket and panel mount types

### Automotive Relays



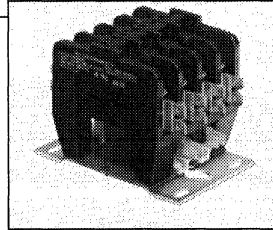
- Current ratings to 70A
- Standard and miniature types
- Choice of quick connect or PC terminals
- Various package styles and mounting options
- Motor-reversing types and flasher modules available

### Power Relays



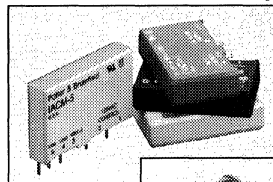
- Ratings to 60A
- Up to 4PDT arrangements
- Available as open relays or with dust covers
- AC and DC coils
- Socket and panel mount types

### Contactors



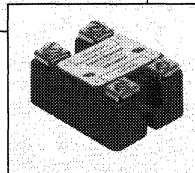
- Ratings to 60A
- 1Ø and 3Ø switching
- Up to 4PST-NC-DM arrangements
- AC and DC coils
- Available with universal mounting plates

### Input/Output Modules



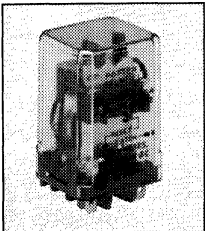
- Standard, and slim line package styles
- Output ratings to 5A, AC, and 3A, DC
- Compatible for series operation
- Mounting boards available

### Solid State Relays



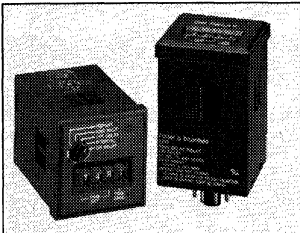
- Current ratings to 125A
- Switch voltage to 480VAC
- P.C. board and chassis mount types
- Single, dual and quad output
- AC and DC input

### Impulse/Latching Relays



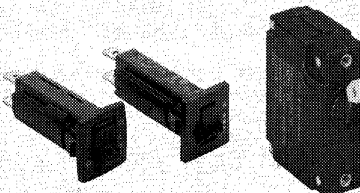
- Mechanical and magnetic latching types
- P.C. board, plug-in and chassis mount types
- Ratings to 20A
- Single and dual coil models
- Up to 16 poles

### Time Delay Relays



- Ratings to 10A
- Time up to 9,990 hours
- Up to 10 timing modes
- Field programmable types
- Knob, resistor, switch and fixed adjustment types
- Socket and DIN rail mountings

### See our circuit breaker pages in Section 4300.



### Thermal Circuit Breakers

- Threaded bushing and snap-in mounting options
- Ratings to 50A
- Choice of quick connect or screw terminals
- Toggle, push/pull, rocker or push-to-reset actuator types

### Magnetic Circuit Breakers

- Choice of screw or snap-in mounting
- Ratings to 50A
- Up to 4 poles
- Actuator-per-unit and actuator-per-pole types
- Various circuit functions and time-trip curves

Specifications are subject to change without notice. Specifications and/or agency recognitions do not necessarily apply to all models within a particular series.

Visit our website at [www.sec.siemens.com](http://www.sec.siemens.com) for detailed product specifications and other info about our firm. If you do not have web access you can still get detailed product specs by calling our fax-on-demand system at 812.386.2561.

# SIEMENS

Siemens Electromechanical Components Inc.  
 200 South Richland Creek Drive, Princeton, Indiana 47671-0001  
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## Printed Circuit Board Relays

Potter & Brumfield Relays®  Siemens Relays®				<b>NEW</b> 	<b>NEW</b> 	<b>NEW</b> 	
<b>Series</b>	<b>JWD/JWS</b>	<b>V23026</b>	<b>T81</b>	<b>V23079</b>	<b>V23106</b>	<b>V23105</b>	<b>V23042</b>
<b>Features</b>	<ul style="list-style-type: none"> <li>• <b>3 - 10W rating</b></li> <li>• Low cost dry reed</li> <li>• DIP and SIP configurations</li> <li>• Molded package</li> <li>• Wave solderable and immersion cleanable</li> <li>• Optional coil suppression diode</li> </ul>	<ul style="list-style-type: none"> <li>• <b>1A rating</b></li> <li>• Miniature relay</li> <li>• Sealed case</li> <li>• Latching or non-latching</li> <li>• Through-hole or surface mount</li> <li>• Low coil power requirement</li> </ul>	<ul style="list-style-type: none"> <li>• <b>0.5 - 1A rating</b></li> <li>• Miniature, high density package</li> <li>• Tape sealed, immersion cleanable-case</li> <li>• Sensitive coil &amp; high dielectric strength</li> <li>• Meets FCC Part 68 isolation</li> </ul>	<ul style="list-style-type: none"> <li>• <b>2A rating</b></li> <li>• Vertical mount</li> <li>• High dielectric</li> <li>• Meets FCC Part 68 and Bellcore isolation</li> <li>• 1,800 Vrms coil-to-contact breakdown</li> <li>• Sealed, immersion cleanable case</li> </ul>	<ul style="list-style-type: none"> <li>• <b>1A rating</b></li> <li>• Low profile relay</li> <li>• Sealed case</li> <li>• Latching or non-latching</li> <li>• Through hole or surface mount</li> <li>• High sensitivity</li> <li>• Meets FCC Part 68 isolation</li> </ul>	<ul style="list-style-type: none"> <li>• <b>2A rating</b></li> <li>• Mini DIP relay</li> <li>• High sensitivity coil</li> <li>• Sealed immersion cleanable case</li> <li>• Meets FCC Part 68 isolation</li> </ul>	<ul style="list-style-type: none"> <li>• <b>5A rating</b></li> <li>• Miniature, telecom relay</li> <li>• Meets FCC Part 68 isolation</li> <li>• Latching or non-latching</li> <li>• Sealed, immersion cleanable case</li> <li>• Sensitive coil types</li> </ul>
<b>Approximate Dimensions</b>	a b c .77" x .30" x .315" h (19.6 x 7.62 x 8.0h) 0.08 oz. (2g)	a b c .51" x .31" x .27" h (13 x 7.9 x 6.9h) 0.06 oz. (1.7g)	a b c .61" x .45" x .43" h (15.4 x 11.4 x 11.0h) 0.14 oz. (4g)	a b c .57" x .28" x .39" h (14.5 x 7.2 x 9.9h) 0.07 oz. (2g)	a b c .55" x .354" x .197" h (14 x 9 x 5h) .053 oz. (1.5g)	a b c .787" x .386" x .472" h (20 x 9.8 x 12h) 0.16 oz. (4.5g)	a b c .79" x .39" x .42" h (20.1 x 10.0 x 10.6h) 0.18 oz. (5g)
<b>Contact Arrangements</b>	1 Form A, 1 Form B, 1 Form C, 2 Form A	1 Form C	1 Form C	2 Form C	2 Form C	2 Form C	2 Form C
<b>Contact Material</b>	Ru	RhAu overlay PdNi	Au overlay AgPd	Au overlay AgPd	Au overlay AgPd & AgPd	Au overlay AgPd	Au overlay Ag & AgPd
<b>Maximum Contact Rating</b>	0.5A, @ 20VAC 10W (Form A & B) 0.5A, @ 12VDC 3W (Form C) resistive	1A, AC or DC 125VAC, 150VDC 60VA, 30W resistive	1A @ 24VDC or 0.5A @ 120VAC, resistive	2A, AC or DC 250VAC, 220VDC 60W or 62.5VA, resistive	1A, AC or DC 220VDC, 250VAC 30W or 62.5VA resistive	2A, AC or DC 220VDC, 250VAC 60W or 125VA, resistive	2A, AC or DC 250VDC, 220VAC 50-150W or 250VA, resistive
<b>Expected Mechanical Life</b>	1 x 10 <sup>8</sup> Ops.	1 x 10 <sup>8</sup> Ops.	5 x 10 <sup>6</sup> Ops.	1 x 10 <sup>8</sup> Ops.	1 x 10 <sup>8</sup> Ops.	1 x 10 <sup>8</sup> Ops.	2 x 10 <sup>7</sup> Ops.
<b>Expected Electrical Life at Rated Load</b>	1 x 10 <sup>6</sup>	2.5 x 10 <sup>5</sup> @ 0.4A, 125VAC 3 x 10 <sup>6</sup> @ 1A, 24VDC	1.5 x 10 <sup>5</sup> @ 1A, 24VDC 1 x 10 <sup>5</sup> @ 0.5A, 120VAC	5 x 10 <sup>5</sup> @ 1A, 30VDC	2 x 10 <sup>5</sup> @ 1A, 30VDC 1 x 10 <sup>5</sup> @ 0.5A, 125VAC	1 x 10 <sup>5</sup> @ 1.25A, 24VDC 1 x 10 <sup>5</sup> @ 0.3A, 150VAC	3 x 10 <sup>5</sup> @ 5A, 12VDC 1 x 10 <sup>5</sup> @ 1A, 250VAC
<b>Nominal Coil Voltage</b>	5-24VDC	1.5-24VDC	1.5-24VDC	3-48VDC	3-24VDC	3-48VDC	3-48VDC
<b>Nominal Coil Power</b>	50-288mW	37-150mW	(standard) 450mW (sensitive) 200mW	No Latch 140mW 1 Coil Latch 70mW 2 Coil Latch 140mW	140-200mW	150-300mW	150-360mW
<b>Mounting Options</b>	PC board	PC board, Surface mount	PC board, Socket	PC board, Surface mount	PC board, Surface mount	PC board	PC board
<b>Sockets / Connectors</b>	Fits 14-pin IC socket	—	Fits 12-pin IC socket	—	—	—	Socket Fits 16-pin IC socket
<b>Fax Document #</b>	5937	8026	8810	8079	8106	8105	8042

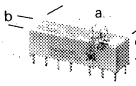
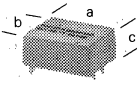
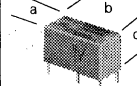
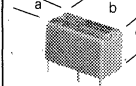
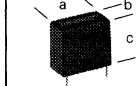
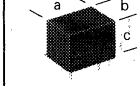
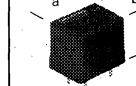







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# SIEMENS

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## Printed Circuit Board Relays

Potter & Brumfield Relays®  Siemens Relays®							
<b>Series</b>	<b>T84</b>	<b>R50</b>	<b>PE</b>	<b>RE</b>	<b>T77</b>	<b>T73</b>	<b>T7N</b>
<b>Features</b>	<ul style="list-style-type: none"> <li>• 1A rating</li> <li>• Miniature, telecom relay</li> <li>• Meets FCC Part 68 isolation</li> <li>• Latching &amp; non-latching</li> <li>• Sealed, immersion cleanable case</li> <li>• Sensitive coil types</li> </ul> 	<ul style="list-style-type: none"> <li>• 1-5A rating</li> <li>• Low profile package</li> <li>• Tape sealed, immersion cleanable case</li> </ul> 	<ul style="list-style-type: none"> <li>• 5A rating</li> <li>• Sensitive coil</li> <li>• flux tight case for wave soldering</li> <li>• Class F coil</li> </ul> 	<ul style="list-style-type: none"> <li>• 6A rating</li> <li>• Sensitive coil</li> <li>• DIP configuration</li> <li>• 4kV coil-to-contact isolation</li> <li>• Immersion-cleanable case with knock-off nib</li> <li>• VDE 0110</li> </ul> 	<ul style="list-style-type: none"> <li>• 3 - 10A rating</li> <li>• Small size</li> <li>• 4,000 Vrms coil-to-contact breakdown</li> <li>• Sealed or flux tight case</li> <li>• Class F coil insulation available</li> </ul> 	<ul style="list-style-type: none"> <li>• 10A rating</li> <li>• Low-profile relay</li> <li>• Sealed case</li> <li>• UL508</li> <li>• Class F coil insulation standard</li> </ul> 	<ul style="list-style-type: none"> <li>• 10A rating</li> <li>• Compact design</li> <li>• UL Class F coil standard</li> <li>• Immersion cleanable sealed case</li> </ul> 
<b>Approximate Dimensions</b>	a b c 1.4" x .40" x .40"h (35.4 x 10.1 x 10.1h) 0.25 oz. (7g)	a b c 1.09" x .60" x .46"h (27.7 x 15.7 x 11.7h) 0.3 oz. (8.5g)	a b c .79" x .39" x .39"h (20 x 10.0 x 10.0h) 0.18 oz. (5g)	a b c .79" x .39" x .42"h (20 x 10.0 x 10.6h) 0.18 oz. (5g)	a b c .72" x .39" x .57"h (18.2 x 10.0 x 14.7h) 0.36 oz. (9g)	a b c .88" x .69" x .61"h (22.3 x 17.6 x 15.5h) 0.42 oz. (12g)	a b c .87" x .63" x .65"h (22.0 x 16.0 x 16.4h) 0.38 oz. (11g)
<b>Contact Arrangements</b>	4 Form C	1 Form C, 2 Form C	1 Form C	1 Form A	1 Form A	1 Form A, 1 Form C	1 Form C
<b>Contact Material</b>	Au overlay AgPd	Ag AgCdO	AgNI 90/10	AgCdO, AgNi 0.15	Ag Ag Alloy	AgCdO	AgCdO
<b>Maximum Contact Rating</b>	1A, AC or DC 120VAC or VDC 24W or 60VA, resistive	2A @ 28VDC or 1A @ 120VAC 5A @ 28VDC or 2.5A @ 120VAC, resistive	5A , 250VAC	6A, 250VAC	3A @ 30VDC or 250VAC 10A @ 30VDC or 250VAC	6A @ 24VDC or 120VAC 10A @ 120VAC (N.O. only)	10A @ 250VAC or 28VDC
<b>Expected Mechanical Life</b>	2 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	15 x 10 <sup>6</sup> Ops.	3 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.
<b>Expected Electrical Life at Rated Load</b>	5 x 10 <sup>5</sup> @ 1A, 24VDC 2 x 10 <sup>5</sup> @ 0.5A, 120VAC	1 x 10 <sup>5</sup> @ 2A, 28VDC and 1A, 120VAC 6 x 10 <sup>5</sup> @ 5A, 28VDC and 2.5A, 120VAC	1 x 10 <sup>5</sup>	5 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup> Ops.
<b>Nominal Coil Voltage</b>	3-48VDC	5-48VDC	5-48VDC	5-48VDC	3-24VDC	3-48VDC	3-48VDC
<b>Nominal Coil Power</b>	90-400mW	0.75-1.3W	200mW	200mW	200-450mW	450-660mW	360mW
<b>Mounting Options</b>	PC board, Socket	PC board	PC board	PC board	PC board	PC board	PC board
<b>Sockets / Connectors</b>	Fits 28-pin IC socket	—	—	—	—	—	—
<b>Fax Document #</b>	8840	7500	4521	4501	8770	8730	8760

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## Printed Circuit Board Relays

Potter & Brumfield Relays®  Siemens Relays®				<b>NEW</b> 			
<b>Series</b>	<b>T7C</b>	<b>T75</b>	<b>RT</b>	<b>RKS</b>	<b>RKA</b>	<b>T90</b>	<b>T9A</b>
<b>Features</b>	<ul style="list-style-type: none"> <li>• 12A rating</li> <li>• Compact design</li> <li>• 1,500 Vrms coil-to-contact breakdown</li> <li>• Immersion cleanable or flux-tight case</li> <li>• UL Class F coil standard</li> </ul>	<ul style="list-style-type: none"> <li>• 8 - 14A rating</li> <li>• Meets international specifications</li> <li>• Sensitive coil</li> <li>• Low profile design</li> <li>• Immersion cleanable case</li> </ul>	<ul style="list-style-type: none"> <li>• 8-16A rating</li> <li>• Sensitive coil</li> <li>• Immersion cleanable case with knock-off nib</li> <li>• Low profile case</li> <li>• 10mm coil-to-contact spacing for 5kV isolation</li> <li>• VDE pending</li> </ul>	<ul style="list-style-type: none"> <li>• 10 - 20A rating</li> <li>• 0.6 in<sup>3</sup> (10cm<sup>3</sup>) package</li> <li>• Tape sealed, immersion cleanable case</li> <li>• Meets 8mm spacing and 4kV isolation</li> </ul>	<ul style="list-style-type: none"> <li>• 10A rating</li> <li>• 0.6 in<sup>3</sup> (10cm<sup>3</sup>) package</li> <li>• Immersion cleanable case</li> <li>• Meets 8mm spacing and 4kV isolation</li> <li>• TV-3 and TV-5 ratings</li> </ul>	<ul style="list-style-type: none"> <li>• 30A rating</li> <li>• Less than 1W coil power requirement</li> <li>• Class F insulation</li> <li>• Open, dust cover or tape sealed, immersion cleanable case</li> </ul>	<ul style="list-style-type: none"> <li>• 30A rating</li> <li>• QC and PC terms.</li> <li>• Meets UL 873 and UL 508 spacings</li> <li>• Optional flanged case for panel mounting</li> <li>• Safety wells accept insulated female quick connects</li> </ul>
<b>Approximate Dimensions</b>	a b c .80" x .65" x .81" (20.3 x 16.5 x 20.6h) 0.42 oz. (12g)	a b c 1.18" x .39" x .59" (30 x 10 x 15h) 0.65 oz. (18.5g)	a b c 1.14" x .50" x .62" (29 x 12.7 x 15.7h) 0.42 oz. (12g)	a b c 1.15" x .51" x 1.03" (29.2 x 13 x 26.2h) 0.65 oz. (18.5g)	a b c 1.15" x .51" x 1.03" (29.2 x 13 x 26.2h) 0.65 oz. (18.5g)	a b c 1.20" x .95" x .67" (30.5 x 24.1 x 16.9h) 0.9 oz. (26g)	a b c 1.28" x 1.08" x 1.10" (32.5 x 27.4 x 27.9h) .9 oz. (26g)
<b>Contact Arrangements</b>	1 Form A, 1 Form C	1 Form A, 1 Form C	1 Form A, 2 Form A, 1 Form C, 2 Form C	1 Form A, 2 Form A, 1 Form C, 2 Form C	1 Form A, 2 Form A, 1 Form C, 2 Form C	1 Form A, 1 Form C	1 Form A, 1 Form C
<b>Contact Material</b>	AgCdO	AgCdO	AgNi 90/10	AgCdO	AgNi AgCdO	Ag AgCdO	AgCdO
<b>Maximum Contact Rating</b>	10A @ 250VAC or 28VDC 12A @ 120VAC	14A @ 120VAC, resistive 10A @ 240 VAC 8A @ 24VDC	16A, AC or DC 250VAC, 30VDC (16A version)	10A @ 30VDC or 277VAC 20A @ 24VDC or 277VAC UL TV-5	5 to 10A @ 24VDC or 240VAC UL TV-3 and TV-5	30A @ 240VAC 20A @ 28VDC 6A @ 277VAC 2 HP @ 240VAC	30A @ 240VAC 20A @ 28VDC 10A @ 277VAC 98LRA/22FLA @ 120VAC 2 HP @ 240VAC
<b>Expected Mechanical Life</b>	1 x 10 <sup>7</sup> Ops.	2 x 10 <sup>7</sup> Ops.	3 x 10 <sup>7</sup> Ops.	1 x 10 <sup>6</sup> Ops.	5 x 10 <sup>6</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.
<b>Expected Electrical Life at Rated Load</b>	1 x 10 <sup>6</sup> Ops.	5 x 10 <sup>4</sup>	1 x 10 <sup>6</sup>	1 x 10 <sup>5</sup> @ 10A, 30VDC or 277VAC 2 x 10 <sup>4</sup> @ 20A, 277VAC	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>
<b>Nominal Coil Voltage</b>	3-48VDC	3-60VDC	5-48VDC	5-110VDC	3-110VDC	5-110VDC	5-110VDC
<b>Nominal Coil Power</b>	360-510mW	230mW	400mW	520mW	530-720mW	870-930mW	900mW, 1.0W
<b>Mounting Options</b>	PC board	PC board	PC board, Socket	PC board	PC board	PC board	PC board, Panel mount
<b>Sockets / Connectors</b>	—	—	—	Screw terminal, PC terminal	Screw terminal, PC terminal	—	—
<b>Fax Document #</b>	8702	8750	7800	7570	7520	8900	8901

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PC. Board Relays		General Purpose Relays					
Potter & Brumfield Relays®  Siemens Relays®							
	<b>T92</b>	<b>R10</b>	<b>KH/KHA</b>	<b>K10</b>	<b>KUP</b>	<b>KUEP</b>	<b>KUIP</b>
<b>Series</b>	<b>T92</b>	<b>R10</b>	<b>KH/KHA</b>	<b>K10</b>	<b>KUP</b>	<b>KUEP</b>	<b>KUIP</b>
<b>Features</b>	<ul style="list-style-type: none"> <li>• <b>30A rating</b></li> <li>• Two pole unit can break both sides of the AC line</li> <li>• PC board or panel mount</li> <li>• Ideal for HVAC and appliance apps.</li> <li>• Meets 8mm spacing</li> </ul>	<ul style="list-style-type: none"> <li>• <b>0 - 7.5A rating</b></li> <li>• Up to 8 poles</li> <li>• Highly sensitive coils available</li> <li>• Many contact options</li> <li>• Various case, terminal and mounting styles</li> </ul>	<ul style="list-style-type: none"> <li>• <b>0 - 5A rating</b></li> <li>• Compact package</li> <li>• 4PDT</li> <li>• Smoked dust cover</li> <li>• Various mounting configurations</li> <li>• Indicator lamp available</li> <li>• Hermetically sealed case option</li> </ul>	<ul style="list-style-type: none"> <li>• <b>15A rating</b></li> <li>• Compact package</li> <li>• DPDT</li> <li>• Smoked dust cover</li> <li>• Various mounting configurations</li> <li>• Indicator lamp available</li> <li>• AC and DC coils</li> </ul>	<ul style="list-style-type: none"> <li>• <b>10A rating</b></li> <li>• Open or enclosed</li> <li>• Plain or bracket mount dust covers</li> <li>• Optional indicator lamp and push-to-test button</li> <li>• Several socket styles</li> </ul>	<ul style="list-style-type: none"> <li>• <b>10A rating</b></li> <li>• Switches DC currents.</li> <li>• Magnetic blowout</li> <li>• Open or enclosed</li> <li>• Plain or bracket mount dust covers</li> <li>• Optional indicator lamp</li> </ul>	<ul style="list-style-type: none"> <li>• <b>10A rating</b></li> <li>• 8mm coil-to-contact spacing</li> <li>• VDE approved design</li> <li>• Plain or bracket mount dust covers</li> <li>• Several socket styles</li> </ul>
<b>Approximate Dimensions</b>	a b c 2.06" x 1.36" x 1.21" h (52.3 x 34.5 x 30.7h) 3 oz. (86g)	a b c 1.17" x .74" x 1.18" h (29.6 x 18.7 x 30.2h) 1.0 oz. (28g)	a b c 1.11" x .86" x 1.28" h (28.2 x 21.8 x 34.9h) 1.6 oz. (45g)	a b c 1.11" x .86" x 1.28" h (28.2 x 21.8 x 34.9h) 1.8 oz. (51g)	a b c 1.53" x 1.41" x 1.91" h (38.9 x 35.7 x 48.4h) 3 oz. (85g)	a b c 1.53" x 1.41" x 1.91" h (38.9 x 35.7 x 48.4h) 3 oz. (85g)	a b c 1.53" x 1.41" x 1.91" h (38.9 x 35.7 x 48.4h) 3 oz. (85g)
<b>Contact Arrangements</b>	2 Form A, 2 Form C	1 Form C to 8 Form C	2 Form C, 4 Form C	2 Form C	1 Form A to 4 Form C	1 Form X, 2 Form A, 2 Form C	1 Form A to 3 Form C
<b>Contact Material</b>	AgCdO	AgCdO, Ag, Au overlay Ag, AuPtAg	Ag, AgCdO, AuAgNi, Pd, Au overlay Ag, Au diffused Ag	Ag AgCdO	Ag AgCdO	AgCdO	Ag AgCdO
<b>Maximum Contact Rating</b>	30A @ 277VAC 20A @ 28VDC 10A @ 600VAC TV10A @ 120VAC 2.5 HP @ 240VAC 1 HP @ 120VAC	Dry circuit to 7.5A @ 28VDC or 115VAC 1/8HP @ 110-120VAC 1/6HP @ 220-240VAC	Dry circuit to 5A @ 28VDC or 240VAC 1/10HP @ 120-240VAC	15A @ 30VDC or 120VAC 10A @ 277VAC 1/3HP @ 120VAC 1/2HP @ 240VAC	5A @ 28VDC or 240VAC 10A @ 28VDC or 240VAC 1/3HP @ 120VAC 1/2HP @ 250-600VAC	10A @ 150VDC (1X) 5A @ 150VDC (2A) 3A @ 150VDC (2C)	5A @ 28VDC or 240VAC 10A @ 28VDC or 240VAC 1/3HP @ 120VAC 1/2HP @ 250-600VAC
<b>Expected Mechanical Life</b>	5 x 10 <sup>6</sup> Ops.	1 x 10 <sup>8</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.
<b>Expected Electrical Life at Rated Load</b>	1 x 10 <sup>5</sup> Ops.	2 x 10 <sup>4</sup> to 6 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>
<b>Nominal Coil Voltage</b>	6-110VDC 12-277VAC	3-115VDC 24-115VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC
<b>Nominal Coil Power</b>	1.7W (DC) 4.0VA (AC)	36mW to 1.6W (DC) 1.5VA (AC)	900mW (DC) 1.2VA (AC)	900mW (DC) 1.2VA (AC)	1.2-1.8W (DC) 2.0-2.7VA (AC)	1.2-1.8W (DC) 2.0-2.7VA (AC)	1.2W (DC) 2.0-2.7VA (AC)
<b>Mounting Options</b>	PC board Panel mount	Socket, Panel mount, PC board	Socket, Panel mount, PC board	Socket, Panel mount, PC board	Socket, Panel mount, PC board	Socket, Panel mount, PC board	Socket, Panel mount, PC board
<b>Sockets / Connectors</b>	—	Screw terminal, Solder terminal, PC terminal	Screw terminal, Solder terminal, PC terminal	Screw terminal, Solder terminal, PC terminal	Screw terminal, Solder terminal, PC terminal, Quick connect terminal	Screw terminal, Solder terminal, PC terminal, Quick connect terminal	Screw terminal, Solder terminal, PC terminal, Quick connect terminal
<b>Fax Document #</b>	8920	7100	5420	5100	5870	5870	5870

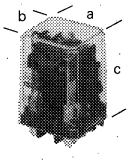
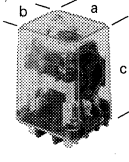
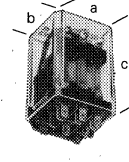
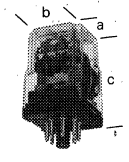
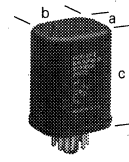
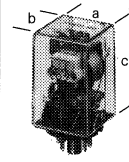
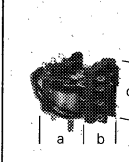







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# SIEMENS

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Tel: 812.386.1000 • Fax: 812.386.2072 • e-mail: info@sec.siemens.com

## General Purpose Relays

Series	KUGP	KUMP	KUP93	KRPA/KRP	KR-E	KR-3H	KA
<b>Potter &amp; Brumfield Relays®</b>  <b>Siemens Relays®</b>							
<b>Features</b>	<ul style="list-style-type: none"> <li>• 10A rating</li> <li>• 3mm contact gap</li> <li>• 8mm coil-to-contact spacing</li> <li>• VDE approved design</li> <li>• Plain or bracket mount dust covers</li> <li>• Several socket styles</li> </ul> 	<ul style="list-style-type: none"> <li>• 15A rating</li> <li>• Open or enclosed</li> <li>• Plain or bracket mount dust covers</li> <li>• Optional indicator lamp and push-to-test button</li> <li>• Several socket styles</li> </ul> 	<ul style="list-style-type: none"> <li>• 3 - 10A rating</li> <li>• Designed primarily for HVAC industry</li> <li>• Accepted pin pattern for HVAC</li> <li>• Dust cover</li> <li>• Optional indicator lamp and push-to-test button</li> </ul> 	<ul style="list-style-type: none"> <li>• 10A rating</li> <li>• Octal-type plug</li> <li>• Dust cover</li> <li>• Optional indicator lamp and push-to-test button</li> </ul> 	<ul style="list-style-type: none"> <li>• 10A rating</li> <li>• Hermetically sealed steel case for use in hazardous locations</li> <li>• Octal-type plug</li> </ul> 	<ul style="list-style-type: none"> <li>• 20A rating</li> <li>• Available with dust cover and octal-type plug or as an open-style relay</li> </ul> 	<ul style="list-style-type: none"> <li>• 10A rating</li> <li>• Compact, open-style relay</li> <li>• Ruggedly constructed</li> <li>• Cost effective</li> <li>• Highly efficient for switching light power loads</li> </ul> 
<b>Approximate Dimensions</b>	a b c 1.53" x 1.41" x 1.91" h (38.9 x 35.7 x 48.4h) 3 oz. (85g)	a b c 1.53" x 1.41" x 1.91" h (38.9 x 35.7 x 48.4h) 3 oz. (85g)	a b c 1.53" x 1.41" x 1.91" h (38.9 x 35.7 x 48.4h) 3 oz. (85g)	a b c 1.41" x 1.41" x 2.00" h (35.7 x 35.7 x 50.8h) 3 oz. (85g)	a b c 1.44" x 1.66" x 2.12" h (36.6 x 42.2 x 53.8h) 4.8 oz. (136g)	a b c 1.53" x 1.41" x 2.28" h (38.9 x 35.7 x 57.9h) 2 oz. (57g)	a b c 1.92" x 1.47" x 1.38" h (48.8 x 37.3 x 34.9h) 1.7 oz. (48g) - KA
<b>Contact Arrangements</b>	1 Form A, 2 Form A, 3 Form A, 1 Form X	1 Form A to 3 Form C	1 Form A to 3 Form C	1 Form A to 3 Form C	1 Form A to 3 Form C	1 Form X	1 Form A to 3 Form C
<b>Contact Material</b>	Ag AgCdO	AgCdO	Ag AgCdO	Ag AgCdO	Ag AgCdO	AgCdO	Ag AgCdO
<b>Maximum Contact Rating</b>	5A @ 28VDC or 240VAC 10A @ 28VDC or 240VAC 1/3HP @ 120VAC 1/2HP @ 250-600VAC	15A @ 277VAC 10A @ 28VDC or 240VAC 1/3HP @ 120VAC 1/2HP @ 250-600VAC	3A @ 32VDC or 250VAC 5A @ 28VDC or 240VAC 10A @ 28VDC or 240VAC	5A @ 28VDC or 120VAC 10A @ 28VDC or 240VAC 1/3HP @ 120VAC 1/2HP @ 240VAC	5A @ 28VDC or 120VAC 10A @ 28VDC or 240VAC 1/3HP @ 120VAC 1/2HP @ 240VAC	20A @ 120VAC 1HP @ 120/240VAC	5A @ 120VAC 10A @ 120VAC 6A @ 240VAC 1/6HP @ 120VAC 1/3HP @ 240VAC
<b>Expected Mechanical Life</b>	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	2.5 x 10 <sup>6</sup> Ops.	1 x 10 <sup>7</sup> Ops.
<b>Expected Electrical Life at Rated Load</b>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>
<b>Nominal Coil Voltage</b>	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-110VDC 6-240VAC
<b>Nominal Coil Power</b>	1.8W (DC) 2.7VA (AC)	1.2W (DC) 2.7VA (AC)	1.2W (DC) 2.0-2.7VA (AC)	1.2W (DC) 2.0VA (AC)	1.2W (DC) 2.0VA (AC)	1.2W (DC) 2.0VA (AC)	1.2W (DC) 2.0VA (AC)
<b>Mounting Options</b>	Socket, Panel mount, PC board	Socket, Panel mount, PC board	Socket	Socket	Socket	Socket, Panel mount	Panel mount
<b>Sockets / Connectors</b>	Screw terminal, Solder terminal, PC terminal, Quick connect terminal	Screw terminal, Solder terminal, PC terminal, Quick connect terminal	Crimp terminal, Solder terminal, PC terminal	Screw terminal	Screw terminal	Screw terminal	—
<b>Fax Document #</b>	5870	5870	5879	5272	5272	5272	5272

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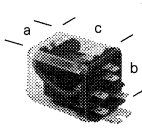
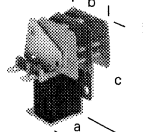
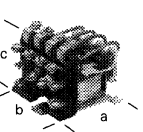
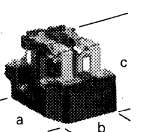
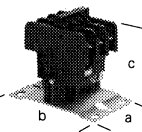
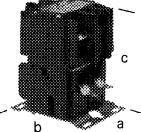
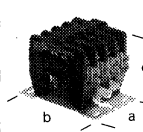
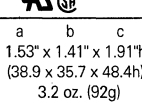
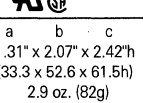
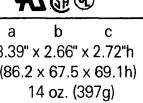
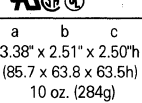
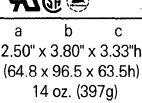
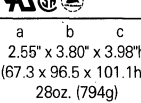
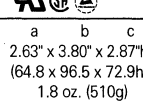
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## Power Relays

## Contactors

	Power Relays				Contactors		
Potter & Brumfield Relays®							
Siemens Relays®							
Series	KUHP	S86/S87	PM	PRD	P25	P30/P40	P31/P41
Features	<ul style="list-style-type: none"> <li>• 20 - 30A rating</li> <li>• Open or enclosed</li> <li>• Various mounting options</li> <li>• 3,750Vrms coil-to-contact breakdown</li> </ul>	<ul style="list-style-type: none"> <li>• 20A rating</li> <li>• Economical switching in a compact package</li> <li>• Sensitive DC coil version available</li> <li>• Choice of two mounting brackets</li> </ul>	<ul style="list-style-type: none"> <li>• 25A rating</li> <li>• 4PDT</li> <li>• High dielectric strength</li> <li>• Screw or quick connect terminals</li> <li>• Dust cover available</li> </ul>	<ul style="list-style-type: none"> <li>• 30A rating</li> <li>• High inrush capacity</li> <li>• Available with magnetic blowouts</li> <li>• Optional auxiliary switch</li> </ul>	<ul style="list-style-type: none"> <li>• 25A rating</li> <li>• Control 3Ø loads</li> <li>• Field replaceable contacts</li> <li>• Optional auxiliary switch</li> <li>• Universal mounting plate</li> </ul>	<ul style="list-style-type: none"> <li>• 30 - 40A rating</li> <li>• P30 switches 30A</li> <li>• P40 switches 40A</li> <li>• Field replaceable contacts</li> <li>• Optional auxiliary switch</li> <li>• Universal mounting plate</li> </ul>	<ul style="list-style-type: none"> <li>• 40A rating</li> <li>• P31 is 3 pole</li> <li>• P41 is 4 pole</li> <li>• Universal mounting plate</li> <li>• Various terminals</li> </ul>
Approximate Dimensions							
Contact Arrangements	1 Form A to 2 Form C	1 Form C, 2 Form C	4 Form C	1 Form A to 2 Form C	2 Form X to 3 Form X	2 Form X to 4 Form Y	2 Form X to 4 Form X
Contact Material	AgCdO	Ag & AgCdO	AgCdO	Ag AgCdO	AgCdO	AgCdO	AgCdO
Maximum Contact Rating	(1C) 30A @ 240VAC 25A @ 28VDC 1HP @ 120VAC (2C) 20A @ 240VAC or 28VDC 3/4HP @ 120VAC	20A @ 277VAC 1HP @ 125VAC 2HP @ 250VAC	25A @ 277VAC 10A @ 28VDC 1HP @ 240VAC	50A @ 277VAC 20A @ 125VDC 1.5HP @ 120VAC 2HP @ 250VAC	25FLA, 100LRA @ 600VAC 30A res. @ 600VAC	(P30) 30FLA, 120LRA @ 600VAC 40A res. @ 600VAC (P40) 40FLA, 160LRA @ 600VAC 50A res. @ 600VAC	40FLA, 160LRA @ 600VAC 50A res. @ 600VAC
Expected Mechanical Life	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>6</sup> Ops.	1 x 10 <sup>7</sup> Ops.	2 x 10 <sup>6</sup> Ops.	2 x 10 <sup>6</sup> Ops. (DC coil) 5 x 10 <sup>6</sup> Ops. (AC coil)	2 x 10 <sup>6</sup> Ops. (DC coil) 1 x 10 <sup>7</sup> Ops. (AC coil)	5 x 10 <sup>5</sup> Ops.
Expected Electrical Life at Rated Load	1 x 10 <sup>5</sup>	5 x 10 <sup>4</sup>	1 x 10 <sup>7</sup>	1 x 10 <sup>5</sup>	5 x 10 <sup>5</sup>	2 x 10 <sup>5</sup>	2 x 10 <sup>5</sup>
Nominal Coil Voltage	6-110VDC 6-240VAC	6-125VDC 6-277VAC	6-125VDC 6-480VAC	6-110VDC 6-480VAC	6-240VDC 24-600VAC	6-240VDC 24-600VAC	12-120VDC 12-240VAC
Nominal Coil Power	1.2W (DC) 2.7VA (AC)	1.13-4.5W (DC) 4.0VA (AC)	4.4W (DC) 14VA (AC)	2.0W (DC) 8.0VA (AC)	4-8W (DC) 10VA (AC)	4-8W (DC) 10VA (AC)	8W (DC) 10VA (AC)
Mounting Options	Panel mount, PC board	Panel mount	Panel mount	Panel mount	Panel mount	Panel mount	Panel mount
Sockets / Connectors	—	—	—	—	—	—	—
Fax Document #	5840	7867	7600	7730	7250	7304	7314

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Latching & Rotary Relays					Automotive Relays		
Potter & Brumfield Relays®  Siemens Relays®	<b>NEW</b> 						
	<b>Series</b>	<b>VPRH/U</b>	<b>KUL</b>	<b>KBP</b>	<b>S89/S90</b>	<b>Series</b>	<b>VKM</b>
<b>Features</b>	<ul style="list-style-type: none"> <li>• <b>35A rating</b></li> <li>• Coil insulation Class B</li> <li>• Bi-stable coil</li> <li>• Meets UL and CSA</li> </ul>	<ul style="list-style-type: none"> <li>• <b>10A rating</b></li> <li>• Magnetic latching relay</li> <li>• Single or dual coil</li> <li>• Good memory stability</li> <li>• Low power req.</li> <li>• Various sockets available</li> </ul>	<ul style="list-style-type: none"> <li>• <b>10A rating</b></li> <li>• Dual coil, mechanical latching relay</li> <li>• Clear dust cover with plug-in base</li> <li>• Up to 5 poles</li> <li>• Sockets available</li> </ul>	<ul style="list-style-type: none"> <li>• <b>15 - 20A rating</b></li> <li>• Low cost, bistable, impulse relay</li> <li>• Optional dust cover with plug-in base</li> <li>• Up to 4 poles</li> </ul>	<b>Features</b>	<ul style="list-style-type: none"> <li>• <b>10A rating</b></li> <li>• Miniature PC board relay</li> <li>• Available open or with sealed case</li> <li>• Various contact arrangements</li> <li>• Minimum PCB real estate</li> </ul>	<ul style="list-style-type: none"> <li>• <b>10A rating</b></li> <li>• Miniature PC board relay</li> <li>• Sealed case</li> <li>• Various contact arrangements</li> </ul>
<b>Approximate Dimensions</b>	a b c 1.12" x 1.12" x 1.04"h (28.5 x 28.5 x 26.6h) 1.1 oz. (31g)	a b c 1.53" x 1.41" x 2.16"h (38.9 x 35.7 x 54.8h) 3.4 oz. (96g)	a b c 1.78" x 2.41" x 3.56"h (45.2 x 61.1 x 90.4h) 10.8 oz. (306g)	a b c 2.70" x 2.00" x 2.42"h (68.6 x 50.8 x 61.5h) 7.8 oz. (241g)	<b>Approximate Dimensions</b>	a b c .689" x .591" x .768"h (17.5 x 15.0 x 19.5h) 0.4 oz. (12g)	a b c .89" x .65" x .67"h (22.5 x 16.5 x 17h) 0.4 oz. (12g)
<b>Contact Arrangements</b>	1 Form C	1 Form C, 2 Form C, 3 Form C	1 Form A to 5 Form C	1 Form A to 4 Form C	<b>Contact Arrangements</b>	1 Form A, 1 Form C, 1 Form U, 1 Form V	1 Form A, 1 Form C
<b>Contact Material</b>	Ag Alloy	Ag AgCdO	Ag AgCdO	Ag AgCdO	<b>Contact Material</b>	AgNi 20 AgNi 0.15	AgNi 0.15
<b>Maximum Contact Rating</b>	35A @ 277VAC	5A @ 28VDC or 240VAC 10A @ 28VDC or 240VAC 1/4HP @ 120VAC 1/3HP @ 240VAC	5A @ 120VAC 10A @ 120VAC	(S89) 15A @ 250VAC 1/2 HP @ 125VAC (S90) 20A @ 277VAC 2 HP @ 250VAC	<b>Contact Rating @ 85°C (Form A contacts with nominal coil voltage)</b>	10A @ 14VDC	10A @ 14VDC
<b>Expected Mechanical Life</b>	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	5 x 10 <sup>6</sup> Ops.	1 x 10 <sup>6</sup> Ops.	<b>Expected Mechanical Life</b>	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.
<b>Expected Electrical Life at Rated Load</b>	—	1 x 10 <sup>5</sup>	5 x 10 <sup>4</sup>	5 x 10 <sup>4</sup>	<b>Expected Electrical Life at Rated Load</b>	1 x 10 <sup>5</sup>	2 x 10 <sup>5</sup>
<b>Nominal Coil Voltage</b>	5-24VDC	6-110VDC 6-240VAC	6-110VDC 6-240VAC	6-120VDC 6-277VAC	<b>Nominal Coil Voltage</b>	6, 12 & 24VDC	6, 12 & 24VDC
<b>Nominal Coil Power</b>	1.6W	1.6W (DC dual coil) 1.2W (DC single coil)	2.7W (DC) 5.3-7.8VA (AC)	6.33W (DC) 9VA (AC)	<b>Nominal Coil Power</b>	1.11W	.36W (T72J) .64W (T72K)
<b>Mounting Options</b>	PC board	Socket, Panel mount	Socket	Panel mount, Socket	<b>Mounting Options</b>	PC board	PC board
<b>Sockets / Connectors</b>	—	Screw terminal, Solder terminal, PC terminal, Quick connect terminal	Screw terminal, Solder terminal	Screw terminal	<b>Sockets / Connectors</b>	—	—
<b>Fax Document #</b>	8774	5850	5270	7890	<b>Fax Document #</b>	8560	8725

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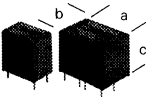
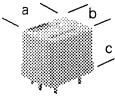

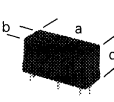
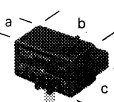
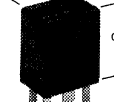
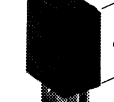
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## Automotive Relays

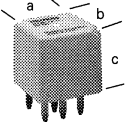
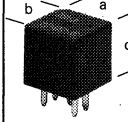
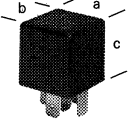
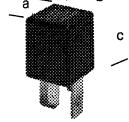
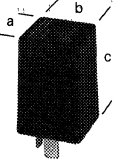


Series	VKS/VKD	T72M	VKP	V2R	VBA	VM28	VFM
<b>Potter &amp; Brumfield Relays®</b>  <b>Siemens Relays®</b>			<b>NEW</b> 				
<b>Features</b>	<ul style="list-style-type: none"> <li>• 10A rating</li> <li>• Low profile</li> <li>• Sealed immersion cleanable case</li> <li>• Single or dual relay package</li> </ul>	<ul style="list-style-type: none"> <li>• 20A rating</li> <li>• Miniature PC board relay</li> <li>• Sealed case</li> <li>• Various contact arrangements</li> <li>• High current version</li> <li>• 105°C ambient</li> </ul>	<ul style="list-style-type: none"> <li>• 40A rating</li> <li>• PC board relay</li> <li>• Available open or with sealed case</li> <li>• Various contact arrangements</li> <li>• Minimum PCB real estate</li> </ul>	<ul style="list-style-type: none"> <li>• 20A rating</li> <li>• Motor reversing contact arrangement</li> <li>• Sealed case</li> <li>• Miniature PC board relay</li> <li>• 105°C ambient</li> </ul>	<ul style="list-style-type: none"> <li>• 30A rating</li> <li>• Motor reversing relay module</li> <li>• Plug-in connections</li> <li>• Various mounting options</li> </ul>	<ul style="list-style-type: none"> <li>• 20A rating</li> <li>• Micro plug-in relay</li> <li>• Plastic enclosure</li> <li>• Various contact arrangements</li> </ul>	<ul style="list-style-type: none"> <li>• 20A rating</li> <li>• Miniature relay for plug-in or PC board mounting</li> <li>• Plastic enclosure</li> <li>• Various contact arrangements</li> </ul>
<b>Approximate Dimensions</b>	a b c .91" x .67" x .634" h (23 x 17 x 16.1h) .27 oz. (7.6g)	a b c .89" x .65" x .67" h (22.5 x 16.5 x 17h) 0.4 oz. (12g)	a b c .911" x .748" x .715" h (23.1 x 19.0 x 18.2h) 0.7 oz. (20g)	a b c 1.46" x .65" x .67" h (37.1 x 16.5 x 17h) 0.9 oz. (25g)	a b c 1.01" x 2.02" x 1.91" h (25.6 x 51.3 x 48.5h) 2.5 oz. (70g)	a b c .610" x .906" x 1.02" h (15.5 x 23 x 26h) 0.72 oz. (20.4g)	a b c .610" x .906" x 1.02" h (15.5 x 23 x 26h) 0.7 oz. (19.8g)
<b>Contact Arrangements</b>	1 Form A, 1 Form C	1 Form A, 1 Form C	1 Form A, 1 Form C	2 x 1 Form C (H-Bridge)	2 x 1 Form C (H-Bridge)	1 Form A, 1 Form C	1 Form A, 1 Form C
<b>Contact Material</b>	AgNi 0.15 AgSnO	AgNi 0.15 AgSnO	AgNi 0.15 PdCu, AgSnO AgSnO	AgNi 0.15	AgNi 0.15	AgSnO	AgSnO AgNi 0.15
<b>Contact Rating @ 85°C (Form A contacts with nominal coil voltage)</b>	10A @ 14VDC	20A @ 14VDC	40A @ 14VDC	20A @ 14VDC	30A @ 14VDC	20A @ 14VDC	20A @ 14VDC
<b>Expected Mechanical Life</b>	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.
<b>Expected Electrical Life at Rated Load</b>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>	1 x 10 <sup>5</sup>
<b>Nominal Coil Voltage</b>	6, 12 & 24VDC	6, 12 & 24VDC	6, 12 & 24VDC	12VDC	12VDC	6, 12 & 24VDC	6, 12 & 24VDC
<b>Nominal Coil Power</b>	.8W	.8W	1.6W	.64W .91W	1.81W	1.3W	1.6W
<b>Mounting Options</b>	PC board	PC board	PC board	PC board	Bracket, Spring-clip, Push-in fastener	Plug-in	Plug-in
<b>Sockets / Connectors</b>	—	—	—	—	Wiring harness style connector	Consult factory	PC terminal socket, wiring harness style connector
<b>Fax Document #</b>	8573	8726	8570	8270	8220	8628	8360

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# SIEMENS

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 200 South Richland Creek Drive, Princeton, Indiana 47671-0001  
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Automotive Relays						Solid State Relays	
Potter & Brumfield Relays®  Siemens Relays®	<i>NEW</i> 						
Series	VPRD/S	VF28	VF4	VF7	VTF	LH	
Features	<ul style="list-style-type: none"> <li>• 30A rating</li> <li>• Magnetic latching</li> <li>• High shock and vibration resistance</li> <li>• Sealed immersion cleanable case</li> </ul>	<ul style="list-style-type: none"> <li>• 30A rating</li> <li>• Plug-in relay</li> <li>• Two enclosure options</li> <li>• Various contact arrangements</li> <li>• Optional mounting bracket</li> </ul>	<ul style="list-style-type: none"> <li>• 40A rating</li> <li>• Plug-in or PC board mountable relay</li> <li>• Several enclosure options</li> <li>• Various contact arrangements</li> <li>• Optional mounting brackets</li> </ul>	<ul style="list-style-type: none"> <li>• 70A rating</li> <li>• Plug-in or PC board mountable relay</li> <li>• 1 Form A contact arrangement</li> <li>• Optional mounting bracket</li> </ul>	<ul style="list-style-type: none"> <li>• 279W rating</li> <li>• Turn signal, hazard, or combination versions</li> <li>• Flash rate not sensitive to load current</li> <li>• Electronic timing with relay output</li> <li>• Meets applicable U.S. safety standards</li> </ul>	<b>Features</b> <ul style="list-style-type: none"> <li>• .05 - 1.4A rating</li> <li>• 6/8-pin DIP</li> <li>• 6/8-pin SMD</li> <li>• 3750 or 5300 Vrms I/O isolation</li> <li>• linear AC &amp; DC operations</li> <li>• Active current limit</li> </ul> 	
Approximate Dimensions	a b c 1.12" x 1.12" x 1.04" h (28.5 x 28.5 x 26.6h) 1.1 oz. (31g)	a b c 1.12" x 1.12" x 1.00" h (28.5 x 28.5 x 25.4h) 1.2 oz. (34g)	a b c 1.12" x 1.12" x .987" h (28.5 x 28.5 x 25.1h) 1.1 oz. (31g)	a b c 1.04" x 1.04" x .992" h (26.5 x 26.5 x 25.2h) 1.1 oz. (31g)	a b c 1.12" x 1.12" x 1.6" h (28.5 x 28.5 x 40.5h) 1.3 oz. (37g)	Approximate Dimensions	Various
Contact Arrangements	1 Form C	1 Form A, 1 Form C	1 Form A, 1 Form C	1 Form A	1 Form A	Switch Arrangement	1 Form A, 1 Form B 1 Form C, 2 Form A Dual 1 Form A & B
Contact Material	AgSnO AgNi 0.15	AgNi 0.15	AgSnO AgNi 0.15	AgNi 0.15	PdCu AgCu	Coupling	Optical
Contact Rating @ 85°C (Form A contacts with nominal coil voltage)	30A @ 14VDC	30A @ 14VDC	40A @ 14VDC	70A @ 14VDC	55W to 275W (Lamp)	DC Input Current (external limiting resistor required)	50mA Max.
Expected Mechanical Life	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	1 x 10 <sup>7</sup> Ops.	Output Structure	Source Coupled MOSFETs
Expected Electrical Life at Rated Load	1 x 10 <sup>6</sup>	1 x 10 <sup>6</sup>	1 x 10 <sup>6</sup>	1 x 10 <sup>6</sup>	1 x 10 <sup>6</sup> - 3 x 10 <sup>6</sup> (Load dependent)	Typical Output Current	<1A
Nominal Coil Voltage	6, 12 & 24VDC	12VDC	6, 12 & 24VDC	6, 12 & 24VDC	12VDC	Off State Leakage Current	<1µA
Nominal Coil Power	1.6W (Dual) .8W (Single)	1.6W	1.6W	2.0W	1.6W	Peak Blocking Voltage	400V Max.
Mounting Options	PC board, Plug-in, Bracket	Plug-in, Bracket	PC board, Plug-in, Bracket	PC board, Plug-in, Bracket	Plug-in	Output Type	AC/DC
Sockets / Connectors	Wiring harness style connector	Wiring harness style connector	PC terminal socket, Wiring harness style connector with or without bracket	Wiring harness style connector	PC terminal socket, wiring harness style connector with or without bracket	Terminals	Screw
Fax Document #	8773	8328	8340	8370	8831	Mounting	PC Board, Surface mount
						Fax Document #	9700

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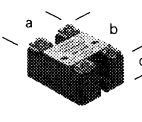
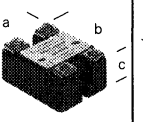
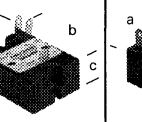
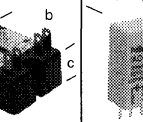
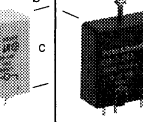
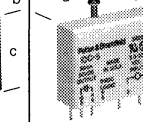
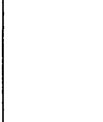
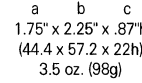
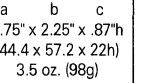
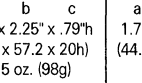
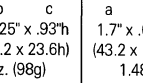
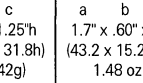
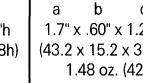

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# SIEMENS

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## Solid State Relays

## Solid State Input/Output Modules

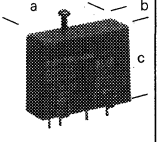
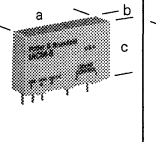
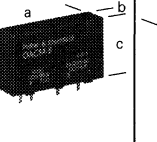
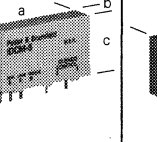
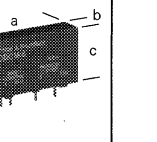
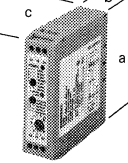






Potter & Brumfield Relays®  Siemens Relays®							
	<b>SSRT</b>	<b>SSR</b>	<b>SSRD</b>	<b>SSRQ</b>	<b>IAC</b>	<b>OAC</b>	<b>IDC</b>
<b>Series</b>	<b>SSRT</b>	<b>SSR</b>	<b>SSRD</b>	<b>SSRQ</b>	<b>IAC</b>	<b>OAC</b>	<b>IDC</b>
<b>Features</b>	<ul style="list-style-type: none"> <li>• 10 - 25A rating</li> <li>• "Hockey Puck" package</li> <li>• Triac output</li> <li>• AC &amp; DC input</li> </ul>	<ul style="list-style-type: none"> <li>• 25 - 125A rating</li> <li>• "Hockey Puck" package</li> <li>• Inverse parallel SCR output</li> <li>• AC &amp; DC input</li> </ul>	<ul style="list-style-type: none"> <li>• 40A rating per output</li> <li>• Two independent solid state relays in one "Hockey Puck" package</li> <li>• Inverse parallel SCR output</li> </ul>	<ul style="list-style-type: none"> <li>• 20A rating per output</li> <li>• Four independent solid state relays in one "Hockey Puck" package</li> <li>• Triac output</li> </ul>	<ul style="list-style-type: none"> <li>• 0.05A rating</li> <li>• AC input module</li> <li>• Industry standard 0.6" (15.2mm) wide package</li> <li>• Series operation compatible</li> </ul>	<ul style="list-style-type: none"> <li>• 5A output rating</li> <li>• AC output module</li> <li>• Industry standard 0.6" (15.2mm) wide package</li> <li>• Series operation compatible</li> </ul>	<ul style="list-style-type: none"> <li>• 0.05A output rating</li> <li>• DC input module</li> <li>• Industry standard 0.6" (15.2mm) wide package</li> <li>• Series operation compatible</li> </ul>
<b>Approximate Dimensions</b>	 1.75" x 2.25" x .87"h (44.4 x 57.2 x 22h) 3.5 oz. (98g)	 1.75" x 2.25" x .87"h (44.4 x 57.2 x 22h) 3.5 oz. (98g)	 1.75" x 2.25" x .79"h (44.4 x 57.2 x 20h) 3.5 oz. (98g)	 1.75" x 2.25" x .93"h (44.4 x 57.2 x 23.6h) 3.5 oz. (98g)	 1.7" x .60" x 1.25"h (43.2 x 15.2 x 31.8h) 1.48 oz. (42g)	 1.7" x .60" x 1.25"h (43.2 x 15.2 x 31.8h) 1.48 oz. (42g)	 1.7" x .60" x 1.25"h (43.2 x 15.2 x 31.8h) 1.48 oz. (42g)
<b>Switch Arrangement</b>	1 Form A	1 Form A	(2) x 1 Form A	(4) x 1 Form A	1 Form A (sinking)	1 Form A	1 Form A (sinking)
<b>Coupling</b>	Optical	Optical	Optical	Optical	Optical	Optical	Optical
<b>Input</b>	3-32VDC 90-280VAC	3-32VDC 90-280VAC	4-15VDC	4-15VDC	18-36VAC/VDC 90-140VAC/VDC 180-280VAC/VDC	5VDC 15VDC 24VDC	3.3-32VDC 4-32VDC 10-60VDC
<b>Output Switching</b>	Zero	Zero, Random	Zero, Random	Zero, Random	Random	Zero, Random	Random
<b>Minimum Output Current</b>	.05A	.05A	.05A	.05A	>0	.05A	>0
<b>Maximum Output Current</b>	25A	125A	40A	20A	0.05A	3A to 5A	0.05A
<b>Minimum Output Voltage</b>	24V	24V	24V	24V	>0	24V	>0
<b>Maximum Output Voltage</b>	240V	480V	240V	240V	30V	280V	30V
<b>Output Type</b>	AC	AC	AC	AC	DC	AC	DC
<b>Terminals</b>	Screw	Screw	Quick connect	Quick connect	Printed circuit	Printed circuit	Printed circuit
<b>Mounting</b>	Chassis mount	Chassis mount	Chassis mount	Chassis mount	Mounting board	Mounting board	Mounting board
<b>Fax Document #</b>	7778	7770	7773	7772	4220	4220	4220

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Solid State Input/Output Modules						Time Delay Relays	
Potter & Brumfield Relays®  Siemens Relays®							
Series	<b>ODC</b>	<b>IACM</b>	<b>OACM</b>	<b>IDCM</b>	<b>ODCM</b>	Series	<b>CND</b>
Features	<ul style="list-style-type: none"> <li>• 3A output rating</li> <li>• DC output module</li> <li>• Industry standard 0.6" (15.2mm) wide package</li> <li>• Series operation compatible</li> </ul> 	<ul style="list-style-type: none"> <li>• 0.05A output rating</li> <li>• Slim line AC input module</li> <li>• Only 0.4" (10.2mm) wide package</li> <li>• Series operation compatible</li> </ul> 	<ul style="list-style-type: none"> <li>• 5A output rating</li> <li>• Slim line AC output module</li> <li>• Only 0.4" (10.2mm) wide package</li> <li>• Series operation compatible</li> </ul> 	<ul style="list-style-type: none"> <li>• 0.05A output rating</li> <li>• Slim line DC input module</li> <li>• Only 0.4" (10.2mm) wide package</li> <li>• Series operation compatible</li> </ul> 	<ul style="list-style-type: none"> <li>• 3A output rating</li> <li>• Slim line DC output module</li> <li>• Only 0.4" (10.2mm) wide package</li> <li>• Series operation compatible</li> </ul> 	Features	<ul style="list-style-type: none"> <li>• 10A rating</li> <li>• Programmable time delay relay</li> <li>• Universal input voltage</li> <li>• Fits 35 mm DIN track</li> <li>• Consult factory for VDE file</li> </ul> 
Approximate Dimensions	a b c 1.7" x .60" x 1.25"h (43.2 x 15.2 x 31.8h) 1.48 oz. (42g)	a b c 1.7" x .4" x 1.0"h (43.2 x 10.2 x 25.4h) 0.9 oz. (25.5g)	a b c 1.7" x .4" x 1.0"h (43.2 x 10.2 x 25.4h) 0.9 oz. (25.5g)	a b c 1.7" x .4" x 1.0"h (43.2 x 10.2 x 25.4h) 0.9 oz. (25.5g)	a b c 1.7" x .4" x 1.0"h (43.2 x 10.2 x 25.4h) 0.9 oz. (25.5g)	Approximate Dimensions	a b c 3.16" x .92" x 2.94"h (80.3 x 23.4 x 74.8h) 4.3 oz. (122g)
Switch Arrangement	1 Form A	1 Form A (sinking)	1 Form A	1 Form A (sinking)	1 Form A	Contact Arrang.	1 Form C
Coupling	Optical	Optical	Optical	Optical	Optical	Contact Rating	10A @ 28VDC or 277VAC
Input	5VDC 15VDC 24VDC	18-36VAC/VDC 90-140VAC/VDC 180-280VAC/VDC	5VDC 15VDC 24VDC 3-15VDC	3.3-32VDC 4-32VDC 10-60VDC	5VDC 15VDC 24VDC 3-15VDC	Mode of Operation	Programmable: 5 timing functions
Output Switching	Random	Random	Zero, Random	Random	Random	Delay Time	0.5 sec. to 100 min.
Minimum Output Current	.01A	>0	.05A	>0	.02A	Type of Control	Rotary switches & Potentiometer Adj.
Maximum Output Current	1A @ 250V 3A @ 60V	0.05A	3A to 5A	0.05A	3A @ 60V 1A @ 250V	Maximum Repeatability	±2%
Minimum Output Voltage	3V	>0	24V	>0	3V	Max. Delta Time	±10%
Maximum Output Voltage	60V, 250V	30V	280V	30V	60V, 250V	Tolerance	-0, +20%
Output Type	DC	DC	AC	DC	DC	Temp. Range	-10°C to +55°C
Terminals	Printed circuit	Printed circuit	Printed circuit	Printed circuit	Printed circuit	Input Voltage	24-240V ±15% 50/60 Hz. AC or DC
Mounting	Mounting board	Mounting board	Mounting board	Mounting board	Mounting board	Mounting	DIN Mount
Fax Document #	4220	4226	4226	4226	4226	Fax Document #	2630

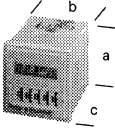
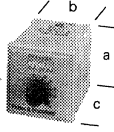
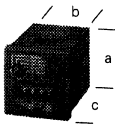
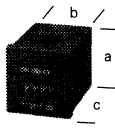
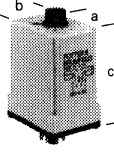


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# SIEMENS

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200 South Richland Creek Drive, Princeton, Indiana 47671-0001  
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## Time Delay Relays

Series	CNT	CNS	CNM5	CN1	CG	CD	CK
<b>Potter &amp; Brumfield Relays®</b>  <b>Siemens Relays®</b>							
<b>Features</b>	<ul style="list-style-type: none"> <li>• 10A rating</li> <li>• Programmable timer/counter</li> <li>• Digital display</li> <li>• Universal input voltage</li> <li>• 1/16 DIN style enclosure</li> </ul>	<ul style="list-style-type: none"> <li>• 10A rating</li> <li>• Programmable time delay relay</li> <li>• Universal input voltage</li> <li>• 1/16 DIN style enclosure</li> </ul>	<ul style="list-style-type: none"> <li>• 10A rating</li> <li>• Economical, programmable time delay relay</li> <li>• Digital accuracy</li> <li>• LED shows status</li> <li>• 1/16 DIN style enclosure</li> </ul>	<ul style="list-style-type: none"> <li>• 10A rating</li> <li>• Economical single function (on delay) time delay relay</li> <li>• Digital accuracy</li> <li>• LED shows status</li> <li>• 1/16 DIN style enclosure</li> </ul>	<ul style="list-style-type: none"> <li>• 10A rating</li> <li>• Top of the line non-programmable time delay relays</li> <li>• Extended timing ranges</li> </ul>	<ul style="list-style-type: none"> <li>• 10A rating</li> <li>• Ideal for many demanding applications</li> <li>• Broad temperature range</li> </ul>	<ul style="list-style-type: none"> <li>• 10A rating</li> <li>• Broad line</li> <li>• Wide choice of functions</li> <li>• Extremely versatile</li> </ul>
<b>Approximate Dimensions</b>	a b c 1.88" x 1.88" x 2.83"h (47.8 x 47.8 x 71.9h) 4.3 oz. (122g)	a b c 1.88" x 1.88" x 2.83"h (47.8 x 47.8 x 71.9h) 4.3 oz. (122g)	a b c 1.88" x 1.88" x 2.83"h (47.8 x 47.8 x 71.9h) 4.3 oz. (122g)	a b c 1.88" x 1.88" x 2.83"h (47.8 x 47.8 x 71.9h) 4.3 oz. (122g)	a b c 2.41" x 1.78" x 2.94"h (61.1 x 45.2 x 74.6h) 8 oz. (227g)	a b c 2.41" x 1.78" x 2.94"h (61.1 x 45.2 x 74.6h) 8 oz. (227g)	a b c 2.41" x 1.78" x 2.94"h (61.1 x 45.2 x 74.6h) 6 oz. (170g)
<b>Contact Arrang.</b>	2 Form C	2 Form C	2 Form C	2 Form C	2 Form C	2 Form C	2 Form C
<b>Contact Rating</b>	10A @ 30VDC or 277VAC	10A @ 30VDC or 277VAC	10A @ 30VDC or 277VAC	10A @ 30VDC or 277VAC	10A @ 240VAC	10A @ 240VAC	10A @ 240VAC
<b>Mode of Operation</b>	Programmable: 10 timing functions 2 counting functions	Programmable: 8 functions (11-pin) 4 functions (8-pin)	Programmable: 5 timing functions	On Delay	Delay on Operate Delay on Release Interval On	Delay on Operate Delay on Release	Delay on Operate Delay on Release Interval On Delay on Dropout
<b>Delay Time</b>	0.1 sec. to 9,990 hr.	0.1 sec. to 100 min.	0.1 sec. to 9,990 hr.	0.1 sec. to 9,990 hr.	0.5 sec. to 100 min.	0.1 sec. to 180 sec.	0.1 sec. to 180 sec.
<b>Type of Control</b>	Thumbwheel switches	DIP switches & Potentiometer Adj.	Thumbwheel switches & Rotary switch	Thumbwheel switches	Potentiometer Adj.	Fixed, Potentiometer Adj., Ext. Res. Adj.	Fixed, Potentiometer Adj., Ext. Res. Adj.
<b>Maximum Repeatability</b>	±0.1% ± 0.05 sec.	±0.2%	±0.05% ± 0.04 sec.	±0.05% ± 0.04 sec.	±0.5% (AC) ±0.1% (DC)	±1%	±2%
<b>Max. Delta Time</b>	±0.1% ± 0.05 sec.	±10%	—	—	±5%	±5%	±10%
<b>Tolerance</b>	±0.1% ± 0.05 sec.	Min. spec. at min.; +20%, -0 at max.	±0.05% ± 0.04 sec.	±0.05% ± 0.04 sec.	+0, -10% at min. +10%, -0 at max.	±5% (fixed only)	±5% (fixed only)
<b>Temp. Range</b>	-10°C to +55°C	-10°C to +55°C	-10°C to +55°C	-10°C to +55°C	-10°C to +55°C	-40°C to +55°C	-10°C to +55°C
<b>Input Voltage</b>	12VDC 24-240VAC/VDC	24-240VAC/VDC	120VAC	120VAC	12-24VDC 120-240VAC	12-110VDC 24-120VAC	12-110VDC 24-120VAC
<b>Mounting</b>	Plug-in	Plug-in	Plug-in	Plug-in	Plug-in	Plug-in	Plug-in
<b>Fax Document #</b>	2680	2670	2665	2610	2400	2300	2500

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Time Delay Relays					Sensors		
Potter & Brumfield Relays®  Siemens Relays®							
Series	<b>CH</b>	<b>CB</b>	<b>CR</b>	<b>CL/CU</b>	Series	<b>CS</b>	<b>SDAS-01</b>
Features	<ul style="list-style-type: none"> <li>• <b>10A rating</b></li> <li>• Wide range of industrial applications</li> <li>• Dependable timing cycles</li> </ul>	<ul style="list-style-type: none"> <li>• <b>10A rating</b></li> <li>• Economical for volume applications</li> <li>• Various timing ranges</li> </ul>	<ul style="list-style-type: none"> <li>• <b>10A rating</b></li> <li>• Recycle timer allows independent control of ON and OFF delays</li> <li>• Time as low as 0.1 sec.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>10A rating</b></li> <li>• Compact package is well-suited for many OEM applications</li> <li>• Various mounting options</li> </ul>	Functions/Features	<ul style="list-style-type: none"> <li>• <b>Voltage sensor</b></li> <li>• Functions as either an overvoltage or an undervoltage sensor</li> <li>• Choice of fixed pick-up and knob adjustable drop-out or knob adjustable pick-up and drop-out</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Current sensor</b></li> <li>• AC current sensor is offered in both overcurrent and undercurrent types</li> <li>• Inductive coupling to power line</li> <li>• Potentiometer adjustable</li> <li>• Internal relay available with one or two poles</li> </ul>
Approximate Dimensions							
Contact Arrang.	2 Form C	2 Form C	2 Form C	2 Form C	Approximate Dimensions	2.41" x 1.78" x 2.94" h (61.1 x 45.2 x 74.6h) 6 oz. (170g)	1.53" x 1.41" x 1.91" h (38.9 x 35.7 x 48.4h) 3.5 oz. (99g)
Contact Rating	10A @ 240VAC	10A @ 240VAC	10A @ 240VAC	10A @ 28VDC or 240VAC	Contact/Switch Arrangements	2 Form C	1 Form C, 2 Form C
Mode of Operation	Delay on Operate Delay on Release Interval On	Delay on Operate Delay on Release Interval On	Recycle Timer	Delay on Operate	Contact/Switch Rating @	10A @ 28VDC or 120VAC	(1C) 5A @ 28VDC or 2.5A @ 120VAC (2C) 2A @ 28VDC or 1A @ 120VAC
Delay Time	1 sec. to 180 sec.	0.1 sec. to 100 min.	0.1 sec. to 180 sec.	0.1 sec. to 120 sec.	Monitor/Sense Range or Threshold	16 to 140VAC or VDC in various ranges	1.5 to 15A AC
Type of Control	Fixed, Potentiometer Adj., Ext. Res. Adj.	Fixed, Potentiometer Adj., Ext. Res. Adj.	Potentiometer Adj.	Fixed, Potentiometer Adj., Ext. Res. Adj.	Temp. Range	-10°C to +55°C	-25°C to +70°C
Maximum Repeatability	±2%	±2%	±2%	±3%	Terminals	Octal plug	Quick connect, PC board
Max. Delta Time	±10%	±10%	±10%	-	Mounting Options	Socket	Socket, Chassis mount, PC board
Tolerance	±5% (fixed only)	±10% (fixed only)	+0, -20% at min. +20%, -0 at max.	±5% (fixed only)	Sockets	Screw terminal	Screw terminal, Solder terminal, PC terminal, Quick connect terminal
Temp. Range	-10°C to +55°C	-10°C to +55°C	-10°C to +55°C	-10°C to +40°C			
Input Voltage	24VDC 24-240VAC	12-110VDC 24-240VAC	12-110VDC 24-120VAC	12-24VDC 24-120VAC			
Mounting	Plug-in	Plug-in	Plug-in	Plug-in			
Fax Document #	2401	2200	2700	2580	Fax Document #	2755	7327

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# ELECTRO-MECHANICAL RELAYS

General Purpose Relays					Automotive Relays		
Relay Series	<b>ST90H</b> 	<b>ST91H</b> 	<b>SR8</b> 	<b>SR11</b> 	<b>AMRM</b> 	<b>AMRK</b> 	<b>AMRB</b> 
<b>FEATURES:</b>	<ul style="list-style-type: none"> <li>• Heavy Duty</li> <li>• High Capacity</li> <li>• PCB Mount</li> <li>• UL 94V-O Flammability</li> <li>• Class F Version Available</li> <li>• UL/CSA</li> </ul>	<ul style="list-style-type: none"> <li>• Heavy Duty</li> <li>• Quick Connect Terminals</li> <li>• Low Profile</li> <li>• Panel Mount</li> <li>• UL 94V-O Flammability</li> <li>• Class F Version Available</li> <li>• UL/CSA</li> </ul>	<ul style="list-style-type: none"> <li>• Small Footprint</li> <li>• Low Coil Power</li> <li>• Low-cost</li> <li>• High Reliability</li> <li>• Washable</li> <li>• PCB Mount</li> <li>• 5A, 10A, 12A Version Available* (GP Rating)</li> <li>• UL/CSA</li> </ul>	<ul style="list-style-type: none"> <li>• Small Footprint</li> <li>• Low Coil Power</li> <li>• Passes Auto. 1m Drop Test</li> <li>• 180°C Coil Wire Used for Class F</li> <li>• 5A, 6A, 10A, 12A, 15A (Form A only) Version Available*</li> <li>• UL/CSA</li> </ul>	<ul style="list-style-type: none"> <li>• Small Footprint</li> <li>• Passes Auto. 1m Drop Test</li> <li>• Improved Resistance to Shock &amp; Vibration</li> <li>• Low Cost</li> </ul>	<ul style="list-style-type: none"> <li>• Rugged Design</li> <li>• High In-Rush Current Capability</li> <li>• Passes Auto. 1m Drop Test</li> <li>• PCB Mount</li> </ul>	<ul style="list-style-type: none"> <li>• High Power</li> <li>• High In-Rush Current Capability</li> <li>• Rugged Design</li> <li>• Passes Auto. 1m Drop Test</li> <li>• High Temperature 180°C Coil Wire Insulation</li> </ul>
<b>CONTACT RATINGS</b>							
Contact Arrangements	1 Form A 1 Form B 1 Form C	1 Form A 1 Form B 1 Form C	1 Form A 1 Form B 1 Form C	1 Form A 1 Form B 1 Form C	1 Form A 1 Form C	1 Form A 1 Form C	1 Form A 1 Form B 1 Form C
Contact Material	AgSnO <sub>2</sub>	AgSnO <sub>2</sub>	AgCdO	AgCdO AgSnO <sub>2</sub>	AgNi AgSnO <sub>2</sub> InO <sub>3</sub>	AgSnO <sub>2</sub>	AgSnO <sub>2</sub>
Maximum Carry Current	30A @ 240 V <sub>AC</sub> 30A @ 14 V <sub>DC</sub>	30A @ 240 V <sub>AC</sub> 30A @ 14 V <sub>DC</sub>	5A @ 125 V <sub>AC</sub> * 10A @ 125 V <sub>AC</sub> * 12A @ 125 V <sub>AC</sub> *	5A @ 125 V <sub>AC</sub> * 6A @ 277 V <sub>AC</sub> * 10A @ 250 V <sub>AC</sub> * 12A @ 125 V <sub>AC</sub> * 15A @ 125 V <sub>AC</sub> *	20A @ 14V <sub>DC</sub>	40A @ 13 V <sub>DC</sub>	40A @ 14V <sub>DC</sub>
<b>GENERAL CHARACTERISTICS</b>							
Coil Voltages	3, 5, 6, 9, 12, 18, 24, 48V <sub>DC</sub>	3, 5, 6, 9, 12, 18, 24, 48V <sub>DC</sub>	3, 5, 6, 9, 12, 24, 48V <sub>DC</sub>	3, 5, 6, 9, 12, 24, 48V <sub>DC</sub>	6, 9, 12, 24 V <sub>DC</sub>	6, 9, 12, 24 V <sub>DC</sub>	6, 12, 24 V <sub>DC</sub>
Dielectric Strength	Minimum 1500 V <sub>AC</sub> rms	Minimum 1500 V <sub>AC</sub> rms	1500 V <sub>AC</sub> rms	1554 Vrms between open contacts and between contact and coil	500 V <sub>AC</sub>	750 V <sub>AC</sub> between contact and coil	750 V <sub>AC</sub> between contact and coil
Oper. Time	≤ 10ms max.	≤ 10ms max.	7ms typ.	8ms typ.	10ms max.	10ms typ.	5ms typ.
Release Time	≤ 8ms max.	≤ 8ms max.	40ms typ.	5ms typ.	5ms max.	10ms typ.	3ms typ.
<b>LIFE</b>							
Mechanical	10,000,000 operations typical	10,000,000 operations typical	10,000,000 operations	10,000,000 operations	1,000,000 operations	1 x 10 <sup>6</sup> at 300CPM	10,000,000 operations
Electrical	100,000 operations resistive	100,000 operations resistive	100,000 operations	100,000 operations	100,000 operations	1 x 10 <sup>6</sup> at 30CPM	100,000 operations
Weight	27g, 33g, 36g	27g, 33g, 36g	11g	10g	6g	17g	Open – 18g Sealed – 20g
Enclosure Styles	<ul style="list-style-type: none"> <li>• Open Frame</li> <li>• Removable Dust Cover</li> <li>• Washable</li> <li>• Epoxy Base Dust Cover</li> </ul>	<ul style="list-style-type: none"> <li>• Open Frame</li> <li>• Removable Dust Cover</li> <li>• Washable</li> <li>• Epoxy Base Dust Cover</li> </ul>	<ul style="list-style-type: none"> <li>• Washable</li> </ul>	<ul style="list-style-type: none"> <li>• Washable</li> </ul>	<ul style="list-style-type: none"> <li>• Washable</li> <li>• Dust Cover</li> </ul>	<ul style="list-style-type: none"> <li>• Open Frame</li> <li>• Washable</li> <li>• Dust Cover</li> </ul>	<ul style="list-style-type: none"> <li>• Open Frame</li> <li>• Epoxy Based Dust Cover</li> </ul>
Footprint (not to scale)							

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**Stetron International Inc.**



# Solid-State Relay Selector's Guide

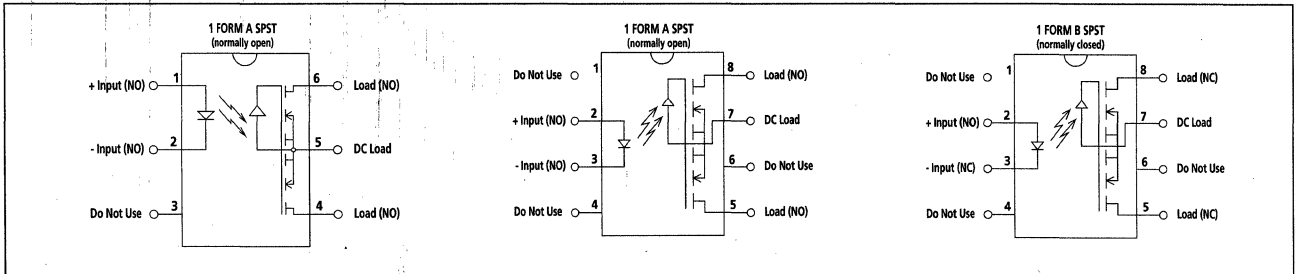
Output Type: **AC/DC (MOS Output)**

Contact Type: **1 Form A** | **1 Form B**

Package Type: **6 PIN DIP/SMD** | **8 PIN DIP/SMD** | **6 PIN DIP/SMD**

PARAMETER	Product	AD611	AD621	AD6C111	AD6C211	AD6C311	AD6C250	AD811	AD821	AD8C111	AD8C211	AD8C311	AD8C250	AD612	AD622	AD6C112
Blocking Voltage (V) Max		400	400	400	400	400	350	400	400	400	400	400	350	350	400	250
Load Current (mA) Max		100	120	120	120	200	25	100	120	120	120	200	25	80	120	120
On Resistance (Ω) Typ		35	20	25	17	6	225	35	20	25	17	6	225	30	20	35
	Max	50	30	35	20	8	300	50	30	35	20	8	300	50	25	40
Leakage Current (μA) Typ		0.2	0.6	0.2	0.7	0.5	0.010	0.2	0.6	0.2	0.7	0.5	0.010	0.6	0.5	0.2
	Max	1.0	1.0	1.0	2.0	2.0	0.100	1.0	1.0	1.0	2.0	2.0	0.100	1.0	1.0	1.0
Turn-On Time (mS) Typ		0.15	0.5	0.5	0.3	2.0	0.050	0.15	0.5	0.5	0.3	2.0	0.050	—	—	0.3
	Max	1.0	1.0	1.0	1.0	5.0	0.500	1.0	1.0	1.0	1.0	5.0	0.500	0.2	0.2	1.0
Turn-Off Time (mS) Typ		0.1	0.1	0.1	0.15	0.15	0.150	0.1	0.1	0.1	0.15	0.15	0.150	—	—	0.1
	Max	1.0	1.0	0.5	0.5	0.5	0.500	1.0	1.0	0.5	0.5	0.5	0.500	1.0	1.0	1.0
CTR(%) Typ		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Current Transfer Ratio Max		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Isolation Voltage (V) Min		2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
	-H Suffix	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750
Approval(s)		UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
		BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT
Page Number																

## Schematic Diagrams



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# Solid-State Relay Selector's Guide



Output Type

**AC/DC (MOS Output)**

Contact Type

**1 Form B**

**Dual 1 Form A**

**Dual 1 Form B**

**1 Form A/1 Form B**

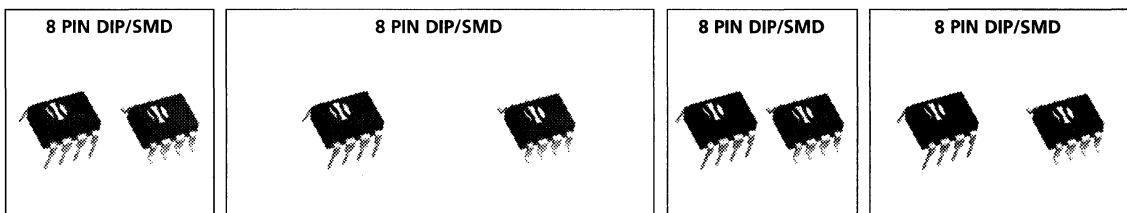
Package Type

**8 PIN DIP/SMD**

**8 PIN DIP/SMD**

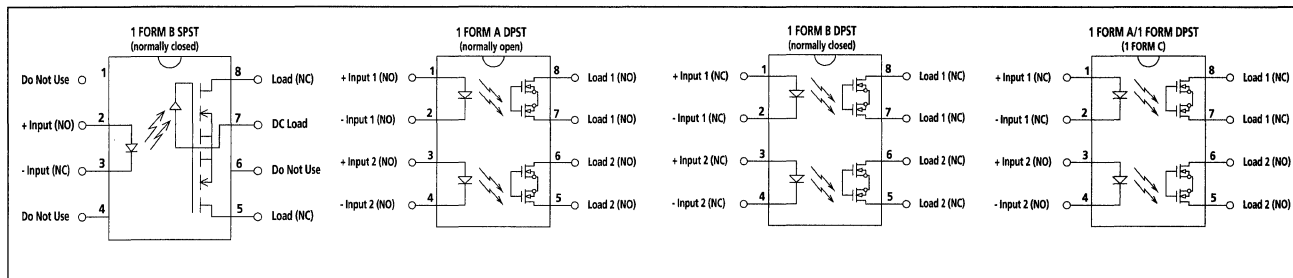
**8 PIN DIP/SMD**

**8 PIN DIP/SMD**



PARAMETER	Product	AD812	AD822	AD8C112	AD411	AD421	AD4C111	AD4C211	AD4C311	AD4C250	AD412	AD422	AD4C112	AD413	AD423	AD4C113	AD4C213
Blocking Voltage (V) Max		350	400	250	400	400	400	400	400	350	350	400	250	400(350)	400	400 (250)	400
Load Current (mA) Max		80	120	120	100	120	120	120	200	25	80	120	120	160(80)	120	120	120
On Resistance (Ω) Typ		30	20	35	35	20	25	17	6	225	30	20	35	35 (30)	20	25 (35)	6 (20)
	Max	50	25	40	50	30	35	20	8	300	50	25	40	35 (40)	30	35 (40)	8 (25)
Leakage Current (μA)		0.6	0.5	0.2	0.2	0.6	0.2	0.7	0.5	0.010	0.6	0.5	0.2	0.5	0.5	0.2	0.5
	Max	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	0.100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Turn-On Time (mS) Typ		—	—	0.3	0.15	0.5	0.5	0.3	2.0	0.050	—	—	0.3	0.2	0.5	0.5 (0.3)	0.5 (0.3)
	Max	0.2	0.2	1.0	1.0	1.0	1.0	1.0	5.0	0.500	0.2	0.2	1.0	1.0	1.0	1.0	1.0
Turn-Off Time (mS) Typ		—	—	0.1	0.1	0.1	0.1	0.15	0.15	0.150	—	—	0.1	0.1	0.1	0.1	0.1
	Max	1.0	1.0	0.5	0.5	0.5	—	1.0	1.0	0.5	0.5	0.5	—	1.0	1.0	1.0	1.0
CTR(%) Typ		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Current Transfer Ratio Max		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Isolation Voltage (V) Min		2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
-H Suffix		3750	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750
Approval(s)		UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
		BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT
Page Number																	

## Schematic Diagrams



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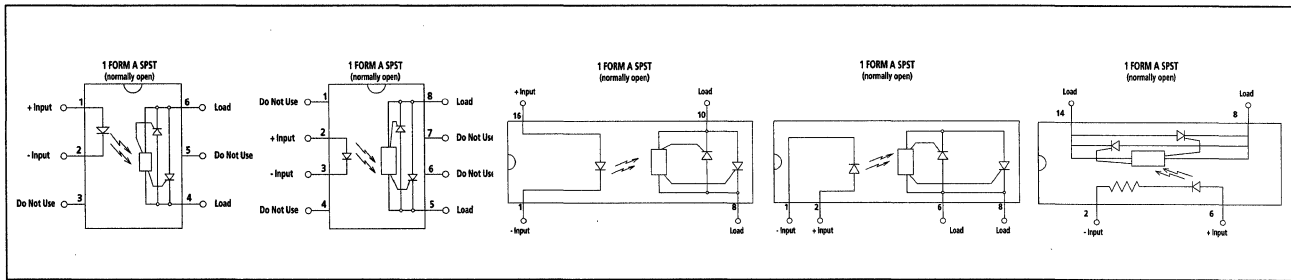


# Solid-State Relay Selector's Guide

Output Type	AC Zero Volt Switching (SCR Output)					AC Zero
Contact Type	1 Form A					1 Form A
Package Type	<b>6 PIN DIP/SMD</b> 	<b>8 PIN DIP/SMD</b> 	<b>16 PIN DIP/SMD</b> 	<b>4 PIN DIP/SMD</b> 	<b>14 PIN DIP</b> 	<b>4 PIN SIP</b> 

PARAMETER	Product	S106	S107	S110	S111	S642	S742	S842	SP646	SP746	SP846	S641	SP641
Blocking Voltage (V) Max		400	600	400	600	400	600	700	400	600	700	400	400
Load Current (mA) Max		800	800	800	800	1000	1000	1000	1200	1200	1200	1000	1200
On Resistance (Ω) Typ		—	—	—	—	—	—	—	—	—	—	—	—
Max		—	—	—	—	—	—	—	—	—	—	—	—
Leakage Current (μA) Typ		—	—	—	—	—	—	—	—	—	—	—	—
Max		—	—	—	—	—	—	—	—	—	—	—	—
Turn-On Time (mS) Typ		—	—	—	—	—	—	—	—	—	—	—	—
Max		—	—	—	—	—	—	—	—	—	—	—	—
Turn-Off Time (mS) Typ		—	—	—	—	—	—	—	—	—	—	—	—
Max		—	—	—	—	—	—	—	—	—	—	—	—
CTR(%) Typ		—	—	—	—	—	—	—	—	—	—	—	—
Current Transfer Ratio Max		—	—	—	—	—	—	—	—	—	—	—	—
Isolation Voltage (V) Min		2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
-H Suffix		3750	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750
Approval(s)		UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
		BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT	BABT
Page Number													

## Schematic Diagrams



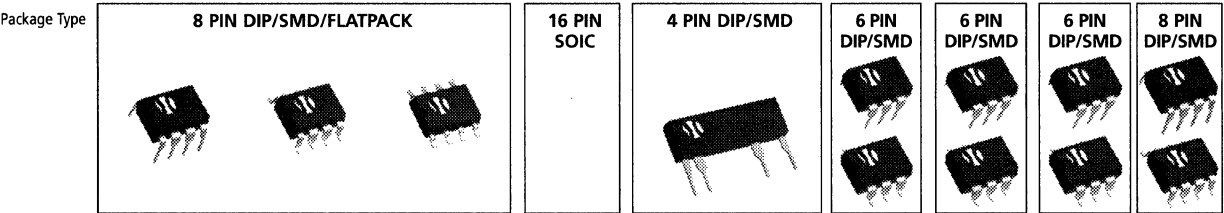
2 NORTH FIRST STREET • SAN JOSE, CA 95113 • 408.293.4600 • FAX: 408.293.4848  
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# Solid-State Relay Selector's Guide



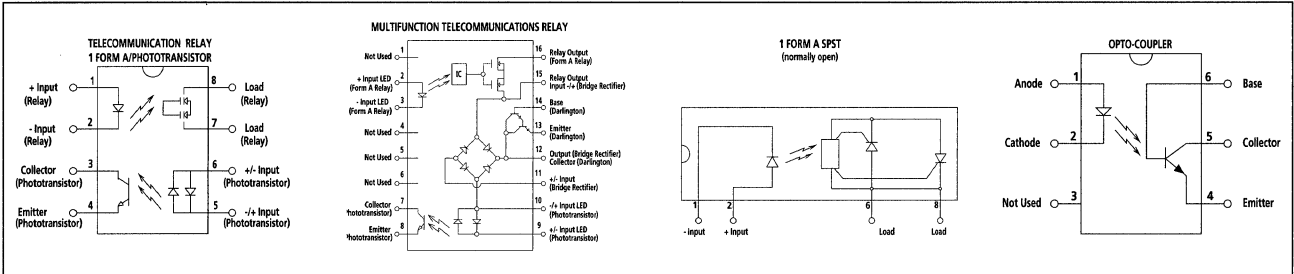
Output Type **Specialty Products**

Contact Type **Multifunction Telecommunication** **DC Relay** **MOS DRIVER** **TRIAC DRIVER** **OPTO-COUPLER** **LINE MONITOR**



PARAMETER	Product	TR115	TR125	TR215	TR225	ST5700	SP540	SP541	MD300	TD300	SOC600	S400
Blocking Voltage (V)	Max	400	400	400	400	400	60	60				
	Load Current (mA)	Max	120	120	200	200	120	1000	2500			
On Resistance (Ω)	Typ	17	17	6	6	25	1.0	0.3				
	Max	20	20	8	8	35	2.0	1.0				
Leakage Current (μA)	Typ	0.7	0.7	0.5	0.5	0.7	0.6	0.6				
	Max	2.0	2.0	2.0	2.0	2.0	1.0	1.0				
Turn-On Time (mS)	Typ	0.3	0.3	2.0	2.0	2.0	—	—				
	Max	1.0	1.0	5.0	5.0	5.0	0.2	0.2				
Turn-Off Time (mS)	Typ	0.15	0.15	0.15	0.15	0.15	—	—				
	Max	0.5	0.5	0.5	0.5	0.5	1.0	1.0				
CTR(%)	Typ	100	500	100	500	100	—	—				
Current Transfer Ratio	Max	300	1000	300	1000	300	—	—				
Isolation Voltage (V)	Min	2500	2500	2500	2500	1500	2500	2500				
	-H Suffix	3750	3750	3750	3750	3750	3750	3750				
Approval(s)		UL	UL	UL	UL		UL	UL				
		BABT	BABT	BABT	BABT							
Page Number												

## Schematic Diagrams



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# STANCOR/RBM

## Relays & Contactors

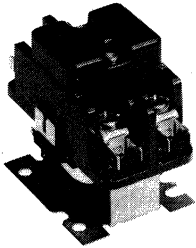


Fig. A Type 122

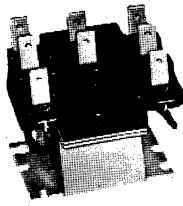


Fig. B. Type 91

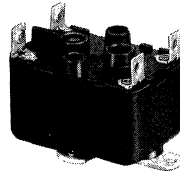


Fig. C. Type 184



Fig. E. Type 129

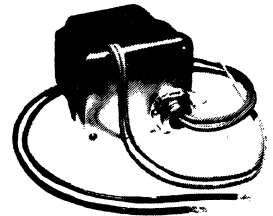


Fig. F. Type 129AR Add-A-Relay

### AC GENERAL PURPOSE RELAYS

Operate in any position. Coils are for 60 Hz operation. Ratings listed are continuous unless noted otherwise. **Breakdown Voltage:** 1500 V rms, 60 Hz, opposite polarity or to ground; 1000 V rms, 60 Hz, open contacts same polarity. **Electrical Life:** 100,000 operations at rated load.

### TWO POLE NORMALLY OPEN

Fig. A. Type 122—2PNO Straight-thru wiring, low cost 1/4" auxiliary quick-connect terminals screw power terminals. For #10 solid wire Max. double-make contacts small size. wt. 10.5 oz (approx).

Part No.	Coil V (50/60 Hz)	Contact Rating	
		Inductive	Resistive
122-901	24	30 Amp. Cont. 150 Amp. Inrush @ 277 V.A.C. Per Pole	40 Amp. @ 600 V.A.C.
122-902	120		
122-903	208/240		
122-905	24	40 Amp. Cont. @ 277 V.A.C. Per Pole With Cover	40 Amp. @ 600 V.A.C.
122-906	120		
122-907	208/240		

U.L. File No. E12139 CSA File No. LR13360

Fig. B. Type 91—Solenoid action type with quick-connect terminals; operates in any position. DPDT contact arrangement. **Power Rating (A):** Enclosed fine silver contacts rated 15 amps, 277 VAC. max., resistive; 12 amps (60 amps inrush), 125 VAC or 6 amps (35 amps inrush), 250 VAC, inductive. **Pilot Rating (B):** Gold alloy crossbar contacts rated 3 amps, 277 VAC. max., resistive; 125 VA, 1/10 hp, 125/250 VAC, inductive. **Size:** 2 1/8" x 1 7/8" x 2 3/8". Quick-connect wiring terminals included in boxed quantity only.

Part No.	Coil V±	Circuit Rating	
		#1*	#2†
91-901	24	A	A
91-902	120	A	A
91-903	240§	A	A
91-905	120	A	B

\*Three terminals at the mounting hole side. † Three terminals at the coil terminal side. §50/60 Hz, §208/240 volts. #A, power rating; B, pilot rating.

Fig. C. Type 184—Totally enclosed type with mounting bracket; operates in any position. Models 184-902-918 rated 18 amps resistive at 277 VAC; 12 amps (60 amps inrush) inductive at 125 VAC; 8 amps (48 amps inrush) inductive at 250 VAC; 7 amps (42 amps inrush) inductive at 277 VAC. Models 184-922-927 rated 3 amps at 277 VAC; 125 VA at 125 VAC; 277 VA at 277 VAC. Models 184-902-907 have screw terminals; others have 1/4" quick-connect terminals. **Size:** 2 1/32" x 1 1/32".

Part No.	Con-tacts	Coil V (50 60 Hz)
184-902	SPNO	24
184-903	SPNO	120
184-907	SPDT	120
184-912	SPNO	24
184-913	SPNO	120
184-916	SPDT	24
184-922	SPNO	24

### AC POWER RELAYS

Fig. E. Type 129—Totally enclosed; silver alloy contacts rated at 18 amps resistive or 18 amps inductive at 250 VAC max., 1 hp at 125 V or 2 hp at 250 V. **Size:** 2 1/16" x 2 1/4" x 2 1/4" overall.

Part No.	Con-tacts	V Coil V±
129-903	SPNO	120
129-904	SPNO	208
129-907†	SPDT	120
129-911§	SPNO	24
129-912§	SPNO	120

\*208/230 volts. †All contact terminals must be wired to same polarity. ‡50/60 Hz. § Quick-connect. 1/4" tab terminals.

Fig. F. Type 129AR Add-A-Relay—Same as Type 129 except has aluminum diecast base and bushing; rated 1 hp at 120 V, 1 1/2 hp at 250 V. High impact phenolic enclosure; 8" color-coded leads. **Size:** 3 1/16" x 2 9/16" x 3 9/16". Mounts in 1/2" dia. knock-out. Mounting hardware supplied. Meets standard code requirements. UL white card Listed.

Part No.	Con-tacts	V Coil V±
129AR-901	SPNO	24
129AR-902	SPNO	120

‡50/60 Hz.

### TYPE 91 QUICK CONNECT SOCKET AND TERMINAL KIT

Polarized to prevent improper assembly. **Part No. 91-180-1—**

# STANCOR/RBM

## DC Power Contractors

### Heavy Duty Power Contactors D.C. Power Contactors Type 124

#### Terminal Hardware Supplied

Coil Voltage D.C.	Coil Resistance +8% 25°	SPNO 4 Terminal Isolated Coil
12 V	13.2	124-902
24 V	53	124-903
36 V	120	124-904

Coil Voltage D.C.	Coil Resistance +8% 25°	SPNO 3 Terminal Grounded Coil
12 V	13.2	124-906
24 V	53	124-907

#### N.O. Contact Rating

D.C. Inductive Load		
Voltage DC	Continuous	Inrush
12 V	100 Amps.	400 Amps.
24 V	100 Amps.	400 Amps.
36 V	100 Amps.	400 Amps.

Coil Voltage D.C.	Coil Resistance +8% 25°	SPDT 6 Terminal Isolated Coil
12 V	13.2	124-910
24 V	53	124-911
36 V	120	124-912

- Max. Pick Up 75% rated coil voltage.
- Design Ambient—40°C to 65°C
- Maximum Continuous coil watts. 12 @ rated voltage.
- Recommended Mounting Position: Unit in vertical plane with coil terminals up. Horizontal plane is acceptable.
- Design meets U.L. 583 Industrial Truck Standard. Dust and splash proof cover.
- Application: Controlling D.C. starting motors on gasoline engine driven auxiliaries. Battery charging power circuits, motor reversing circuits as found in winch applications.
- The 124 is also applicable where ruggedness and high current capacity is required for D.C. mobile equipment such as: in-plant lifts, industrial equipment, recreational vehicle—golf carts, camp trailers, motor homes.
- Contact Termination: 5/16" -24 UNF-2A stud.
- Coil Termination: #10-32 UNF-2A thread.

### Type 70

#### CONTACT RATING D.C. INDUCTIVE LOAD—36 V. MAX.

Voltage	Normally Open		Normally Closed	
	Continuous	Inrush	Continuous	Inrush
6	80 Amp.	300 Amp.	60 Amp.	100 Amp.
12	80 Amp.	150 Amp.	60 Amp.	60 Amp.
24-36	50 Amp.	50 Amp.	30 Amp.	30 Amp.

- Non-turning studs
- Drawn steel dust proof enclosure
- Copper stud power & coil terminals
- Double break rotating disc movable contact
- Solenoid actuated
- Suggested mounting—cap down

#### SINGLE POLE NORMALLY OPEN 4 TERMINAL

Coil Voltage (D.C.)	Resistance in Ohms @ 25°C	Catalog Number	Contact Material
6	4	70-901	Copper
12	16	70-902	
24	60	70-903	
36	114	70-904	
12	16	70-906	Silver
24	60	70-907	
36	114	70-908	

### TYPE 586

Sealed Solenoid is Dust and Splash Proof

Continuous Duty Coil Silver Contacts

Pole Form: SPNO, SPDT

Incorporates double-make or double-break contacts

Type 586 coil is rated approximately 12 watts continuous duty.

Contact rating 200 Amps. continuous. 600 Amp in rush N.O. contacts.

#### SINGLE POLE NORMALLY OPEN 4 TERMINALS SINGLE POLE DOUBLE THROW 6 TERMINALS

Coil Voltage (D.C.)	Resistance in Ohms @ 25°C SPNO	Cat. No. S.P.N.O.	Cat. No. S.P.D.T.	Resistance in Ohms @ 25°C SPDT
6	5.25	586-901	586-911	13.2
12	21.0	586-902		
24	84.0	586-905	586-914	53.0
36	189.0	586-906	586-915	120.0
48	336.0	586-907		

Type 586 Sealed Contactors are designed for controlling DC starting motors on gasoline engine driven auxiliaries, battery-charging power circuits, low-voltage DC motor generator sets, golf carts, reversing circuits in winch applications, industrial lift trucks, to mention a few.

#### SINGLE POLE NORMALLY OPEN 3 TERMINAL

Coil Voltage (D.C.)	Resistance in Ohms @ 25°C	Catalog Number	Contact Material
12	16	70-914	Copper — Coil Grounded to Case
24	60	70-915	
6	4	70-917	Copper — Coil Grounded to Load
12	16	70-918	

#### SINGLE POLE DOUBLE THROW 6 TERMINAL

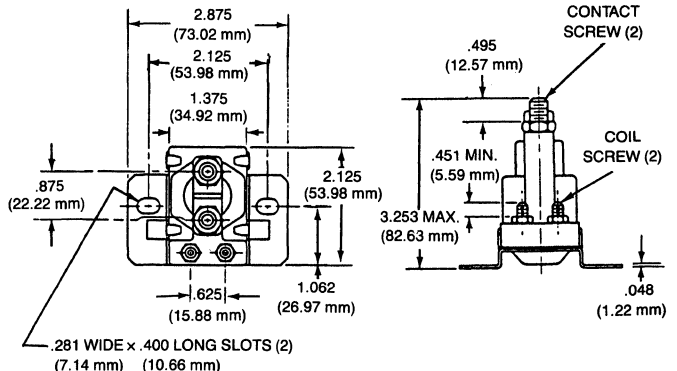
Coil Voltage (D.C.)	Resistance in Ohms @ 25°C	Catalog Number	Contact Material
12	16	70-910	N.O. and N.C. Silver
24	60	70-911	
36	114	70-912	
12	16	70-922	N.O. Copper and N.C. Silver
24	60	70-923	

### HEAVY DUTY D.C. POWER CONTACTOR TYPE 120 SOLENOID

#### SINGLE POLE NORMALLY OPEN

Catalog Number Continuous Duty		Coil Volts DC	Coil Resistance Continuous Duty
Standard Bracket	L Bracket		
120-901	120-907	12	16.0
120-902	—	15	20.8
120-904	—	24	64.0
—	—	36	100.0
Intermittent Duty		Coil Volts DC	Intermittent Duty
Standard Bracket	L Bracket		
—	120-912	12	6.0

Rating	Full Load	Inrush	Elec. Life	Contact Material
Continuous	100A	400A	25,000	Silver Alloy
Intermittent	80A	400A	10,000	Copper



TYPE 120 STANDARD BRACKET

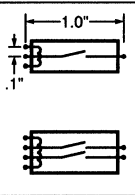
# STANDEX REED RELAYS

- ❑ Widest range of pin-outs, contact configurations and contact ratings
- ❑ Versions to meet US, CSA, FCC and European Standards – up to 5000 VDC contact to coil breakdown voltages
- ❑ Standex relays use our own reed switches with contact ratings for dry circuit and power switching applications
- ❑ Competitive pricing & delivery from stock
- ❑ Most recognized under Component Program of Underwriters Laboratories

## Series LG Form A



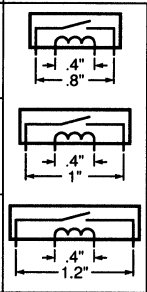
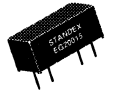
P/N	Coil VDC	Coil Res (ohms) @20°C	Max Pick-up VDC @20°C	Min. Drop Out VDC @20°C	Contact Form
LG100-1-5	5	500	3.5	0.5	1A
LG100-1-6	6	125	4.0	0.5	
LG100-1-12	12	500	8.0	1.0	
LG100-1-24	24	2000	16.0	2.0	
LG100-2-5	5	500	3.5	0.5	2A
LG100-2-6	6	125	4.0	0.5	
LG100-2-12	12	500	8.0	1.0	
LG100-2-24	24	2000	16.0	2.0	



## Series EG Form A



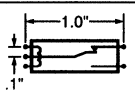
P/N	Coil VDC	Coil Res (ohms) @20°C	Max Pick-up VDC @20°C	Min. Drop Out VDC @20°C	Contact Form
EG200-1-5	5	500	3.5	0.5	1A
EG200-1-6	6	125	4.0	0.5	
EG200-1-12	12	500	9.0	1.0	
EG200-1-24	24	2000	18.0	2.0	
EG300-1-5	5	500	3.5	0.5	1A
EG300-1-6	6	125	4.0	0.5	
EG300-1-12	12	500	9.0	1.0	
EG300-1-24	24	2000	18.0	2.0	
EG400-1-5	5	500	3.5	0.5	1A
EG400-1-6	6	125	4.0	0.5	
EG400-1-12	12	500	9.0	1.0	
EG400-1	24	2000	18.0	2.0	



## Series LC Form C



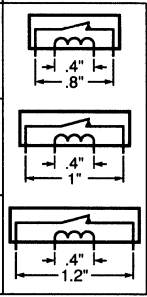
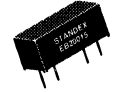
P/N	Coil VDC	Coil Res (ohms) @20°C	Max Pick-up VDC @20°C	Min. Drop Out VDC @20°C	Contact Form
LC100-1-5	5	500	3.5	0.5	1C
LC100-1-6	6	125	4.0	0.5	
LC100-1-12	12	500	9.0	1.0	
LC100-1-24	24	2000	18.0	2.0	



## Series EB Form B



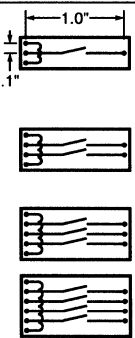
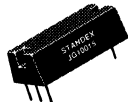
P/N	Coil VDC	Coil Res (ohms) @20°C	Max Pick-up VDC @20°C	Min. Drop Out VDC @20°C	Contact Form
EB200-1-5	5	500	3.8	0.5	1B
EB200-1-6	6	125	4.0	0.5	
EB200-1-12	12	500	9.0	1.0	
EB200-1-24	24	2000	18.0	2.0	
EB300-1-5	5	500	3.8	0.5	1B
EB300-1-6	6	125	4.0	0.5	
EB300-1-12	12	500	9.0	1.0	
EB300-1-24	24	2000	18.0	2.0	
EB400-1-5	5	500	3.8	0.5	1B
EB400-1-6	6	125	4.0	0.5	
EB400-1-12	12	500	9.0	1.0	
EB400-1	24	2000	18.0	2.0	



## Series JG Form A

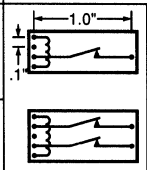
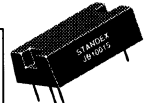


P/N	Coil VDC	Coil Res (ohms) @20°C	Max Pick-up VDC @20°C	Min. Drop Out VDC @20°C	Contact Form
JG100-1-5	5	500	3.5	0.5	1A
JG100-1-6	6	125	4.0	0.5	
JG100-1-12	12	500	9.0	1.0	
JG100-1-24	24	2000	18.0	2.0	
JG100-2-5	5	250	3.5	0.5	2A
JG100-2-6	6	110	4.0	0.5	
JG100-2-12	12	440	9.0	1.0	
JG100-2-24	24	1760	18.0	2.0	
JG100-3-6	6	85	4.0	0.5	3A
JG100-3-12	12	340	9.0	1.0	
JG100-3-24	24	1360	18.0	2.0	
JG100-4-6	6	62	4.0	0.5	4A
JG100-4-12	12	250	9.0	1.0	
JG100-4-24	24	1000	18.0	2.0	



## Series JB Form B

P/N	Coil VDC	Coil Res (ohms) @20°C	Max Pick-up VDC @20°C	Min. Drop Out VDC @20°C	Contact Form
JB100-1-5	5	500	3.8	0.5	1B
JB100-1-6	6	125	4.0	0.5	
JB100-1-12	12	500	9.0	1.0	
JB100-1-24	24	2000	18.0	2.0	
JB100-2-6	6	110	4.0	0.5	2B
JB100-2-12	12	440	9.0	1.0	
JB100-2-24	24	1760	18.0	2.0	



# Standex Electronics

4538 Camberwell Road  
 Cincinnati, OH 45209  
 Phone: (513) 871-3777  
 Fax: (513) 871-3779  
 Internet: <http://www.stdxelec.com>  
 Email: [standex@stdxelec.com](mailto:standex@stdxelec.com)

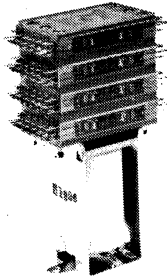


Standex manufactures over 500 standard reed relays for a broad range of applications including security, instrumentation, ATE, appliance, automotive and telecommunications. Standex reed relays use Standex reed switches (see our ad in the switch section). – A broad range of reed switches for demanding applications.

**Call or write for complete information and application assistance.**

# T-bar THE SOURCE FOR MULTI-CONTACT RELAYS AND SWITCHES

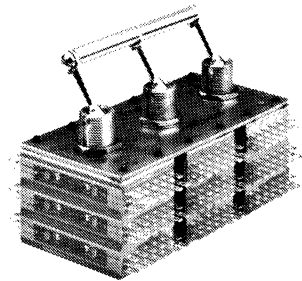
**RELAYS** General purpose 800-series, with contact ratings to 5A, and 900-series with low-level to 1A ratings. Both available with 12, 24, 36, 48, and 52 poles in form A (N.O.), form B (N.C.), and form C (D.T.) and 60 poles, form A. Operation from continuous ac or dc power, pulsed power (latching), or solid-state logic. Environmentally sealed and hermetically sealed relays for aerospace, shipboard and ground support hostile environments are available.



## TOGGLE SWITCHES

Same 800-series and 900-series as relays. Available with 12 to 144 poles in form C, maintained action.

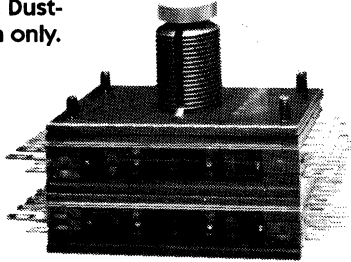
Typical life in excess of 50,000 operations. Normally dust-tight, T-Bar toggle switches are also available in an environmentally sealed version.



## PUSHBUTTON SWITCHES

Momentary pushbutton switches, 800-series only are available with 12 to 36 poles, form C.

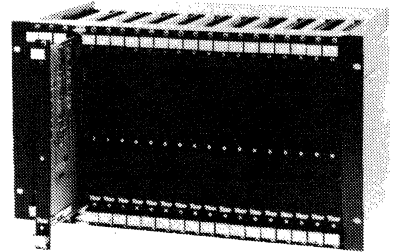
Typical applications include press-to-test for control panel lamps, reset, and all-call. Dust-tight construction only.



## SWITCH 1000 CIRCUITS

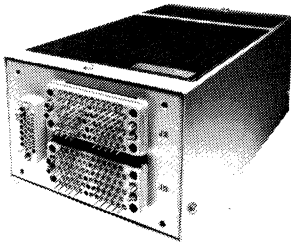
T-Bar's Multipole Switch Module! Design engineers find it perfect for switching applications like testing and process control. T-Bar's Multipole Switch Module

provides a simple, low-cost way to create a wide variety of switch configurations. Each compact unit has four 48-pin DIN standard male connectors that can be wired independently as four 12-wire circuits, two 24-wire circuits, or one 48-wire circuit—in a matrix, test monitor, or BUS configuration. Up to 21 switching modules (over 1000 circuits) fit in a standard 19" rackmount 6U x 220MM, Euro Cage, so you can have just the capacity you need for virtually any multi-circuit application.



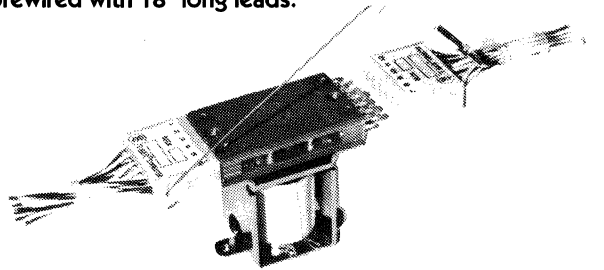
## SELECTOR UNITS

Standard T-Bar relays, 800 or 900-series, are packaged as an automatic, selector unit to random or sequential circuit selection and addressed through binary weighted coils. Available as Treeselect (all unaddressed lines remain open) or Norselect (all unaddressed lines connected to a bus), selector units can be provided with 16 to 128 positions



## CONNECTORS

T-Bar plug-on connectors are available for all relays and switches. Each connector provides wiring to one-half of a wafer deck (6 poles; A, B, or C). A 36-pole device, for example, requires 6 connectors. The connectors are available in kits and prewired with 18" long leads.

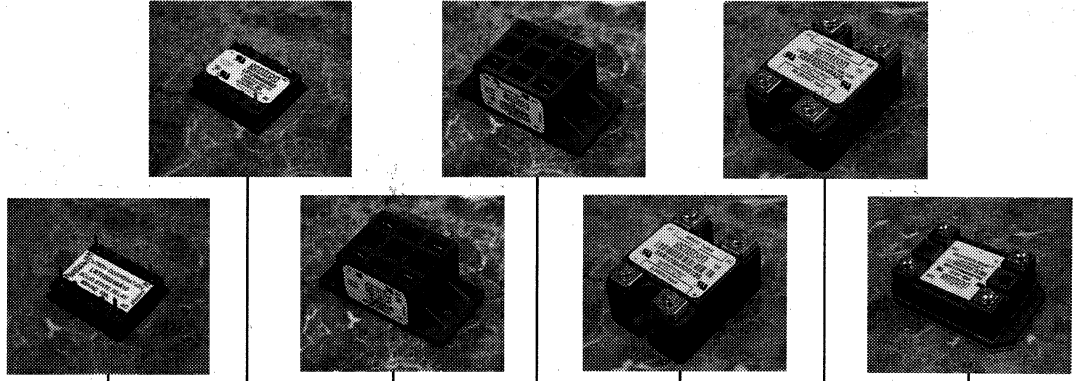


**T-bar**

Subsidiary of  
General Signal Networks, Inc.

One Waterview Drive, Shelton, CT 06484  
Telephone: (203) 926-1801, Fax: (203) 924-6400

**SOLID STATE RELAYS**



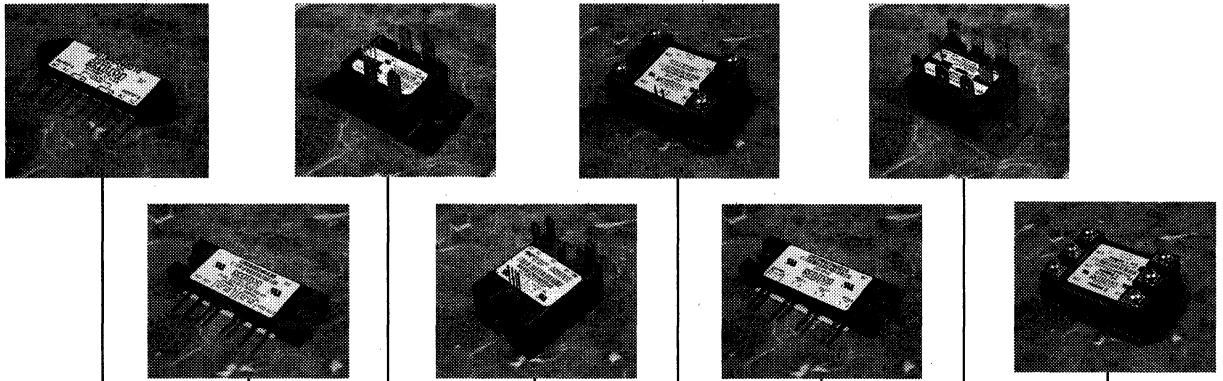
	LR	LRT	BR	BRT	SSR	SSRT	EFR
<b>Features</b>	Rated to 40 A, Compact Size, PCB or SMT	Rated to 25 A, Compact Size, PCB or SMT, Low Cost	Rated to 40 A, Compact Size, Same mounting as SSR Package	Rated to 25 A, Compact Size, Same mounting as SSR Package, Low Cost	Rated to 125 A, SCR based	Rated to 25 A, Triac based, Low Cost	Rated to 150 A, High Power
<b>Approvals</b>	UL & ULC	UL & ULC	UL & ULC	UL & ULC	UL & ULC	UL & ULC	UL & ULC
<b>Approx. Dim. (LXWXH)</b>	1.37" X 1.12" X 0.25"	1.37" X 1.12" X 0.25"	2.5" X 1.25" X 0.78"	2.5" X 1.25" X 0.78"	2.25" X 1.75" X 0.865"	2.25" X 1.75" X 0.865"	4" X 2.5" X 1.075"
<b>Type</b>	Single Pole	Single Pole	Single Pole	Single Pole	Single Pole Hockey Puck	Single Pole Hockey Puck	Single Pole
<b>Input</b>	3 - 32VDC 90 - 280VAC	3 - 32VDC 90 - 280VAC	3 - 32VDC 90 - 280VAC	3 - 32VDC 90 - 280VAC	3 - 32VDC 90 - 280VAC	3 - 32VDC 90 - 280VAC	3 - 32VDC 90 - 280VAC
<b>Output Switching</b>	Zero, Random	Zero, Random	Zero, Random	Zero, Random	Zero, Random	Zero, Random	Zero, Random
<b>Line Voltage Typ.</b>	24 - 480	24 - 240	24 - 480	24 - 240	24 - 660	24 - 240	24 - 660
<b>Max. Output Current Per Leg - A</b>	40	25	40	25	125	25	150
<b>Max. Single Cycle Surge - A</b>	400	50	600	100	1400	250	1600
<b>Max Fusing FT Value - A<sup>2</sup> sec.</b>	1200	600	3000	600	12760	600	13500
<b>Max. Power Dissipation - W</b>	85	50	110	50	200	50	1000
<b>Max J<sub>c</sub> - °C/W</b>	.35	.5	.35	.5	.25	.4	.25
<b>Output Type</b>	AC	AC	AC	AC	AC	AC	AC
<b>Terminals</b>	PC, SMT	PC, SMT	Faston	Faston	Screw	Screw	Screw
<b>Device</b>	SCR	Triac	SCR	Triac	SCR	Triac	SCR

**TELEDYNE RELAYS**

Telephone 602-443-1288 Fax 602-443-1408 7345 East Acoma Dr. Suite #101, Scottsdale, AZ 85260 USA <http://www.teledynereleys.com>

Detailed specifications on any of our products or a complete data book are available on request



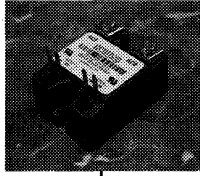
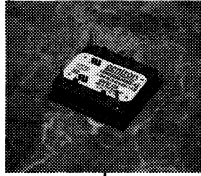
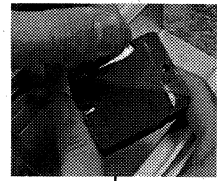
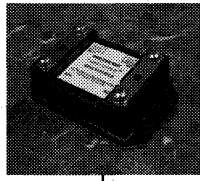
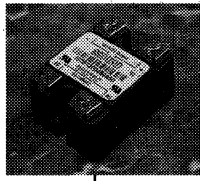
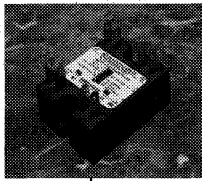


DRDT	CRD	BRD	SSRD	EFRD	CRTP	TRTP	EFRTP
Rated to 10 A, PCB SIP Package, Compact Design, Low Cost	Rated to 25 A, PCB SIP Package, Compact Design, SCR based	Rated to 40 A, Compact Design, Same Mounting as SSRD Package, SCR based	Rated to 40 A, SCR based	Rated to 150 A, High Power	Rated to 25 A, PCB, SIP Package, Compact Design, SCR based, Low Cost	Rated to 55 A, Compact Design, SCR based Design, Low Cost	Rated to 150 A, Highest Three - Phase, SCR based
UL & CSA	UL & ULC	UL & ULC	UL & ULC	UL & ULC	UL & ULC	UL & ULC	UL & ULC
2.49" X 0.74" X 0.2"	3.2" X 1.09" X 0.32"	2.5" X 1.25" X 0.6"	2.25" X 1.75" X 0.79"	4" X 2.5" X 1.07"	3.2" X 1.09" X 0.32"	2.5" X 1.25" X 0.6"	4" X 2.5" X 0.95"
Two Pole	Two Pole	Two Pole	Two Pole Dual	Two Pole	Three Phase	Three Phase	Three Phase
3 - 32VDC 90 - 280VAC	3 - 32VDC 90 - 280VAC	3 - 32VDC 90 - 280VAC	3 - 32VDC 90 - 280VAC	3 - 32VDC 90 - 280VAC	3 - 32VDC 90 - 280VAC	3 - 32VDC 90 - 280VAC	3 - 32VDC 90 - 280VAC
Zero, Random	Zero, Random	Zero, Random	Zero, Random	Zero, Random	Zero, Random	Zero, Random	Zero, Random
24 - 240	24 - 480	24 - 480	24 - 480	24 - 660	24 - 480	24 - 480	24 - 660
10	25	40	40	150	25	55	150
100	300	500	500	1600	300	600	1950
60	370	1040	1040	13500	370	3000	13500
50	45	85	85	1000	50	110	1000
.6	.4	.5	.5	.25	.4	.35	.25
AC	AC	AC	AC	AC	AC	AC	AC
PC	PC	Faston	Faston	Screw	PC	Faston	Screw
Triac	SCR	SCR	SCR	SCR	SCR	SCR	SCR

**TELEDYNE RELAYS**

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SSRO	LRIGTA/D LRMOS	IGTA/D MOS	IGFA/D MOSFD	EFIGFA/D EFMOSEF	Option -012
Rated to 20 A, Quad Design, Triac based	Rated to 25 A, DC or AC Output, PCB or SMT Mounting Low Voltage Drops	Rated to 100 A, AC or DC Output Low Voltage Drops	Rated to 200 A, Fast Device, AC or DC Output Low Voltage Drops	Rated to 200 A, Fast Device, AC or DC Output Low Voltage Drops	
UL & ULC	UL & ULC	UL & ULC	UL & ULC	UL & ULC	
2.25" X 1.75" X 0.79"	1.37" X 1.12" X 0.25"	2.25" X 1.75" X 0.86"	2.25" X 1.75" X 0.86"	4" X 2.5" X 1.07"	
Four Pole Quad	Single Pole	Single Pole	Single Pole	Single Pole	
3 - 32VDC 90 - 280VAC	3.5 - 32VDC	3.5 - 32VDC	3.5 - 32VDC	3.5 - 32VDC	
Zero, Random	n/a	n/a	n/a	n/a	
24 - 240	0 - 480	0 - 480	0 - 480	0 - 480	
20	100	200	200	200	
250	n/a	n/a	n/a	n/a	
260	n/a	n/a	n/a	n/a	
50	110	500	500	1000	
.6	.5	.2	.2	.25	
AC	AC or DC	AC or DC	DC	DC	
Faston	PC, SMT	Screw	Screw	Screw	
Triac	MOSFET/IGBT	MOSFET/IGBT	MOSFET/IGBT	MOSFET/IGBT	

**Option -012 EZMount™**  
 The new exclusive Gentrion product called EZmount. It is a replacement of the thermal compound or typically called thermal grease. EZmount is a thermal conductive pad which is attached at the factory. When the user is ready to mount the relay just clean the heatsink surface and peel off EZmount's adhesive backing. Press the relay firmly onto the heat sink and it will form a permanent bond.

**Features:**

Easy Handling.

Clean.

Excellent thermal characteristics.

**Benefits:**

No mess of thermal compound/grease.

Less prone to operator error.

Cost savings.

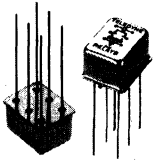
**TELEDYNE RELAYS**

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### ATTENUATOR RELAYS

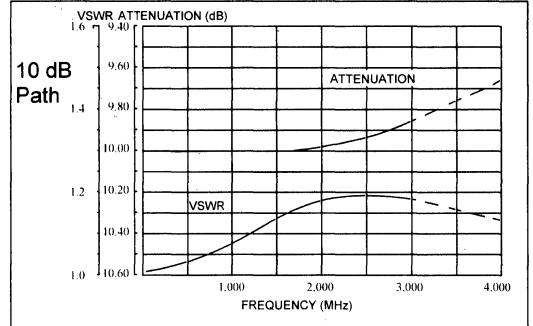
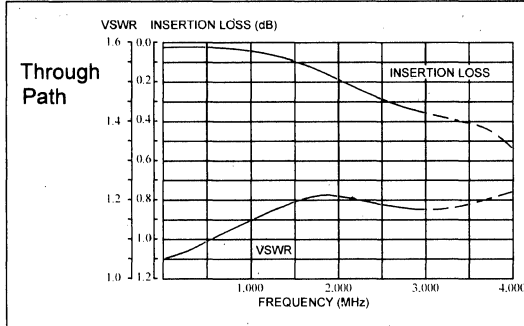
#### A150



The A150 series is a relay which, while in the energized position, will provide an attenuation path for RF signals which requires no external resistors.

SERIES	SWITCHING TIME MAX. (ms)	COIL VOLTAGE (VDC)	INSERTION LOSS (dB)	VSWR THROUGH PATH	VSWR ATTENUATED PATH	IMPEDANCE Ω	FREQUENCY RANGE	ATTENUATION (dB)
A150	6.0	5	0.55 MAX.	1.30 MAX.	1.45 MAX.	50	DC-3 GHz	1, 2, 3, 4, 5, 6, 8, 10, 16, 20
		12						
		15						
		26.5						

Shown right are RF curves for the 10dB attenuator which are typical of attenuator performance.



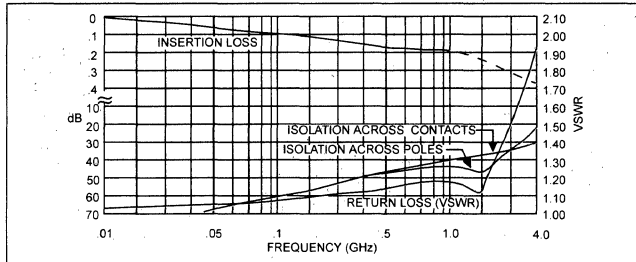
### RF RELAYS

#### RF170

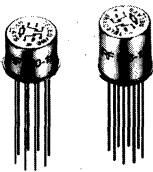


The RF170 series is a magnetic latching relay designed to optimize contact isolation.

SERIES	COIL DATA		CONTACT DATA		TYPICAL RF DATA			
	NOMINAL VOLTAGE	NOMINAL RESISTANCE Ω	MAX. RATING (AMPS @ 28 VDC)	RESISTANCE mΩ MAX.	FREQUENCY RANGE	ISOLATION (ACROSS CONTACTS)	VSWR (@1 GHz)	INSERTION LOSS (dB @ 1GHz)
RF170	5	61	0.250	150	DC-4 GHz	70-30 dB	1.19 : 1	0.2
	12	500						
	26.5	2000						

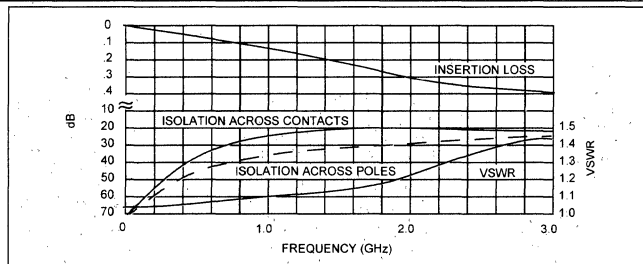


#### RF300 AND RF303



The RF300 and RF303 relays are designed to provide RF signal repeatability over the frequency range by balancing the aggregate insertion loss of the relays' design.

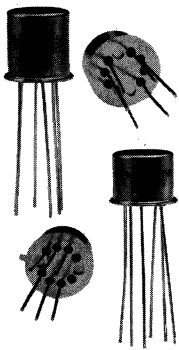
SERIES	COIL DATA		TIMING		CONTACT DATA		RF DATA	
	NOMINAL VOLTAGE	NOMINAL RESISTANCE Ω	OPERATE TIME ms MAX.	RELEASE TIME ms MAX.	RESISTANCE mΩ MAX.	MAX. RATING (AMPS @ 28 VDC)	FREQUENCY RANGE	REPEATABILITY
RF300	5	50	4.0	3.0	150	1.0	DC - 3 GHz	±0.1 dB
	12	390						
RF303	5	100	6.0	3.0	150	1.0	DC - 3 GHz	±0.1 dB
	12	850						



12525 Daphne Ave., Hawthorne, California 90250 Telephone 1-800-596-3855

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**BYPASS RF RELAYS**



The RF310/RF320 and RF320/RF313 relays are similar in design and RF performance to the high repeatability RF300/RF303 relays. In addition to the enhanced signal repeatability, this relay family features an internal bypass link for applications in which circuitry or components must be circumvented. This internal bypass provides for inherently lower, overall, circuit insertion loss and unwanted signal attenuation.

SERIES	COIL DATA		TIMING		CONTACT DATA		RF DATA	
	NOMINAL VOLTAGE	NOMINAL RESISTANCE Ω	OPERATE TIME ms MAX.	RELEASE TIME ms MAX.	RESISTANCE mΩ MAX.	MAX. RATING (AMPS @ 28 VDC)	FREQUENCY RANGE	REPEATABILITY
RF310 RF320	5	50	4.0	3.0	150	1.0	DC - 3 GHz	±0.1 dB
	12	390						
RF313 RF323	5	100	6.0	3.0	150	1.0	DC - 3 GHz	±0.1 dB
	12	850						

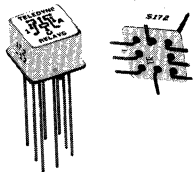
DPDT

RF310/RF313

RF320/RF323

**GENERAL PURPOSE RELAYS**

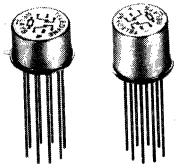
**COMMERCIAL/INDUSTRIAL CENTGRID® THROUGH HOLE AND SURFACE MOUNT**



The 172 Centgrid® relay is an ultraminiature, sealed armature relay for commercial applications. Its low profile and .1" grid spacing makes it an ideal choice when close PC board spacing is required. The surface mount S172 can be supplied in tape and reel packaging.

SERIES		CONTACT DATA		COIL DATA	
		RESISTANCE mΩ MAX.	MAX. RATING AMPS @28 VDC	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE Ω
172	THROUGH HOLE	150	1.0	5, 12, 26.5	64, 400, 1600
172D	THROUGH HOLE	150	1.0	5, 12, 26.5	64, 400, 1600
S172	SURFACE MOUNT	150	1.0	5, 12, 26.5	64, 400, 1600
S172D	SURFACE MOUNT	150	1.0	5, 12, 26.5	64, 400, 1600

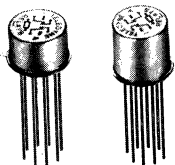
**COMMERCIAL/INDUSTRIAL TO-5 RELAYS**



The TO-5 relay, originally conceived and developed by Teledyne, has become one of the industry standards for switching from dry circuit to 1 ampere. Designed expressly for high density PC board mounting, its small size and low coil power dissipation make the TO-5 relay one of the most versatile ultraminiature relays available. The "D" type includes an internal diode for coil transient protection. The "TN" type features an internal diode and transistor driver to reduce PC board floor space as well as component installation costs.

SERIES		CONTACT DATA		COIL DATA	
		RESISTANCE mΩ MAX.	MAX. RATING AMPS@ 28VDC	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE Ω
712	SENSITIVE	150	1.0	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560
712D		150	1.0	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560
712TN		150	1.0	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560
732	SENSITIVE	150	1.0	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300
732D		150	1.0	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300
732TN		150	1.0	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300
722	MAG LATCH	150	1.0	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000
722D		150	1.0	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000

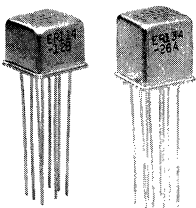
**ENVIRONMENTALLY HARDENED TO-5 RELAYS**



DESCRIPTION	SERIES	CONTACT DATA		COIL DATA	
		RESISTANCE mΩ MAX.	MAX. RATING AMPS @ 28VDC	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE Ω
HIGH TEMPERATURE 200° C	412H	125	1.0	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560
HIGH SHOCK 1,000 G / 0.5ms	412K	100	1.0	5, 6, 9, 12, 18, 26.5	50, 80, 160, 300, 600, 1350
HIGH VIBRATION 100 G @ 2,000 Hz	412V	100	1.0	5, 6, 9, 12, 18, 26.5	50, 70, 155, 235, 610, 1130
HIGH VIBRATION 100 G @ 2,000 Hz	412DV	100	1.0	5, 6, 9, 12, 18, 26.5	50, 70, 155, 235, 610, 1130
HIGH TEMPERATURE 200° C	SENSITIVE	432H	125	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300
HIGH VIBRATION 100 G @ 2,000 Hz		432V	100	5, 6, 9, 12, 18, 26.5	80, 120, 240, 480, 950, 1900
HIGH VIBRATION 100 G @ 2,000 Hz		432DV	100	5, 6, 9, 12, 18, 26.5	80, 120, 240, 480, 950, 1900
HIGH TEMPERATURE 200° C		422H	150	1.0	5, 6, 9, 12, 18, 26.5
HIGH SHOCK 2,000 G / 0.5 ms	422K	125	1.0	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000

**ESTABLISHED RELIABILITY AND AEROSPACE RELAYS**

**ESTABLISHED RELIABILITY CENTGRID® RELAYS (Note 1)**



The 114 and 134 Centgrid® relays are ultraminiature, hermetically sealed, armature relays. Their low profile and .1" grid spacing makes them an ideal choice when close PC board spacing is required. These relays meet or exceed all applicable military specifications.

SERIES		CONTACT DATA		COIL DATA	
		RESISTANCE mΩ MAX.	MAX. RATING AMPS @28 VDC	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE Ω
114*	SENSITIVE	100	1.0	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560
114D*		100	1.0	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560
114DD*		100	1.0	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560
134*		100	1.0	5, 6, 9, 12, 18, 26.5	100, 200, 400, 800, 1600, 3200
134D*		100	1.0	5, 6, 9, 12, 18, 26.5	100, 200, 400, 800, 1600, 3200
134DD*	100	1.0	5, 6, 9, 12, 18, 26.5	64, 125, 400, 800, 1600, 3200	



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**ESTABLISHED RELIABILITY TO-5 RELAYS (Note 1)**

The TO-5 relay, originally conceived and developed by Teledyne, has become one of the industry standards for switching from dry circuit to 1 ampere. Designed expressly for high density PC board mounting, its small size and low coil power dissipation make the TO-5 relay one of the most versatile ultraminiature relays available. The "D" type includes an internal diode for coil transient protection. The "DD" type features an internal series diode which protects against an inadvertent reversal of polarity. These relays meet or exceed all applicable military specifications.

SERIES	ARRANGEMENT	CONTACT DATA		COIL DATA		
		RESISTANCE mΩ MAX.	MAX. RATING AMPS @ 28 VDC	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE Ω	
411*	1 FORM C	100	1.0	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	
411D*	1 FORM C	100	1.0	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	
411DD*	1 FORM C	100	1.0	5, 6, 9, 12, 18, 26.5	50, 98, 280, 500, 1130, 2000	
412*	2 FORM C	100	1.0	5, 6, 9, 12, 18, 26.5	50, 98, 280, 500, 1130, 1560	
412D*	2 FORM C	100	1.0	5, 6, 9, 12, 18, 26.5	50, 98, 280, 500, 1130, 1560	
412DD*	2 FORM C	100	1.0	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	
431*	SENSITIVE	1 FORM C	100	1.0	5, 6, 9, 12, 18, 26.5	125, 255, 630, 1025, 2300, 4000
431D*		1 FORM C	100	1.0	5, 6, 9, 12, 18, 26.5	125, 255, 630, 1025, 2300, 4000
431DD*		1 FORM C	100	1.0	5, 6, 9, 12, 18, 26.5	100, 200, 630, 1025, 2300, 4000
432*	SENSITIVE	2 FORM C	100	1.0	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300
432D*		2 FORM C	100	1.0	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300
432DD*		2 FORM C	100	1.0	5, 6, 9, 12, 18, 26.5	64, 125, 400, 850, 1600, 3300
421*	MAGNETIC LATCHING	1 FORM C	125	0.5	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000
421D*		1 FORM C	125	0.5	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000
421DD*		1 FORM C	125	0.5	5, 6, 9, 12, 18, 26.5	48, 97, 280, 500, 1300, 2000
420*/422*		2 FORM C	125	1.0	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000
420D*/422D*	2 FORM C	125	1.0	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	
420DD*/422DD*	2 FORM C	125	1.0	5, 6, 9, 12, 18, 26.5	48, 97, 280, 500, 1300, 2000	

**ESTABLISHED RELIABILITY & AEROSPACE TO-5 AND CENTIGRID® HYBRID RELAYS (Note 1)**

The TO-5 and Centigridd® hybrid relay lines incorporate either bipolar or FET chips. These internal transistors serve as drivers, thus eliminating the need for extra circuitry to energize the relay coils and allow a direct interface to most logic families.

SERIES	CONTACT DATA		COIL DATA		SEMICONDUCTOR REQUIREMENT. (TO ASSURE TURN ON)
	RESISTANCE mΩ MAX.	MAX RATING AMPS @ 28VDC	NOMINAL VOLTAGE (VDC)	NOMINAL CURRENT mA	
411T*	100	1.0	5, 6, 9, 12, 18, 26.5	78.3, 48.8, 33.1, 34.5, 15.5, 13.0	2.38 mA
431T*	100	1.0	5, 6, 9, 12, 18, 26.5	41.3, 24.5, 14.3, 11.9, 7.9, 6.7	1.2 mA
412T*	100	1.0	5, 6, 9, 12, 18, 26.5	97.2, 61.4, 41.4, 31.2, 21.0, 17.3	3.00 mA
432T*	100	1.0	5, 6, 9, 12, 18, 26.5	51.4, 30.9, 22.8, 14.5, 11.4, 8.2	1.5 mA
116C*	100	1.0	5, 6, 9, 12, 18, 26.5	114.4, 72.1, 40.1, 30.5, 20.1, 16.4	3.8 VDC
136C*	100	1.0	5, 6, 9, 12, 18, 26.5	49.5, 30.0, 22.1, 14.5, 11.1, 8.0	3.8 VDC
122C	125	1.0	5, 6, 9, 12, 18, 26.5	96.6, 49.3, 32.3, 24.2, 16.0, 13.3	3.8 VDC

**SURFACE MOUNT CENTIGRID® AEROSPACE RELAYS**

The S114 and S134 series are Centigridd® relays whose leads have been configured to allow them to be surface mounted. The leads are pre-tinned making them compatible with most types of surface mount solder reflow processes. This series is available in tape and reel packaging

SERIES	CONTACT DATA		COIL DATA	
	RESISTANCE mΩ MAX.	MAX. RATING AMPS @ 28VDC	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE Ω
S114	100	1.0	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560
S114D	100	1.0	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560
S114DD	100	1.0	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560
S134	100	1.0	5, 6, 9, 12, 18, 26.5	100, 200, 400, 800, 1600, 3200
S134D	100	1.0	5, 6, 9, 12, 18, 26.5	100, 200, 400, 800, 1600, 3200
S134DD	100	1.0	5, 6, 9, 12, 18, 26.5	64, 125, 400, 800, 1600, 3200

**RF120**

**Description**  
The RF120 series is a magnetic latching relay designed to optimize contact isolation. (See RF170 for typical RF performance curves.)

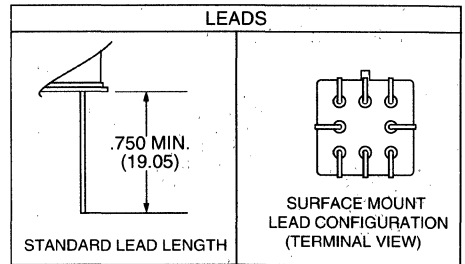
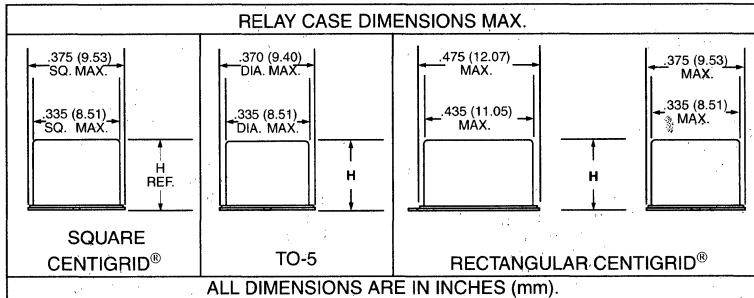
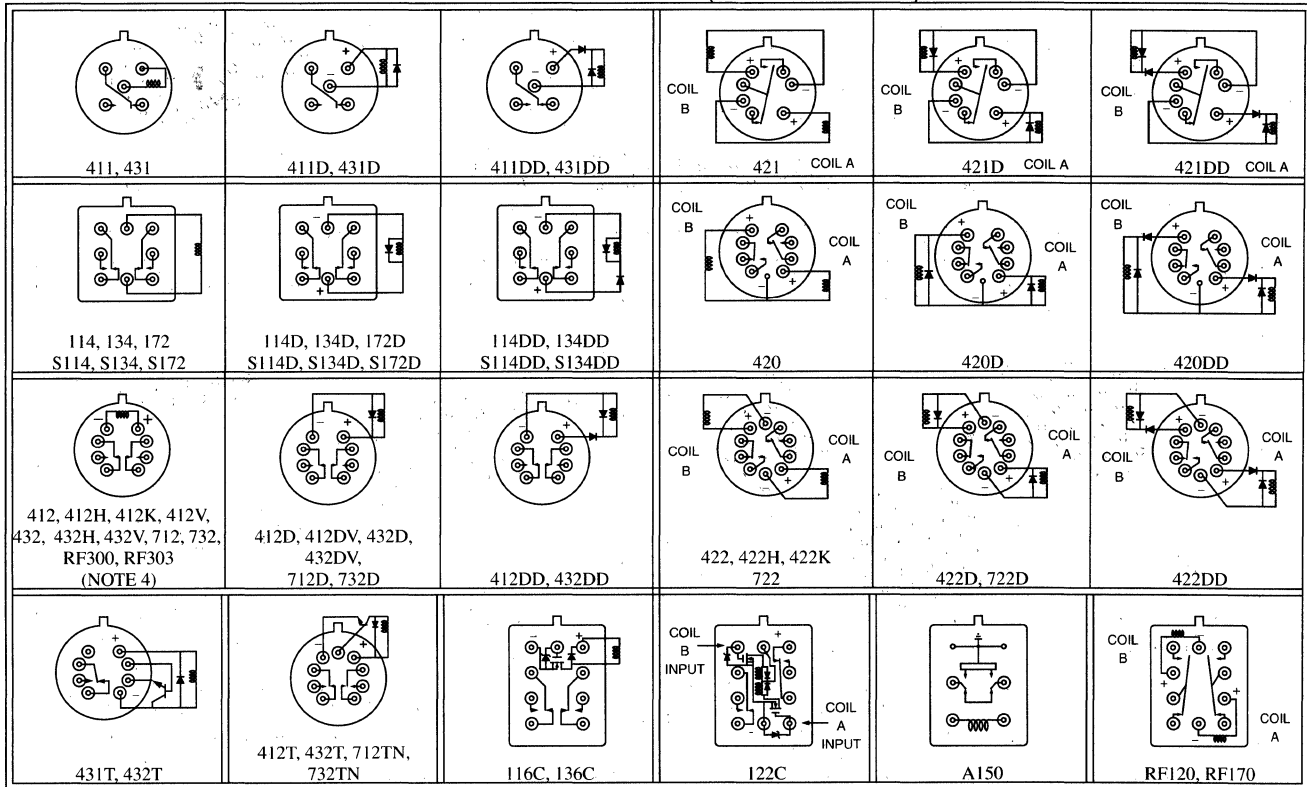
SERIES	COIL DATA		CONTACT DATA		TYPICAL RF DATA			
	NOMINAL VOLTAGE	NOMINAL RESISTANCE Ω	MAX RATING (AMPS @ 28 VDC)	RESISTANCE mΩ MAX.	FREQUENCY RANGE	ISOLATION (ACROSS CONTACTS)	VSWR (@ 1 GHz)	INSERTION LOSS (dB @ 1 GHz)
RF120	5, 6, 9, 12, 18, 26.5	61, 120, 500, 1130, 2000	0.250	125	DC-4 GHz	70-30 dB	1.19 : 1	0.2

**TELEDYNE RELAYS**

12525 Daphne Ave., Hawthorne, California 90250 Telephone 1-800-596-3855

Detailed specifications on any of our products or a complete data book are available on request

**SCHEMATIC DIAGRAMS (NOTES 2 AND 3)**



**ORDERING INFORMATION**

Teledyne Relays' part numbering system is structured as follows: Series designation, attenuation value (A150 only), then nominal coil voltage and reliability level (if applicable) following a dash.

**EXAMPLES: A150-10-5 or RF300-12 or ER412-12B**

A full description of Teledyne Relays' part numbering and options can be found in our data book.

**TO-5 "H" DIMENSION MAX.**

SERIES	411, 412, 412H, 412V	RF300, 712,	420, 421, 422, 412K, 422H, 422K, 722	431, 432, 432H, 432V	RF303, 732
HEIGHT IN INCHES (mm)	.270 (6.86)	.275 (6.99)	.280 (7.11)	.375 (9.52)	.385 (9.78)

**CENTIGRAD® "H" DIMENSION MAX.**

SERIES	114, 116C	A150, 172 (note 5)	RF120, 122C	RF170	134, 136C
HEIGHT IN INCHES (mm)	.275 (6.99)	.280 (7.11)	.295 (7.49)	.300 (7.62)	.375 (9.52)

- Notes:**
1. Relays indicated with an asterisk (\*) are Established Reliability relays and should include in the part number, the prefix ER and a reliability designator after the coil voltage. See reliability chart and part number example.
  2. Schematics are terminal view.
  3. For latching relays, the contact position is the result of coil A being last energized.
  4. Polarity is applicable to "V" type relays only.
  5. Unless otherwise specified, .280" or .380" height may be supplied for the 172. To order the lower profile, add /28 to the end of the part number, e.g. 172-26/28 (NOTE: /28 will not be marked on the part). Unless otherwise specified, relays may be supplied with either can height.
  6. Specifications published herein are subject to change without notice.

**ESTABLISHED RELIABILITY TABLE**

RELIABILITY DESIGNATOR	FAILURE RATE (%/10,000 UNIT CYCLES)
A	1.5
B	.75



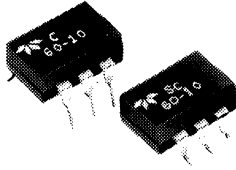
12525 Daphne Ave., Hawthorne, California 90250 Telephone 1-800-596-3855

Detailed specifications on any of our products or a complete data book are available on request

**TELEDYNE RELAYS**

**Commercial and Industrial Solid State Products**

**C60 Series - Bi-Directional/DC, Optically Isolated, Surface or Through Hole Mount**



• Packaged in a 6 Pin Mini DIP • Control Current 50 ma @ 1.5 Vdc

PART NUMBER	MAXIMUM LOAD RATINGS	
	CURRENT	VOLTAGE
C60-10	2.5 Adc	60 Vdc
C60-20	1.5 Adc	100 Vdc
C60-30	1.0 Adc	200 Vdc
C60-40	0.5 Adc	400 Vdc

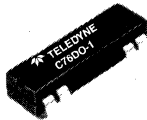
**C45 Series - AC, Optionally Isolated, 16 Pin DIP Package, Surface or Through Hole Mount**



• UL and CUL Registered

TELEDYNE PART NO.	CONTROL VOLTAGE RANGE	MAXIMUM VOLTAGE		MAX. LOAD CURRENT
		CONTINUOUS	TRANSIENT	
C45-21	5 ma @ 1.5 Vdc	280 Vrms	500 Vdc	1.0 Arms
C45-22	10 ma @ 3.0 Vdc			
C45-23	10 ma @ 3.5 Vdc			

**Solid State Computer Input/Output Interface Devices**

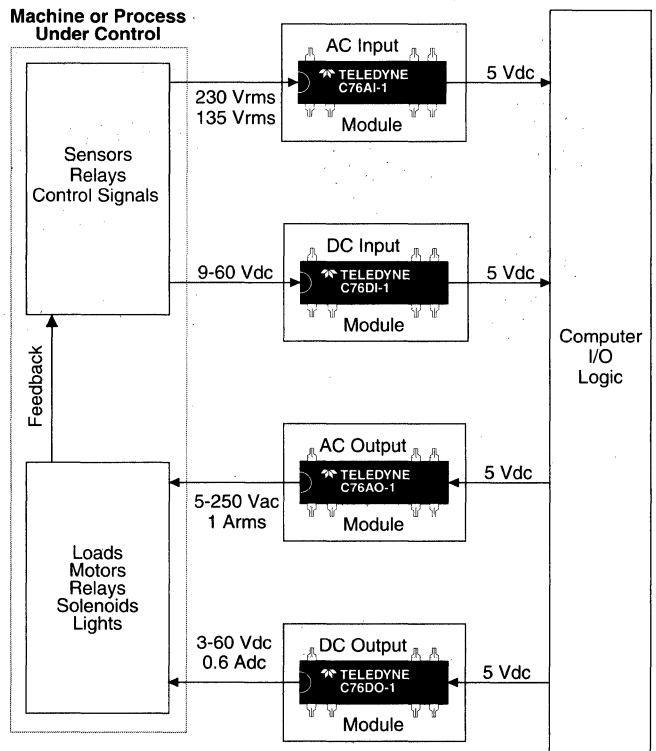


**Computer Input/Output Interface Modules**

The C76 DIP I/O™ Modules are designed for use in computerized control systems. They offer optical isolation for noise free interfacing of computer logic circuitry into harsh industrial power switching environments. For use in Robotics, Process Control, Programmable Controllers and ATE.

PART NUMBER	TYPE	CHARACTERISTICS
C76AO-1	AC Output	3.8-16 Vdc Input 5-250 Vrms, 1A Output
C76AI-1	AC Input	180 - 250 Vrms and 90-135 Vrms inputs
C76DO-1	DC Output	3.8-16 Vdc Input 3-60 Vdc, 0.6 A Output
C76DI-1	DC Input	9-60 Vdc Input

**C76 I/O INTERFACE SYSTEM**



**TELEDYNE RELAYS**

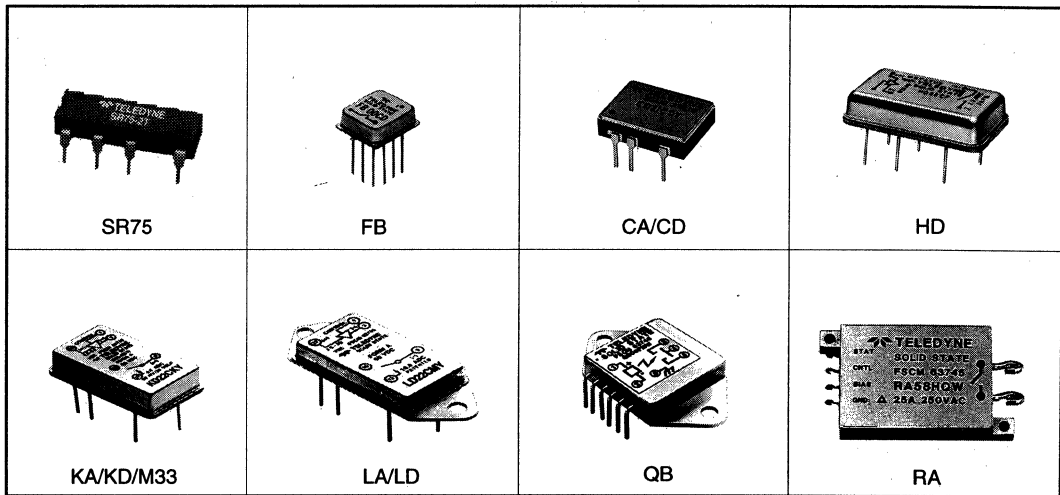
12525 Daphne Ave., Hawthorne, California 90250 Telephone 1-800-596-3855

Detailed Specifications on any of our products or complete catalogs are available on request.


**TELEDYNE RELAYS**

## Part Selection Guide For Military Solid State Relays

### PACKAGE STYLES



	SERIES/MODEL	MAXIMUM RATINGS
DC RELAYS	SR75	Up to 1.5 Amp, Up to 300 Vdc <sup>1,4</sup>
	CD	2.0 A @ 60 V <sup>1,2</sup>
	HD	2 A @ 60 V <sup>1,2</sup>
	KD	5 A @ 60 V <sup>1</sup>
	M33-2N	7.0 A @ 60 V
	LD	10 A @ 60 V <sup>1</sup>
BI-DIRECTIONAL RELAYS	FB	.025 A @ 350 V to 1 A @ 80 V <sup>2</sup>
	QB00FM	10 A @ 150 V
AC RELAYS	CA	1 A @ 250 Vrms
	KA	2 A @ 250 Vrms <sup>1</sup>
	LA	7.5 A @ 250 Vrms <sup>1</sup>
	RA	25 A @ 250 Vrms <sup>1</sup>
DC POWER CONTROLLERS	PC	2 A, 5 A, 7.5 A, 10 A, 15 A @ 28 V
		1 A, 2 A, 5 A, 7.5 A, 10 A @ 270 V <sup>1</sup>

**Notes:**

- 1 Available with "smart" features: Status, short Circuit Protection, or Thermal Shut Down.
- 2 Covered by DESC drawing. See catalog sheet for DESC drawing number.
- 3 Qualified to MIL-R-28750. See catalog for slash sheet number.
- 4 Cots solid state relay, available to Teledyne S<sup>2</sup>R™ "T" screening in a plastic package.


**TELEDYNE RELAYS**

12525 Daphne Ave., Hawthorne, California 90250 Telephone 1-800-596-3855

Detailed Specifications on any of our products or complete catalogs are available on request.



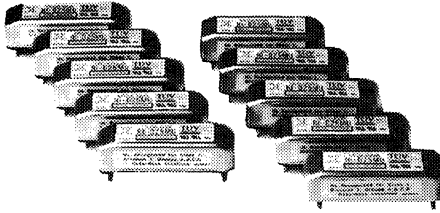


# Bestact™ High Power I/O Reed Relays

## ■ RATINGS AND SPECIFICATIONS

Type	Capacity		Medium-Capacity Type				Large-Capacity Type			
	Standard Type	High Insulation Type	RI-D24MU	RI-D25MU	RI-E25MU	RI-B14MU	RI-B15MU	RI-C14MU	RI-C15MU	
Contact Ratings	Contact Arrangement		1NO		1NC	1NO		1NC		
	Incorporated Bestact Type		R24U		R25U	R14U	R15U	R14U	R15U	
	Operational Power Ratings (Inductive Load)		240V 0.5A (180VA, 1/8 HP)			240A 1A (360VA, 1/2 HP)				
	DC		115V 0.3A (69VA)			230V 0.2A, 115V 0.5A (69VA)				
Characteristics	Minimum Operational Power Ratings		5V 1mA**	24V 1mA**		1V 1mA	24V 1mA**	1V 1mA	24V 1mA**	
	Vibration Resistance		98.0m/s <sup>2</sup> (10G) or greater (20 to 1000Hz)				98.0m/s <sup>2</sup> (10G) or greater (20 to 1000Hz)			
	Shock Resistance	Erroneous Operation	147.0m/s <sup>2</sup> (15G)				147.0m/s <sup>2</sup> (15G)			
		Breakdown	980.0m/s <sup>2</sup> (100G) or greater				980.0 m/s <sup>2</sup> (100G) or greater			
	Withstand Voltage (Across Input and Output)		1500VAC for 1 minute (across contacts: 500VAC)				2000VAC for 1 minute (across contacts: 800VAC)			
Ambient Temperature	Operating Temperature	-40 to +60°C				-40 to +60°C				
	Storage	-60 to +80°C				-60 to +80°C				
Approx. Weight		15g	20g		35g	40g				

Note: 1. For details of the contact ratings, service life, characteristics, etc., refer to the Ratings, Specifications, and Electrical Life, on our Switch pages in Section 5100.  
 2. Large-capacity can be used at ratings of 115VDC 0.5A or greater. For more information, contact Yaskawa.  
 3. In circuit with optocoupler 5V 10mA can be used.



### Medium-Capacity

Type RI-D□MU, -E25MU (Standard type)

### Large-Capacity

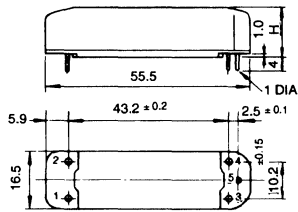
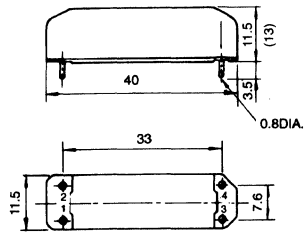
Type RI-B□MU, -C□MU (Standard type)

Type RI-B□MHU, -C□MHU (High insulation type)

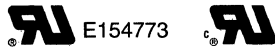
## ■ DIMENSIONS in mm

□ MEDIUM-CAPACITY TYPE

□ LARGE-CAPACITY TYPE



\* Value in parenthesis where Type RI-E indicates.



Recognized in accordance with USA, Canadian and European Standards. For Class I, Division 2 Groups A,B,C,D. Hazardous Locations UL File No. E154773, European Conformance TÜV File No. 950823987 001.

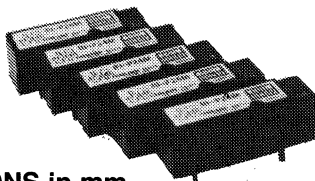
## ■ COIL SPECIFICATIONS (With polarity)

Type	Medium-Capacity				Large-Capacity				
	RI-D	RI-E	RI-B	RI-C	RI-D	RI-E	RI-B	RI-C	
Rated Voltage (E) V	12	24	48	12	24	48	12	24	48
Coil Resistance Ω	405	1520	5530	295	1160	4060	250	1020	3980
Rated Power Consumption W	0.4	0.5	0.45	0.55	0.6	0.6	0.6	0.6	0.7
Continuous Allowable Coil Voltage/Wattage	170%E		150%E		220%E		150%E		150%E
Operating Voltage	Approx. 1.2W				Approx. 1.1W				Approx. 1.3W
Releasing Voltage	75%E or less				75%E or less				8.5%E or greater

Note: 1. Values tabulated indicate operation at ambient temperature of 20°C.  
 2. Coil resistance values can vary by ±10%.  
 3. Type RI-E & -C may erroneously operate if the maximum allowable power or voltage ratings are exceeded for a short period of time.

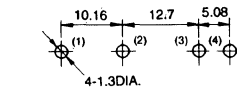
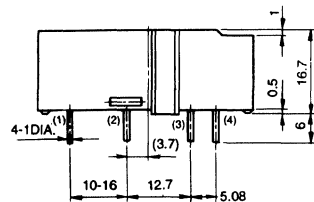
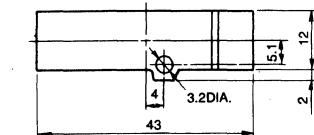
Dim	Type	RI-B	RI-C
H		14.5	17

# Bestact™ High Power I/O Module Reed Relays



## ■ DIMENSIONS in mm

• PC FOOTPRINTS (Bottom view)



## ■ RATINGS AND SPECIFICATIONS

Type		RI-P25MU	
Contact Ratings	Rated Insulation Voltage	250VAC	
	Rated Continuous Current	3A	
	Contact Arrangement	1NO	
	Incorporated Bestact Type	R25U	
	Operational Power Ratings (Inductive Load)	AC: 240V 5A ON, 0.5A OFF (180VA, 1/8 HP) DC: 115V 0.3 A (69VA)	
Minimum Operational Power Ratings		24V 1mA**	
Characteristics	Vibration Resistance	147.0m/s <sup>2</sup> (15G) or greater (20 to 1000Hz)	
	Shock Resistance	Erroneous Operation	196.0m/s <sup>2</sup> (20G)
		Breakdown	980.0m/s <sup>2</sup> (100G)
	Withstand Voltage (Across Input and Output)		1500VAC for 1minute (across contacts: 500VAC)
Ambient Temperature	Operating Temperature	-40 to +60°C	
	Storage	-60 to +80°C	

Note: \*1. In circuit with optocoupler 5V 10mA can be used.

## ■ COIL SPECIFICATION (With polarity)

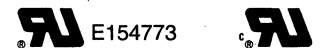
Rated Voltage (E) V	Coil Resistance Ω	Rated Power Consumption	Maximum Continuous Allowable Voltage	Operating Characteristics	
				Minimum Operating Voltage	Release Voltage
5	50±10%	0.5W	140%E (at 20°C)	72%E or less	8.5%E or greater
12	295±10%				
24	1155±10%				

Note: Values tabulated indicate operation at ambient temperature of 20°C.

**YASKAWA ELECTRIC AMERICA, INC.**  
 2121 NORMAN DRIVE SOUTH, WAUKEGAN, IL. 60085  
 PH. 847 / 887-7000 ■ FAX 847 / 480-9731

See our additional pages in Sections 5100 and 5500.

Recognized in accordance with USA and Canadian Standards. For Class I, Division 2 Groups A,B,C,D. Hazardous Locations UL File No. E154773



## SOLENOIDS

Manufacturer	Starting EEM Page No.	Model/Series	Linear				Rotary	Proportional (Servo)	Magnetic Latching
			Frame Type		Tubular	Box			
			C	D					
Bicon Electronics	B-1451		√	√	√	√		√	
Communications Instruments Inc.	B-1452	100 and 200 4000 5000 3000 7000 (Custom)	√			√			
Dormeyer Ind.	B-1455		√	√	√	√		√	
Electro-Mechanisms, Inc.	B-1456	SP 25-100, PO 25-100, TSP/TPO 30-65	√	√	√				
Guardian Electric Mfg. Co.	B-1458	11HD 12, 14, 16, 18 20L, 22, 4, 11, 28 2, 2HD, 3HD, 4HD 24, 26, 34, 42 28HD T3, 5X9, T4X7, T4X12, T4X16 T5X9, T6X12, T8X9, T8X16, T12X13 T12X19, LT3.5X9, LT4X7, LT4X12, LT4X16, LT6X12, LT8X9, LT8X16, LT12X13 LT12X19	√	√	√	√		√	
Liberty Controls	B-1460	M-22; L-05, 06, 61, 24, -26, 62, -63, -65; L-15-2HD, L-10-1, L-15-1, L-75-1, L15-2; L-22, L28, L81, L11 L-82, L04-L88, L90	√	√	√	√		√	
Magnet Schultz	B-1462	5x7 828 R12x12 940 GDAY GRCY 2U3-L, 313-L	√	√	√	√	√	√	
Oakgrisby	B-1465		√	√	√		√		



# BICRON Solenoid Products

Visit BICRON OnLine  
[www.solenoid.com](http://www.solenoid.com)  
 for product detail

## Typical Applications

- Automated Teller Machines
- Automatic Sorting Equipment
- Automotive
- Business Equipment
- Camera/Photo Equipment
- Compressor Controls
- Computer Peripherals
- Electrical Appliances
- Fluid Control/Dispensing
- Fuel Control
- Gaming Machines
- Industrial Automation
- Locking Mechanisms
- Machine Tools
- Office Equipment
- Security Systems
- Textile Machinery
- Vending Equipment

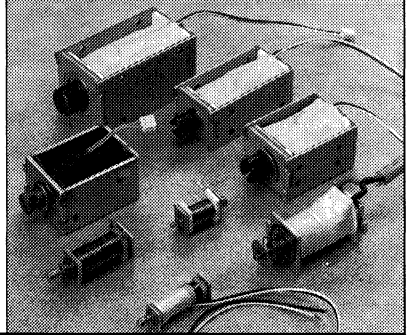
## The Bicron Advantage

- Over 30 Years in Electromechanical Field
- Qualified Automotive Supplier to AIAG Quality Standards
- US Design and Manufacture with Global Sourcing Partners
- Value Added Capabilities



## Open Frame Solenoids

Bicron standard open C and D frame solenoids provide ideal, low cost solutions for many electromechanical applications. Expect high performance, fast delivery and economical pricing.



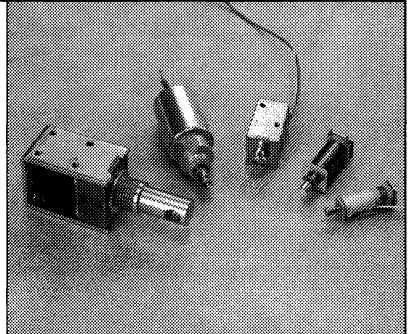
## Tubular Solenoids

Bicron tubular and push-pull solenoids offer high forces in a limited space. Many standard sizes are available for direct application . . . or can be easily modified to include special features or value added assemblies for non-standard applications.



## Magnetic Latching Solenoids

Bicron magnetic latching solenoids provide positive holding in power-off mode and are ideal for low power, battery operation applications. Choose from a number of standard models or model designs modified for your special application.



## Special Solenoids

30 years of electromechanical experience gives us the edge in designing special solenoid products for volume applications. Whether for business, commercial, consumer or military requirements, we have the know-how and production facilities to deliver superior products at competitive prices.



*"Excellence Through Teamwork"*



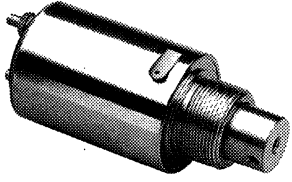
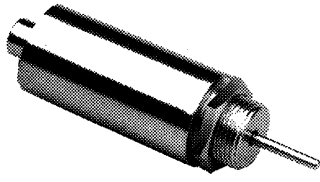
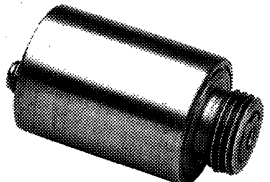
**BICRON Electronics Company**

50 Barlow Street • Canaan • Connecticut 06018

Tel: 860-824-5125 • Fax: 860-824-1137 • Toll-free Tel: 800-624-2766 • Toll-free Fax: 800-355-5125

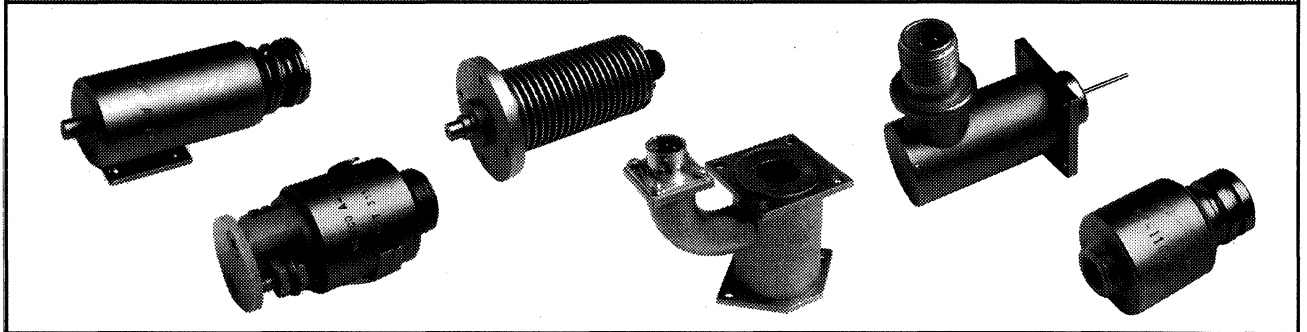
Call for information or visit our web site: [www.bcrn.com](http://www.bcrn.com) or e-mail: [info@bcrn.com](mailto:info@bcrn.com)

# High Performance Tubular Solenoids

PULL-TYPE	PUSH-TYPE	SWITCH-TYPE
		
<p>DC tubular pull-type solenoid is designed to provide up to 90 lbs. of force with a maximum stroke of .500 in.</p> <p>Actual usable force will depend on the stroke and power level.</p> <p>Coils are available from 6 to 115 Vdc with a continuous duty power level of 2.2 to 54 watts and an intermittent duty power level of 12 to 585 watts.</p>	<p>DC tubular push-type solenoid provides up to 50 lbs. of force with a maximum stroke of .562 in.</p> <p>Actual usable force will depend on the stroke and power level.</p> <p>Coils are available from 6 to 115 Vdc with a continuous duty power level of 3 to 36 watts and an intermittent duty power level of 9 to 240 watts.</p>	<p>DC tubular switch-type solenoid provides up to 120 lbs. of force with a maximum stroke of 1 in.</p> <p>Actual usable force will depend on the stroke and power level.</p> <p>Coils are available from 12 to 115 Vdc. Each solenoid utilizes two coils, one energized at pull-in for extra force and a holding coil for continuous operation. Intermittent pull-in duty power level is 112 to 700 watts and continuous power level of 3 to 14 watts.</p>

# High Performance Custom Solenoids

## APPLICATION SPECIFIC DESIGNS



Communications Instruments, Inc. can provide customized solenoids with many of the following features :

### SOLENOID STYLES

- High temperature
- 400 Hz AC
- Commercial AC
- Air frame
- Heavy duty
- Two coil designs
- Pressure sealed
- Corrosion resistant

### CONNECTOR STYLES

- Flexible leads
- Connector assemblies
- Right angle AN connectors
- Square flange AN connectors
- Quick-connects
- Screw terminals
- Solder terminals
- Stud terminals

### MOUNTING STYLES

- Round flanges
- Square flanges
- Threaded flanges
- Shaped flanges

### PLUNGER STYLES

- Internal threads
- External threads
- Clevice plungers
- Extension plungers
- Captive plungers

WORLDWIDE LEADER IN HIGH PERFORMANCE SWITCHING TECHNOLOGY <sup>SM</sup>

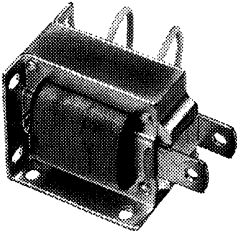
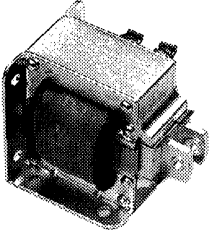
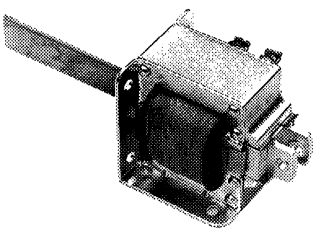
**CII Technologies™**

Communications Instruments, Inc.™ Division

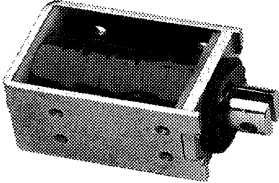
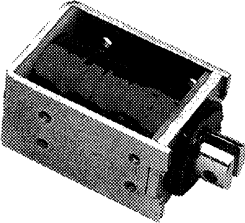
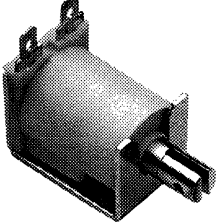
P.O. Box 520 • 1396 Charlotte Highway  
Fairview, North Carolina 28730

Phone 828-628-1711 • Fax 828-628-1726 (Sales)  
Internet : [www.ciidiv.com](http://www.ciidiv.com) • E-mail : [info@ciidiv.com](mailto:info@ciidiv.com)

## Commercial AC Solenoids

100 SERIES PULL-TYPE	200 SERIES PULL-TYPE	100 & 200 SERIES PUSH-TYPE
		
<p>The 100 Type AC laminated solenoids provide up to 6 lbs. of force with a stroke of .875 in.</p> <p>Actual usable force will depend on the stroke and power level.</p> <p>Coils are available from 24 to 230 Vac and power levels of 230 Va to 550 Va.</p>	<p>The 200 Type AC laminated solenoids provide up to 20 lbs. of force with a stroke of 1 in.</p> <p>Actual usable force will depend on the stroke and power level.</p> <p>Coils are available from 24 to 440 Vac and power levels of 518 to 1840 Va.</p>	<p>By utilizing a stainless steel shaft the 100 and 200 Series are available as push-type solenoids. The solenoids provide up to 20 lbs. of force with a stroke of 1 in.</p> <p>Actual usable force will depend on the stroke and power level.</p> <p>Coils are available from 24 to 440 Vac and power levels of 230 to 1840 Va.</p>

## Commercial Box & C-Frame Solenoids

BOX FRAME PULL-TYPE	BOX FRAME PUSH-TYPE	C-FRAME
		
<p>DC box-frame pull-type solenoid provides up to 170 ozs. force with a maximum stroke of .250 in.</p> <p>Actual usable force will depend on the stroke and power level.</p> <p>Coils are available from 6 to 115 Vdc with a continuous duty power level of 8 watts and an intermittent duty power level of 18 watts. Pulse-type coils are also available.</p>	<p>DC box-frame push-type solenoid provides up to 20 ozs. force with a maximum stroke of .200 in.</p> <p>Actual usable force will depend on the stroke and power level.</p> <p>Coils are available from 6 to 115 Vdc with a continuous duty power level of 3.0 watts and an intermittent duty power level of 9.0 watts.</p>	<p>C-frame (open) pull-type solenoid, available for DC or AC operation, is designed to provide up to 65 oz. (DC) - 34 oz. (AC) with a maximum stroke of .250 in.</p> <p>Actual usable force will depend on the stroke and power level.</p> <p>Coils are available from 6 to 115 Vdc and 6 to 240 Vac with a continuous duty power level of 5 watts (DC) - 7 Va (AC) and an intermittent duty power level of 15 watts (DC) - 20 Va (AC).</p>

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**Communications  
Instruments, Inc.™** Division

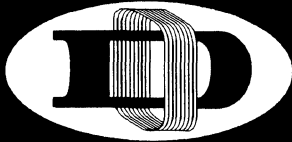
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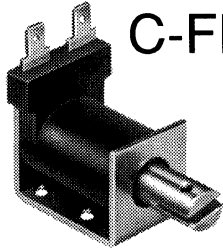
# WIRE GAUGES— DIAMETER, AREA AND COPPER WEIGHT

Size, AWG	Diameter at 20°C (68°F)		Area at 20°C (68°F)			Weight at 20°C (68°F), bare copper wire		
	mils	mm	mils	c mils	mm	lb/1,000 ft.	lb/mile	kg/km
4/0	460.0	11.68	166,200	211,600	107.2	640.5	3,382	953.2
3/0	409.6	10.40	131,800	167,800	85.01	507.8	2,681	755.7
2/0	364.8	9.266	104,500	133,100	67.43	402.8	2,127	599.5
1/0	324.9	8.252	82,891	105,600	53.49	319.5	1,687	477.6
1	289.3	7.348	85,730	83,690	42.41	253.3	1,338	337.0
2	257.6	6.543	52,120	66,360	33.62	200.9	1,061	298.9
3	229.4	5.827	41,330	52,620	26.67	159.3	841.1	237.1
4	204.3	5.189	32,780	41,740	21.15	126.3	667.1	188.0
5	181.9	4.620	25,990	33,090	16.77	100.2	528.8	149.0
6	162.0	4.115	20,610	26,240	13.30	79.44	419.4	118.2
7	144.3	3.665	16,350	20,820	10.55	63.03	332.8	93.80
8	128.5	3.264	12,970	16,510	8.367	49.98	263.9	74.38
9	114.4	2.906	10,280	13,090	6.631	39.61	209.2	58.95
10	101.9	2.588	8,155	10,380	5.261	31.43	166.0	46.77
11	90.7	2.304	6,460	8,230	4.17	24.90	131	37.1
12	80	2.05	5,130	6,530	3.310	19.8	104	29.4
13	72.0	1.83	4,070	5,180	2.63	15.7	82.9	23.4
14	64.1	1.63	3,230	4,110	2.08	12.4	65.7	18.5
15	57.1	1.45	2,560	3,260	1.650	9.87	52.1	14.7
16	50.8	1.29	2,030	2,580	1.31	7.81	41.2	11.6
17	45.3	1.150	1,610	2,050	1.040	6.21	32.8	9.24
18	40.3	1.02	1,280	1,620	0.823	4.92	26.0	7.32
19	35.9	0.912	1,010	1,290	0.653	3.90	20.6	5.81
20	32.0	0.813	804.0	1,020	0.519	3.10	16.4	4.61
21	28.5	0.724	638.0	812.0	0.412	2.46	13.0	3.66
22	25.3	0.643	503.0	640.0	0.324	1.94	10.2	2.88
23	22.6	0.574	401.0	511.0	0.259	1.55	8.16	2.30
24	20.1	0.511	317.0	404.0	0.205	1.22	6.46	1.82
25	17.9	0.455	252.0	320.0	0.162	0.970	5.12	1.44
26	15.9	0.404	199.0	253.0	0.128	0.765	4.04	1.14
27	14.2	0.361	158.0	202.0	0.102	0.610	3.22	0.908
28	12.6	0.320	125	159.0	0.0804	0.481	2.54	0.715
29	11.3	0.287	100.0	128.0	0.0647	0.387	2.04	0.575
30	10.0	0.254	78.50	100.0	0.0507	0.303	1.60	0.450
31	8.9	0.226	62.20	79.2	0.0401	0.240	1.27	0.357
32	8.0	0.203	50.30	64.0	0.0324	0.194	1.02	0.288
33	7.1	0.180	39.60	50.40	0.0255	0.153	0.806	0.227
34	6.3	0.160	31.20	39.7	0.0201	0.120	0.634	0.179
35	5.6	0.142	24.60	31.4	0.0159	0.0940	0.501	0.141
36	5.0	0.127	19.60	25.00	0.0127	0.0757	0.400	0.113
37	4.50	0.114	15.90	20.20	0.0103	0.0613	0.324	0.0912
38	4.0	0.102	12.60	16.0	0.00811	0.0484	0.256	0.0721
39	3.5	0.0889	9.62	12.2	0.00621	0.0371	0.196	0.0552
40	3.1	0.0787	7.55	9.61	0.00487	0.0291	0.154	0.0433
41	2.8	0.0711	6.16	7.84	0.00397	0.0237	0.125	0.0353
42	2.5	0.0635	4.91	6.25	0.00317	0.0189	0.0999	0.0282
43	2.2	0.0559	3.80	4.84	0.00245	0.0147	0.0774	0.0218
44	2.0	0.0508	3.14	4.00	0.00203	0.0121	0.0639	0.0180
45	1.8	0.0457	2.54	3.24	0.00164	0.00981	0.0519	0.0146
46	1.6	0.0406	2.01	2.56	0.00130	0.00775	0.0409	0.0115
47	1.4	0.0356	1.54	1.96	0.000993	0.00593	0.0313	0.00883
48	1.2	0.0305	1.13	1.44	0.000730	0.00436	0.0230	0.00649
49	1.1	0.0279	0.950	1.21	0.000613	0.00366	0.0193	0.00545
50	1.0	0.0254	0.785	1.00	0.000507	0.00303	0.0160	0.00450



# Dormeyer Industries

## Standard and Custom Solenoids



### C-FRAME

#### STANDARD MODEL ORDERING INFORMATION

PART NUMBER	INPUT VOLT.	DUTY CYCLE	COIL RES. (Ohms)	FORCE (oz.) @ 1/8"	DIMENSIONS (Inches) L. x W. x H.
C8-271-M-36	24 DC	CONT	126	5	1.125 x 0.750 x 0.812
C8-771-M-36	24 DC	INT	59	12.5	
C8-19-M-36	120 AC	CONT	840	6.5	
C8-519-M-36	120 AC	INT	500	15	
C26-271-M-36	24 DC	CONT	104	17	1.730 x 0.845 x 1.320
C26-771-M-36	24 DC	INT	41.5	35	
C26-19-M-36	120 AC	CONT	31.5	15	
C26-519-M-36	120 AC	INT	140	22	
C33-271-M-33	24 DC	CONT	76	11	1.363 x 1.312 x 1.140
C33-771-M-33	24 DC	INT	37	20	
C33-19-M-33	120 AC	CONT	290	14	
C33-519-M-33	120 AC	INT	165.5	22	
C34-271-M-33	24 DC	CONT	54	28	1.657 x 1.312 x 1.437
C34-771-M-33	24 DC	INT	25	56	
C34-19-M-33	120 AC	CONT	128.5	20	
C34-519-M-33	120 AC	INT	55	44	

- Low Cost
- Wide Range of Sizes
- AC Models 6-240 VAC
- DC Models 6-110 VDC
- Encapsulated Coils
- Available in Magnetic Latch

#### FEATURES:

- Moderate Life with Excellent Electrical Characteristics
- Ideal for Most Low Force Applications

### BOX-FRAME

#### STANDARD MODEL ORDERING INFORMATION

PART NUMBER	INPUT VOLT.	DUTY CYCLE	COIL RES. (Ohms)	FORCE (oz.) @ 1/8"	DIMENSIONS (Inches) L. x W. x H.
B4HD-253-M-36	24 DC	CONT	44.3	110	2.177 x 1.440 x 1.625
B4HD-753-M-36	24 DC	INT	14.6	140	
B4HD-1-M-36	120 AC	CONT	73	27	
B4HD-501-M-36	120 AC	INT	19.3	62	
B11-253-M-36	24 DC	CONT	73	17	1.860 x 0.937 x 1.182
B11-753-M-36	24 DC	INT	30.5	34	
B11-1-M-36	120 AC	CONT	192	22	
B11-501-M-36	120 AC	INT	79.2	33	
B22-253-M-36	24 DC	CONT	66	28	1.609 x 1.312 x 1.468
B22-753-M-36	24 DC	INT	22	80	
B22-1-M-36	120 AC	CONT	107	16	
B22-501-M-36	120 AC	INT	40.5	44	
B41-253-A-1	24 DC	CONT	46	11	3.051 x 1.732 x 2.028
B41-753-A-1	24 DC	INT	14	15	

#### FEATURES:

- Suitable for Wide Range of Applications
- Higher Force than C-Frame
- Moderate-to-Long Life
- Wide Range of Sizes
- Versatile Mounting
- AC Versions 6-240 VAC
- DC Versions 6-110 VDC

- Encapsulated Coils Available
- New Patent Pending Frame Design Available
- Available in Magnetic Latch

### LAMINATED

#### STANDARD MODEL ORDERING INFORMATION

PART NUMBER	INPUT VOLT.	DUTY CYCLE	COIL RES. (Ohms)	FORCE (oz.) @ 1/8"	DIMENSIONS (Inches) L. x W. x H.
1000-M-1	120 AC	CONT	87.3	48	1.609 x 1.188 x 1.438
1500-M-1	120 AC	INT	57.2	72	
1001-M-1	240 AC	CONT	354	48	
1501-M-1	240 AC	INT	240	72	
1250-A-1	120 AC	CONT	64.2	67	1.609 x 1.427 x 1.438
1750-A-1	120 AC	INT	40.5	104	
1251-A-1	240 AC	CONT	258	67	
1751-A-1	240 AC	INT	161	104	
2005-M-1	120 AC	CONT	20.5	128	2.500 x 1.811 x 2.060
2255-M-1	120 AC	INT	18.3	160	
2006-M-1	240 AC	CONT	81.6	128	
2256-M-2	240 AC	INT	73.5	160	
2536-M-1	120 AC	CONT	14.9	176	2.500 x 2.062 x 2.060
2786-M-1	120 AC	INT	11.9	272	
2537-M-1	240 AC	CONT	60	176	
2787-M-1	240 AC	INT	48	272	
3000-M-1	120 AC	CONT	6.5	256	2.937 x 2.375 x 2.937
3500-M-1	120 AC	INT	4.8	448	
3001-M-1	240 AC	CONT	26	256	
3501-M-1	240 AC	INT	19.3	448	

#### FEATURES:

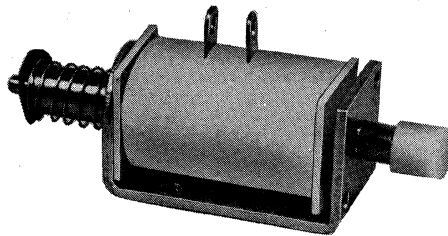
- High Force up to 23 lbs.
- Moderate Life for Dependability
- Five Sizes
- AC Input 6 - 240 VAC
- Class B Insulation System - Class F Available
- Encapsulated Coils

Dormeyer Industries • 6585 N. Avondale, Chicago, IL 60631-1521  
 Tel: (773) 775-3600 • Fax: (773) 775-6495

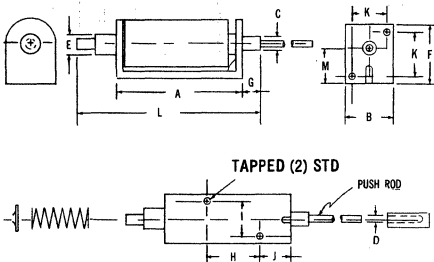
# electro-mechanisms INCORPORATED

990 AMELIA AVENUE, SAN DIMAS, CA 91773  
 PHONE (909) 394-9953 FAX (909) 394-0782  
 email: roy@electromechanisms.com  
 internet: www.electromechanisms.com

## MINI-SOLENOID ACTUATORS



### SP SERIES PUSH TYPE



Wire: ..... 155°C Magnet Wire  
 Termination: ..... Heavy Leads — PVC, Type BU, 5"  
                   ..... Terminals — Solder Lugs  
 Tape: ..... Mylar  
 Bobbin: ..... 30% Glass Filled Nylon  
 Tip: ..... Delrin  
 Pushrod: ..... Phosphor Bronze  
 Tol: ..... .xxx ± .005  
       ..... .xxx ± .010  
       ..... Frac. ± 1/64

3, 6, 12, 24, 48, 110 VDC available voltage for push/pull

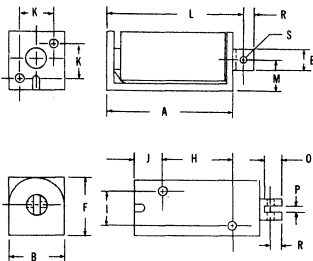
#### SPECIFICATIONS

Note: Dimension L is shown with solenoid in energized position. Return Spring and Delrin Tip are Standard on all SP Series.

Part No.	A	B	C	D	E	F	G	H	I	J	K	L	M	S	Max. Stroke*	Weight Oz.	Tapped Holes	Wattage Nom.
SP-25	.548	.236	.093	.036	.100	.298	.093	1/4	.136	1/8	*	.84	.180		1/4	.1	1-72	2
SP-37	.820	.360	.125	.051	.150	.430	.125	5/16	1/4	3/16	1/4	1.22	.250		3/8	.3	1-72	3
SP-50	.980	.488	.125	.051	.187	.510	.150	1/2	3/8	7/32	5/16	1.44	.285		1/2	.7	1-72	4.5
SP-62	1.215	.600	.187	.091	.250	.691	.178	3/8	7/16	1/4	7/16	1.732	.391		5/8	1.2	4-40	6
SP-75	1.621	.730	.240	.091	.306	.838	.172	3/8	7/16	1/4	1/2	2.15	.473		3/4	2.7	4-40	9

Standard Coils 105°C, Hi Temp Available. \* Max Stroke, Standard Pushrod length.

### PO SERIES PULL TYPE



Wire: ..... 155°C Magnet Wire  
 Termination: ..... Heavy Leads — PVC, Type BU, 5"  
                   ..... Terminals — Solder Lugs  
 Tape: ..... Mylar  
 Bobbin: ..... 30% Glass Filled Nylon  
 Tol: ..... .xxx ± .005  
       ..... .xxx ± .010  
       ..... Frac. ± 1/64

#### SPECIFICATIONS

Note: Dimension L is shown with solenoid in energized position.

Part No.	A	B	E	F	H	I	J	K	L	M	O	P	R	S	Max. Stroke	Weight Oz.	Tapped Holes	Wattage Nom.
PO-25	.548	.236	.100	.298	1/4	.136	1/8	*	.672	.180	.130	.025	.062	.031	1/4	.1	1-72	2
PO-37	.820	.360	.150	.430	5/16	1/4	3/16	1/4	.892	.250	.150	.051	.075	.031	3/8	.3	1-72	3
PO-50	.980	.488	.187	.510	1/2	3/8	7/32	5/16	1.074	.285	.200	.063	.106	.063	1/2	.7	1-72	4.5
PO-62	1.215	.600	.250	.691	5/8	7/16	1/4	7/16	1.340	.391	.200	.063	.094	.063	5/8	1.2	4-40	6
PO-75	1.621	.730	.306	.838	3/4	7/16	1/4	1/2	1.797	.473	.200	.063	.094	.063	3/4	2.7	4-40	9

Standard Coils 105°C, Hi Temp Available.

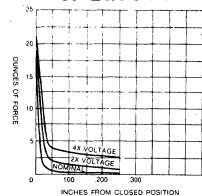
#### SPECIALS

ELECTRO-MECHANISMS, INC., is completely equipped, both engineering and production wise, to supply you with variations of our solenoids that you might need for your application. We are also capable of designing special types that you might need within the size range of our products. We would appreciate the opportunity to help you solve design and application problems you may have in the area of miniature solenoid actuators.

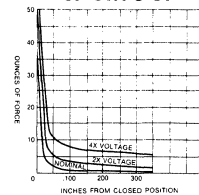
The force charts below represent three different duty cycles.  
 Nominal voltage represents continuous duty.  
 2X Nominal voltage represents a 25%, intermittent duty cycle  
 4X Nominal voltage represents a 6% intermittent duty cycle.  
 The duty cycle consists of two factors:

1. Percentage of time solenoid is energized in one complete operating cycle.  
 (Ref: DUTY CYCLE =  $\frac{\text{Time On}}{\text{Time On} + \text{Time Off}} \times 100$ )
2. Length of time of the longest single energization in one complete operating cycle.

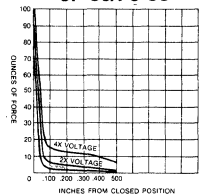
SP-25/PO-25



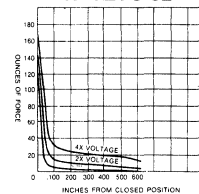
SP-37/PO-37



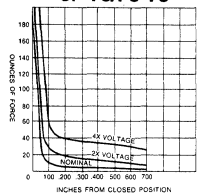
SP-50/PO-50



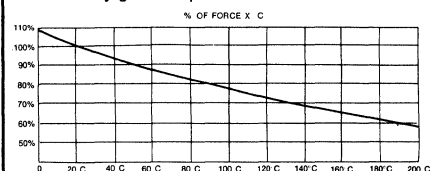
SP-62/PO-62



SP-75/PO-75



All forces shown are at 25° ambient. For use at higher ambient temperatures use the chart below to determine force at any given temperature.



#### FEATURES

ELECTRO-MECHANISMS micro-miniature solenoids offer you static and impact forces equal to standard solenoids 2 to 3 times the size of these units.

Because of their small size, they have extremely fast reaction time. As fast as 2 msec at 4x nominal voltage.

The unique design of PUSH or PULL action, offers many applications beyond the conventional pull type solenoid.

A complete line of 20 solenoids from 1/8" O.D. to 1/4" O.D. allows you to choose the correct solenoid with the force you require, from stock items.

The units are highly reliable with life of many millions of operations.

The solenoids are also available with coils in Class F and Class H for high temperature requirements.

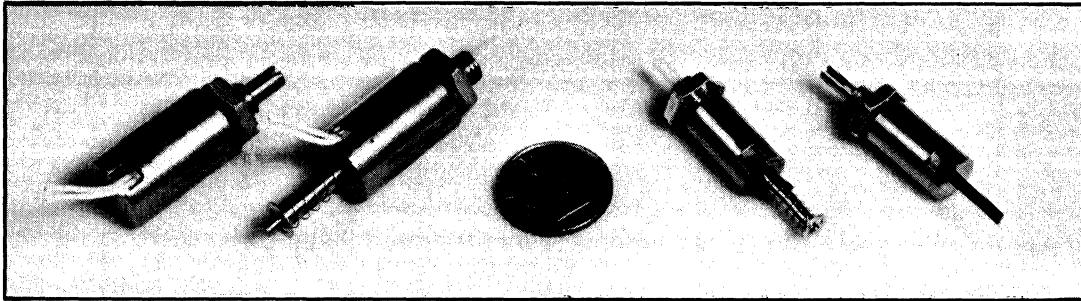
Simplicity of design helps keep the costs down and allows us to pass these savings on to you, our customer.

#### TYPICAL APPLICATIONS

- Hammers for high speed printers
- Camera shutter actuators
- Locking mechanisms for switches, adding machines and typewriters
- Interposers for card punching and tape perforation
- Cam actuation
- Pen lifters for plotters
- Event markers for chart recorders
- Key actuators for numerical readouts on typewriters and adding machines
- For life testing different devices
- For indicator flags
- Sensing devices
- Remote switching and actuation

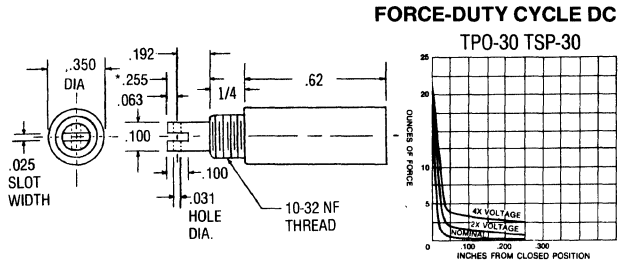


**MINIATURE TUBULAR SOLENOIDS**

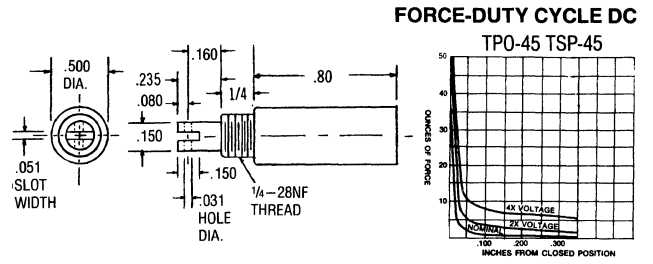


**AVAILABLE PUSH (TSP) or PULL (TPO)**

**.350" DIA. X .58**  
**2 WATTS**  
**MODELS TPO-TSP-30**

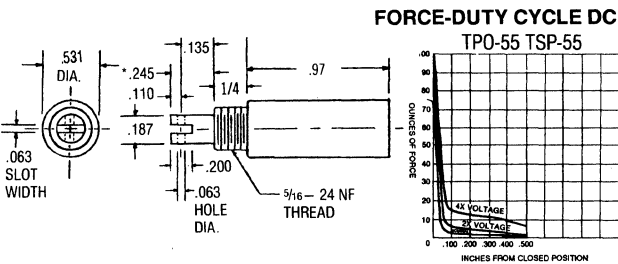


**1/2" DIA. X .86**  
**3 WATTS**  
**MODELS TPO-TSP-45**

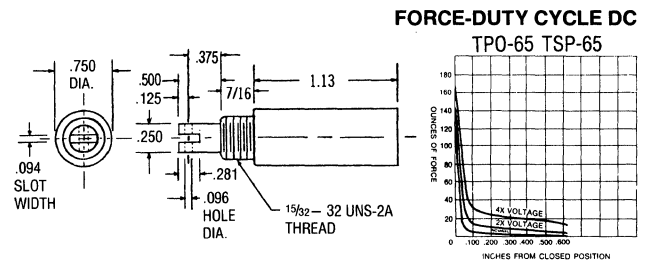


\* All forces shown are at 25°C ambient at energized position.

**.531" DIA. X .97**  
**4.5 WATTS**  
**MODELS TPO-TSP-55**

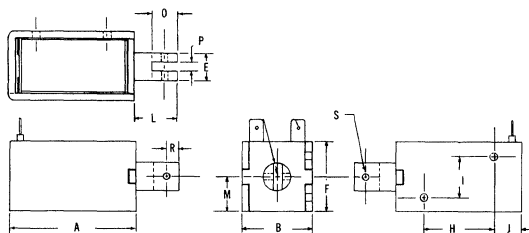


**3/4" DIA. X 1.15**  
**6 WATTS**  
**MODELS TPO-TSP-65**



**PO-100 SERIES**  
**60° CONICAL**  
**12 WATTS**

**AVAILABLE PUSH TYPE (SP)**

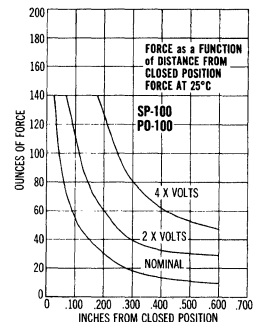


**SPECIFICATIONS**

Part No.	A	B	E	F	H	I	J	L	M	O	P	R	S	Height of Terms	Max. Stroke	Tapped Holes	Weight Oz.
PO-100	2.270	1.254	.500	1.254	1.115	.750	.530	.700	.627	.375	.143	.168	.100	.365	1	6-32	10

Standard Coils 105°C, Hi Temp Available.

\* Not Applicable.

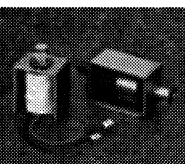
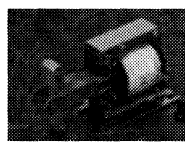
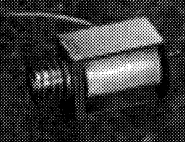
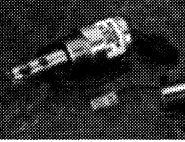


# GUARDIAN

GUARDIAN ELECTRIC MANUFACTURING COMPANY

## SOLENOIDS

- **Box & C Frame Types**
- **Tubular Type**
- **Laminated Type**
- **Magnetic Latching Type**
- **Push Type Std. / Pull Type Avail.**
- **Custom Configurations**

Series	Size (LxWxH)	Plunger Dia.	Coil Voltages	AC Power (VA)		DC Power (W)		
				Int.	Cont.	Int.	Cont.	
	2	1.54x1.57x1.62	.438	AC-120/DC-12,24	44	13	27.5	8.5
	2HD	1.70x1.57x1.68	.438	AC-120/DC-24	66	16.5	26.5	9.0
	3HD	1.74x1.57x1.62	.500	AC-120/DC-24	103	20	28.5	9.0
	4	1.98x1.57x1.62	.438	AC-120/DC-12,24,110	60	10	37.5	10.4
	4HD	2.17x1.57x1.62	.500	AC-120/DC-12,24,110	171	31	35.5	10.5
	11	1.84x.94x1.19	.313	AC-24,120/DC-6,12,24	40	12	22	7.8
11HD	2.00x.94x1.25	.438	AC-120/DC-12,24	40	16	20	7.8	
	12	1.625x1.25x1.40	.498x.312	AC-120A	33	22	--	--
	14	2.45x1.90x2.08	.625x.500	AC-120A	180	63	--	--
	16	1.62x1.21x1.43	.375x.548	AC-120,240	70	20	--	--
	18	2.50x1.81x2.09	.500x.735	AC-120/240	228	49	--	--
	20L	.985x.591x.512	.236	DC-6,12,24	--	--	6	6
	22	1.13x.75x.75	.250	AC-120/DC-6,12,24	9	5.5	7	3.2
	24	1.23x.91x1.11	.313	AC-120/DC-12,24	14	7.5	11.8	4.3
	26	1.73x.92x1.13	.313	AC-120/DC-12,24	24	12	15.5	5.5
	28	1.13x.94x1.19	.313	AC-24,120/DC-6,12,24	22	8	13.5	5.0
	28HD	1.23x.94x1.25	.438	AC-24,120/DC-6,12,24	28	9	13.5	5.6
	34	1.13x.82x.72	.313	AC-24,120/DC-12,24	13	6	9	3.8
	42	.64x.30x.46	.156	DC-12,24	--	--	1.9	1.5
	T3.5X9	1.18x.44	.156	DC - 12,24	--	--	5	2.5
	T4X7	.89x.50	.188	DC - 12,24	--	--	4.5	2.3
	T4X12	1.51x.50	.188	DC - 12,24	--	--	6.8	3.0
	T4X16	2.01x.50	.188	DC - 12,24	--	--	8.1	3.3
	T5X9	1.12x.625	.250	DC - 6,12,24	--	--	7.0	3.5
	T6X12	1.54x.75	.250	DC - 12,24	--	--	11.9	4.9
	T8X9	1.17x1.00	.438	DC - 12,24	--	--	14	5.0
	T8X16	2.04x1.00	.438	DC - 12,24	--	--	16	5.5
	T12X13	1.68x1.50	.500	DC - 12,24	--	--	21	7.5
	T12X19	2.43x1.50	.500	DC - 12,24	--	--	29	8.5
	LT3.5X9	1.15x.44	.156	DC - 12,24	--	--	5.7	2.8
	LT4X7	.89x.50	.203	DC - 12,24	--	--	5	2.3
	LT4X12	1.51x.50	.203	DC - 12,24	--	--	7.6	3.0
	LT4X16	2.01x.50	.203	DC - 12,24	--	--	10.3	3.5
LT6X12	1.54x.75	.313	DC - 12,24	--	--	11.5	4.5	
LT8X9	1.17x1.00	.438	DC - 12,24	--	--	15	5.5	
LT8X16	2.04x1.00	.438	DC - 12,24	--	--	23.2	7.5	
LT12X13	1.63x1.50	.500	DC - 12,24	--	--	27	8.1	
LT12X19	2.38x1.50	.500	DC - 12,24	--	--	32	9.8	

Int. Duty = 25% Duty Cycle 100 Sec. on Max.



**GUARDIAN ELECTRIC MANUFACTURING COMPANY**

1425 Lake Avenue Woodstock, IL 60098

Ph: (815)334-3600 Fax: (815)337-0377 Internet: www.guardian-electric.com

Contact us for details on standard products or custom capabilities

**1-800-762-0369**

See Our Web Site for an Interactive  
Solenoid Selector™ Tool

<http://www.guardian-electric.com>

# GUARDIAN

GUARDIAN ELECTRIC MANUFACTURING COMPANY

## SOLENOIDS

Series	Force (oz) AC max @ Stroke (in)		Force (oz) AC min @ Stroke (in)		Force (oz) DC max @ Stroke (in)		Force (oz) DC min @ Stroke (in)		Mech. Life	Coil Termination
2	55@.12	20@.12	14@.75	5@.75	96@.12	45@.12	20@.50	2@.50	10 <sup>6</sup>	.187x.020 QC
2HD	63@.12	25@.75	22@.75	9@.75	105@.12	48@.12	17@.50	5@.50	10 <sup>6</sup>	.187x.020 QC
3HD	88@.12	26@.12	6@1.0	4@1.0	128@.12	55@.12	25@.50	8@.50	10 <sup>6</sup>	.187x.020 QC
4	38@.12	10@.12	42@1.0	12@1.0	110@.12	60@.12	35@.75	5@.75	10 <sup>6</sup>	.187x.020 QC
4HD	72@.12	20@.12	62@1.0	22@1.0	130@.12	75@.12	10@1.0	1@1.0	10 <sup>6</sup>	.187x.020 QC
11	25@.12	13@.12	15@.75	7@.75	45@.12	22@.12	10@.50	2@.50	10 <sup>6</sup>	.187x.020 QC
11HD	30@.12	15@.12	14@1.0	5@1.0	70@.12	35@.12	14@.50	5@.50	10 <sup>6</sup>	.187x.020 QC
12	49@.12	30@.75	12@.88	7@.88	--	--	--	--	2.5x10 <sup>5</sup>	Lead Wires-22GA
14	132@.12	96@.12	120@1.0	112@1.0	--	--	--	--	2.5x10 <sup>5</sup>	Lead Wires-22GA
16	112@.12	65@.12	36@.75	18@.75	--	--	--	--	2.5x10 <sup>5</sup>	.187x.020 QC
18	336@.12	152@.12	144@1.0	60@1.0	--	--	--	--	2.5x10 <sup>5</sup>	.203x.028 Lugs
20L	--	--	--	--	6@.12	6@.12	1.5@.25	--	10 <sup>6</sup>	Lead Wires-26GA
22	13@.06	7@.12	2.5@.50	1.25@.50	17@.06	10@.06	3@.25	2@.25	10 <sup>6</sup>	.110x.018 QC
24	13@.12	8@.12	6@.50	3.75@.50	17@.12	6@.12	7.5@.25	2@.25	10 <sup>6</sup>	.187x.020 QC
26	20@.12	10@.12	7@.75	5@.75	22@.12	12@.12	12@.25	4@.25	10 <sup>6</sup>	.187x.020 QC
28	26@.06	15@.12	5@.50	4@.50	45@.06	23@.06	12@.25	4@.25	10 <sup>6</sup>	.187x.020 QC
28HD	34@.06	16@.12	8@.50	4@.50	55@.06	25@.06	10@.25	5@.25	10 <sup>6</sup>	.187x.020 QC
34	15@.06	8.5@.12	3@.50	2@.50	22@.06	10@.06	5@.25	2@.25	10 <sup>6</sup>	.187x.020 QC
42	--	--	--	--	9@.03	.75@.03	.30@.07	.25@.07	10 <sup>6</sup>	.025 Square
T3.5X9	--	--	--	--	3.5@.06	3.5@.06	1@.25	.5@.25	10 <sup>6</sup>	Lead Wires-28GA
T4X7	--	--	--	--	8.5@.03	8.5@.03	1@.25	.5@.25	10 <sup>6</sup>	Lead Wires-26GA
T4X12	--	--	--	--	6@.06	6@.06	1.5@.20	.9@.20	10 <sup>6</sup>	Lead Wires-26GA
T4X16	--	--	--	--	11@.03	11@.03	3@.15	1.7@.15	10 <sup>6</sup>	Lead Wires-26GA
T5X9	--	--	--	--	10@.12	6@.12	5@.25	3@.25	10 <sup>6</sup>	Lead Wires-26GA
T6X12	--	--	--	--	14@.12	14@.12	3@.75	1@.75	10 <sup>6</sup>	Lead Wires-26GA
T8X9	--	--	--	--	45@.06	45@.06	2@.50	.75@.50	10 <sup>6</sup>	Lead Wires-26GA
T8X16	--	--	--	--	40.5@.12	40.5@.12	15@.50	2.5@.50	10 <sup>6</sup>	Lead Wires-22GA
T12X13	--	--	--	--	104@.12	104@.12	20@.50	5@.50	10 <sup>6</sup>	Lead Wires-22GA
T12X19	--	--	--	--	116@.12	116@.12	25@.75	9@.75	10 <sup>6</sup>	Lead Wires-22GA
LT3.5X9	--	--	--	--	5@.06	2.7@.06	1@.25	.5@.25	10 <sup>6</sup>	Lead Wires-26GA
LT4X7	--	--	--	--	5@.06	2.5@.06	1@.20	.5@.20	10 <sup>6</sup>	Lead Wires-26GA
LT4X12	--	--	--	--	8@.12	3.5@.12	3@.25	1@.25	10 <sup>6</sup>	Lead Wires-26GA
LT4X16	--	--	--	--	5.5@.12	2.4@.12	2.5@.20	1@.20	10 <sup>6</sup>	Lead Wires-26GA
LT6X12	--	--	--	--	20@.12	7@.12	1@.50	.5@.50	10 <sup>6</sup>	Lead Wires-26GA
LT8X9	--	--	--	--	21@.12	8@.12	3@.50	1@.50	10 <sup>6</sup>	Lead Wires-22GA
LT8X16	--	--	--	--	55@.12	21@.12	16@.50	3@.50	10 <sup>6</sup>	Lead Wires-22GA
LT12X13	--	--	--	--	105@.12	35@.12	15@.50	5@.50	10 <sup>6</sup>	Lead Wires-22GA
LT12X19	--	--	--	--	129@.12	68@.12	18@.75	5@.75	10 <sup>6</sup>	Lead Wires-22GA

Int. Duty = 25% Duty Cycle 100 Sec. on Max.

Breakdown Voltage: 1500 Volts

Material Insulation Class: B

**GUARDIAN ELECTRIC MANUFACTURING COMPANY**

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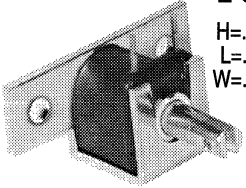




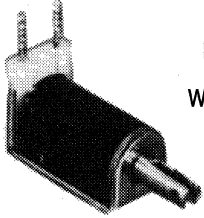
# Solenoids

Latching, Open Frame & Tubular Solenoids

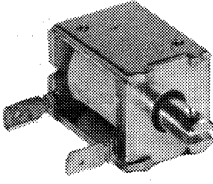
The products shown below represent our standard solenoid designs. We can modify our standard solenoids to your specifications and design custom assemblies featuring solenoid action.



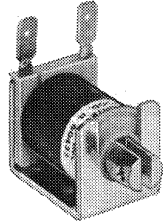
**L-05**  
H=.61  
L=.63  
W=.50



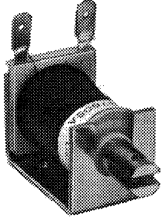
**L-06**  
H=.58  
L=.82  
W=.360



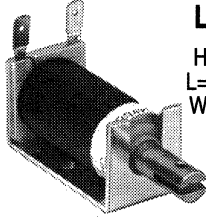
**L-22**  
H=.75  
L=1.16  
W=.75



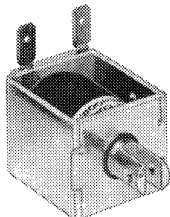
**L-61**  
H=.83  
L=1.13  
W=.75



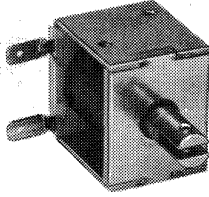
**L-24**  
H=1.00  
L=1.23  
W=.84



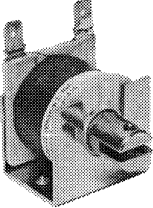
**L-26**  
H=.94  
L=1.75  
W=.84



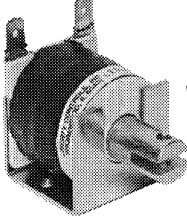
**L-20**  
H=.94  
L=1.14  
W=.81



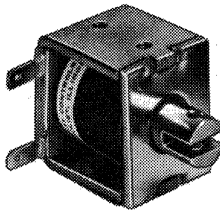
**L-28**  
H=1.19  
L=1.13  
W=.94



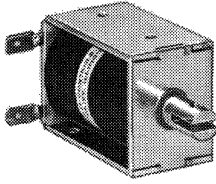
**L-62**  
H=1.42  
L=1.07  
W=1.38



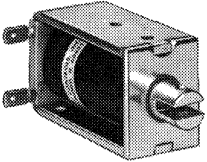
**L-63**  
H=1.42  
L=1.29  
W=1.38



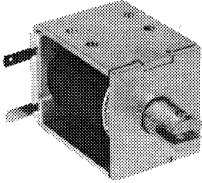
**L-81**  
H=1.24  
L=1.25  
W=1.00



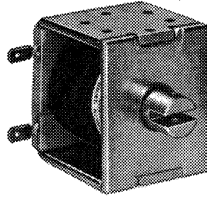
**L-11**  
H=1.19  
L=1.84  
W=1.00



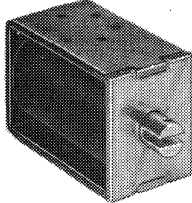
**L-82**  
H=1.24  
L=2.01  
W=1.00



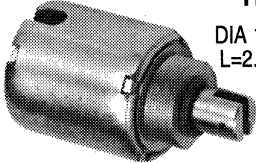
**L-04**  
H=1.63  
L=2.19  
W=1.44



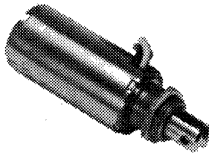
**L-88**  
H=1.85  
L=1.65  
W=1.58




**L-90**  
H=1.85  
L=2.63  
W=1.58



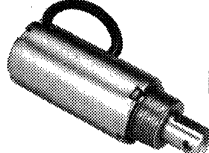
**L-15-2  
HD**  
DIA 1.5  
L=2.38




**L-75-1**  
DIA .75  
L=.75



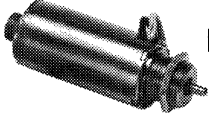
**L-75-2**  
DIA .75  
L=1.5




**L-10-1**  
DIA 1.0  
L=1.13



**L-10-2**  
DIA 1.0  
L=1.5



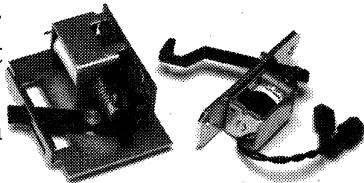
**L-15-1**  
DIA 1.5  
L=1.63



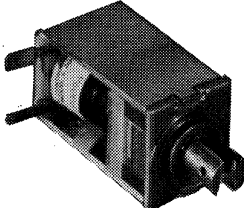
**L-15-2**  
DIA 1.5  
L=2.38

### Custom Assemblies featuring solenoid action.

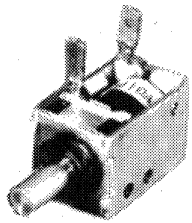
We also design specific products to meet your exact needs. Examples are shown at right.



### Latching Solenoids



**M-82**  
H=1.22  
L=2.01  
W=1.00



**M-22**  
H=.75  
L=1.16  
W=.75

# Solenoid Selector

(Stroke in inches vs. Force in ounces)



TYPE	1/16	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4
L6	2	1	.5							
L-5	2.5	1	.5							
L-75-1	13	3	1							
L22	13	5	2	1	.5					
L61	14	7	3	2	1					
L-20	22	9	4	2.3	1.5					
L-24	24	11	5	2.7	2	1.5				
L-81	23	14	8	4						
L-75-2	28	14	6	3	2.5					
L-28	31	15	5	3	1					
L-26	33	18	7	4	3	2	1			
L-10-1	64	20	8	4	2	1.5	1			
L-62	37	26	13	7	5.5					
L-11	46	26	10	6	4	3	2			
L-63	56	31	14	8	5	3	2			
L-82	55	40	19	10	5	3	2			
L-10-2	104	56	23	12	8	6	5	2		
L-4	96	56	29	17	12	9	7	5	4	
L-88	120	74	30	15	8	4				
L-90	148	114	62	35	23	17	13	11	8	5
L-15-1	150	96	39	23	11	7	2			
L-15-2	160	128	64	38	24	16	13	9	5	3
L-15-2HD	224	136	70	40	28	19	13	11	8	5
M-82	72	45	24	13	6	4	3			

COIL MAY BE ENERGIZED CONTINUOUSLY

The charts on this page were developed as an aid for solenoid selection and were derived from the typical force curves presented throughout this catalog. These values should not be interpreted as minimum values. Deviations can be expected due to normal manufacturing, and coil winding tolerances.

Due to differences in size, the wattage for continuous, intermittent, and pulse duty coils will be different from one type of solenoid to another.

Although only 3 wattages (duty cycles) are described in the catalog for each type of solenoid, other possibilities are available. Contact Liberty Controls for help in determining a solenoid to fit your application.

TYPE	1/16	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4
L-06	4.8	3	2	1						
L-05	7.5	3	.75							
L-22	22	10	3	2	1					
L-75-1	27	10	3	1						
L-61	30	17	7	4.4	2					
L-20	34	21	8	4	2					
L-81	40	27	14	7						
L-24	44	24	11	7	4.5	3.2				
L-28	50	28	11	7	4					
L-26	52	36	21	11	7	4	1			
L-62	56	37	20	11	7					
L-75-2	64	46	28	20	14	11	6	4		
L-11	64	45	24	15	11	8	6			
L-63	84	54	27	15	10	6	4			
L-10-1	96	54	20	9	4	2	1			
L-82	92	70	43	24	14	9	7			
L-10-2	160	118	80	53	35	25	16	12		
L-88	184	136	68	36	20	11				
L-04	213	160	107	75	53	36	27	19	14	
L-90	208	176	131	95	72	56	44	36	28	16
L-15-1	210	178	120	74	48	80	16			
L-15-2	210	184	138	110	80	62	48	38	28	16
L-15-2HD	275	256	192	144	104	74	53	38	28	16
M-82	100	78	48	26	14	9	7			

25% DUTY CYCLE MAXIMUM ON TIME 1 MINUTE

TYPE	1/16	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4
L6	9	7.5	6.5	5						
L-5	15	7	1.5							
L22	38	25	11	6	3					
L-75-1	56	30	10	3						
L20	60	47	24	13	7					
L-61	67	51	27	14	8					
L-24	68	52	32	20	13	8				
L-75-2	68	52	34	26	21	14	10	6		
L-26	74	62	43	30	22	17				
L-28	83	70	23	13						
L-11	90	80	53	42	37	34				
L-81	104	85	64	33						
L-10-1	158	122	66	32	15	8	3			
L-82	136	117	90	62	40	26	16			
L-62	172	142	89	43	27					
L-63	168	147	105	67	45	28	16			
L-10-2	175	150	120	96	70	58	40	26	16	3
L-04	240	208	163	128	98	79	60	46	32	
L-88	241	180	94	71	40					
L-15-1	230	202	150	112	80	50	28	16		
L-90	266	230	188	154	126	106	94	89	68	40
L-15-2	250	224	198	164	144	120	100	82	66	24
L-15-2HD	336	312	272	235	200	160	115	88	69	32
M-82	150	130	96	59	30	26	16			

10% DUTY CYCLE MAXIMUM ON TIME 100ms

TYPE	1/16	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4
L-22	5.5	4	2.5	1.5	.5					
L-20	10	7	5	3.5	2					
L-61	10	7	5	4	2					
L-90	12	9	7	7	7	8	8	9	9	7
L-24	14	10	7	6	4	2				
L-28	15	11	7	4.5	2					
L-26	16	12	9	8	6	5	3			
L-04	17	12	9	9	10	10	10	10	8	3
L-82	17	12	10	10	11	11	11			
L-11	18	13	10	10	10	8	6			
L-81	19	13	9	5						
L-63	20	15	13	13	11	9	6			
L-88	24	18	14	11	8					
L-62	24	19	15	13	10					

COIL MAY BE ENERGIZED CONTINUOUSLY (If plunger is seated)

TYPE	1/16	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4
L-22	10	6	4	2	1.5					
L-20	20	14	9	7	4					
L-61	22	15	12	9	5					
L-24	26	19	14	11	8	5				
L-26	25	19	15	13	11	9	6			
L-28	29	20	14	9	4					
L-90	27	22	18	17	18	19	20	21	21	17
L-81	34	23	15	8						
L-11	33	25	20	18	18	16	13			
L-82	46	31	26	26	28	29	28			
L-88	49	36	28	23	17	10	4			
L-63	56	44	38	36	34	27	18			
L-62	64	55	42	36	26					
L-04	74	64	51	50	50	53	53	50	45	18

25% DUTY CYCLE 1 MINUTE MAXIMUM ON TIME (If plunger is seated)

TYPE	1/16	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1	1-1/4
L-22	19	14	9	6	3					
L-61	44	21	24	20	11					
L-20	48	36	26	19	11					
L-24	52	38	30	25	18					
L-11	54	42	34	32	30	27	23			
L-28	62	46	34	21	11					
L-26	72	53	43	39	36	30	20			
L-90	80	58	47	45	46	47	50	51	51	43
L-81	90	61	41	25						
L-82	96	66	53	52	54	55	51			
L-63	103	80	70	67	60	50	34			
L-04	106	74	61	65	67	68	72	70	60	25
L-62	117	91	76	66	48					
L-88	138	101	76	63	47	31	13			

10% DUTY CYCLE MAXIMUM ON TIME 100ms

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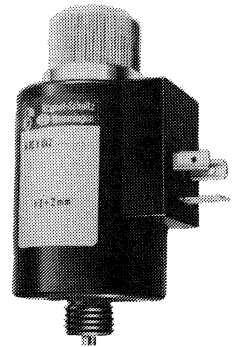
# APPLICATION SPECIFIC SOLENOIDS

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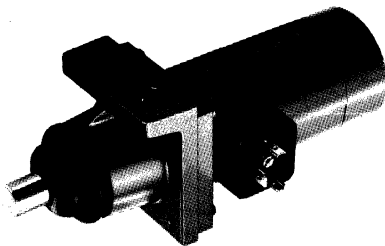
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Image	Type	Volts	Duty	Ohms	Forces and Strokes ounces @ inches		Body inches		
					(min.)	(max.)	H	x L	x W
	312-6005	24VDC	Cont.	144	22@1/32"	2@1/4"	3/4	1 5/32	3/4
	312-6006	24VDC	Int.	60	28@1/32"	4@1/4"	3/4	1 5/32	3/4
	312-6011	120VAC	Cont.	390	12@1/32"	2.5@1/4"	3/4	1 5/32	3/4
	312-6012	120VAC	Int.	100	20@1/32"	4@1/4"	3/4	1 5/32	3/4
	5U5-6053	24VDC	Cont.	114	14@1/16"	2.5@3/8"	1 5/16	1 1/4	27/32
	5U5-6054	24VDC	Int.	52	27@1/16"	5@3/8"	1 5/16	1 1/4	27/32
	5U5-6059	120VAC	Cont.	500	10@1/16"	4.5@3/8"	1 5/16	1 1/4	27/32
	5U5-6060	120VAC	Int.	310	17@1/16"	8.5@3/8"	1 5/16	1 1/4	27/32
	5U7-6065	24VDC	Cont.	85	15@1/8"	3@1/2"	1 5/16	1 3/4	27/32
	5U7-6066	24VDC	Int.	33	32@1/8"	7@1/2"	1 5/16	1 3/4	27/32
	5U7-6071	120VAC	Cont.	250	11@1/8"	7.5@1/2"	1 5/16	1 3/4	27/32
	5U7-6072	120VAC	Int.	140	18@1/8"	12@1/2"	1 5/16	1 3/4	27/32
	809-6101	24VDC	Cont.	104	12@1/8"	2@1/2"	1 3/16	1 1/8	1 5/16
	809-6102	24VDC	Int.	50	22@1/8"	3@1/2"	1 3/16	1 1/8	1 5/16
	809-6107	120VAC	Cont.	400	12@1/8"	5@1/2"	1 3/16	1 1/8	1 5/16
	809-6108	120VAC	Int.	220	24@1/8"	7@1/2"	1 3/16	1 1/8	1 5/16
	827-6113	24VDC	Cont.	72	24@1/8"	4@5/8"	1 3/16	1 7/8	1 5/16
	827-6114	24VDC	Int.	32	40@1/8"	8@5/8"	1 3/16	1 7/8	1 5/16
	827-6119	120VAC	Cont.	200	12@1/8"	6@5/8"	1 3/16	1 7/8	1 5/16
	827-6120	120VAC	Int.	85	20@1/8"	13@5/8"	1 3/16	1 7/8	1 5/16
	940-6137	24VDC	Cont.	50	78@1/8"	8@3/4"	1 5/8	2 3/16	1 7/16
	940-6138	24VDC	Int.	15	140@1/8"	18@3/4"	1 5/8	2 3/16	1 7/16
	940-6143	120VAC	Cont.	53	24@1/8"	15@3/4"	1 5/8	2 3/16	1 7/16
	940-6144	120VAC	Int.	15	100@1/8"	65@3/4"	1 5/8	2 3/16	1 7/16

**Tubular Solenoids** (Pull Version Part Numbers Designated) Push Version Also Available.

Image	Type	Volts	Duty	Ohms	Forces and Strokes ounces @ inches		Body inches	
					(min.)	(max.)	Length	x Dia.
	R7X9-6171	12VDC	Cont.	80	5@1/32"	1.2@3/32"	1 1/8	7/16
	R7X9-6172	12VDC	Int.	14	9@1/32"	2.5@3/32"	1 1/8	7/16
	R7X9-6173	24VDC	Cont.	260	5@1/32"	1.2@3/32"	1 1/8	7/16
	R7X9-6174	24VDC	Int.	57	9@1/32"	2.5@3/32"	1 1/8	7/16
	R8X7-6362	12VDC	Cont.	55	2.5@1/16"	1@3/16"	7/8	1/2
	R8X7-6363	12VDC	Int.	20	6@1/16"	1.5@3/16"	7/8	1/2
	R8X7-6364	24VDC	Cont.	240	2.5@1/16"	1@3/16"	7/8	1/2
	R8X7-6365	24VDC	Int.	80	6@1/16"	1.5@3/16"	7/8	1/2
	R8X12-6372	12VDC	Cont.	40	7@1/32"	1.5@1/4"	1 1/2	1/2
	R8X12-6373	12VDC	Int.	10	14@1/32"	4@1/4"	1 1/2	1/2
	R8X12-6374	24VDC	Cont.	160	7@1/32"	1.5@1/4"	1 1/2	1/2
	R8X12-6375	24VDC	Int.	38	14@1/32"	4@1/4"	1 1/2	1/2
	R12X12-6211	12VDC	Cont.	41	6.5@1/8"	1.2@5/8"	1 1/2	3/4
	R12X12-6212	12VDC	Int.	6	20@1/8"	6@5/8"	1 1/2	3/4
	R12X12-6213	24VDC	Cont.	165	6.5@1/8"	1.2@5/8"	1 1/2	3/4
	R12X12-6214	24VDC	Int.	25	20@1/8"	6@5/8"	1 1/2	3/4
	R16X16-6231	12VDC	Cont.	26	21@1/8"	6.5@5/8"	2	1
	R16X16-6232	12VDC	Int.	3.8	56@1/8"	20@5/8"	2	1
	R16X16-6233	24VDC	Cont.	105	21@1/8"	6.5@5/8"	2	1
	R16X16-6234	24VDC	Int.	15	56@1/8"	20@5/8"	2	1
	R24X13-6243	24VDC	Cont.	85	50@1/8"	5@5/8"	1 5/8	1 1/2
	R24X13-6244	24VDC	Int.	14	150@1/8"	20@5/8"	1 5/8	1 1/2
	R24X19-6253	24VDC	Cont.	59	80@1/8"	8@1"	2 3/8	1 1/2
	R24X19-6254	24VDC	Int.	10	140@1/8"	32@1"	2 3/8	1 1/2

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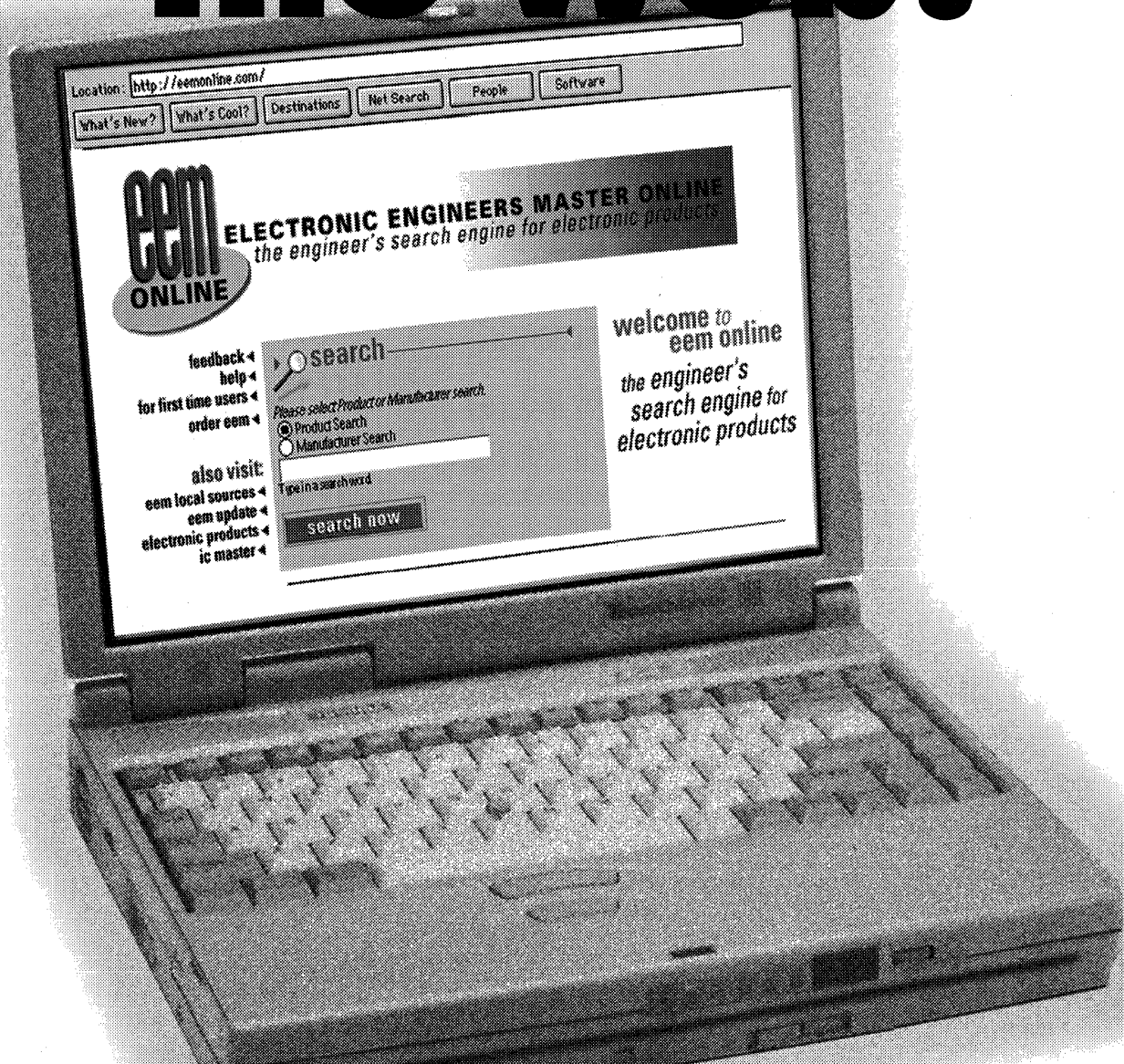
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# Solenoids

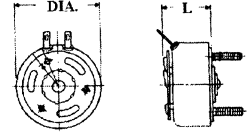


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## ROTARY SOLENOIDS

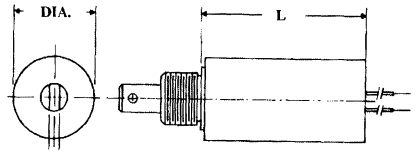
<u>Voltage (DC)</u>	<u>Type</u>	<u>Size (D x L)</u>	<u>Stroke/Motion</u> <u>(Right/Left Hand Strokes)</u>	<u>Starting Torque</u>
6, 12, 24	2NE	1.125" x .716"	25°, 35°, 45°	up to 1.4 lb in
	3NB	1.312" x .718"	25°, 35°, 45°, 67.5°	up to 2.7 lb in
	5NB	1.875" x 1.265"	25°, 35°, 45°, 67.5°, 95°	up to 8.3 lb in
<u>Duty Cycles</u> Int., Cont.				



Note: Standard rotary solenoid uses needle bearing for increased life and performance.

## TUBULAR SOLENOIDS - PUSH/PULL TYPE

<u>Voltage (DC)</u>	<u>Type</u>	<u>Size (D x L)</u>	<u>Type</u>	<u>Size (D x L)</u>
6, 12, 18, 24, 48	C7-18	7/16" x 1 1/8"	C12-24	3/4" x 1 1/2"
	C8-14	1/2" x 7/8"	C16-18	1" x 1 1/8"
	C8-24	1/2" x 1 1/2"	C16-32	1" x 2"
	C8-32	1/2" x 2"	C24-26	1 1/2" x 1 5/8"
			C24-38	1 1/2" x 2 3/8"

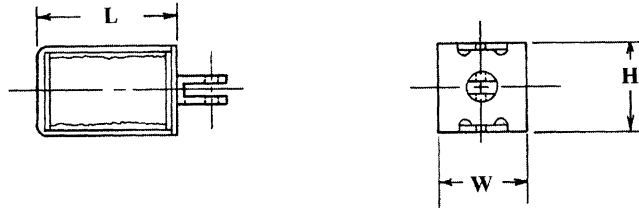


**Force Range**

up to 7.5 lbs @ 1/4" stroke

## D FRAME SOLENOIDS - PULL TYPE

<u>Voltage (DC)</u>	<u>Type</u>	<u>Size (W x H x L)</u>
6, 12, 24, 48	34	.750" x .750" x .765"
	35	.750" x .750" x 1.187"
	37	.937" x .812" x 1.625"
	40	1.828" x 1.562" x 2.625"
	42	1.218" x 1" x 2"

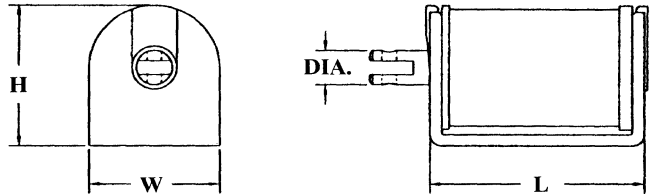


**Force Range**

up to 10 lbs @ 1/4" stroke

## C FRAME SOLENOIDS - PUSH/PULL TYPE

<u>Voltage (DC)</u>	<u>Size (W x H x L)</u>
12, 24, 36	1.13" x 1.28" x 1.84"
	1.56" x 1.70" x 1.70"



**Duty Cycles**

Int., Cont.

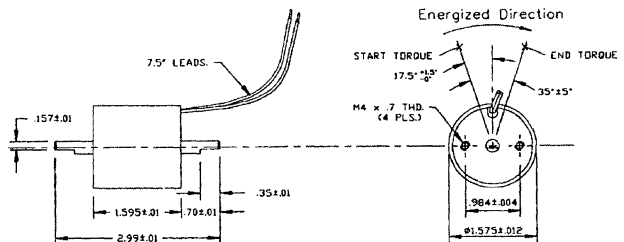
**Force Range**

up to 6 lbs @ 1/4" stroke

## ELECTROMECHANICAL TORQUE ACTUATORS

<u>Voltage (DC)</u>	<u>Size (D x L)</u>
6, 12, 24, 48, 120	1.575" x 1.595"

<u>Duty Cycles</u>	<u>Starting Torque</u>
Int., Cont.	up to 5 lb in



Note: Various shaft dimensions available upon request.

## APPLICATION-SPECIFIC SOLENOIDS

OakGrigsby has the unique ability in developing application-specific solenoid assemblies. With our advanced engineering software capabilities and long-term experience in developing application-specific solenoid assemblies, we already have the immediate expertise to meet your design needs. OakGrigsby provides a custom cost-saving solution for your application.

We begin with a standard solenoid, design an assembly which will integrate the specific solenoid function. Our "perfect fit" assembly increases performance efficiency, decreases the number of components and reduces manufacturing costs. Let us design a solution for you.

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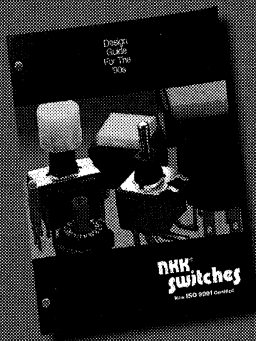
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Service is another measure of quality. And NKK more than measures up. Strategically located distributors blanket North America to make certain NKK quality is always within easy reach.

Find out more about the switches and service that define quality for the entire industry. Send for your free copy of our Switch Design Guide. Fax 602-998-1435, call 602-991-0942 or write NKK Switches, 7850 E. Geilding Drive, Scottsdale, AZ 85260.

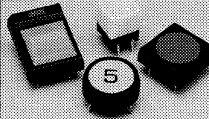
[www.nkkswitches.com](http://www.nkkswitches.com)

## FREE SWITCH DESIGN GUIDE



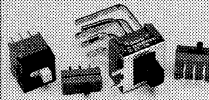
**NKK®**  
**switches**

### KEYS TO SUCCESS



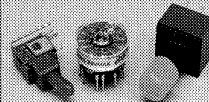
Dome contact, low profile keypad switches. Lighted and non-lighted, round and square. Up to 5,000,000 actuations.

### SLIDE SHOW



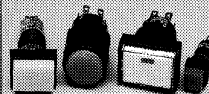
Huge selection of micro to miniature slide switches. Award-winning STC contacts. Numerous terminal types.

### WASH AND GO



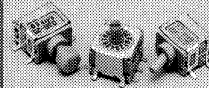
NKK washables lead the way with the industry's widest range of circuits, actuators, terminals and accessories.

### LIGHT FANTASTICS

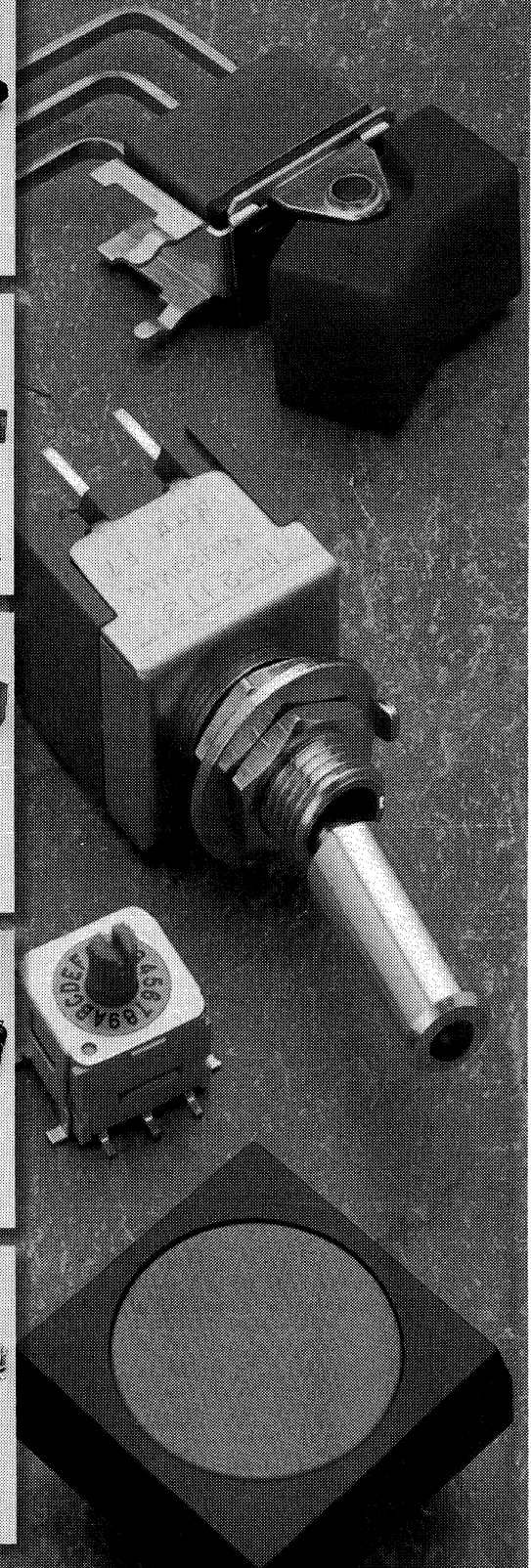


Bright, low-profile PC or panel mounting. Numerous actuator shapes, colors, circuits, lamps, terminals, ratings and accessories.

### STAY ON TOP



Advanced surface mount technology. Washable, vapor phase solderable toggles, push-buttons, DIP rotaries.



## SWITCHES

Manufacturer	Starting EEM Page No.	DIP	Le- ver	Pushbutton						Rocker/ Paddle	Rotary		Snap Act- ion	Thumb- wheel	Tog- gle	Mer- cury	Features		
				Momentary Action		Positive Action		Interlock			Light- ed	Non- Light- ed						Sec- tion	tion
				Light- ed	Non- Light- ed	Light- ed	Non- Light- ed	Light- ed	Non- Light- ed										
Aleph International Corp.	B-1471	√	√		√		√		√	√					√		Sealed		
Altech Corp.	B-1473										√				√		To 80A, DIN Rail Mount		
AME Corp.	B-1475			√		√		√		√	√	√	√		√		Switch seals, Toggle, Pushbutton, Rotary, Custom		
APEM Components, Inc.	B-1476	√	√	√	√	√	√	√	√	√		√	√	√	√				
APM Hexseal Corp.	B-1492			√		√				√	√	√	√		√		Switch sealing boots to protect panel mounted switches, potentiometers and circuit breakers from environmental hazards.		
Arcoelectric Corp.	B-1486			√	√	√	√			√	√		√	√			UL, CSA, VDE and others up to 20A and 250V		
Barantec, Inc.	B-1493			√													Sealed, Piezo		
C & K Components, Inc.	B-1494	√§†	√†	√§†	√§†	√§†	√§†	√†	√†	√†	√†	√†	√	√	√§†		Illuminated, Key lock, power, sealed, coded		
Cole Instrument Corp.	B-1502										√	√							
Comus International	B-1504															√	Sealed		
Crouzet Corp.	B-1506												√	√			Sealed, coded. Other types: Limit switches		
CTS Corp.	B-1508	√§†															Through-holed SMT		
CW Industries	B-1510			√		√				√	√		√						
Dreefs Controls	B-1512		√	√	√	√	√			√	√	√	√	√		√	Custom		
Direct Sound Corp.	B-1511			√	√	√	√			√	√				√		Illuminated, power		
EAO Switch Corp.	B-1514	√§†	√	√	√	√	√	√	√			√	√	√†	√		Also Keylocks, Emergency Stop Switches, Tact Switches		
Eaton Corporation	B-1518			√	√			√	√							√	Miniature-Intermediate, full-sized, sealed		
EECO Division	B-1522	√§								√	√	√			√		Specialist in coded switches		
Elma Electronics, Inc.	B-1527	√	√	√	√	√	√	√	√		√	√	√	√	√	√	Gold contacts		
E-Switch	B-1528	√	√	√	√	√	√			√	√	√	√		√		Custom		
Excel Cell Electronic	B-1531	√§†		√		√					√		√		√		Sealed, coded, SMT		

§ Surface Mount  
† Wave Solderable

## SWITCHES

Manufacturer	Starting EEM Page No.	DIP	Lever	Pushbutton						Reed	Rocker/Paddle		Rotary		Snap Action	Thumb-wheel	Toggle	Mercury	Features
				Momentary Action		Positive Action		Interlock			Light-Ed	Non-Lighted	Single Section	Multi-Section					
				Light-Ed	Non-Lighted	Light-Ed	Non-Lighted	Light-Ed	Non-Lighted										
Fifth Dimension, Inc.	B-1533								√					√				√	
Grayhill Inc.	B-1534	√§			√§		√§					√	√	√					Explosion proof, key lock, sealed, coded.
Guardian Electric	B-1538			√	√	√	√				√			√	√	√	√		Custom
Hasco Components International Company	B-1539								√										
Hermetic Switch	B-1540								√										
Honeywell	B-1541		√	√	√					√	√			√			√		Miniature, standard, basics, pushbutton, toggles and rockers
Idec Corp.	B-1544		√	√	√	√	√	√	√										
Illinois Lock Company	B-1548											√		√	√				Keylock
Interswitch	B-1551												√†			√			
ITT Cannon Switch Products	B-1552			√	√§	√	√	√	√			√	√						
ITW Switches	B-1554			√§	√§	√§	√§	√	√	√	√	√	√	√§	√				
Janco Corp.	B-1556											√	√	√	√				Custom rotary
Lamb Industries, Inc.	B-1560	√§†		√	√	√	√			√	√	√	√	√	√		√		
Marquardt Switches, Inc.	B-1566									√	√								
McGill Electrical Switch Product Group	B-1569		√		√				√	√	√			√			√		Sealed, Unsealed, Up to 25 amp rating
Meder Electronic, Inc.	B-1571								√§									√§	
MG Electronics	B-1572		√	√	√	√	√			√	√			√	√		√		Illuminated, high voltage, key lock, power, sealed, touch, coded. Other types: surface mount, wave solderable
NKK Switches	B-1573	√§†		√†	√§†					√†	√§†	√†	√	√	√†		√§†		

§ Surface Mount  
† Wave Solderable

## SWITCHES

Manufacturer	Starting EEM Page No.	DIP	Le-ver	Pushbutton						Reed	Rocker/Paddle		Rotary		Slide	Snap Act-ion	Thumb-wheel	Tog-gle	Mer-cury	Features	
				Momentary Action		Positive Action		Interlock			Light-ed	Non-Light-ed	Sin-gle Sec-tion	Mut-ti Sec-tion							
				Light-ed	Non-Light-ed	Light-ed	Non-Light-ed	Light-ed	Non-Light-ed												
Oakgrigsby, Inc.	B•1578		√	√	√							√	√								
Omega Engineering	B•1579		√									√	√								Decade. Other types: Thermo-couple switches, meter mounted, panel mounted, switch assemblies, DIN rail, multipole, multithrow
Omron Electronics Inc.	B•1581	√§	√				√§								√	√					
Oslo Switch	B•1585			√	√	√	√			√	√										Low level through high current
Otto Controls	B•1586		√		√	√	√		√	√					√			√			Sealed, Long life, Low level
Pres-Air-Trol Corp.	B•1589				√		√														Waterproof, Shock-proof, Explosion-proof.
RDI Electronics, Inc.	B•1590	√	√		√	√	√		√	√				√	√			√			
SAIA-Burgess Electronics Inc.	B•1593		√		√		√								√						
Schurter, Inc.	B•1596		√§†	√§†	√§†	√§†				√†	√†	√†	√†		√†§						
Shallco, Inc.	B•1597	√			√							√	√		√						Explosion proof, high voltage, key lock, power sealed, coded
Shogyo International Corp.	B•1598	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		
Shokai Far East Limited	B•1599	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
Solico/MEC	B•1601		√§	√§	√	√															
Standex Electronics	B•1602								√†												
Tschudin & Heid, Inc.	B•1605		√§	√§	√§	√§	√§	√§	√§			√§	√§			√§					
Veetronix, Inc.	B•1606		√†	√†	√†	√†	√†	√†	√†												
XCel Digitran	B•1609		√			√	√	√	√			√	√			√					BCD Coding, MIL versions available
Yaskawa Electric	B•1610			√	√					√†					√						Explosion proof, power(†), sealed(†). Other types: Hazardous locations meets MIL Spec for shock & vibration

§ Surface Mount  
† Wave Solderable

## PRESSURE SWITCHES

Manufacturer	Starting EEM Page No.	Type					Sensor Type					Switch Mechanism		Features					
		Atmospheric	Absolute	Differential	Gauge		Diaphragm	Piston	Bourdon Tube	Bellows	Other	Momentary	Snap Action	Current Capabilities	Hysteresis	Seal Contacts	Wet Proof	Explosion Proof	Indicator
					Vacuum	Pressure													
Aleph International Corp.	B•1471											√	√			√	√		
Janco Corp.	B•1556											√	√			√	√	√	
Lamb Industries, Inc	B•1560			√	√	√	√				√	√	√	√	√	√			√
Omega Engineering	B•1579					√													
Pres-Air-Trol Corp.	B•1589	√		√	√	√	√				√	√	√	√	√	√	√	√	√
Schurter Inc.	B•1596										√	√	√			√	√	√	√

§ Surface Mount  
† Wave Solderable

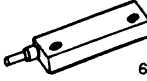
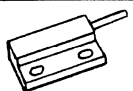
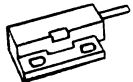
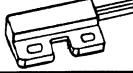
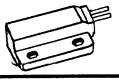
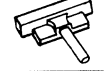
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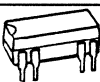
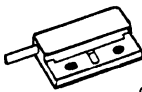
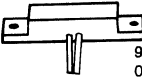
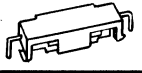
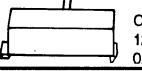

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## REED SWITCH TYPE PROXIMITY SENSORS

### MAGNET ACTUATION

Technical information is subject to revision without notice. For critical applications, please call to verify specifications.


FEATURES	CONTACT CONFIG.	CONTACT RATING	PART NUMBER
 Miniature Sealed 6 x 32 x 10 0.23 x 1.25 x 0.39	N O	10W	PS-500
	N C	10W	PS-510
	Transfer(SPDT)	3W	PS-520
	Latching	10W	DS-M2
 General purpose 6 x 23 x 14 0.23 x 0.90 x 0.55	N O	10W	PS-3150
	N O	10W	PS-3529
	N C	10W	PS-3251
 Low cost 6 x 23 x 14 0.23 x 0.90 x 0.55	N O	10W	PS-3170
	N O	10W	PS-3870
 Long life 6 x 23 x 14 0.23 x 0.90 x 0.55	N O	10W	PS-3670
	N C	5W	PS-3980
 Connector terminated 6 x 25.2 x 14 0.23 x 0.99 x 0.55	N O	10W	PS-0048
	N O	10W	PS-4122
 Ultra Miniature 3.5 x 17 x 7.5 0.13 x 0.66 x 0.29	N O	10W	PS-4221
	N C	10W	PS-4221

FEATURES	CONTACT CONFIG.	CONTACT RATING	PART NUMBER
 PCB mount INDUSTRY STD. 14 PIN DIP PKG.	N O	10W	PS-5171
	N O	50W	PS-6132
 High power Sealed Pkg. 6 x 30 x 18 0.23 x 1.18 x 0.7	N C	25W	PS-6231
	Transfer(SPDT)	3W	PS-6341
	NO (Mercury)	50W	PS-6503
 Waterproof 9 x 48 x 10 0.35 x 1.88 x 0.38	N O	10W	PS-0016
	N C	3W	PS-0018
 PCB mount 6 x 25 x 7 0.23 x 1.0 x 0.27	N C	10W	PS-0024
	N C	10W	PS-0024
 High Inrush Current Contact 12 x 40 x 14 0.46 x 1.57 x 0.54	N O	20W	PS-0021
	N O	10W	PS-1522
 Threaded package 11.7 DIA x 25.4 0.46 Dia. x 1.0	N O	10W	PS-1522
	N O	10W	PS-1522

(MM/IN)

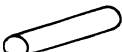
### MAGNETS

**TG-0016**




Barium-Ferrite 4 x 9 x 13  
 270 ~ 440 Gauss 0.15 x 0.35 x 0.51

**D-4575**




Alnico-5 1200 Gauss min. 31 x 6 Dia.  
 Fully magnetized 1.26 x 0.25 Dia.

**TG-0001**



Alnico-5 600 ~ 800 Gauss 12.7 x 1.6 x 1.6  
 Fully magnetized 0.5 x 0.06 x 0.06

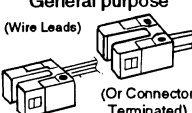
**PS-3002**

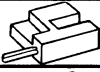
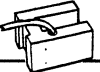


Barium-Ferrite 450 ~ 750 Gauss 6 x 23 x 14  
 Fully magnetized 0.23 x 0.9 x 0.55

(MM/IN)




### SHIELD ACTUATION




FEATURES	SENSING GAP WIDTH	CONTACT CONFIG.	CONTACT RATING	PART NUMBER
 General purpose (Wire Leads) (Or Connector Terminated)	5 (0.2)	N C	10W	PS-7711
				PS-7702

FEATURES	SENSING GAP WIDTH	CONTACT CONFIG.	CONTACT RATING	PART NUMBER
 Waterproof	7 (0.27)	N C	10W	PS-0031
 Large type (for elevator applications)	24 (0.94)	N C	10W	PS-0015

(MM/IN)

### LEVER ACTUATION

FEATURES	OPERATING FORCE	CONTACT CONFIG.	CONTACT RATING	PART NUMBER
 Counter-weight	0.3 - 1.0g	N C	20W	AS-101
 Counter-weight	0.4 - 1.2g	N C	20W	AS-202
 Spring Loaded	0.5 - 1.5g	N C	20W	AS-303

FEATURES	OPERATING FORCE	CONTACT CONFIG.	CONTACT RATING	PART NUMBER
 Counter-weight	1.5g MAX	N C	20W	AS-001
 Counter-weight	1.5g MAX	N C	10W	AS-039
 Counter-weight	1.5g MAX	N C	10W	AS-040



**Free evaluation samples and design assistance to qualified OEM Designers**

For specifications & information on additional Aleph Products, see our catalog pages in EEM Sections 3700 (Electro-Optical Equipment); 5100 (Switches); 5500 (Transducers, Sensors, Encoders).

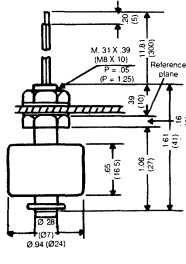
# ALEPH INTERNATIONAL

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 Telephone: (800) 423-5622 • (818) 365-9856  
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## LEVEL & FLOW SENSORS

Technical information is subject to revision without notice. For critical applications, please call to verify specifications.

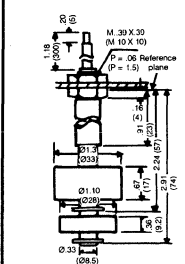
### LEVEL SENSORS



PRODUCT		FS-3101	FS-3201
Operation		On for float rise	Off for float rise
Suitable specific gravity		At least 1.0	
Operating level (spec. grav. 1.0)	On	Above 10.5	Below 17.5
	Off	Below 16.0	Above 10.5
Maximum make/break	power voltage	50W	
	current	200V	
	contact withstand voltage (DC)	0.6A	
Contact withstand voltage (DC)		300V	
Operating life with res. load (cycles)		5 X 10 <sup>7</sup> @ 10VAC, 0.5A	
Ambient temp.		0 ~ +70°C	

Case: Polypropylene resin  
 Float: PP foam  
 Cord: UL 1007 AWG#22

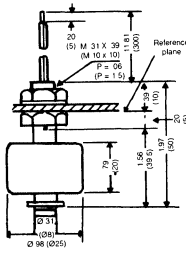
Contact res.: Below 0.2Ω Insulation rating: 1,500V AC



PRODUCT		TW-1205	TW-1206	TW-1207
Operation		Kero serie	Off for float rise	
Water		On for float rise		
Liquids used		Kerosene (S.G. 0.75) Water (S.G. 1.0)		
Operating levels	Kero serie	On Below 43.0	Below 43.2	Below 42.5
	Water	Off Above 37.0	Above 37.2	Above 36.5
Maximum make/break	power voltage	On Above 65.5	Above 61.7	Above 61.0
	current	Off Below 74.0	Below 70.0	Below 69.3
Maximum make/break	power voltage	7W		
	current	100V		
	contact withstand voltage (DC)	0.25A		
Contact withstand voltage (DC)		250V		
Operating life with Res. load (cycles)		10 <sup>6</sup> @ 6VDC, 10mA		
Ambient temp.		-20 ~ +80°C		

Case: nylon-6 resin  
 Float: NBR foam  
 Cord: UL 1007 AWG#22

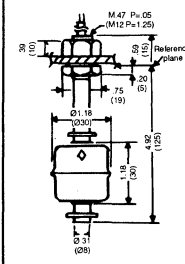
Contact res.: Below 0.2Ω Insulation rating: 1,500V AC



PRODUCT		FS-6101
Operation		On for float rise
Suitable specific gravity		At least 1.0
Operating level (spec. grav. 1.0)	On	Above 9
	Off	Below 19.5
Maximum make/break	power voltage	50W
	current	200V
	contact withstand voltage (DC)	0.6A
Contact withstand voltage (DC)		300V
Operating life with res. load (cycles)		5 X 10 <sup>6</sup> @ 100VAC, 0.5A
Ambient temp.		0 ~ +70°C

Case: PP resin  
 Float: PP foam  
 Cord: UL 1007 AWG#22

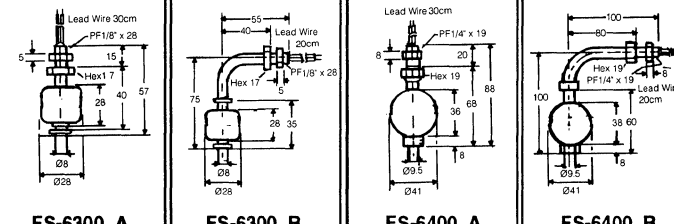
Contact res.: below 0.2Ω Insulation rating: 1,500V AC



PRODUCT		FS-9501	FS-9502
Operation		Off for float rise	On for float rise
Suitable specific gravity		At least 1.0	
Operating level (spec. grav. 1.0)	On	Below 77.0	Above 65.0
	Off	Above 69.0	Below 72.5
Maximum make/break	power voltage	10W	
	current	200V	
	contact withstand voltage (DC)	0.25A	
Contact withstand voltage (DC)		250V	
Operating life with Res. load (cycles)		5 X 10 <sup>6</sup> @ 100VAC, 0.1A	
Ambient temp.		-20 ~ +80°C	

Case: Sus  
 Float: Sus  
 Cord: heat-resistant PVC. AWG#22

Contact res.: Below 0.2Ω Insulation rating: 1,500V AC [IN (MM)]

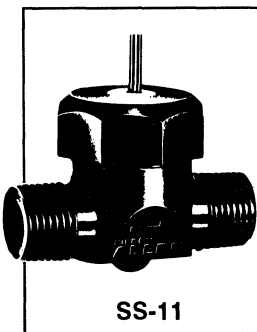


**FS-6300 A**      **FS-6300 B**      **FS-6400 A**      **FS-6400 B**

SPECIFICATIONS	FS-6300 A/B	FS-6400 A/B
Switching Capacity MAX.	50/40	60
MAX. VAC/VDC	200/220	220
Switching Current MAX. (A)	1.0/2.0	3.0
Carry Current MAX. (A)	2.0/3.0	4.0
Lead Wire	UL 1007 AWG #2	UL 1007 AWG #2
Reverse Switch Action	Yes	Yes
MAX. Pressure	15kg/cm <sup>2</sup>	20kg/cm <sup>2</sup>
Operating Temp	-10~120°C	-10~120°C
Material	SUS:304	SUS:304
Suitable Specific Gravity	0.75	0.65
Weight Grain	1-1 = 40	1-1 = 80
	2-1 = 50	2-1 = 100

(MM)

### FLOW SENSORS



SPECIFICATIONS	
<b>Electrical characteristics</b>	
Maximum switching capacity	3VA, 3W
Maximum switching voltage (AC/DC)	28V
Maximum switching current (AC/DC)	0.11A
Initial contact resistance	200mΩ MAX
Contact withstand voltage (DC)	200V
Electrical life	1 x 10 <sup>6</sup> minimum (resistive load)
<b>Operating characteristics</b>	
Operating flow	As flow is increased, switches on before reaching 2.5 ± 0.3 μ/min. As flow is decreased, switches off before reaching 2.0 ± 0.3 μ/min (Operating flow may be set in the range 2 ~ 10 μ/min.)
Pressure loss	0.2kg/cm <sup>2</sup> or less (at 10 μ/min. flow)

Mechanical characteristics	
Resistance to shock	Up to 30G
Resistance to vibration	Vibration frequency of 10 ~ 55Hz with a peak-to-peak amplitude of 1.52mm (0.06 in.)
Mechanical life	1x10 <sup>6</sup> minimum (with no load)
Maximum pressure	8kg/cm <sup>2</sup>
<b>Environmental characteristics</b>	
Operating temperature range	-10°C ~ +80°C
Applicable liquids	Water, propylene glycol, ethylene glycol

- Optional built-in thermistors available.
- Custom manufacturing capacity.
- Hygienic models for medical/food processing applications available.



**Free evaluation samples and design assistance to qualified OEM Designers**

For specifications & information on additional Aleph Products, see our catalog pages in EEM Sections 3700 (Electro-Optical Equipment); 4500 (Relays); 5500 (Transducers, Sensors, Encoders).



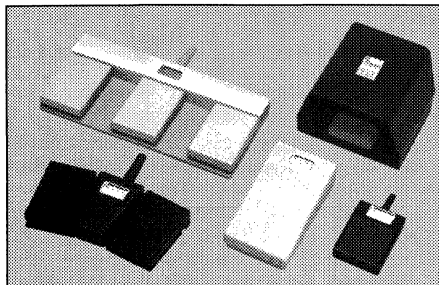
# Altech Corp.

35 Royal Road • Flemington, NJ 08822-6000  
Phone (908) 806-9400 • Fax (908) 806-9490 • www.altechcorp.com

## FOOT SWITCHES

Altech/ASA foot switches offers a wide range of foot switches for light, medium, heavy duty, and medical applications. Manufactured according to european national and international standards, such as VDE, DIN, IEC, CE.

### Light & Medium Duty Applications



### FM & FK Series

#### Application examples:

- Conveyor belt in supermarket
- Sewing machine in textile factory
- Control of dentistry tools
- Operation of logical or digital signals
- Medical equipment (tablet sorter, labeling machines, etc.)
- Photo laboratory equipment
- Medium industrial machines

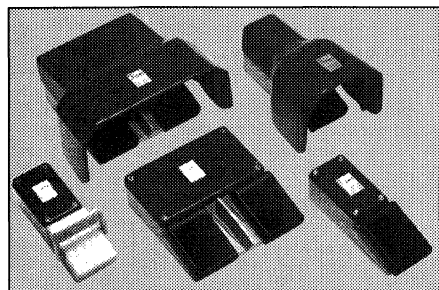
#### Standard Features:

- Housing: Gray or black ABS body and pedal cover
- Protection Level: IP 43 and IP 65
- Switch Insert: Snap action microswitch, UL/CSA approved
  - Electrical Rating: 5A, 125-250V AC (if used with appropriate cable)
  - Contact Types: Momentary, maintained, or two stage momentary
  - Circuit: SPDT-SB, DPDT-SB, 2x SPDT-SB
- Strain Relief: Vinyl sleeve
- Cable:
  - Multi conductor, PVC, SJT, 2 m (6 ft. - 6 in.)
  - Without cable
- Temperature Rating: -20°C up to +80°C (-4°F up to +176°F)

#### Options:

- Protection Level: IP 67
- Switch Insert: Gold plated contacts for low current applications
  - Electrical Rating: 0.1A, 125V AC
  - Silver-Nickel plated contacts
  - Electrical Rating: 10.1A, (1/4HP) 125-250V AC
- Strain Relief:
  - Standard straight-through (IP 68)
  - Bend protection (IP 68)
  - Trumpet Pull/Bend protection (IP 68)
- Cable:
  - Shielded cable
  - Per customer specifications
- Connectors:
  - Per customer specifications
- IEC 601-1 certified

### Medium & Heavy Duty Applications



### FL & FS Series

#### Application examples:

- Drilling processes
- Cleaning in food industry
- Ironing machines
- Construction machinery
- Sand blasting machines
- Bending machines
- Machine tools
- Medical equipment

#### Standard Features:

- Housing: Die cast aluminum body and cover with Polyamide 6.6 pedal
  - Colors: Gray body, red cover and black pedal
  - Anti-Trip: Die cast aluminum pedal and lever in gray
- Protection Level: IP 65
- Switch Insert: Snap action or slow make-break
  - Silver alloy contact material
  - Electrical Rating: 10A, 500V AC (if used with appropriate cable)
  - Contact Types: Momentary, maintained, or two stage momentary
  - Circuit: SPDT-SB; DPDT-SB; 10k Ohm, 2.0W Potentiometer with SPDT-SB microswitch
- Strain Relief: Vinyl sleeve
- Cable Entry: Threaded hole (PG 13.5)
  - Without cable
- Temperature Rating: -30°C up to +80°C (-22°F up to +176°F)

#### Options:

- Protection Level: Ex - Explosion protected
- Switch Insert: Gold plated contacts for low current applications
  - Max. Power Consumption: 12.5mW at max. 25mA or max. 25V DC
- Strain Relief:
  - Standard straight-through (IP 68)
  - Bend protection (IP 68)
  - Trumpet Pull/Bend protection (IP 68)
- Cable:
  - Multi conductor, PVC, SJT
  - Multi conductor, PVC, SJT, shielded
  - Per customer specifications
  - Per customer specifications
- Connectors:
  - Per customer specifications
- IEC 601-1 certified
- Other potentiometer values available upon request
- Custom colors available upon request
- Foot rest also available

#### SPECIFICATIONS

**Excitation:** The input voltage and frequency.

**Transformation Ratio:** The ratio of the output voltage, at maximum coupling, to the input voltage.

**Phase Shift:** The lead or lag of the output voltage with respect to the input voltage. For most synchros and resolvers, the phase shift can be approximated by the angle whose tangent is the ratio of the primary winding's DC resistance to its reactive component.

**Impedance:** Specified as  $R + jX$ , where  $R$  is the AC resistive component and  $X$  is the reactive component. Important impedances are: (a)  $Z_{po}$  (or  $Z_{ro}$  for rotor primary units), which is the impedance of the primary winding with the secondary open; (b)  $Z_{so}$ , which is the impedance of the secondary winding with the primary open; and (c)  $Z_{ss}$ , which is the impedance of the secondary with the primary shorted (essentially when driven by a low impedance).

**Null Voltage:** The voltage remaining when the unit is at electrical zero or in the minimum coupling position.

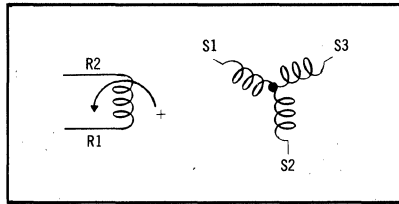
**Accuracy:** The error of the position of the rotor with respect to the electrical angle. It is defined as the output voltage driven by the "speed" (pole pairs) of the unit, referenced to the starting point of the calibration (usually the electrical zero position). Error is commonly expressed in minutes of arc (1/60 of a degree) or in seconds of arc.

**Loads:** For a transmitting unit, the impedance that the output voltage signal faces. This can be a receiver, a differential with its load, a control transformer, an A/D converter, etc.

**Operation Temperature:** The ambient temperature range over which the unit performs its primary function.

#### FUNCTIONS

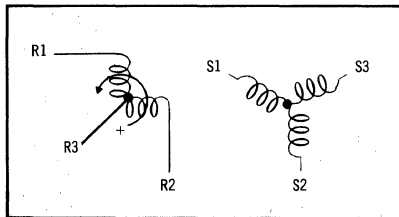
**Transmitter:** A unit with a Y-connected stator that outputs a signal proportional to the position of its single-phase excited rotor. High power units, called "torque transmitters," are used to drive one or more receivers. Low power transmitters are used to drive control transformers.



**Receiver:** A unit with a three-phase stator excited by the input, usually from a torque transmitter, and a single-phase rotor that follows the resulting stator field. Usually used to drive a position pointer.

**Control Transformer:** A unit with a three-phase stator excited by the input from a transmitter and a single-phase rotor mechanically driven to the null position by an external motor or other device.

**Differential:** A unit with a three-phase stator and a three-phase rotor. It is usually connected between a transmitter, which excites its stator, and a receiver or control transformer. It can be used to "dial in" correction factors for the synchro chain.

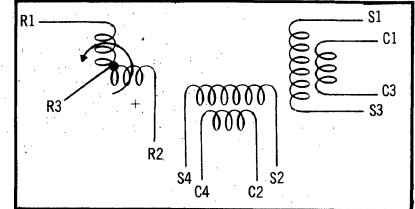


**Transolver:** A unit with a three-phase stator and a two-phase rotor that can be used either as a control transmitter (with one rotor phase excited and the other shorted), or as a control transformer with the signal obtained from one phase of the rotor—making sure the other phase is equally loaded to prevent unbalances.

**Differential Resolver:** A unit with a two-phase stator and a three-phase rotor that is used as a transolver with the advantage that when connected as a control transformer, the signal does not travel through slip rings.

**Resolver:** A unit with a two-phase rotor and a two-phase stator that is used to create or receive SIN-COS signals such as vector resolutions for

solving inertial platform coordinate transformations, unknowns of right triangles, etc. Resolvers can also be used as transmitting, differential, or receiving elements by proper choice of impedances. It is also possible to use resolvers as phase shifters where, in one mode, one rotor phase is excited and the two stator windings are feeding an appropriate RC network and indicating a phase shift, referred to the input, that corresponds to the rotor position.



**Compensated Resolver:** A unit with a "2x2" phase stator and a two-phase rotor used as a resolver with the added benefit of feedback windings in parallel with the stator windings that increase the useful accuracy over a wide range of environmental operating conditions.

**Linear Transformer:** A unit with a single-phase stator and single-phase rotor designed to provide a linear output voltage that is directly proportional to the rotor input angle. It operates over a range of less than  $\pm 90^\circ$ , and is analogous to a potentiometer providing infinite resolution, but without contact between the elements. It can be used only with AC voltages.

**Brushless Synchro:** Available in two types—hairspring and bobbin. Hair-spring synchros use spiral wound conductor springs to pick off the rotor signal, and are generally limited to a  $\pm 165^\circ$  rotation. Most have mechanical stops to prevent damage due to over-rotation. Bobbin synchros pick off the rotor signal with rotary transformers inside the unit, allowing the rotor unlimited motion.

**Pancake Unit:** A name derived from the physical dimensions of the unit, which has a diameter that exceeds axial length. Sizes range from under 1" to 20" or more. The unit is frequently used as a gimbal pickoff element and is designed to fit a particular application envelope. It can be supplied as a rotor and stator only.



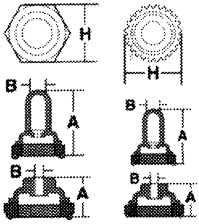
# SWITCH SEALS



- Panel-mounted seals protect switch and internal components
- Seal out oil, chemicals, solvents, dust
- Do not interfere with switch operation
- Standard and miniature sizes
- Vibration resistant
- One-piece, fully encapsulates switch and bushing to panel
- Eliminates the need for gaskets or packings
- 100 standard sizes and configurations
- Special configurations, colors, and materials available

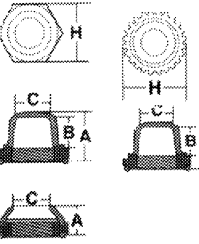
The summary tables below are designed to give you an overview of our standard line. Not every specification is available for every part number. For applications data, or to receive a full catalog, contact the factory or see our web site at [www.amerubberproducts.com](http://www.amerubberproducts.com).

## TOGGLE SWITCH SEALS — Hex (H) and Round Base (R)

	Thread Sizes	Base	A In (mm)	B In (mm)	H In (mm)	Materials	Colors	Equiv. MIL Part Numbers*
	10-48	H	From:	From:	Hex	Nuts: Brass, Nickel Plated and Black Oxidized	Silicone Gray (Grade 60) Clear (Grade 60&70)	M5423/01-01
	1/4-40	H	(H) .25 (6.35)	(H) .05 (1.27)	From:			
	15/32-32	H, R	(R) .40 (10.16)	(R) .09 (2.29)	.325 (8.26)	Rubber: Silicone per ZZ-R- 765 Class III, & Neoprene	Neoprene Black (50 Durometer)	M5423/02-01
	1/2-32	H, R	To:	(H) .31 (7.87)	To:			
	5/8-24	H	(H) .97 (24.64)	(R) .22 (5.59)	.875 (22.23)	Thru-Hole (H) .059 (1.27)	Neoprene Black (50 Durometer)	M5423/05-01
	5/8-32	H	(R) .90 (22.86)	(R) .09 (2.29)	Round			
	3/4-32	H			.730 (18.54)			NONE
	M12 x 0.75	H						

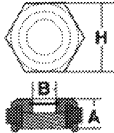
\*Do not apply to all seals in this category

## PUSH BUTTON SWITCH SEALS — Hex (H) and Round Base (R)

	Thread Sizes	Base	A In (mm)	B In (mm)	C In (mm)	H In (mm)	Materials	Colors	Equiv. MIL Part Numbers*
	10-48	H	From:	From:	From:	From:	Nuts: Brass, Nickel Plated and Black Oxidized	Silicone Gray (Grade 60) Clear (Grade 60&70)	12324858
	1/4-32	H	(H) .27 (6.86)	(H) .15 (3.81)	(H) .12 (3.05)	(H) .325 (8.26)			
	1/4-40	H	(R) .46 (11.68)	(R) .20 (5.08)	(R) .33 (8.38)	(R) .595 (15.11)	Rubber: Silicone per ZZ-R- 765 Class III, & Neoprene	Neoprene Black (50 Durometer)	5191042 1 thru 3 8437249
	3/8-27	H, R	To:	To:	To:	To:			
	3/8-32	H, R	(H) .87 (22.10)	(H) .54 (13.72)	(H) .52 (13.21)	(H) .750 (19.05)	Thru-Hole (H) From: .22 (5.72)	Neoprene Black (50 Durometer)	M5423/07 -01 thru -05
	7/16-28	H, R	(R) 1.06 (26.92)	(R) .70 (17.78)	(R) .65 (16.51)	(R) 1.06 (29.92)			
	7/16-32	R							
	15/32-32	H, R							
	1/2-20	H							
	1/2-32	H, R							
	5/8-24	H							
	11/16-32	R							
	M6 x 0.75	H			.38 (9.65)				SM-A-919065-1

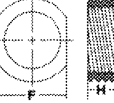
\*Do not apply to all seals in this category

## ROTARY SWITCH & POTENTIOMETER SEALS

	Thread Sizes	A In (mm)	B In (mm)	H In (mm)	Materials	Colors	Equiv. MIL Part Numbers*
	1/4-32	.22 (5.59)	.125 (3.18)	.375 (9.53)	Nuts: Brass, Nickel Plated	Gray: Grade 60	M5423/09-01 thru -06
	3/8-32						
	7/16-32						
	15/32-32						
	1/2-32						
	5/8-24		.375 (9.53)	.750 (19.05)	Rubber Silicone per ZZ-R- 765 Class III		
	M7, 8, 9 & 10 x 0.75						

\*Do not apply to all seals in this category

## SWITCH SEAL ADAPTERS

	F In (mm)	H In (mm)	External Thread	Materials	Internal Thread Size
	.42 (10.67)	.12 (3.05)	15/32-32 UNS-2A	Brass, Nickel Plated	1/4-40 UNS-2B, 3/8-32 UNEF-2B 3/8-27 UNS-2B, 3/8-24 UNF-2B
	.55 (13.97)				

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**SWITCH SEALS**



**APEM**<sup>®</sup>  
APEM COMPONENTS, INC.

**A World of Switching Capabilities**

The listings below show some popular models. Consult factory for more extensive offerings and giant catalog. Photos show a representative selection for each Series. Parenthesis in 'Action' tables indicates momentary.

World wide web: <http://www.apem.com> E mail: [info@apem.com](mailto:info@apem.com)

**TL series tiny sealed toggle switches**

Contact rating 0.4 volt-amperes (VA) max. at 20 volts max. (AC or DC). Operating temp. range -30° C to +85° C. Chrome plated brass toggle. Gold over nickel plated brass contacts & terminals. Blue glass filled PBT body, UL94V-0. O-ring bushing seal. Epoxy terminal seal. S.P. body size .200" w x .320" h x .320" d. D.P. body size .360" w x .320" h x .320" d. Process compatible.

MODEL NO.	CIRCUIT	ACTION	
TL36P000000 TL39P000000 TL37P000000 TL38P000000 TL32P000000	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	 STRAIGHT P.C. TERMINALS
TL46P000000 TL49P000000 TL47P000000 TL48P000000 TL42P000000	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	
TL36Y000050 TL39Y000050 TL37Y000050 TL38Y000050 TL32Y000050	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	
TL46Y000050 TL49Y000050 TL47Y000050 TL48Y000050 TL42Y000050	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	
TL36W000050 TL39W000050 TL37W000050 TL38W000050 TL32W000050	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	
TL46W000050 TL49W000050 TL47W000050 TL48W000050 TL42W000050	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	RT. ANGLE HORIZ. PC TERMS.
TL36WW00050 TL39WW00050 TL37WW00050 TL38WW00050 TL32WW00050	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	 RT. ANGLE VERT. P.C. TERMS.
TL46WW00050 TL49WW00050 TL47WW00050 TL48WW00050 TL42WW00050	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	
TL36MW00000 TL39MW00000 TL37MW00000 TL38MW00000 TL32MW00000	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	
TL46MW00000 TL49MW00000 TL47MW00000 TL48MW00000 TL42MW00000	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	

**S series miniature sealed toggle switches (p.c. mt.)**

Contact rating 0.4 volt-amperes (VA) max. at 20 volts max. (AC or DC). Operating temp. range -20° C to +85° C. Chrome plated brass toggle (.296" lg.). Gold over nickel plated brass contacts & terminals. Glass filled polyamide body, UL94V-0. O-ring bushing seal. Epoxy terminal seal. S.P. body size .500" w x .259" h x .425" d. D.P. body size .500" w x .458" h x .425" d. Process compatible.

MODEL NO.	CIRCUIT	ACTION	
SW236CD7 SW239CD7 SW237CD7 SW238CD7 SW232CD7	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	 RT. ANGLE HORIZ. PC TERMS.
SW246CD7 SW249CD7 SW247CD7 SW248CD7 SW242CD7 SW244THCD7	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On	

**S series mini. sealed toggle switches (p.c. mt.) (cont.)**

MODEL NO.	CIRCUIT	ACTION	
SWW236CD7 SWW239CD7 SWW237CD7 SWW238CD7 SWW232CD7	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	 RT. ANGLE VERT. PC TERMS.
SWW246CD7 SWW249CD7 SWW247CD7 SWW248CD7 SWW242CD7 SWW244THCD7	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On	
SY236CD7 SY239CD7 SY237CD7 SY238CD7 SY232CD7	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	
SY246CD7 SY249CD7 SY247CD7 SY248CD7 SY242CD7 SY244THCD7	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On	

**SF series mini. sealed toggle switches (Panel mt.)**

Contact ratings: **S0** models- 5 amps at 125 VAC, 2 amps at 250 VAC or 4 amps at 30 VDC (silver contacts & terminals). **P0** models- 0.4 volt-amperes (VA) max. at 20 volts max. (gold plated contacts & terms.). Operating temp. range -20° C to +85° C. Chrome plated brass toggle (.421" lg.). Glass filled polyamide body, UL94V-0. O-ring bushing seal. Epoxy terminal seal. S.P. body size .500" w x .259" h x .425" d. D.P. body size .500" w x .458" h x .425" d. Mounts in 1/4" hole. Mounting hardware supplied. Process compatible.

MODEL NO.	CIRCUIT	ACTION	
SF36S0100 SF39S0100 SF37S0100 SF37S0100 SF32S0100	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	 STRAIGHT PC TERMS. SHOWN
SF36P0000 SF39P0000 SF37P0000 SF38P0000 SF32P0000	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	

**5000 series miniature toggle switches (panel mt.)**

Contact rating 6 amps at 120 VAC or 3 amps at 250 VAC or 4 amps at 30 VDC. Operating temperature range -40° C to 85° C. Chrome plated brass toggle. Nickel plated brass bushing. Silver contacts. Silver plated brass terminals. Dialyl phthalate case. Epoxy term. seal. Mounting hardware included. S.P. body size .275" w x .519" h x .472" d. D.P. body size .519" w x .472" h x .472" d. 3P. body size .519" w x .649" h x .516" d. 4P. body size .519" w x .834" h x .516" d. Mounts in 1/4" hole (except 'M' models). UL & CSA listing available - consult factory. Dry ckt. models w/gold over nickel conts. & terms. and rating of 0.4 volt-amperes (VA) max. at 20 volts max. also available. To specify, substitute 'CD' for 'A' in model number below. **This Series continued on next page**

MODEL NO.	CIRCUIT	ACTION	
5636AB 5639AB 5637AB 5638AB 5632AB	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	 STANDARD ROUND HANDLE SOLDER LUG TERMINALS
5646AB 5649AB 5647AB 5648AB 5642AB 5644THAB	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On	
5656AB 5659AB 5657AB 5658AB 5652AB	3PDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	
5666AB 5669AB 5667AB 5668AB 5662AB 5664THAB	4PDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On	

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**5000 series mini. toggle switches (panel mt.) (cont.)**

MODEL NO.	CIRCUIT	ACTION			
5636AB9 5639AB9 5637AB9 5638AB9 5632AB9	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	 <b>FLATTED TOGGLE HANDLE SOLDER LUG TERMINALS</b>		
5646AB9 5649AB9 5647AB9 5648AB9 5642AB9 5644THAB9	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On			
5656AB9 5659AB9 5657AB9 5658AB9 5652AB9	3PDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)			
5666AB9 5669AB9 5667AB9 5668AB9 5662AB9 5664THAB9	4PDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On			
5636MAB 5639MAB 5637MAB 5638MAB 5632MAB	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)		 <b>15/32" BUSHING LONG ROUND HANDLE SOLDER LUG TERMINALS</b>	
5646MAB 5649MAB 5647MAB 5648MAB 5642MAB 5644MTHAB	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On			
5656MAB 5659MAB 5657MAB 5658MAB 5652MAB	3PDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)			
5666MAB 5669MAB 5667MAB 5668MAB 5662MAB 5664MTHAB	4PDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On			
5636AKB 5639AKB 5637AKB 5638AKB 5632AKB	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)			 <b>1/4" SPLASHPROOF BUSHING STANDARD ROUND HANDLE SOLDER LUG TERMINALS</b>
5646AKB 5649AKB 5647AKB 5648AKB 5642AKB 5644THAKB	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On			
5656AKB 5659AKB 5657AKB 5658AKB 5652AKB	3PDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)			
5666AKB 5669AKB 5667AKB 5668AKB 5662AKB 5664THAKB	4PDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On			
MODEL	CKT.	ACTION	POSITIONS		
5636AB-1V 5636AB-2V 5639AB-3V	SPDT	On-None-On On-None-On On-Off-On	1 2 3		
5646AB-1V 5646AB-2V 5649AB-3V	DPDT	On-None-On On-None-On On-Off-On	1 2 3		
5656AB-1V 5656AB-2V 5659AB-3V	3PDT	On-None-On On-None-On On-Off-On	1 2 3		
5666AB-1V 5666AB-2V 5669AB-3V	4PDT	On-None-On On-None-On On-Off-On	1 2 3		

**5000 series miniature toggle switches (p.c. mt.)**

Contact rating 0.4 volt-amperes (VA) at 20 volts max. Operating temp. range -40° C to 85° C. Chrome plated brass toggle. Nickel plated brass bushing. Gold plated brass contacts & terminals. Diallyl phthalate case. Epoxy term. seal. Mtg. hardware included (Th'd. models only). S.P. body size .275" w x .519" h x .472" d. D.P. body size .519" w x .472" h x .472" d. 3P. body size .519" w x .649" h x .516" d. 4P. body size .519" w x .834" h x .516" d. UL & CSA listing available - consult factory. Power models w/silver conts. & terms. and ratings of 6 amps at 120 VAC or 3 amps at 250 VAC or 4 amps at 30 VDC also available. To specify, substitute 'A' for 'CD' in model number below.

MODEL NO.	CKT.	ACTION		
5236CDB 5239CDB 5237CDB 5238CDB 5232CDB	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	 <b>THREADED BUSHING STANDARD ROUND HANDLE STRAIGHT P.C. TERMINALS</b>	
5246CDB 5249CDB 5247CDB 5248CDB 5242CDB 5244THCDB	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On		
5256CDB 5259CDB 5257CDB 5258CDB 5252CDB	3PDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)		
5266CDB 5269CDB 5267CDB 5268CDB 5262CDB 5264THCDB	4PDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On		
5236WCDB16X404 5239WCDB16X404 5237WCDB16X404 5238WCDB16X404 5232WCDB16X404	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)		 <b>SHORT ROUND HANDLE RT. ANGLE HOR. TERMS.</b>
5246WCDB16X404 5249WCDB16X404 5247WCDB16X404 5248WCDB16X404 5242WCDB16X404 5244WTHCDB16X404	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On		
5256WCDB16 5259WCDB16 5257WCDB16 5258WCDB16 5252WCDB16	3PDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)		
5236WWCDB16X445 5239WWCDB16X445 5237WWCDB16X445 5238WWCDB16X445 5232WWCDB16X445	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)		
5246WWCDB16X445 5249WWCDB16X445 5247WWCDB16X445 5248WWCDB16X445 5242WWCDB16X445 5244WVTHCDB16X445	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On		
5256WWCDB16X514 5259WWCDB16X514 5257WWCDB16X514 5258WWCDB16X514 5252WWCDB16X514	3PDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)		
5266WWCDB16X514 5269WWCDB16X514 5267WWCDB16X514 5268WWCDB16X514 5262WWCDB16X514 5264WVTHCDB16X514	4PDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On		
5236YCDB-16X445 5239YCDB-16X445 5237YCDB-16X445 5238YCDB-16X445 5232YCDB-16X445	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)		
5246YCDB-16X445 5249YCDB-16X445 5247YCDB-16X445 5248YCDB-16X445 5242YCDB-16X445 5244YTHCDB-16X445	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On		

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### 600 series Industrial toggle switches -12 mm bushing

Contact rating 15 amps at 120 VAC or 10 amps at 250 VAC or 5 amps at 25 VDC. Also 10 amps, 1/2 HP, 125/250 VAC. Op. temp. range -20° C to 55° C. Nickel plated brass or black nylon toggle. Nickel plated brass bushing. Silver/nickel alloy contacts. Melamine/polyester case. Mounting hardware included. S.P. body size .551" w x 1.161" h x .590" d. D.P. body size .846" w x 1.169" h x .846" d. 3P body size 1.358" w x 1.252" h x .949" d. Models with solder lug terminals listed below - omit /2' from Model no. for screw type terminals with clamps. UL & CSA recognized. VDE available some models.

	MODEL NO.	CIRCUIT	ACTION
Nickel bat toggle	631H/2	SPST	On-None-Off
	635H/2	SPDT	(On)-None-On
	636H/2		(On)-None-On
	637H/2		(On)-Off-(On)
	638H/2		On-Off-(On)
639H/2		On-Off-On	
Flat nylon toggle	631NH/2	SPST	On-None-Off
	635NH/2	SPDT	(On)-None-On
	636NH/2		On-None-On
	637NH/2		(On)-Off-(On)
	638NH/2		On-Off-(On)
639NH/2		On-Off-On	
Nickel bat toggle	641H/2	DPST	On-None-Off
	644H/2	DPDT	On-On-On
	645H/2		(On)-None-On
	646H/2		On-None-On
	647H/2		(On)-Off-(On)
648H/2		On-Off-(On)	
649H/2		On-Off-On	
Flat nylon toggle	641NH/2	DPST	On-None-Off
	644NH/2	DPDT	On-On-On
	645NH/2		(On)-None-On
	646NH/2		On-None-On
	647NH/2		(On)-Off-(On)
648NH/2		On-Off-(On)	
649NH/2		On-Off-On	
Nickel bat toggle	651H/2	3PST	On-None-Off
	655H/2	3PDT	(On)-None-On
	656H/2		On-None-On
	657H/2		(On)-Off-(On)
	658H/2		On-Off-(On)
659H/2		On-Off-On	
Flat nylon toggle	651NH/2	3PST	On-None-Off
	655NH/2	3PDT	(On)-None-On
	656NH/2		On-None-On
	657NH/2		(On)-Off-(On)
	658NH/2		On-Off-(On)
659NH/2		On-Off-On	



SP WITH BAT TOGGLE & SOLDER/QUICK CON. TERMS



DP WITH FLAT NYLON TOG. & SOLDER/QUICK CON. TERMS



3P WITH BAT TOGGLE & SCREW TERMINALS W/CLAMP

### 12000 series industrial hi-rel. toggle switches - 15/32" bushing

Contact rating 4 amps at 120 VAC or 2 amps at 250 VAC or 4 amps at 30 VDC. Operating temperature range -40° C to 85° C. Chrome plated brass toggle. Nickel plated brass bushing. Silver contacts & solder lug terms. DAP case. Epoxy terminal seal. 2 Nuts and anti-rotate ring included. D.P. body size .551" w x .551" h x .539" d. 3P body size .551" w x .787" h x .539" d. 4P body size .551" w x 1.023" h x .539" d. Meets MIL STANDARD 3950.

MODEL NO.	CIRCUIT	ACTION
12146A	DPDT	On-None-On
12149A		On-Off-On
12147A		(On)-Off-(On)
12148A		On-Off-(On)
12144A		On-On-On
12145A	None-On-(On)	
12156A	3PDT	On-None-On
12159A		On-Off-On
12157A		(On)-Off-(On)
12158A		On-Off-(On)
12166A	4PDT	On-None-On
12169A		On-Off-On
12167A		(On)-Off-(On)
12168A		On-Off-(On)
12164A		On-On-On



### 4600 series indust. toggle switches-12 mm bushing

Contact rating 6 amps at 120 VAC or 4 amps at 250 VAC. Operating temperature range -20° C to 55° C. Black nylon toggle (other colors available - consult factory). Black nylon bushing. Silver contacts. Solder/quick con. terms. Melamine phenolic case. 1 hex. nut and 1 insulated knurl. nut included. S.P. body size .472" w x .748" h x .610" d. D.P. body size .649" w x .826" h x .610" d. UL & CSA recognized. VDE recognized on 2 position models.

MODEL NO.	CIRCUIT	ACTION
4631A22UU	SPST	On-None-Off
4636A22UU	SPDT	On-None-On
4639A22UU		On-Off-On
4641A22UU	DPST	On-None-Off
4646A22UU	DPDT	On-None-On
4649A22UU		On-Off-On



FLATTED INSULATED TOGGLE SOLDER/QUICK CON. TERMS.

### TR series tiny sealed rocker switches

Contact rating 0.4 volt-amps (VA) max. at 20 volts max. (AC or DC). Operating temp. range -30° C to +85° C. Black polyamide rocker. Gold over nickel plated brass contacts & terminals. Blue glass filled PBT body, UL94V-0. O-ring bushing seal. Epoxy terminal seal. S.P. body size .200" w x .320" h x .320" d. D.P. body size .360" w x .320" h x .320" d. Process compatible.

MODEL NO.	CIRCUIT	ACTION
TR36P00000012	SPDT	On-None-On
TR39P00000012		On-Off-On
TR37P00000012		(On)-Off-(On)
TR38P00000012		On-Off-(On)
TR32P00000012		On-None-(On)
TR46P00000012	DPDT	On-None-On
TR49P00000012		On-Off-On
TR47P00000012		(On)-Off-(On)
TR48P00000012		On-Off-(On)
TR42P00000012	On-None-(On)	
TR36Y000005012	SPDT	On-None-On
TR39Y000005012		On-Off-On
TR37Y000005012		(On)-Off-(On)
TR38Y000005012		On-Off-(On)
TR32Y000005012		On-None-(On)
TR46Y000005012	DPDT	On-None-On
TR49Y000005012		On-Off-On
TR47Y000005012		(On)-Off-(On)
TR48Y000005012		On-Off-(On)
TR42Y000005012	On-None-(On)	
TR36W000005012	SPDT	On-None-On
TR39W000005012		On-Off-On
TR37W000005012		(On)-Off-(On)
TR38W000005012		On-Off-(On)
TR32W000005012		On-None-(On)
TR46W000005012	DPDT	On-None-On
TR49W000005012		On-Off-On
TR47W000005012		(On)-Off-(On)
TR48W000005012		On-Off-(On)
TR42W000005012	On-None-(On)	
TR36MW0000012	SPDT	On-None-On
TR39MW0000012		On-Off-On
TR37MW0000012		(On)-Off-(On)
TR38MW0000012		On-Off-(On)
TR32MW0000012		On-None-(On)
TR46MW0000012	DPDT	On-None-On
TR49MW0000012		On-Off-On
TR47MW0000012		(On)-Off-(On)
TR48MW0000012		On-Off-(On)
TR42MW0000012	On-None-(On)	



STR'T P.C. TERMS. NO BRKT.



STR'T P.C. TERMS. W/BRKT.



RT. ANGLE HOR. PC TERMS.



RT. ANGLE VERT. PC TERMS.



WIRE-WRAP TERMINALS



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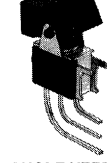
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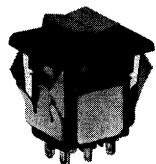


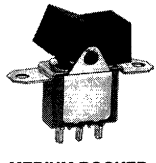
**S series miniature sealed rocker switches (p.c. mt.)**

Contact rating 0.4 volt-amperes (VA) max. at 20 volts max. (AC or DC). Operating temp. range -20° C to +85° C. Black polyamide rocker. Gold over nickel plated brass contacts & terminals. Glass filled polyamide body, UL94V-0. O-ring bushing seal. Epoxy terminal seal. S.P. body size .500" w x .259" h x .425" d. D.P. body size .500" w x .446" h x .425" d. Process compatible.

MODEL NO.	CKT.	ACTION		
SW236CD6+U622 SW239CD6+U622 SW237CD6+U622 SW238CD6+U622 SW232CD6+U622	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	 <b>RIGHT ANGLE HORIZ. P.C. TERMINALS</b>	
SW246CD6+U622 SW249CD6+U622 SW247CD6+U622 SW248CD6+U622 SW242CD6+U622 SW244THCD6+U622	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On		
SWW236CD6+U622 SWW239CD6+U622 SWW237CD6+U622 SWW238CD6+U622 SWW232CD6+U622	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)		 <b>RIGHT ANGLE VERT. P.C. TERMINALS</b>
SWW246CD6+U622 SWW249CD6+U622 SWW247CD6+U622 SWW248CD6+U622 SWW242CD6+U622 SWW244THCD6+U622	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On		
SY236CD6+U622 SY239CD6+U622 SY237CD6+U622 SY238CD6+U622 SY232CD6+U622	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)		
SY246CD6+U622 SY249CD6+U622 SY247CD6+U622 SY248CD6+U622 SY242CD6+U622 SY244THCD6+U622	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On		
SWW236CD6X653+U622 SWW239CD6X653+U622 SWW237CD6X653+U622 SWW238CD6X653+U622 SWW232CD6X653+U622	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	 <b>RT. ANGLE VERT. P.C. TERMS./ SPACING BRKT.</b>	
SWW246CD6X653+U622 SWW249CD6X653+U622 SWW247CD6X653+U622 SWW248CD6X653+U622 SWW242CD6X653+U622 SWW244THCD6X653+U622	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On		


**7000 series miniature rocker/lever switches (pnl. mt.)**

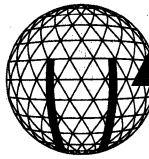
Contact rating 6 amps at 120 VAC or 3 amps at 250 VAC or 4 amps at 30 VDC. Operating temperature range -40° C to 85° C. Black polyamide actuator/bezel. Silver contacts. Silver plated brass terminals. Diallyl phthalate case. Epoxy term. seal. Mounting hardware included. S.P. body size .275" w x .500" h x .433" d. D.P. body size .500" w x .472" h x .433" d. Mounts in panel cutout. UL & CSA listing available - consult factory. Dry ckt. models with gold over nickel conds. & terms. and rating of 0.4 volt-amperes (VA) max. at 20 volts max. also available. To specify, substitute 'CD' for 'A' in model number below.

MODEL NO.	CKT.	ACTION		
7636AB+U732+U1202 7639AB+U732+U1202 7637AB+U732+U1202 7638AB+U732+U1202 7632AB+U732+U1202	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	 <b>SMALL ROCKER SOLDER LUG TERMINALS</b>	
7646AB+U732+U1202 7649AB+U732+U1202 7647AB+U732+U1202 7648AB+U732+U1202 7642AB+U732+U1202 7644THAB+U732+U1202	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On		
7236AB+U732+U1202 7239AB+U732+U1202 7237AB+U732+U1202 7238AB+U732+U1202 7232AB+U732+U1202	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)		 <b>SMALL LEVER U702 SHOWN STRAIGHT P.C. TERMINALS</b>
7246AB+U732+U1202 7249AB+U732+U1202 7247AB+U732+U1202 7248AB+U732+U1202 7242AB+U732+U1202 7244THAB+U732+U1202	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On		
7736AB+U532 7739AB+U532 7737AB+U532 7738AB+U532 7732AB+U532	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)		
7746AB+U532 7749AB+U532 7747AB+U532 7748AB+U532 7742AB+U532 7744THAB+U532	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On		
7936AB+U532 7939AB+U532 7937AB+U532 7938AB+U532 7932AB+U532	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	 <b>LARGE LEVER U492 SHOWN STRAIGHT P.C. TERMINALS</b>	
7946AB+U532 7949AB+U532 7947AB+U532 7948AB+U532 7942AB+U532 7944THAB+U532	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On		
7736NAB+U622 7739NAB+U622 7737NAB+U622 7738NAB+U622 7732NAB+U622	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)		 <b>MEDIUM ROCKER SOLDER LUG TERMINALS</b>
7746NAB+U622 7749NAB+U622 7747NAB+U622 7748NAB+U622 7742NAB+U622 7744NTHAB+U622	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On		
7936NAB+U622 7939NAB+U622 7937NAB+U622 7938NAB+U622 7932NAB+U622	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)		
7946NAB+U622 7949NAB+U622 7947NAB+U622 7948NAB+U622 7942NAB+U622 7944NTHAB+U622	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On		

**SR series mini. sealed rocker switches (panel mt.)**

Contact rating 0.4 volt-amperes (VA) max. at 20 volts max. (AC or DC). Operating temp. range -20° C to +85° C. Black polyamide rocker. Gold over nickel plated brass contacts & terminals. Glass filled polyamide body, UL94V-0. O-ring bushing seal. Epoxy terminal seal. S.P. body size .500" w x .259" h x .425" d. D.P. body size .500" w x .446" h x .425" d. Mounts in .610" x 1.082" panel cutout. Process compatible.

MODEL NO.	CIRCUIT	ACTION	
SR36S010012 SR39S010012 SR37S010012 SR37S010012 SR32S010012	SPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On)	 <b>SOLDER LUG TERMINALS</b>
SR46S010012 SR49S010012 SR47S010012 SR48S010012 SR42S010012 SR44S010012	DPDT	On-None-On On-Off-On (On)-Off-(On) On-Off-(On) On-None-(On) On-On-On	



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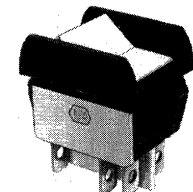
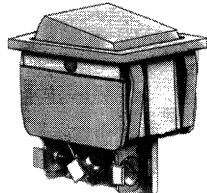
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**2600 series Industrial illuminated & non-illuminated snap-in power rocker switches**

Contact rating for On-None-Off & On-None-On actions: 10 amps at 380 VAC or 16 amps at 250 VAC or 20 amps at 125 VAC. Other actions: 10 amps at 250 VAC or 15 amps at 125 VAC. Also 1/6 HP 125/250 VAC. Operating temperature range -10° C to +55° C. Polycarbonate actuator. Black polyamide frame. Silver contacts. Melamine/polyester case. Lamps: 110 VAC neon for red & amber rockers, 110 VAC fluorescent for green rocker. Other rocker colors available - consult factory. Snap fits (no hardware) in .866" x 1.181" cutout in panels. .031" to .157" tk. Models with solder lug terms. listed below - omit 1/2" from Model no. for screw type terms. with clamps. UL, CSA & VDE recognized.

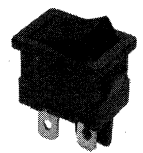
MOD. NO. (non-ill. black)	CKT.	ACTION
2631LH/2A212000L0	SPST	On-None-Off
2636LH/2A212000L0	SPDT	On-None-On
2639LH/2A212000L0	SPDT	On-Off-On
2641LH/2A212000L0	DPST	On-None-Off
2645LH/2A212000L0	DPDT	Mom-None-On
2646LH/2A212000L0	DPDT	On-None-On
2647LH/2A212000L0	DPDT	Mom-Off-Mom
2648LH/2A212000L0	DPDT	On-Off-Mom
2649LH/2A212000L0	DPDT	On-Off-On
MOD. NO. (ill. green)	CKT.	ACTION
2641LH/2A21300L110V3	DPST	On-None-Off
2646LH/2A21300L110V3	DPDT	On-None-On
2649LH/2A21300L110V3	DPDT	On-Off-On
MOD. NO. (ill. red)	CKT.	ACTION
2641LH/2A21600L110V	DPST	On-None-Off
2646LH/2A21600L110V	DPDT	On-None-On
2649LH/2A21600L110V	DPDT	On-Off-On
MOD. NO. (ill. amber)	CKT.	ACTION
2641LH/2A21900L110V	DPST	On-None-Off
2646LH/2A21900L110V	DPDT	On-None-On
2649LH/2A21900L110V	DPDT	On-Off-On
MOD. NO. (ill. red) with protection guard	CKT.	ACTION
2641LP/2A21600L110V	DPST	On-None-Off
2646LP/2A21600L110V	DPDT	On-None-On
2649LP/2A21600L110V	DPDT	On-Off-On



**MR series Industrial illuminated & non-illuminated snap-in power rocker switches**

Contact ratings: 10A 125 VAC 1/4 HP (UL). 8A 250 VAC 1/4 HP (UL). 12A 125 VAC 1/4 HP (CSA). 8(4)A 250V ~ T85 (VDE, SEMCO, NEMCO, DEMCO, FEMCO & SEV). Op. temp. range -30° C to +80° C. Non-illum. models have black nylon rocker. Illum. model has orange rocker and 125V neon lamp. Black nylon case. .189" x .032" quick connect terminals. Other rocker colors available - consult factory. Snap fits in .508" x .756" - .780" panel cutout in panels. .030" to .118" thick.

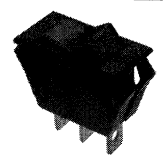
MOD. NO. (non-ill.)	CIRCUIT	ACTION
MR110C2BB	SPST	On-Off
MR210C2BB	DPST	On-Off
MOD. NO. (illum.)	CIRCUIT	ACTION
MR210C2LBO	DPST	On-Off



**B series Industrial illuminated & non-illuminated snap-in power rocker switches**

Contact ratings: 15A 125 VAC (UL & CSA). 10A 250 VAC (UL & CSA). Op. temp. range -30° C to +80° C. Non-illum. models have black nylon rocker. Illum. models have orange rocker and 125V neon lamp. Black nylon case. .250" x .032" quick connect terminals. Other rocker colors available - consult factory. Snap fits in .550" x 1.125" panel cutout in panels up to .083" thick.

MOD. NO. (non-ill.)	CIRCUIT	ACTION
B110R2BBNN	SPDT	On-None-On
B120R2BBNN	SPDT	On-Off-On
B160R2BBNN	SPST	On-Off
MOD. NO. (illum.)	CIRCUIT	ACTION
B110R2LBO1NN	SPDT	On-None-On
B160R2LBO1NN	SPST	On-Off



**AS series miniature snap-in rocker switches**

Contact ratings: S0 models- 4 amps at 125 VAC or 2 amps at 250 VAC (silver contacts & terminals). P0 models- 0.4 volt-amps (VA) max. at 20 volts max. (gold plated contacts & terminals). Operating temperature range -40° C to +85° C. Black polyamide rocker. Black PES case. Other rocker colors available - consult factory. Snap fits (no hardware) in .350" x .734" panel cutout. S0 models below are UL & CSA recognized.

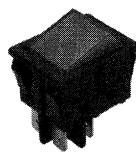
MODEL NO.	CIRCUIT	ACTION
AS36S010010	SPDT	On-None-On
AS39S010010		On-Off-On
AS37S010010		(On)-Off-(On)
AS38S010010		On-Off-(On)
AS32S010010		On-None-(On)
AS36P0000	SPDT	On-None-On
AS39P0000		On-Off-On
AS37P0000		(On)-Off-(On)
AS38P0000		On-Off-(On)
AS32P0000		On-None-(On)



**R series Industrial illuminated & non-illuminated snap-in power rocker switches**

Contact ratings: 16A 125 VAC 1/4 HP (UL/CSA). 16A 250 VAC 1/4 HP (UL/CSA). 16(4)A 250 V ~ T85 (VDE) & 10(2)A 250 V ~ +++ (VDE, SEMCO, NEMCO, DEMCO, FIMCO & SEV). Op. temp. range -30° C to +80° C. Non-illum. models have black nylon rocker. Illum. model has orange rocker and 125V neon lamp. Black nylon case. .250" x .032" quick connect terminals. Other rocker colors available - consult factory. Snap fits in .878" x .1.213" panel cutout in panels up to .083" thick.

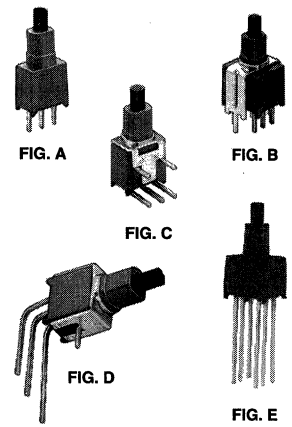
MOD. NO. (non-ill.)	CIRCUIT	ACTION
R110C2BB	SPST	On-Off
R120C2BB	SPDT	On-None-On
R210C2BB	DPST	On-Off
R220C2BB	DPDT	On-None-(On)
MOD. NO. (illum.)	CIRCUIT	ACTION
R210F2LBO	DPST	On-Off



**TP series tiny sealed pushbutton switches (p.c. mt.)**

SPDT & DPDT momentary action. Contact rating 0.4 volt-amps (VA) max. at 20 volts max. Operating temp. range -30° C to 85° C. Black glass polyester actuator. Gold over nickel plated brass contacts & terminals. PBT body. O-ring bushing seal. Epoxy terminal seal. S.P. body size .196" w x .318" h x .318" d. D.P. body size .358" w x .318" h x .318" d. Sealed for process compatibility.

MODEL NO.	CKT.	ACTION	FIG.
TP32P003000	SPDT	On-(On)	A
TP33P003000	SPST	Off-(On)	A
TP42P003000	DPDT	On-(On)	A
TP43P003000	DPST	Off-(On)	A
TP32Y003050	SPDT	On-(On)	B
TP33Y003050	SPST	Off-(On)	B
TP42Y003050	DPDT	On-(On)	B
TP43Y003050	DPST	Off-(On)	B
TP32W003050	SPDT	On-(On)	C
TP33W003050	SPST	Off-(On)	C
TP42W003050	DPDT	On-(On)	C
TP43W003050	DPST	Off-(On)	C
TP32WW03050	SPDT	On-(On)	D
TP33WW03050	SPST	Off-(On)	D
TP42WW03050	DPDT	On-(On)	D
TP43WW03050	DPST	Off-(On)	D
TP32MW03000	SPDT	On-(On)	E
TP33MW03000	SPST	Off-(On)	E
TP42MW03000	DPDT	On-(On)	E
TP43MW03000	DPST	Off-(On)	E



**1200 series power pushbutton switches-12 mm bush.**

SPST mom. action. Contact rating 4 amps at 250 VAC or 8 amps at 125 VAC or 4 amps at 24 VDC. Black polyamide actuator. Note-last digit of model no. is actuator color- 2 = black. Specify to 6 for red or 7/1 for white. Black polyamide case. Silver contacts and terms. Mtg. hardware included. Body size .551" w x .669" h x .834" d. X209 model is UL, CSA & VDE recognized. UU models UL & CSA recognized.

MODEL NO.	ACT.	TERMINALS
1212A2	NC	Solder lug/quick connect
1213A2UU	NO	Solder lug/quick connect
1222A2	NC	Screw type
1223A2UU	NO	Screw type
1202A2	NC	Screw type w/clamp
1203A2UU	NO	Screw type w/clamp
1233A2X209UU	NO	Solder lug/quick connect



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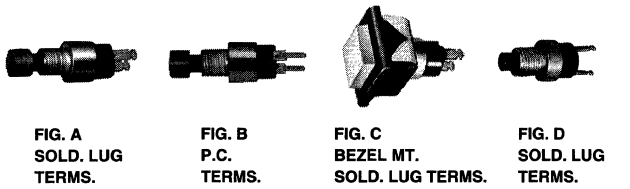


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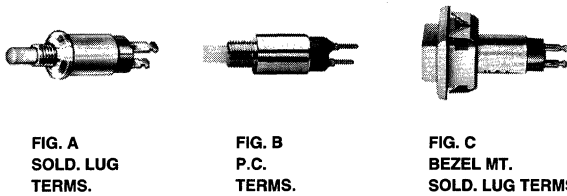
## 300 series miniature mom. pushbutton switches



SPST momentary action. Contact rating 3 amp at 120 VAC or 28 VDC or 1.5 amp at 250 VAC. Operating temp. range -30° C to 85° C. Black nylon actuator. Nickel plated brass bushing. Coin silver contacts. Silver plated brass terms. Epoxy term. seal. Hex. nut and lockwasher included except bezel unit which requires no mtg. hardware. Body size 301, 303 & 305 - .370" dia. x .429" long. .302 & 304 - .370" dia. x .319" long. Bezel & cap color - black for J81 model. Dry ckt. models w/gold over nickel conts. & terms. and rating of 0.4 volt-amps (VA) max. at 20 volts max. also available. To specify, substitute 'B' for 'Q' in model number below.

MODEL NO.	ACTION	TRAVEL	FIG.
301ZQE	Off-(On)	.110" total, .020" min. overtravel	A
301CQE	Off-(On)	.110" total, .020" min. overtravel	B
301SZQEJ81	Off-(On)	.110" total, .020" min. overtravel	C
302ZQE	Off-(On)	.060" total, no overtravel	D
303ZQE	On-(Off)	.055" total, .020" min. pretravel	A
304ZQE	On-(Off)	.040 total, no overtravel	D
305ZQE	Off-(On)	.110" total, .060" min. overtravel	A

## 400 series min. mom. & maint. pushbutton switches



SPST latching & mom. action. Contact rating 3 amp at 120 VAC or 28 VDC or 1.5 amp at 250 VAC. Operating temp. range -30° C to 85° C. White nylon actuator. Nickel plated brass bushing. Coin silver contacts. Silver plated brass terminals. Epoxy terminal seal. Panel dress nut and lockwasher included except bezel unit which requires no mounting hardware. Body size .370" dia. x .625" long. Bezel and cap color - black for J81 models. Dry ckt. models w/gold over nickel conts. & terms. and rating of 0.4 volt-amps (VA) max. at 20 volts max. also available. To specify, substitute 'B' for 'Q' in model number below.

MODEL NO.	ACTION	FIG.	MODEL NO.	ACTION	FIG.
401ZQE	On-Off	A	402ZQE	Off-(On)	A
401CQE	On-Off	B	402CQE	Off-(On)	B
401SZQEJ81	On-Off	C	402SZQEJ81	Off-(On)	C

## 9000 series subminiature mom. pushbutton switches

SP NO & NC actions. Contact rating 100 mA at 30 VDC. Operating temp. range -30° C to 65° C. Black glass polyamide actuator. Gold over nickel plated brass contacts & terminals. PPS case. Nickel plated brass bushing. Epoxy terminal seal. Body size .255" dia. x .314" long for self-cleaning contacts and .240" long for butt action contacts. Mounting nut included for panel mtg. models. Mounts in .165" dia. panel hole.

Self-cleaning contacts		
MODEL NO.	ACT.	FIG.
9532CD	NC	A
9533CD	NO	A
9232CD	NC	B
9233CD	NO	B
9232YCD	NC	C
9233YCD	NO	C
9232WWCD	NC	D
9233WWCD	NO	D




FIG. A  
SOLD. LUG TERMS.




FIG. B  
P.C. TERMS.

butt action contacts		
MODEL NO.	ACT.	FIG.
9533NCD	NO	A
9133CD	NO	B
9133YCD	NO	C
9133WWCD	NO	D




FIG. C  
P.C. TERMS W/BRKT.




FIG. D  
RT. ANGLE P.C.

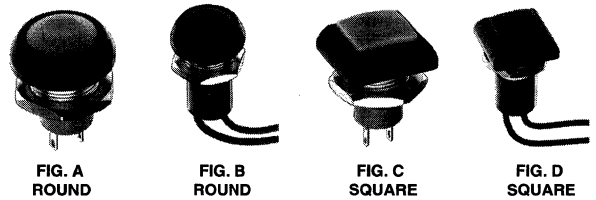
## 9000 series miniature mom. pushbutton switches

SP NO, NC & NC/NO mom. actions. Contact ratings: Model no's with 'A' - 0.6 amps at 125 VAC, 0.3 amps at 250 VAC or 1 amp at 30 VDC (silver contacts & terms.). Model no's with 'CD' - 100 mA at 30 VDC. (gold plated contacts & terms.). Operating temp. -30° C to 65° C. Black glass polyamide actuator. X model has metal actuator. Dialyl phthalate case. Nickel plated bushing. Epoxy term. seal. Body size .393" dia. x. approx. .334"-.466 long. Mtg. hdw. included for panel mtg. models. Mounts in .255" dia. hole.

MODEL NO.	ACT.	FIG.
9632AB	NC	A
9635AB	NC/NO	A
9432CDB	NC	B
9433CDB	NO	B
9435CDB	NC/NO	B
9432YCDB	NC	C
9433YCDB	NO	C
9435YCDB	NC/NO	C
9633NAB	NO	D
9433NCDB	NO	E
9633AX1146	NO	F



## IP series sealed momentary pushbutton switches



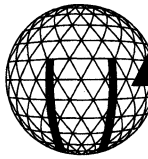
SP NO mom. action with double break. Contact ratings: 500 mA at 48 VAC, 200 mA at 50 VDC or 200 mA at 250 VAC. (gold plated silver contacts). Operating temp. range -40° C to 125° C. Polyamide 6/6 actuator. Zamac bushing & bezel. Bezel color black. PBT UL94V-0 case. Solder lug terminals or 20 AWG flexible wire leads. Totally sealed (per IP 67). Bezel size .688" dia. or square. Body size .472" dia. x approx. 1/2" - 3/4" long. Mounting hardware included. Mounts in 535" dia. panel hole.

MODEL NUMBER	ACT. COLOR	FIG.	MODEL NUMBER	ACT. COLOR	FIG.
IPR3SAD1	Blue	A	IPR3FAD1	Blue	B
IPR3SAD2	Black	A	IPR3FAD2	Black	B
IPR3SAD3	Green	A	IPR3FAD3	Green	B
IPR3SAD5	Yellow	A	IPR3FAD5	Yellow	B
IPR3SAD6	Red	A	IPR3FAD6	Red	B
IPR3SAD9	Orange	A	IPR3FAD7	Orange	B
IPC3SAD1	Blue	C	IPC3FAD1	Blue	D
IPC3SAD2	Black	C	IPC3FAD2	Black	D
IPC3SAD3	Green	C	IPC3FAD3	Green	D
IPC3SAD5	Yellow	C	IPC3FAD5	Yellow	D
IPC3SAD6	Red	C	IPC3FAD6	Red	D
IPC3SAD9	Orange	C	IPC3FAD9	Orange	D

## SP series miniature sealed momentary pushbutton switches (p.c. and panel mt.)

Single pole-double throw & double pole-double throw models. On - Mom action. Contact rating 0.4 volt-amps (VA) max. at 20 volts max. (AC or DC). Operating temp. range -20° C to +85° C. Gold over nickel plated brass contacts & terminals. Glass filled polyamide body & actuator, UL94V-0. O-ring bushing seal. Epoxy terminal seal. S.P. body size .500" w x .259" h x .425" d. D.P. body size .500" w x .446" h x .425" d. Panel mounting models mount in .255" dia. hole with included hardware. Process compatible.

This Series continued on next page



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**SP series miniature sealed momentary pushbutton switches (p.c. and panel mt.) (cont.).**

**FIG. A** P.C. TERMS. **FIG. B** P.C. TERMS W/BRKT. **FIG. C** RT. ANGLE HOR. P.C. TERMS. **FIG. D** RT. ANGLE VERT. P.C. TERMS.

MODEL NO.	CKT.	FIG.
SP35P000000	SPDT	A
SP45P000000	DPDT	A
SP35Y000000	SPDT	B
SP45Y000000	DPDT	B
SP35W000000	SPDT	C
SP45W000000	DPDT	C
SP35WW000000	SPDT	D
SP45WW000000	DPDT	D
SP35S000077	SPDT	E
SP35P000077	SPDT	F

**FIG. E** THD'D. BUSHING SOLD. LUG TERMS. **FIG. F** THD'D. BUSHING P.C. TERMS.

**18000 series miniature snap action momentary pushbutton switches (panel mt.)**

**FIG. A** SOLD. LUG TERMS. **FIG. B** P.C. TERMINALS **FIG. C** SNAP-IN MTG/SOLD. LUG TERMS.

Contact rating 1 amp at 120 VAC or 30 VDC. Operating temp. range -30° C to 65° C. Glass filled polyamide actuator. Nickel plated brass bushing. Gold plated silver contacts. Silver plated brass terminals. Diallyl phthalate case. Tin plated steel bracket. Epoxy term. seal. Mounting hardware included. S.P. body size .275" w x .519" h x .472" d. D.P. body size .472" w x .519" h x .472" d. Mounts in .255" hole (except snap-in models). Snap-in models have black bezel & cap & mount in .492" x .590" panel cutout.

MOD. NO.	CKT.	FIG.	MODEL NUMBER	CKT.	FIG.
18535AD	SPDT	A	18245AD	DPDT	B
18545AD	DPDT	A	18835AD+U912+U1202	SPDT	C
18235AD	SPDT	B	18845AD+U912+U1202	DPDT	C

**18000 series miniature snap action momentary pushbutton switches (p.c. mt.)**

**FIG. A** BRACKET MTG. MOUNTING. **FIG. B** RT. ANGLE HOR. MTG. **FIG. C** SHORT BRKT. MTG. W.SHORT ACT. & BUSH. **FIG. D** SNAP-IN MOUNTING

Contact rating 100 mA at 30 VDC. Operating temp. range -30° C to 65° C. Glass filled polyamide actuator. Nickel plated brass bushing. Gold plated brass contacts and terminals. Diallyl phthalate case. Tin plated steel bracket. Epoxy term. seal. S.P. body size .275" w x .519" h x .472" d. D.P. body size .472" w x .519" h x .472" d. Snap-in models have black bezel & cap & mount in .492" x .590" panel cutout.

MOD. NO.	CKT.	FIG.	MODEL NUMBER	CKT.	FIG.
18235YCD3	SPDT	A	18235YCD2X624	SPDT	C
18245YCD3	DPDT	A	18245YCD2X624	DPDT	C
18235WCD3	SPDT	B	18835CDX662	SPDT	D
18245WCD3	DPDT	B	18845CDX662	DPDT	D

**8000 series miniature momentary or alternate action pushbutton switches (p.c. and panel mt.)**

**FIG. A** SOLDER LUG TERMINALS **FIG. B** P.C. TERMS. **FIG. C** RIGHT ANGLE P.C. TERMS.

Contact ratings: Model no's with 'A'. - 6 amps at 125 VAC, 3 amps at 250 VAC or 4 amps at 30 VDC (gold plated silver contacts). Model no's. with 'CD' - 0.4 VA at 20 V. (gold plated brass contacts & terms.). Operating temp. range -40° C to 85° C. Nickel plated brass actuator & bushing. Diallyl phthalate case. Stainless steel housing. Epoxy term. seal. S.P. body size .275" w x .519" h x .767" d. D.P. body size .472" w x .519" h x .767" d. Mounts in .255" panel hole. Models with UL recognition available on request (silver contacts only).

SINGLE POLE- DOUBLE THROW			DOUBLE POLE- DOUBLE THROW		
MODEL NO.	ACTION	FIG.	MODEL NO.	ACTION	FIG.
8632AB	On Mom	A	8642AB	On Mom	A
8636AB	On On	A	8646AB	On On	A
8432AB	On Mom	B	8442AB	On Mom	B
8436AB	On On	B	8446AB	On On	B
8432WCDB	On Mom	C	8442WCDB	On Mom	C
8436WCDB	On On	C	8446WCDB	On On	C

**4700 & 4800 series alternate action pushbutton switches (panel mt.)**

**FIG. A** SOLDER LUG TERMINALS **FIG. B** P.C. TERMS. **FIG. C** QUICK CONNECT TERMS. (.185" X .031")

SPST, SPDT, DPST & DPDT models. Contact ratings: 6 amps at 125 VAC or 3 amps at 250 VAC (silver contacts). Operating temp. range -20° C to 65° C. Polyamide actuator. Nickel plated brass bushing. Diallyl phthalate case. Epoxy term. seal. S.P. body size .472" w x .748" h x .550" d. D.P. body size .649" w x .826" h x .590" d. Mounts in .480" panel hole. 1 hex nut and one insulating knurled nut supplied. Color of knurled nut supplied in same color as actuator (specify below). Models ending with **UU** are UL, CSA & VDE recognized. Models not ending with **UU** are VDE recognized.

SINGLE POLE			DOUBLE POLE		
MODEL NO.	ACTION	FIG.	MODEL NO.	ACTION	FIG.
4731A02UU	On Off	A	4741A02UU	On Off	A
4736A02UU	On On	A	4746A02UU	On On	A
A4831A02	On Off	B	4841A02	On Off	B
4836A02	On On	B	4846A02	On On	B
47318A02UU	On Off	C			
47368A02UU	On On	C			

Note: Above models have black actuator and black knurled nut. To specify a different color selection, replace the '02' in model number with the following color code:

Color	Code
Blue	01
Green	03
Yellow	05
Red	06
White	07/1
Orange	09



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**MD series pushbutton switches (p.c. and panel mt.)**

**SLB series miniature slide switches (p.c. mtg.) (cont.)**

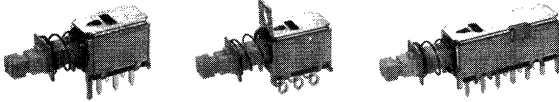


FIG. A  
2P2T P.C. MT.

FIG. B  
2P2T PANEL MT.

FIG. C  
4P2T P.C. MT.

1, 2 & 4 pole 2 throw models with momentary and maintained actions. Contact ratings: 200 mA at 30 VDC. Operating temp. -20° C to 85° C. Polyacetal actuator. Tin plated steel frame. Laminated phenolic base. Silver plated contacts & terminals. Body size .283" w x .378" h x .472" or .850" lg. Self-cleaning contacts. Panel mtg. models have M2 threaded mtg. hole.

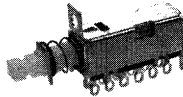


FIG. D  
4P2T PANEL MT.

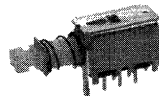
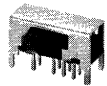
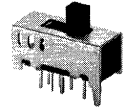
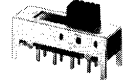


FIG. E  
2P2T P.C. MT.  
SHORT ACTUATOR

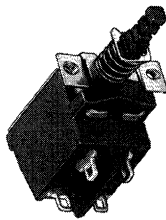
MODEL NO.	CKT.	ACTION	FIG.
MDPS522PN	2P2T	Mom	A
MDPA522PN	2P2T	Maint	A
MDPS522WN	2P2T	Mom	B
MDPA522WN	2P2T	Maint	B
MDPS542PN	4P2T	Mom	C
MDPA542PN	4P2T	Maint	C
MDPS542WN	4P2T	Mom	D
MDPA542WN	4P2T	Maint	D
MDPS822PN	2P2T	Mom	E
MDPA822PN	2P2T	Maint	E

MODEL NUMBER	POLES/THROW	BODY SIZE (IN.)		
		L	W	H
SLB1280R5	1P2T	.551X.244X.217		
SLB12814	1P2T	.551X.244X.217		
SLB1281R5	1P2T	.551X.244X.217		
SLB1340R4.5	1P3T	.630X.264X.295		
SLB13414.5	1P3T	.630X.264X.295		
SLB1370	1P3T	.787X.197X.295		
SLB1370R	1P3T	.787X.295X.197		
SLB13804	1P3T	.701X.244X.217		
SLB1380R5	1P3T	.701X.244X.217		
SLB13814	1P3T	.701X.244X.217		
SLB1381R5	1P3T	.701X.244X.217		
SLB1470	1P4T	.787X.197X.295		
SLB1470R	1P4T	.787X.295X.197		
SLB1570	1P5T	.866X.197X.295		
SLB1570R	1P5T	.866X.295X.197		
SLB2240R4.5	2P2T	.630X.264X.295		
SLB22414.5	2P2T	.630X.264X.295		
SLB22804	2P2T	.551X.244X.217		
SLB2280R5	2P2T	.551X.244X.217		
SLB22814	2P2T	.551X.244X.217		
SLB2281R5	2P2T	.551X.244X.217		
SLB2340R4.5	2P3T	.630X.264X.295		
SLB23414.5	2P3T	.630X.264X.295		
SLB23804	2P3T	.701X.244X.217		
SLB2380R4.5	2P3T	.701X.244X.217		
SLB23814	2P3T	.701X.244X.217		
SLB2381R5	2P3T	.701X.244X.217		



**MD1 series TV rated pushbutton switches (panel mt.)**

Double pole single throw alternate action. Contact ratings: UL- 7.5 amps at 125/250 VAC, TV5 & 8. CSA- 10 amps at 125/250 VAC, TV5 & 8. VDE, SEMCO, NEMCO, SETI, DEMCO & SEV-8A/128A at 250 VAC  $\mu$ T85. Operating temp. -10° C to 85° C. 30% glass fiber PBT actuator. Zinc plated steel frame. Phenolic base, 94V-O. Silver alloy contacts. Silver plated terminals. Body size .750" w x .760" h x 1.232" lg. Self-cleaning contacts. Panel mtg. with mtg. holes in frame.

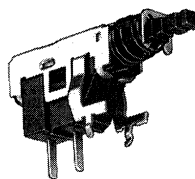


SOLDER LUG TERMS. SHOWN

MODEL NO.	TERMINALS	FIG.
MD12T5	SOLDER LUG	A
MD12L5	QUICK CONNECT	A

**MD2 series TV rated pushbutton switches (p.c. and panel mt.)**

Single pole single throw alternate action. Contact ratings: UL & CSA- 15 amps at 125 VAC, 10 amps at 250 VAC, TV-5, VDE & SEMCO - 5A/80A at 250 VAC  $\mu$ T85. Operating temperature 10° C to 85° C. PBT actuator, UL94V-2. Steel frame. Phenolic base, 94V-O. Silver alloy contacts. Silver plated terminals. Body size .378" w x .778" h x 1.075" lg. Self-cleaning contacts. Solder lug model has panel mounting holes in frame.



PRINTED CKT. TERMS. SHOWN

MODEL NO.	TERMINALS	FIG.
MD2BM4T1	SOLDER LUG	A
MD2CP4T3	PRINTED CIRCUIT	A

**SLB series miniature slide switches (p.c. mtg.)**

Contact rating 300 mA at 125 VAC or 30 VDC. Operating temperature range -20° C to 85° C. Thermoplastic actuator. Zinc plated steel combination p.c. bracket and frame. Phenolic laminated base. Silver plated contacts & terminals. Epoxy sealed terminals. Washable open frame construction. Vertical and right angle actuation models. Note - right angle actuation models have 'R' in model no.



MODEL NUMBER	POLES/THROW	BODY SIZE (IN.)		
		L	W	H
SLB1240R4.5	1P2T	.630X.264X.295		
SLB12414.5	1P2T	.630X.264X.295		
SLB1250R8	1P2T	.669X.315X.315		
SLB12804	1P2T	.551X.244X.217		

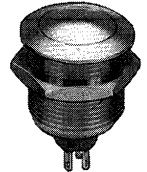
**Anti-vandal single pole pushbutton switches**



AV091003C900



AV031003C900



AV199035D200

Momentary action. Vandal resistant anti-jam construction meets hammer blow specs. NFC 20-010. Stainless steel bushing & actuator. 2 sizes for mtg. in 19.2 or 22.2 mm panel hole. Hex mtg. nut supplied. Low-profile curved bezel with flat or curved act. Models ending in 'E' have internal seal per IP65. Models ending in 'K' have internal & panel seals per IP65. Models listed have either solder lug or screw terminals. Consult factory for additional specifications and models.

MODEL NO.	SIZE	ACT.	CIRCUIT	CONTACT RATING
AV091003C900	19.2	Flat	SP NO Mom	2A 48VDC
AV091003C900K	19.2	Flat	SP NO Mom	2A 48VDC
AV031003C900	22.2	Flat	SP NO Mom	2A 48VDC
AV199035D200	19.2	Curved	SP NC&NO Mom	1A 30V, 10 $\mu$ A 5V
AV199035D200E	19.2	Curved	SP NC&NO Mom	1A 30V, 10 $\mu$ A 5V
AV091003C940N	19.2	Flat	SP NO Mom	2A 48VDC
AV021202C000	22.2	Curved	SP NC Mom	3A 125VAC, 2A 250 VAC
AV09C703D200	19.2	Flat	SP NO Mom	50 mA 24 VDC
AV19C703D200K	19.2	Flat	SP NO Mom	50 mA 24 VDC

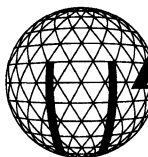
**TG series microminiature slide switches**

Contact ratings: Gold; 0.4 VA max. at 20 V max. Silver; 500 mA at 48 V max. (AC or DC) SPDT maintained circuit. Op. temp. range -30° C to 85° C. Thermoplastic actuator. Flame retardant thermoplastic case. Tin plated steel ground plate or bracket. Gold or silver plated contacts & terminals. Epoxy sealed terms. Washable models (ending in 50) have translucent silicone rubber seal. Body size .398" x .197" x .378".

Vertical p.c. mount. (no bracket)	MODEL NUMBER	CONT. MAT'L.	ACTION
	TG36P000000	Gold	on - on
TG39P000000	Gold	on off on	
TG36P010000	Silver	on - on	
TG39P010000	Silver	on off on	
TG36P000050	Gold	on - on	
TG39P000050	Gold	on off on	
TG36P010050	Silver	on - on	
TG39P010050	Silver	on off on	



This Series continued on next page



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## TG series microminiature slide switches (cont.)

	MODEL NUMBER	CONT. MAT'L.	ACTION	
Vertical p.c. mount. with bracket	TG36Y000000	Gold	on - on	
	TG39Y000000	Gold	on off on	
	TG36Y010000	Silver	on - on	
	TG39Y010000	Silver	on off on	
	TG36Y000050	Gold	0n - on	
	TG39Y000050	Gold	on off on	
Rt. angle p.c. mount. with bracket	TG36Y010050	Silver	on - on	
	TG39Y010050	Silver	on off on	
	TG36W000000	Gold	on - on	
	TG39W000000	Gold	on off on	
	TG36W010000	Silver	on - on	
	TG39W010000	Silver	on off on	
	TG36W000050	Gold	on - on	
	TG39W000050	Gold	on off on	
	TG36W010050	Silver	on - on	
	TG39W010050	Silver	on off on	

TRANSLUCENT SEAL SHOWN

## 25000 series miniature slide switches (cont.)

	MODEL NO.	CIRCUIT	ACTION	
cont'd	25449NAB	DPDT	on off on	
	25536NA	SPDT	on - on	
	25539NA	SPDT	on off on	
	25546NA	DPDT	on - on	
	25549NA	DPDT	on off on	
.200" c to c terminal spacing	25436NAH	SPDT	on - on	
	25439NAH	SPDT	on off on	
	25446NAH	DPDT	on - on	
	25449NAH	DPDT	on off on	
	25536NA6	SPDT	on - on	
Rt. ang. act. .236 ang.	25539NA6	SPDT	on off on	
	25546NA6	DPDT	on - on	
	25549NA6	DPDT	on off on	
	25549NA6	DPDT	on off on	

## GH series instrument grade miniature slide switches

Contact rating: 4 amps at 125 VAC, 2 amps at 250 VAC or 3 amps at 30 VDC. SPDT & DPDT maint'd. circuits. Op. temp. range -30° C to 85° C. Glass filled polyamide actuator. PES case. Stainless st. cover. Silver plated contacts & terms. Epoxy sealed terms. Body size approx. .500"l x .262"w x .250"h. DP .500"l x .449"w x .299"h. Note - dry circuit models with gold plated contacts & terms. available - consult factory.

	MODEL NO.	CIRCUIT	ACTION	
Panel mtg. w/brkt.	GH36S010001	SPDT	on - on	
	GH39S010001	SPDT	on off on	
	GH46S010001	DPDT	on - on	
	GH49S010001	DPDT	on off on	
	GH36P010001	SPDT	on - on	
Vert. p.c. no brkt.	GH39P010001	SPDT	on off on	
	GH46P010001	DPDT	on - on	
	GH49P010001	DPDT	on off on	
	GH36W010001	SPDT	on - on	
	GH39W010001	SPDT	on off on	
Actuator length approx. .200"	GH46W010001	DPDT	on - on	
	GH49W010001	DPDT	on off on	
	GH36WW10001	SPDT	on - on	
	GH39WW10001	SPDT	on off on	
	GH46WW10001	DPDT	on - on	
Right angle hor. wbrkt.	GH49WW10001	DPDT	on off on	
	GH36Y010001	SPDT	on - on	
	GH39Y010001	SPDT	on off on	
	GH46Y010001	DPDT	on - on	
	GH49Y010001	DPDT	on off on	
Right angle vert. wbrkt.	GH36Y010001	SPDT	on - on	
	GH39Y010001	SPDT	on off on	
	GH46Y010001	DPDT	on - on	
	GH49Y010001	DPDT	on off on	
	GH36Y410001	SPDT	on - on	
Vert. p.c. w/brkt.	GH39Y410001	SPDT	on off on	
	GH46Y410001	DPDT	on - on	
	GH49Y410001	DPDT	on off on	
	GH49Y410001	DPDT	on off on	

## 25000 series miniature slide switches

Contact rating: 4 amps at 125 VAC, 2 amps at 250 VAC or 3 amps at 30 VDC. SPDT & DPDT maint'd. circuits. Op. temp. range -40° C to +85° C. Glass filled polyamide actuator and cover. PBT case. Silver plated contacts & terms. Epoxy sealed terms. Terminal spacing is .200" c to c. Body size- SP .555"l x .295"w x .319"h. DP same except. .465"w. Note - dry circuit models with gold plated contacts & terminals available - consult factory.

	MODEL NO.	CIRCUIT	ACTION	
Vert. act. flush	25136NAB	SPDT	on - on	
	25139NAB	SPDT	on off on	
	25146NAB	DPDT	on - on	
	25149NAB	DPDT	on off on	
.100" c to c terminal spacing	25336NA	SPDT	on - on	
	25339NA	SPDT	on off on	
	25346NA	DPDT	on - on	
	25349NA	DPDT	on off on	
Rt. ang. act. .091 long	25136NAH	SPDT	on - on	
	25139NAH	SPDT	on off on	
	25146NAH	DPDT	on - on	
	25149NAH	DPDT	on off on	
Rt. ang. act. .110 long	25336NAH	SPDT	on - on	
	25339NAH	SPDT	on off on	
	25346NAH	DPDT	on - on	
	25349NAH	DPDT	on off on	
Rt. ang. act. .236 long	25336NA6	SPDT	on - on	
	25339NA6	SPDT	on off on	
	25346NA6	DPDT	on - on	
	25349NA6	DPDT	on off on	
.200" c-c	25436NAB	SPDT	on - on	
	25439NAB	SPDT	on off on	
	25446NAB	DPDT	on - on	

## PT65 series DIP coded rotary switches

Contact rating: Carry - 400 mA max. at 24 VDC; Switching - 150 mA max. at 24 VDC. Op. temp. range -20° C to +70° C. Glass filled thermoplastic body, color - lt. gray. Glass filled thermoplastic actuator, color - dk. gray. Internal o-ring actuator seal. Contacts gold over nickel plated. Molded-in solder coated terms.. 10 & 16 position models. Body size .393" sq. x .256" high. Process compatible. Code 1: BCD (2 common terms.). Code 2: BCD complement. Code 3: Hexadecimal. Code 6: Hex. comp. Code 5: Gray code

CODE	MODEL NO. BY TERMINAL STYLE				
	STRAIGHT .200" X .300"	RIGHT ANGLE AT PITCH =			
		.100"	.200"		
1	PT65101	PT65101L254	PT65101L508	PT65101	
	2	PT65102	PT65102L254		PT65102L508
	3	PT65103	PT65103L254		PT65103L508
	4	PT65106	PT65106L254		PT65106L508
	5	PT65105	PT65105L254		PT65105L508
1	PT65301	PT65301L254	PT65301L508	PT65301	
	2	PT65302	PT65302L254		PT65302L508
	3	PT65303	PT65303L254		PT65303L508
	4	PT65306	PT65306L254		PT65306L508
	5	PT65305	PT65306L254		PT65306L508
1	PT65501	PT65501L254	PT65501L508	PT65501	
	2	PT65502	PT65502L254		PT65502L508
	3	PT65503	PT65503L254		PT65503L508
	4	PT65506	PT65506L254		PT65506L508
	5	PT65505	PT65505L254		PT65505L508

## DS & DP series DIP switches

Contact rating: Carry - 100 mA max. at 50 VDC; Switching - 50 mA max. at 24 VDC. Op. temp. range -40° C to +70° C. UL94V-O case, color - red. UL94V-O actuator, color - white. Contacts & terms. gold over nickel over phosphor bronze. Epoxy sealed terms.. Std'd. DIP package term. spacing of .100" x .300". Process compatible when optional tape seal is specified. SPST Off-On action.

ACTUATOR STYLE	MOD. NO. NO TAPE SEAL	MOD. NO. WTAPE SEAL	NO. OF POS.		
RAISED ACTUATOR	DS02	DS02T	2		
	DS03	DS03T	3		
	DS04	DS04T	4		
	DS05	DS05T	5		
	DS06	DS06T	6		
	DS07	DS07T	7		
	DS08	DS08T	8		
	DS09	DS09T	9		
	DS10	DS10T	10		
	DS12	DS12T	12		
	RECESSED ACTUATOR	DP02	DP02T		2
		DP03	DP03T		3
DP04		DP04T	4		
DP05		DP05T	5		
DP06		DP06T	6		
DP07		DP07T	7		
DP08		DP08T	8		
DP09		DP09T	9		
DP10		DP10T	10		
DP12		DP12T	12		

Consult factory for extensive DIP switch listings.



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## DSR, DA & DPL series DIP switches

Contact rating : Carry - 100 mA max. at 50 VDC; Switching - 50 mA max. at 24 VDC. Op. temp. range -40° C to +70° C. UL94V-O case, color - red. UL94V-O actuator, color - white. Contacts & terms. gold over nickel over phosphor bronze. Epoxy sealed terms.. Std'd. DIP package term. spacing of .100" x .300" (.100" x .100" for DA models). Process compatible when optional tape seal is specified. SPST Off-On action.

ACT- UATOR STYLE	MOD. NO. NO TAPE SEAL	MOD. NO. W/TAPE SEAL	NO. OF POS.			
RECESSED ACTUATOR	DSR02	DSR02T	2			
	DSR03	DSR03T	3			
	DSR04	DSR04T	4			
	DSR05	DSR05T	5			
	DSR06	DSR06T	6			
	DSR07	DSR07T	7			
	DSR08	DSR08T	8			
	DSR09	DSR09T	9			
	DSR10	DSR10T	10			
	DSR11	DSR11T	11			
	DSR12	DSR12T	12			
	RAISED ACT.	DA04	DA04T		4	
DA05		DA05T	5			
DA06		DA06T	6			
DA07		DA07T	7			
DA08		DA08T	8			
DA09		DA09T	9			
DA10		DA10T	10			
DA11		DA11T	11			
DA12		DA12T	12			
EXTENDED ACT.		DPL02	DPL02T	2		
		DPL03	DPL03T	3		
		DPL04	DPL04T	4		
	DPL05	DPL05T	5			
	DPL06	DPL06T	6			
	DPL07	DPL07T	7			
	DPL08	DPL08T	8			
	DPL09	DPL09T	9			
	DPL10	DPL10T	10			
	DPL11	DPL11T	11			
	DPL12	DPL12T	12			

## IK series high rel surface mount DIP switches

Contact rating : Carry - 100 mA max. at 48 VDC; Switching - 100 mA max. at 24 VDC. Op. temp. range -40° C to +100° C. UL94V-O case, color - white. UL94V-O actuator, color - black. Contacts gold over copper alloy. Molded-in tin/nickel plated terms.. Term. spacing .100" x .400". Process compatible with standard tape seal. SPST Off-On action. Auto-insertable. IR and vapor phase reflow solderable. Self-cleaning wiping contacts. Low profile .112"h.

ACT- UATOR STYLE	MOD. NO. (TAPE & REEL)	MOD. NO. (IC TUBES)	NO. OF POS.	
FLUSH	IKNO204000	IKNO203000	2	
	IKNO404000	IKNO403000	4	
	IKNO604000	IKNO603000	6	
	IKNO804000	IKNO803000	8	

## IK series high rel thru-hole mount DIP switches

Contact rating : Carry - 100 mA max. at 48 VDC; Switching - 100 mA max. at 24 VDC. Op. temp. range -40° C to +100° C. UL94V-O case, color - white. UL94V-O actuator, color - black. Contacts gold over copper alloy. Molded-in tin/nickel plated terms.. Term. spacing .100" x .300". Process compatible with standard tape seal. SPST Off-On action. Auto-insertable. IR and vapor phase reflow solderable. Self-cleaning wiping contacts. Low profile .112"h.

ACT- UATOR STYLE	MOD. NO. (IC TUBES)	NO. OF POS.	
FLUSH	IKNO200000	2	
	IKNO400000	4	
	IKNO600000	6	
	IKNO800000	8	

## MJTP series miniature tact switches

SPST momentary action. Excellent tactile feed-back. Contact rating 50 milliamps at 12 VDC. Operating temp. range -20° C to +70° C. Thermoplastic actuator and case. Phosphor bronze or stainless steel with silver clad shunting contact. Silver plated brass terms. PET film, tin plated brass or stainless steel cover/bracket. Molded-in terminals. L.E.D. rating for model MJTP1194: 2.1 V (3.0 V max.) forward voltage. Cont. forward current at 25° C is 20 mA max. Dims. shown in inches. Consult factory for numerous additional models.

MODEL NO. NUMBER	BODY SIZE L X W X H	ACT. HT./CLR.	GRD TAB	
MJTP1105T	.291x.258x.285	.142	Y	
MJTP1109	.299X.283X.102	.056	Y	
MJTP1109A	.315X.244X.102	.213	Y	
MJTP1109B	.315X.244X.102	.371	Y	
MJTP1119	.283X.283X.102	.056	N	
MJTP1119A	.283X.283X.102	.213	N	
MJTP1119B	.283X.283X.102	.371	N	
MJTP1194	.252X.252X.228	-(no LED)	N	
MJTP1194R	.252X.252X.228	-(red LED)	N	
MJTP1194Y	.252X.252X.228	-(ylw LED)	N	
MJTP1194G	.252X.252X.228	-(grn LED)	N	
MJTP1230	.238X.238X.142	.028	N	
MJTP1230A	.238X.238X.142	.055	N	
MJTP1230B	.238X.238X.142	.232	N	
MJTP1230C	.238X.238X.142	.173	N	
MJTP1230D	.238X.238X.142	.370	N	
MJTP1230E	.238X.238X.142	.145	N	
MJTP1230F	.238X.238X.142	.193	N	
MJTP1230G	.238X.238X.142	.133	N	
MJTP1232	.238X.238X.142	.028	Y	
MJTP1232A	.238X.238X.142	.055	Y	
MJTP1232B	.238X.238X.142	.232	Y	
MJTP1232C	.238X.238X.142	.173	Y	
MJTP1232D	.238X.238X.142	.370	Y	
MJTP1232E	.238X.238X.142	.145	Y	
MJTP1232F	.238X.238X.142	.193	Y	
MJTP1232G	.238X.238X.142	.133	Y	

## DIR series DIP switches

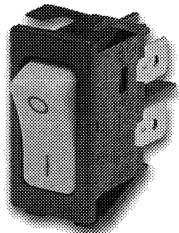
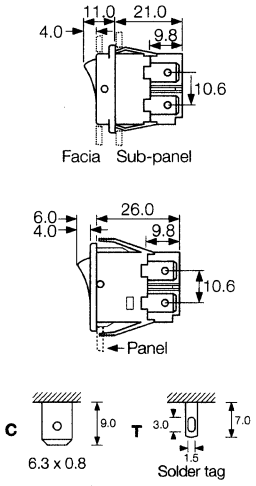
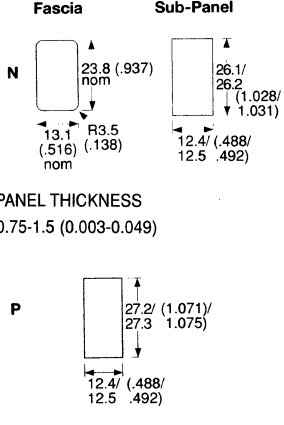
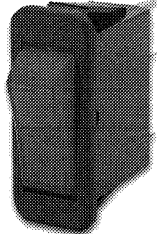
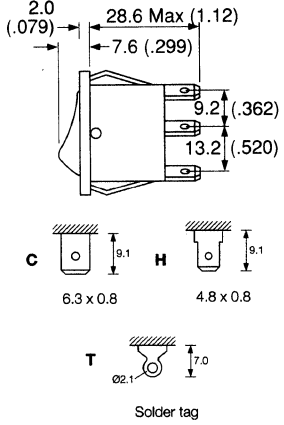
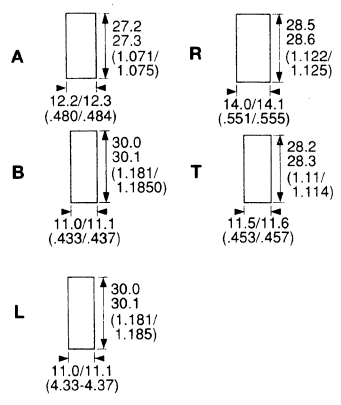
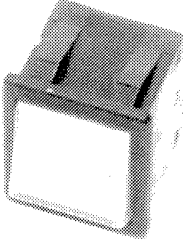
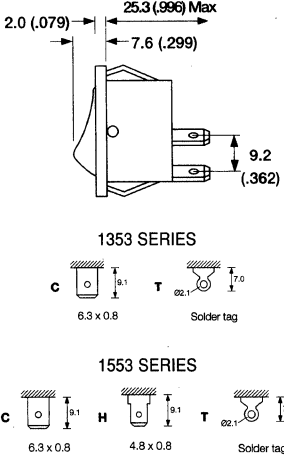
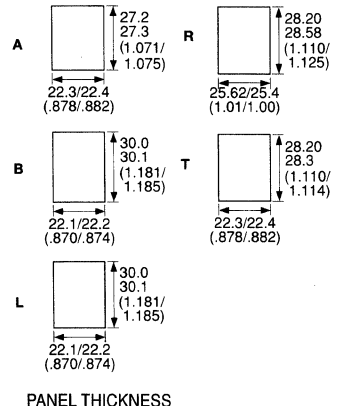
Contact rating : Carry - 100 mA max. at 50 VDC; Switching - 25 mA max. at 24 VDC. Op. temp. range -40° C to +85° C. UL94V-O base & cover, color - black. UL94V-O actuator, color - white. Contacts gold over nickel plated brass. Epoxy sealed tin/lead plated brass terms.. Std'd. DIP package term. spacing of .100" x .300" Process compatible when optional tape seal is specified. SPST Off-On action. Auto-insertable spread terminals.

ACT- UATOR STYLE	MOD. NO. NO TAPE SEAL	MOD. NO. W/TAPE SEAL	NO. OF POS.	
RAISED	D101S	-	1	
	D102S	-	2	
	D104S	-	4	
	D106S	-	6	
	D108S	-	8	
	D110S	-	10	
	RECESSED	DIR01S	DIR01ST	
DIR02S		DIR02ST	2	
DIR04S		DIR04ST	4	
DIR06S		DIR06ST	6	
DIR08S		DIR08ST	8	
DIR10S		DIR10ST	10	

## DHS series 1/2 pitch surface mount DIP switches

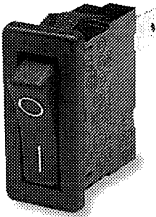
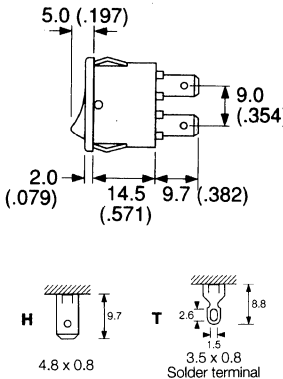
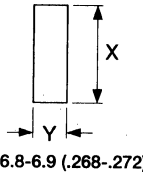
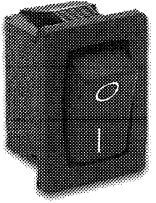
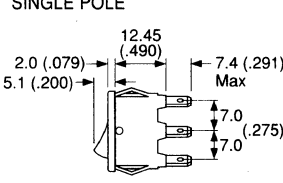
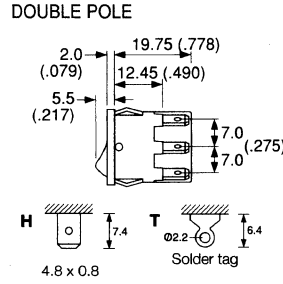
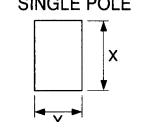
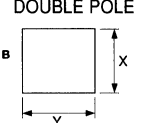
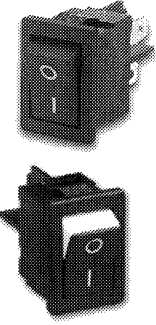
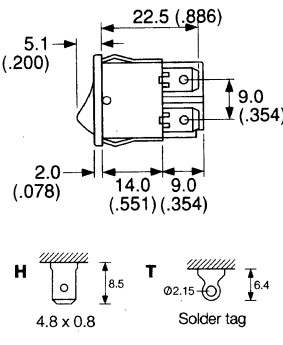
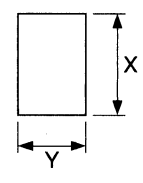
Contact rating : Carry - 100 mA max. at 50 VDC; Switching - 100 mA max. at 6 VDC. Op. temp. range -40° C to +80° C. UL94V-O base & cover, color - black. UL94V-O actuator, color - yellow. Contacts gold plated beryllium copper. Epoxy sealed gold plated brass terms. Term. spacing .050" x .315". Process compatible with standard tape seal. SPST Off-On action. Auto-insertable and reflow solderable. Ultra-compact .244"w x .087"h.

ACT- UATOR STYLE	MOD. NO. W/TAPE SEAL	NUMBER OF POSITIONS	
FLUSH	DHS4S	4	
	DHS6S	6	
	DHS8S	8	
	DHS10S	10	

MODEL	OPTIONS/RATINGS	DIMENSIONS	CUTOUT SIZES
<p><b>1250 SERIES</b> <i>Double-Pole Rocker Switches</i></p>  <p>Single- and double-pole rocker switches in a compact body size.</p>	<p>RATINGS: 16A 125-250VAC 65C 1A 30VDC 1/2HP 125VAC 10A 125-250VAC 65C 10 (6)A 250VAC T100 75A Inrush 10A 28VDC</p> <p>CIRCUITS: 1250 DPST On Off 1250SP SPST On Off</p>	 <p>Facia Sub-panel Panel Solder tag</p>	<p>Fascia Sub-Panel</p>  <p>N P</p> <p>PANEL THICKNESS 0.75-1.5 (0.003-0.049)</p> <p>PANEL THICKNESS 0.75-3.0 (0.029-0.118)</p>
<p><b>5503 SERIES</b> <i>Lighted Single-Pole Rocker Switches</i></p>  <p>Illuminated rocker switches available in several voltages and colors.</p>	<p>RATINGS: 15A 125-250VAC T85 1/2HP 125VAC 1HP 250VAC 16 (4)A 250VAC T85 20A 28VDC</p> <p>CIRCUITS: 5503 SPST On Off 5508 SPST On Off</p> <p>CIRCUIT DIAGRAMS: 5503 5508</p> <p>Load terminal 1, Line In terminal 2, Line Out terminal 3. Light will be On or Off when switch is in On or Off position.</p>	 <p>C H T</p> <p>Solder tag</p>	 <p>A B L R T</p> <p>PANEL THICKNESS 0.75-2.5 (0.029-0.098)</p>
<p><b>1353/1553 SERIES</b> <i>Lighted Double-Pole Rocker Switches</i></p> 	<p>1353 RATINGS: 20A 125-250VAC 85C 1/2HP 125VAC 1HP 250VAC 16 (4)A 250VAC T85 150A Inrush Semko IEC65</p> <p>1553 RATINGS: 16A 125-250VAC 85C 1/2HP 125VAC 1HP 250VAC 16A 125-250VAC 16 (4)A 250VAC T85</p> <p>CIRCUITS: 1353 DPST On Off Hi inrush version</p> <p>1553 DPST On Off</p>	 <p>1353 SERIES 1553 SERIES</p> <p>C H T</p> <p>Solder tag</p>	 <p>A B L R T</p> <p>PANEL THICKNESS A 0.75-3.3 (0.029-0.130) B, L, T 0.75-2.5 (0.029-0.098) R 1.00-3.0 (0.039-0.118)</p>



**ROCKER SWITCHES**

MODEL	OPTIONS/RATINGS	DIMENSIONS	CUTOUT SIZES																																																																								
<p><b>8800 SERIES</b> <i>Thinline Single-Pole Rocker Switches</i></p>  <p>Ideal for small appliances or controls with limited space.</p>	<p><b>RATINGS:</b>                      15A 125-250VAC 100C                      1/2HP 125VAC                      10 (6)A 250VAC T100                      6 (2)A 250VAC T100 5E4                      75A Inrush to EN61058-1                      10A 28VDC</p> <p><b>CIRCUIT:</b>                      8800 SPST On Off</p>	 <p>5.0 (.197)                      9.0 (.354)                      2.0 (.079) 14.5 (.571) 9.7 (.382)                      H 4.8 x 0.8                      T 2.6 1.5 8.8                      Solder terminal 3.5 x 0.8</p>	 <p>6.8-6.9 (.268-.272)</p> <table border="1"> <thead> <tr> <th>PANEL THICKNESS</th> <th>DIMENSION X</th> </tr> </thead> <tbody> <tr> <td>0.75-1.25</td> <td>19.1/19.2</td> </tr> <tr> <td>1.25-2.0</td> <td>19.3/19.4</td> </tr> <tr> <td>2.0-3.0</td> <td>19.7/19.8</td> </tr> </tbody> </table>	PANEL THICKNESS	DIMENSION X	0.75-1.25	19.1/19.2	1.25-2.0	19.3/19.4	2.0-3.0	19.7/19.8																																																																
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<p><b>8600 SERIES</b> <i>Single- and Double-Pole Rocker Switches</i></p>  <p>Used in computers, audio, medical, office products, instruments and appliances.</p>	<p><b>RATINGS:</b>                      10A 277VAC 65C                      1/4HP 125VAC 1/2HP 250VAC                      6A 277VAC Models 8601,8602                      15A 125-250VAC 90C                      1/2HP 250VAC Model 8620                      10 (4)A 250VAC T90 Models 8600, 8650, 8653                      25A Inrush                      10A 28VDC</p> <p><b>CIRCUITS:</b></p> <table border="1"> <thead> <tr> <th>Single Pole</th> <th>Double Pole</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>8600</td> <td>8650</td> <td>On</td> <td>Off</td> </tr> <tr> <td>8601</td> <td>8651</td> <td>(On)</td> <td>Off</td> </tr> <tr> <td>8602</td> <td>8652</td> <td>On</td> <td>(Off)</td> </tr> <tr> <td>8610</td> <td>8660</td> <td>On</td> <td>On</td> </tr> <tr> <td>8611</td> <td>8661</td> <td>(On)</td> <td>On</td> </tr> <tr> <td>8620</td> <td>-</td> <td>On</td> <td>Off On</td> </tr> <tr> <td>8630</td> <td>-</td> <td>Blank hole plug</td> <td></td> </tr> <tr> <td>-</td> <td>8653</td> <td>On</td> <td>Off Lighted</td> </tr> <tr> <td>-</td> <td>8670</td> <td>On</td> <td>Off On</td> </tr> <tr> <td>-</td> <td>8671</td> <td>(On)</td> <td>Off On</td> </tr> <tr> <td>-</td> <td>8672</td> <td>(On)</td> <td>Off (On)</td> </tr> </tbody> </table> <p>( ) = Momentary</p>	Single Pole	Double Pole			8600	8650	On	Off	8601	8651	(On)	Off	8602	8652	On	(Off)	8610	8660	On	On	8611	8661	(On)	On	8620	-	On	Off On	8630	-	Blank hole plug		-	8653	On	Off Lighted	-	8670	On	Off On	-	8671	(On)	Off On	-	8672	(On)	Off (On)	<p><b>SINGLE POLE</b></p>  <p>12.45 (.490)                      7.4 (.291) Max                      2.0 (.079) 5.1 (.200) 7.0 (.275) 7.0                      For Model 8620, overall depth from bezel is 23.5 (0.925).</p> <p><b>DOUBLE POLE</b></p>  <p>19.75 (.778)                      12.45 (.490)                      2.0 (.079) 5.5 (.217) 7.0 (.275) 7.0                      H 4.8 x 0.8                      T 7.4 6.4                      Solder tag 02.2</p>	<p><b>SINGLE POLE</b></p>  <table border="1"> <thead> <tr> <th>PANEL THICKNESS</th> <th>DIMEN. X</th> <th>DIMEN. Y</th> </tr> </thead> <tbody> <tr> <td>0.75-1.25</td> <td>19.2/19.1</td> <td>13.0/12.9</td> </tr> <tr> <td>1.25-2.0</td> <td>19.4/19.3</td> <td>13.0/12.9</td> </tr> <tr> <td>2.0-3.0</td> <td>19.8/19.7</td> <td>13.0/12.9</td> </tr> </tbody> </table> <p><b>DOUBLE POLE</b></p>  <table border="1"> <thead> <tr> <th>PANEL THICKNESS</th> <th>DIMEN. X</th> <th>DIMEN. Y</th> </tr> </thead> <tbody> <tr> <td>0.75-1.25</td> <td>19.2/19.1</td> <td>21.9/22.0</td> </tr> <tr> <td>1.25-2.0</td> <td>19.4/19.3</td> <td>21.9/22.0</td> </tr> <tr> <td>2.0-3.0</td> <td>19.8/19.7</td> <td>21.9/22.0</td> </tr> </tbody> </table>	PANEL THICKNESS	DIMEN. X	DIMEN. Y	0.75-1.25	19.2/19.1	13.0/12.9	1.25-2.0	19.4/19.3	13.0/12.9	2.0-3.0	19.8/19.7	13.0/12.9	PANEL THICKNESS	DIMEN. X	DIMEN. Y	0.75-1.25	19.2/19.1	21.9/22.0	1.25-2.0	19.4/19.3	21.9/22.0	2.0-3.0	19.8/19.7	21.9/22.0
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<p><b>8500 SERIES</b> <i>Single- and Double-Pole Rocker Switches</i></p> 	<p><b>RATINGS:</b>                      15A 277VAC 65C                      1/4HP 125VAC 1/2HP 250VAC                      10 (6)A 250VAC T125                      150A Inrush BS1415                      75A Inrush EN61058-1                      10A 28VDC</p> <p><b>CIRCUITS:</b></p> <table border="1"> <thead> <tr> <th>8500</th> <th>SPST</th> <th>On</th> <th>Off</th> </tr> </thead> <tbody> <tr> <td>8550</td> <td>DPST</td> <td>On</td> <td>Off</td> </tr> </tbody> </table> <p><b>Two-Color Rocker</b></p> <table border="1"> <thead> <tr> <th>8500X</th> <th>SPST</th> <th>On</th> <th>Off</th> </tr> </thead> <tbody> <tr> <td>8550X</td> <td>DPST</td> <td>On</td> <td>Off</td> </tr> </tbody> </table> <p><b>Lighted Model</b></p> <table border="1"> <thead> <tr> <th>8503</th> <th>SPST</th> <th>On</th> <th>Off</th> </tr> </thead> <tbody> <tr> <td>8553</td> <td>DPST</td> <td>On</td> <td>Off</td> </tr> </tbody> </table>	8500	SPST	On	Off	8550	DPST	On	Off	8500X	SPST	On	Off	8550X	DPST	On	Off	8503	SPST	On	Off	8553	DPST	On	Off	 <p>22.5 (.886)                      5.1 (.200) 9.0 (.354)                      2.0 (.078) 14.0 (.551) 9.0 (.354)                      H 4.8 x 0.8                      T 8.5 6.4                      Solder tag 02.15</p> <p>Short-body version available.</p>	 <table border="1"> <thead> <tr> <th>PANEL THICKNESS</th> <th>DIMEN. X</th> <th>DIMEN. Y</th> </tr> </thead> <tbody> <tr> <td>0.75-1.25</td> <td>19.2/19.1</td> <td>13.0/12.9</td> </tr> <tr> <td>1.25-2.0</td> <td>19.4/19.3</td> <td>13.0/12.9</td> </tr> <tr> <td>2.0-3.0</td> <td>19.8/19.7</td> <td>13.0/12.9</td> </tr> </tbody> </table>	PANEL THICKNESS	DIMEN. X	DIMEN. Y	0.75-1.25	19.2/19.1	13.0/12.9	1.25-2.0	19.4/19.3	13.0/12.9	2.0-3.0	19.8/19.7	13.0/12.9																																				
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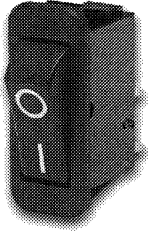
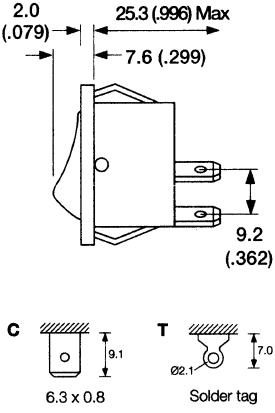
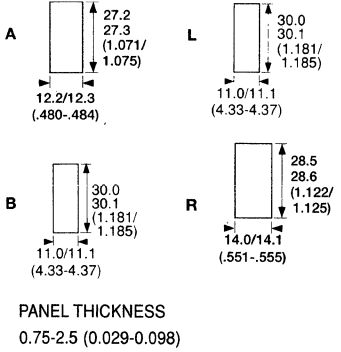
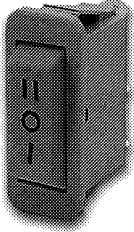
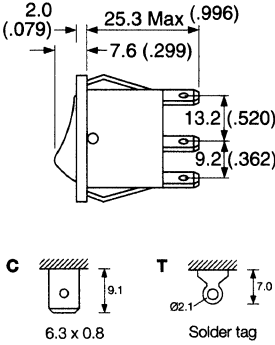
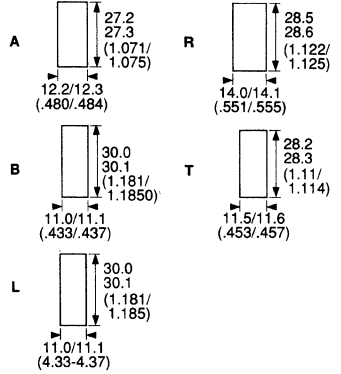
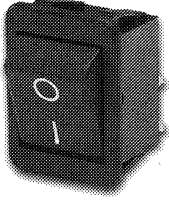
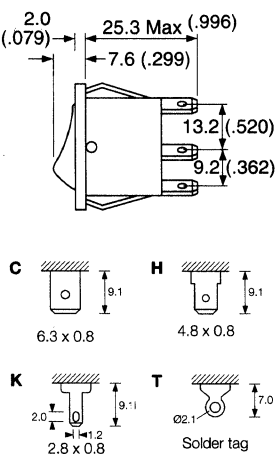
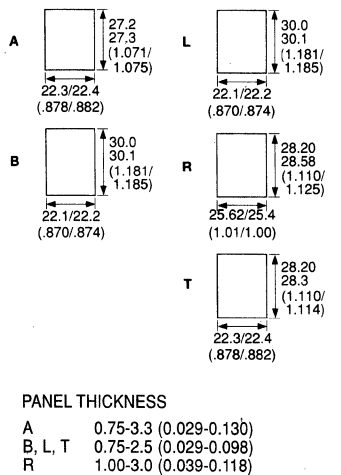


Consult factory for current approval status.

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 E-mail: info@arcoswitch.com • http://www.arcoswitch.com



**ROCKER SWITCHES**

MODEL	OPTIONS/RATINGS	DIMENSIONS	CUTOUT SIZES																																
<p><b>1300 SERIES</b> High Inrush Single-Pole Rocker Switches</p>  <p>Featuring positive break switching to ensure reliable isolation when high inrush currents exist.</p>	<p><b>RATINGS:</b> 20A 125-250VAC 85C 1/2HP 125VAC 1HP 250VAC 20A 125-250VAC 65C 16 (4)A 250VAC T85 16 (6)A 250VAC T125 5E4 150A Inrush-IEC65 20A 28VDC</p> <p><b>CIRCUIT:</b> 1300 SPST On Off</p>	 <p>2.0 (.079) 25.3 (.996) Max 7.6 (.299) 9.2 (.362) 6.3 x 0.8 9.1 7.0 Solder tag</p>	 <p><b>A</b> 27.2 27.3 (1.071/1.075) 12.2/12.3 (.480-.484) <b>L</b> 30.0 30.1 (1.181/1.185) 11.0/11.1 (4.33-4.37) <b>B</b> 30.0 30.1 (1.181/1.185) 11.0/11.1 (4.33-4.37) <b>R</b> 28.5 28.6 (1.122/1.125) 14.0/14.1 (.551-.555)</p> <p>PANEL THICKNESS 0.75-2.5 (0.029-0.098)</p>																																
<p><b>1500 SERIES</b> Single-Pole Rocker Switches</p>  <p>Matte finish is standard. A wide range of circuits, terminals, etc. is available.</p>	<p><b>RATINGS:</b> 16A 125-250VAC 85C 1/2HP 125VAC 1HP 250VAC 2-pos. 1/4HP 125VAC 1/2HP 250VAC 3-pos. 16 (4)A 250VAC T85 20A 28VDC HP ratings n/a 1501, 1502, 1511, 1521, 1522</p> <p><b>CIRCUITS:</b></p> <table border="0"> <tr> <td>1500</td> <td>SPST</td> <td>On</td> <td>Off</td> </tr> <tr> <td>1501</td> <td>SPST</td> <td>(On)</td> <td>Off</td> </tr> <tr> <td>1502</td> <td>SPSP</td> <td>On</td> <td>(Off)</td> </tr> <tr> <td>1510</td> <td>SPDT</td> <td>On</td> <td>On</td> </tr> <tr> <td>1511</td> <td>SPDT</td> <td>(On)</td> <td>On</td> </tr> <tr> <td>1520</td> <td>SPDT</td> <td>On</td> <td>Off</td> </tr> <tr> <td>1521</td> <td>SPDT</td> <td>(On)</td> <td>Off</td> </tr> <tr> <td>1522</td> <td>SPDT</td> <td>(On)</td> <td>Off</td> </tr> </table> <p>( ) = Momentary</p>	1500	SPST	On	Off	1501	SPST	(On)	Off	1502	SPSP	On	(Off)	1510	SPDT	On	On	1511	SPDT	(On)	On	1520	SPDT	On	Off	1521	SPDT	(On)	Off	1522	SPDT	(On)	Off	 <p>2.0 (.079) 25.3 Max (.996) 7.6 (.299) 13.2 (.520) 9.2 (.362) 6.3 x 0.8 9.1 7.0 Solder tag</p>	 <p><b>A</b> 27.2 27.3 (1.071/1.075) 12.2/12.3 (.480/.484) <b>R</b> 28.5 28.6 (1.122/1.125) 14.0/14.1 (.551/.555) <b>B</b> 30.0 30.1 (1.181/1.185) 11.0/11.1 (4.33/4.37) <b>T</b> 28.2 28.3 (1.11/1.114) 11.5/11.6 (4.53/4.57) <b>L</b> 30.0 30.1 (1.181/1.185) 11.0/11.1 (4.33-4.37)</p> <p>PANEL THICKNESS 0.75-2.5 (0.029-0.098)</p>
1500	SPST	On	Off																																
1501	SPST	(On)	Off																																
1502	SPSP	On	(Off)																																
1510	SPDT	On	On																																
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1520	SPDT	On	Off																																
1521	SPDT	(On)	Off																																
1522	SPDT	(On)	Off																																
<p><b>1550 SERIES</b> Double-Pole Rocker Switches</p>  <p>Matte finish is standard. A wide range of circuits, terminals, etc. is available. Splashproof versions and covers also are available.</p>	<p><b>RATINGS:</b> 16A 125-250VAC 85C 1/2HP 125VAC 1HP 250VAC 2-pos. 1/4HP 125VAC 1/2HP 250VAC 3-pos. 16A 125-250VAC 16 (4)A 250VAC T85 20A 28VDC HP ratings n/a 1551, 1552, 1561, 1571, 1572</p> <p><b>CIRCUIT:</b></p> <table border="0"> <tr> <td>1550</td> <td>DPST</td> <td>On</td> <td>Off</td> </tr> <tr> <td>1551</td> <td>DPST</td> <td>(On)</td> <td>Off</td> </tr> <tr> <td>1552</td> <td>DPST</td> <td>On</td> <td>(Off)</td> </tr> <tr> <td>1560</td> <td>DPDT</td> <td>On</td> <td>On</td> </tr> <tr> <td>1561</td> <td>DPDT</td> <td>(On)</td> <td>On</td> </tr> <tr> <td>1570</td> <td>DPDT</td> <td>On</td> <td>Off</td> </tr> <tr> <td>1571</td> <td>DPDT</td> <td>(On)</td> <td>Off</td> </tr> <tr> <td>1572</td> <td>DPDT</td> <td>(On)</td> <td>Off</td> </tr> </table> <p>( ) = Momentary</p>	1550	DPST	On	Off	1551	DPST	(On)	Off	1552	DPST	On	(Off)	1560	DPDT	On	On	1561	DPDT	(On)	On	1570	DPDT	On	Off	1571	DPDT	(On)	Off	1572	DPDT	(On)	Off	 <p>2.0 (.079) 25.3 Max (.996) 7.6 (.299) 13.2 (.520) 9.2 (.362) 6.3 x 0.8 9.1 4.8 x 0.8 9.1 7.0 Solder tag</p>	 <p><b>A</b> 27.2 27.3 (1.071/1.075) 22.3/22.4 (.878/.882) <b>L</b> 30.0 30.1 (1.181/1.185) 22.1/22.2 (.870/.874) <b>B</b> 30.0 30.1 (1.181/1.185) 22.1/22.2 (.870/.874) <b>R</b> 28.20 28.58 (1.110/1.125) 25.62/25.4 (1.01/1.00) <b>T</b> 28.20 28.3 (1.110/1.114) 22.3/22.4 (.878/.882)</p> <p>PANEL THICKNESS A 0.75-3.3 (0.029-0.130) B, L, T 0.75-2.5 (0.029-0.098) R 1.00-3.0 (0.039-0.118)</p>
1550	DPST	On	Off																																
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1552	DPST	On	(Off)																																
1560	DPDT	On	On																																
1561	DPDT	(On)	On																																
1570	DPDT	On	Off																																
1571	DPDT	(On)	Off																																
1572	DPDT	(On)	Off																																



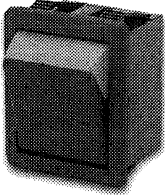
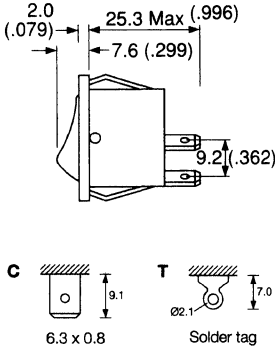
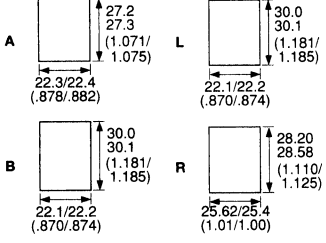

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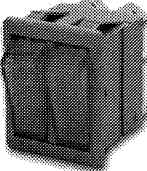
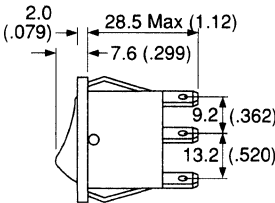
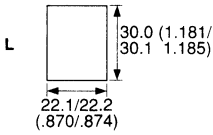
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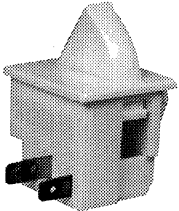
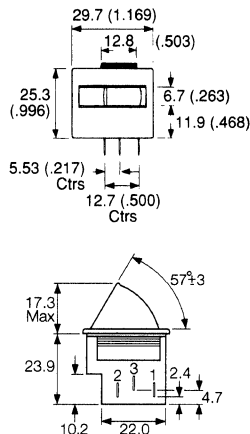
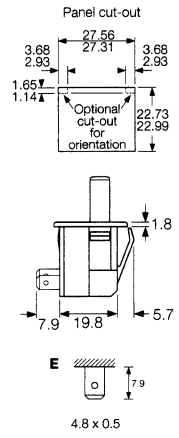
**ROCKER SWITCHES**

MODEL	OPTIONS/RATINGS	DIMENSIONS	CUTOUT SIZES
<p><b>1350 SERIES</b> High-Inrush Double-Pole Rocker Switches</p>  <p>Matte finish is standard. An extensive range of terminals, cutout sizes and actuator styles is available.</p>	<p>RATINGS: 20A 125-250VAC 85C 1/2HP 125VAC 1HP 250VAC 20A 125-250VAC 16 (4)A 250VAC T85 16 (6)A 250VAC T125 5E4 150A Inrush IEC65 20A 28VDC</p> <p>CIRCUIT: 1350 DPST On Off</p>	 <p>2.0 (.079) 25.3 Max (.996) 7.6 (.299) 9.2 (.362) 9.1 7.0 6.3 x 0.8 Solder tag</p>	 <p>A 27.2 27.3 (1.071/1.075) 22.3/22.4 (.878/.882) L 30.0 30.1 (1.181/1.185) 22.1/22.2 (.870/.874) B 30.0 30.1 (1.181/1.185) 22.1/22.2 (.870/.874) R 28.20 28.58 (1.110/1.125) 25.62/25.4 (1.01/1.00)</p> <p>PANEL THICKNESS Cutout size Panel thickness A 0.75-3.3 (0.029-0.130) B,L 0.75-2.5 (0.029-0.098) R 1.00-3.0 (0.039-0.118)</p>

<p><b>5500 SERIES</b> Twin Lighted or Non-Lighted Single-Pole Rocker Switches</p>  <p>Two independent, single-pole switches in one body.</p>	<p>RATINGS: 15A 125-250VAC 85C 1/2HP 125VAC 1HP 250VAC 16A 125-250VAC 16 (4)A 250VAC 20A 28VDC</p> <p>CIRCUITS: 55005503 Side 1 On Side 2 Off 55035503 Side 1 On Lighted Side 2 Off Lighted</p>	 <p>2.0 (.079) 28.5 Max (1.12) 7.6 (.299) 9.2 (.362) 13.2 (.520)</p>	 <p>L 30.0 (1.181/30.1 1.185) 22.1/22.2 (.870/.874)</p> <p>PANEL THICKNESS 0.75-3.3 (0.029-0.130)</p>
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**DOOR SWITCHES**

<p><b>3100 SERIES</b> Momentary Door Switches</p> 	<p>RATINGS: 5A 125-250VAC 80W 250VAC in-house test to 500K OPS</p> <p>CIRCUITS: 3101 SPST Normally open 3102 SPST Normally closed 3111 SPDT N/O N/C</p>	 <p>29.7 (1.169) 12.8 (.503) 25.3 (.996) 6.7 (.263) 11.9 (.468) 5.53 (.217) Ctrs 12.7 (.500) Ctrs 17.3 Max 23.9 10.2 22.0 57±3 2.4 4.7</p>	 <p>Panel cut-out 27.56 27.31 3.68 2.93 3.68 2.93 1.65 1.14 22.73 22.99 1.8 7.9 19.8 5.7 7.9 4.8 x 0.5</p> <p>PANEL THICKNESS 1.00-2.5 (0.039-0.098)</p>
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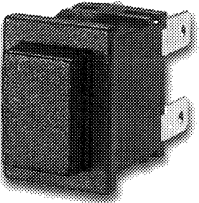
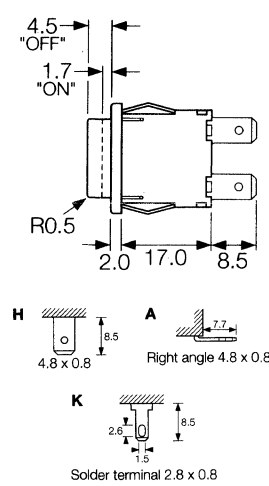
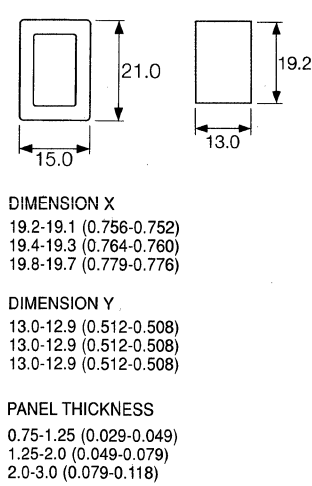
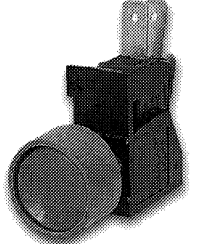
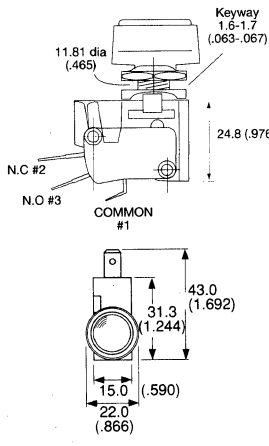
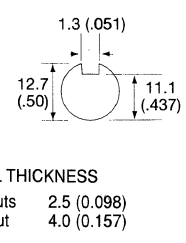
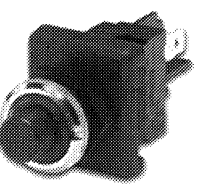
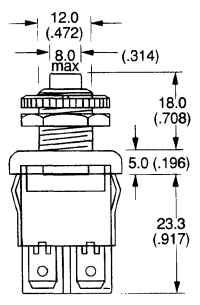
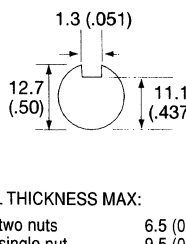


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**PUSHBUTTON SWITCHES**

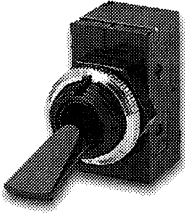
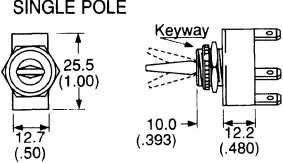
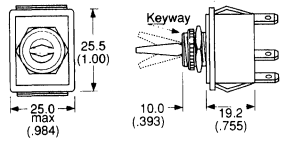
MODEL	OPTIONS/RATINGS	DIMENSIONS	CUTOUT SIZES																																
<p><b>8300 SERIES</b>                      Lighted and Non-Lighted Pushbutton Switches</p>  <p>Custom buttons made to order.</p>	<p>RATINGS:                      13A 250VAC SP 12A 250VAC DP                      1/2HP 250VAC                      1/4HP 125VAC                      6 (6)A 250VAC T125 50K OPS                      8 (8)A 250VAC T105 50K OPS</p> <p>CIRCUIT:</p> <table border="0"> <tr> <td>8300</td> <td>SPST</td> <td>On</td> <td>Off</td> </tr> <tr> <td>8301</td> <td>SPST</td> <td>(On)</td> <td>Off</td> </tr> <tr> <td>8303</td> <td>SPST</td> <td>On</td> <td>Off*</td> </tr> <tr> <td>8304</td> <td>SPST</td> <td>(On)</td> <td>Off*</td> </tr> <tr> <td>8350</td> <td>DPST</td> <td>On</td> <td>Off</td> </tr> <tr> <td>8351</td> <td>DPST</td> <td>(On)</td> <td>Off</td> </tr> <tr> <td>8353</td> <td>DPST</td> <td>On</td> <td>Off*</td> </tr> <tr> <td>8354</td> <td>DPST</td> <td>(On)</td> <td>Off*</td> </tr> </table> <p>( ) = Momentary</p> <p>*Lighted versions</p>	8300	SPST	On	Off	8301	SPST	(On)	Off	8303	SPST	On	Off*	8304	SPST	(On)	Off*	8350	DPST	On	Off	8351	DPST	(On)	Off	8353	DPST	On	Off*	8354	DPST	(On)	Off*	 <p>4.5" "OFF" 1.7" "ON" R0.5 2.0 17.0 8.5 H 4.8 x 0.8 A Right angle 4.8 x 0.8 K Solder terminal 2.8 x 0.8</p>	 <p>21.0 15.0 19.2 13.0</p> <p>DIMENSION X                      19.2-19.1 (0.756-0.752)                      19.4-19.3 (0.764-0.760)                      19.8-19.7 (0.779-0.776)</p> <p>DIMENSION Y                      13.0-12.9 (0.512-0.508)                      13.0-12.9 (0.512-0.508)</p> <p>PANEL THICKNESS                      0.75-1.25 (0.029-0.049)                      1.25-2.0 (0.049-0.079)                      2.0-3.0 (0.079-0.118)</p>
8300	SPST	On	Off																																
8301	SPST	(On)	Off																																
8303	SPST	On	Off*																																
8304	SPST	(On)	Off*																																
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8353	DPST	On	Off*																																
8354	DPST	(On)	Off*																																
<p><b>380 SERIES</b>                      Momentary Pushbutton Snap-Action Switches</p>  <p>Additional actuator styles available.</p>	<p>RATINGS:                      15A 125-250VAC 65C                      1/2HP 125-250VAC                      15A (2) 250VAC T125</p> <p>OPERATING FORCE: 10 oz. (280 g.)</p> <p>CIRCUIT:                      2510 SPDT                      Momentary                      Normally open                      Normally closed</p>	 <p>Keyway 1.6-1.7 (.063-.067)                      11.81 dia (.465)                      24.8 (.976)                      N.C #2                      N.O #3                      COMMON #1                      43.0 (1.692)                      31.3 (1.244)                      15.0 (.590)                      22.0 (.866)</p>	 <p>1.3 (.051)                      12.7 (.50)                      11.1 (.437)</p> <p>PANEL THICKNESS                      Two nuts 2.5 (0.098)                      One nut 4.0 (0.157)</p>																																
<p><b>8500PO SERIES</b>                      Alternate Action Pushbutton Switches</p> 	<p>RATINGS:                      15A 125-250VAC 65C                      1/4HP 125VAC 1/2HP 250VAC                      10 (6)A 250VAC T100                      10A 28VDC</p> <p>CIRCUIT:                      8500 SPST On Off</p>	 <p>12.0 (.472)                      8.0 max (.314)                      18.0 (.708)                      5.0 (.196)                      23.3 (.917)</p>	 <p>1.3 (.051)                      12.7 (.50)                      11.1 (.437)</p> <p>PANEL THICKNESS MAX:                      Using two nuts 6.5 (0.260)                      Using single nut 9.5 (0.370)</p>																																




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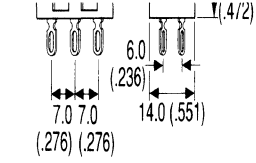
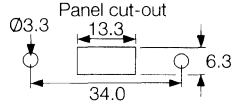

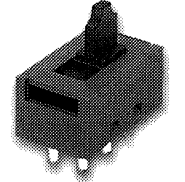
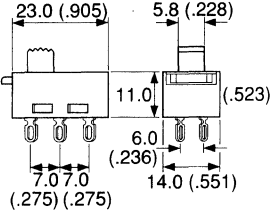

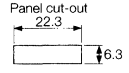

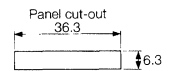


**TOGGLE SWITCHES**

MODEL	OPTIONS/RATINGS	DIMENSIONS	CUTOUT SIZES
<p><b>1700 SERIES</b> Toggle Switches</p> 	<p>RATINGS:                      20A 125-250VAC 85C single pole                      16A 125-250VAC double pole                      1/4HP 125VAC 1/2HP 250VAC 3 pos.                      1/2HP 125VAC 1HP 250VAC 2 pos.                      16 (4) 250VAC                      20A 28VDC</p> <p>CIRCUITS:                      1700 SPST On Off                      1710 SPST On On                      1720 SPST On Off Off                      1721 SPDT (On) Off On                      1722 SPDT (On) Off (On)                      1750 DPST On Off                      1760 DPDT On On                      1770 DPDT On Off On</p> <p>( ) = Momentary</p>	<p>SINGLE POLE</p>  <p>DOUBLE POLE</p> 	<p>1.3 (.051)                      12.7 (.500) 11.1 (.437)</p> <p>PANEL THICKNESS MAX:                      Using two nuts 3.5 (0.137)                      Using single nut 6.5 (0.255)</p>

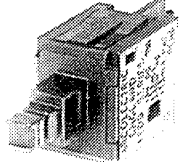
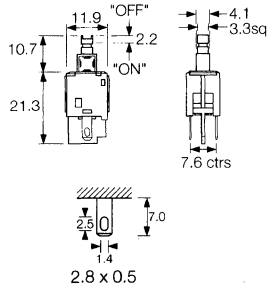
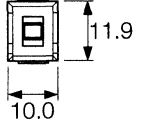


**SLIDE SWITCHES**

<p><b>2000 SERIES</b> Snap-In and Two-Hole Mounting; Single- and Double-Pole; 2 or 3 positions.</p> 	<p>RATINGS:                      SINGLE POLE                      16A 125-250VAC 65C                      10 (1)A 250VAC T85                      DOUBLE POLE                      12A 125-250VAC 65C                      10 (1)A 250VAC T85</p> <p>SNAP-IN VERSION (MODELS E, F):</p> 		<p>2 POS</p>  <p>3 POS</p> 
<p><b>2000 SERIES</b> Custom-Mounting; Single- and Double-Pole; up to 5 positions.</p> 	<p>RATINGS:                      SINGLE POLE                      16A 125-250VAC 65C                      6 (1)A 250VAC T85                      10 (1)A 250VAC T85                      DOUBLE POLE                      12A 125-250VAC 65C                      6 (1)A 250VAC T85                      10 (1)A 250VAC T85</p>		<p>2 POS</p>  <p>3 POS</p>  <p>4 POS</p>  <p>5 POS</p> 



**PUSHBUTTON SWITCHES**

<p><b>1100 SERIES</b></p> 	<p>RATINGS:                      SINGLE POLE                      0.125A 125-250VAC                      0.125A 45VDC</p> <p>CIRCUIT:                      1100 SPST On Off                      1100 SPST (On) Off</p> <p>( ) = Momentary</p>		
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Consult factory for current approval status.

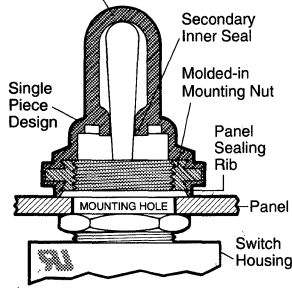
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# HEXSEAL® SEALING BOOTS PREVENT SWITCH & CIRCUIT BREAKER FAILURE!

## Three Performance Levels to Choose From:

UL-Recognized  
HEXSEAL® &  
E-SEEL® Silicone  
Rubber Boot



### HEXSEALS®

Industrial Grade, Military-Qualified  
• High tear strength silicone rubber, per ZZ-R-765  
• Single-piece design  
• -94°F to +400°F temp. range  
• QPL-listed versions available

### E-SEELS®

Commercial Grade  
• High tear strength silicone rubber  
• Single-piece design  
• -80°F to +400°F temp. range

### SNAP-SEELS®

Commercial Grade  
• Neoprene rubber  
• Two-piece design  
• -65°F to +300°F temp. range

## Protects Against:

- Washdowns • Salt water
- Oil and grease • Dust and dirt
- Corrosion • Fungus • Cleaning solvents
- Acids • Ozone • Other harmful environmental contaminants



Built-in Trigger\*

UL-Recognized HEXSEAL® & E-SEEL® Transparent Silicone Rubber Boot



## Toggle Boots



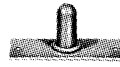
### COMPLETELY COVERS TOGGLE

Thread sizes from 1/4-40NS-2B  
5/8-32 UNS-2B  
Armor and RF1/EMI Shielding Boots version also available



### TOGGLE OF SWITCH PROTRUDES

Thread sizes from 1/4-40 NS-2B to 15/32-32 NS-2B



### BACK OF PANEL MOUNTED BOOTS- COMPLETELY COVERS TOGGLE (FLUSH MOUNTED)

Toggle of switch products version also available

## Push button Boots



### COMPLETELY COVERS PLUNGER

Thread sizes from 8-40 NS-2B to 5/8-24 NEF-2B



### ARMORED SEAL FOR PUSH BUTTON SWITCHES

Thread sizes 15/32-32 NS-2B



### BUTTON OF SWITCH PROTRUDES

Thread sizes from 7/16-32 UN-2B to 1/2-32 NS-2B  
Used primarily for push-pull circuit breakers

## Rotary Shaft Boots



### NON-LOCKING

Thread sizes from 1/4-28NF-2B to 5/8-24NEF-2B



### LOCKING

Thread sizes from 1/4-32NS-2 to 3/8-32NS-2



### RFI/EMI SHIELDING

Thread sizes from 1/4-32NEF-2B to 1/2-32NS-2B

## SnapSeal™ Commercial Switch Boots

Black neoprene boot. Operating temp.: -65°F to +300°F. Available in push-button, toggle, and rotary models



### PUSH BUTTON BOOTS



### TOGGLE SWITCH BOOTS



### ROTARY SHAFT SEALS

## Rocker Boots



### ROCKER SWITCH SINGLE POLE

Height .359" (9.13mm)



### ROCKER SWITCH (LIGHTED) DOUBLE POLE

Height .297" (7.54mm)



### ROCKER SWITCH (LIGHTED) SINGLE POLE

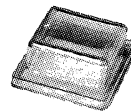
Height .297" (7.54mm)

## Indicator & Lighted Switch Boots (transparent)



### INDICATOR SEAL

Height .359" (9.13mm)  
A gasket rib on the underside of this product makes a complete seal against the panel



### LIGHTED PUSH-BUTTON SEAL

Customized clear silicone rubber covers that provide dust-tight, splash-proof protection for LPB switches and visual displays.

## Circuit Breaker Boots (transparent)

Fits most circuit breakers such as Heinemann Elec., Texas Inst., Wood Elec., AIRPAX, & Carlingswitch



### SINGLE SWITCH HANDLE

Height sizes from 7/8" to 1-1/2"



### DOUBLE SWITCH HANDLE

Height sizes from 7/8" to 1"



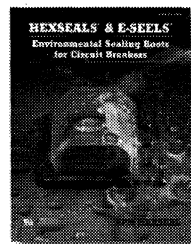
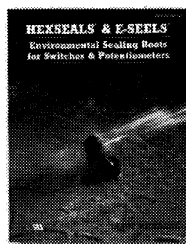
### TRIPLE SWITCH HANDLE

Height sizes from 7/8" to 1"

Switch specifiers: Ask for Catalog HEX-100

# APM HEXSEAL

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Tel: (888) 326-9479 • Fax: (201) 569-4106  
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Circuit Breaker specifiers: Ask for Catalog CB-100

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**EVERSWITCH**<sup>®</sup>  
 Family of Patented Piezo Switches & Keypads

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Supported with an unprecedented  
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**GUARANTEE\***

**SML Family (with LED)**

Elevator Buttons, Vending, Intercoms



Prison Equipment, Phone Systems, Food Processing, Medical Equipment

**SMA, SMF, SMH Family**

RATED VOLTAGE: 0-230V ac/dc  
 RATED CURRENT: 0-2 amps  
 TEMPERATURE (OPER): -40C to +85C  
 {available to +125C}  
 TEMPERATURE (STORE): -40C to +125C  
 ACTIVATION FORCE: 3-5N (adjustable)  
 ACTIVATION TIME: One-shot @ 120mSec  
 RESISTANCE "ON": <10 Ohms  
 RESISTANCE "OFF": >5 Mega Ohms  
 MIL STDS: 810C; 202E; 461B; 462  
 TOTALLY SEALED: To IP68  
 HOUSING MATERIAL: Aluminum, STS, Plastic  
 MOUNTING STYLES: Various  
 COLORS: Various  
 CYCLES: >50,000,000+  
 AVAILABLE: Standard & custom designs

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# DIP Switches

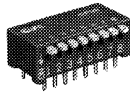
## TD SERIES SEALED .050" PITCH DIP SWITCHES



Tape sealed, surface mountable, SPST DIP switches are .098" high. Can withstand vapor phase and IR soldering to 260°C. **Rating:** 0.4 VA at 20 V DC.

C&K Part No.	No. Positions	Body Length
TD04HOSKI	4	.250
TD06HOSKI	6	.350
TD08HOSKI	8	.450
TD10HOSKI	10	.550

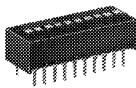
## BP SERIES SIDE ACTUATED DIP SWITCHES



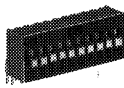
SPST DIPS are .315" high. **Rating:** Carry—100 mA max. at 50 V DC; Switch—100 mA max. at 5 V DC or 25 mA max. at 25 V DC. **Contacts:** Gold over nickel over phosphor bronze. **Tape Seal:** Metalized polyester.

C&K Part No.	No. Positions	Overall Length (In.)
BP01KT	1	.217
BP02KT	2	.315
BP03KT	3	.413
BP04KT	4	.512
BP05KT	5	.610
BP06KT	6	.709
BP07KT	7	.807
BP08KT	8	.906
BP10KT	10	1.102
BP12KT	12	1.299

## BD SERIES SIDE ACTUATED DIP SWITCHES



A



B

SPST BDXX is .30" high, SPST BDAV is .38" high. **Rating:** Carry—100 mA max. at 50 V DC. Switch—100 mA max. at 5 V DC or 25 mA max. at 25 V DC. Washable design. Wiping contacts. Tin-lead terminals.

C&K Part No.	No. Positions	Overall Length (In.)	Fig.
BD01	1	.180	A
BD02	2	.280	A
BD03	3	.380	A
BD04	4	.480	A
BD05	5	.580	A
BD06	6	.680	A
BD07	7	.780	A
BD08	8	.880	A
BD09	9	.980	A
BD10	10	1.080	A
BD12	12	1.280	A
BD02AV	2	.280	B
BD04AV	4	.480	B
BD06AV	6	.680	B
BD08AV	8	.880	B
BD10AV	10	1.080	B
BD02AV2	2	.280	B
BD04AV2	4	.480	B
BD06AV2	6	.680	B
BD08AV2	8	.880	B
BD10AV2	10	1.080	B

## CD SERIES DIP CODED ROTARY SWITCHES



C



D



E

8mm square x 4 mm high. Sealed for wave soldering, surface mounting and cleaning process. **Rating:** 0.4 VA max. @ 20 V AC or DC max. **Life Expectancy:** 10 & 16 pos.: 20,000 position changes. 8 pos.: 8000 changes. Case, cover and actuator are high temperature UL 94V-0 material. MO: flush actuator, L1: extended shaft actuator. To order knob actuator, replace "L1" with "K1".

C&K Part No.	No. Positions	Circuit	Fig.
CD08RM0AK	8	BCD	C
CD08RM0CK	8	BCD	E
CD08CM0AK	8	BCD complement	C
CD08CM0CK	8	BCD complement	E
CD08RL1AK	8	BCD	C
CD08RL1CK	8	BCD	E
CD08CL1AK	8	BCD complement	C
CD08CL1CK	8	BCD complement	E
CD08RM0SK	8	BCD	D
CD08CM0SK	8	BCD complement	D
CD10RM0AK	10	BCD	C
CD10RM0CK	10	BCD	E
CD10CM0AK	10	BCD complement	C
CD10CM0CK	10	BCD complement	E
CD10RL1AK	10	BCD	C
CD10RL1CK	10	BCD	E
CD10CL1AK	10	BCD complement	C
CD10CL1CK	10	BCD complement	E
CD16RM0AK	16	Hexadecimal	C
CD16RM0CK	16	Hexadecimal	E
CD16CM0AK	16	Hexadecimal complement	C
CD16CM0CK	16	Hexadecimal complement	E
CD16RL1AK	16	Hexadecimal	C
CD16RL1CK	16	Hexadecimal	E
CD16CL1AK	16	Hexadecimal complement	C
CD16CL1CK	16	Hexadecimal complement	E
CD10RM0SK	10	BCD	D
CD10CM0SK	10	BCD complement	D
CD16RM0SK	16	Hexadecimal	D
CD16CM0SK	16	Hexadecimal complement	D

## SD SERIES SEALED DIP SWITCHES



F

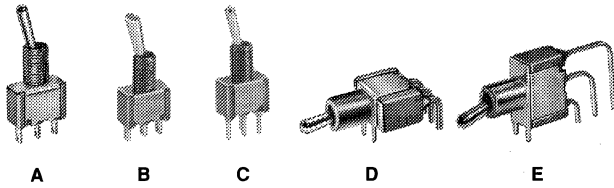


G

Tape sealed, low profile SPST DIP switches withstand soldering and cleaning processes. "SK" models are surface mount. H0: flush actuator. To order extended actuator, replace "H0" with "H1". **Rating:** 100 mA max. @ 20 V DC for 2000 cycles. Terminals are tin-lead.

C&K Part No.	No. Positions	Overall Length (In.)	Fig.
SD02H0SK	2	.258	F
SD03H0SK	3	.358	F
SD04H0SK	4	.458	F
SD05H0SK	5	.558	F
SD06H0SK	6	.658	F
SD07H0SK	7	.758	F
SD08H0SK	8	.858	F
SD09H0SK	9	.958	F
SD10H0SK	10	1.058	F
SD12H0SK	12	1.258	F
SD02H0K	2	.258	G
SD03H0K	3	.358	G
SD04H0K	4	.458	G
SD05H0K	5	.558	G
SD06H0K	6	.658	G
SD07H0K	7	.758	G
SD08H0K	8	.858	G
SD09H0K	9	.958	G
SD10H0K	10	1.058	G
SD12H0K	12	1.258	G

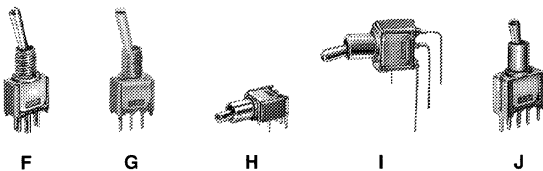
**7000 SERIES TOGGLE SWITCHES**



**Q Model Rating:** 5 Amps at 120 V AC or 28 V DC; 2 Amps at 250 V AC. B models: 0.4 VA max. at 20 V AC or DC max. Epoxy seal. **Mounting Hole:** All except Fig. D: .250" (6,35) dia.; Fig D: .469" (11,91) dia. Terminal spacing .185" (4,70) typ. 3 & 4 pole models available.

C&K Part No.	No. Poles	Switch Function Open-Closed	Fig.
7101SYZQE	SPDT	On-None-On	A
7103SYZQE	SPDT	On-Off-On	A
7105SYZQE	SPDT	Mom-Off-Mom	A
7107SYZQE	SPDT	On-Off-Mom	A
7201SYZQE	DPDT	On-None-On	A
7203SYZQE	DPDT	On-Off-On	A
7205SYZQE	DPDT	Mom-Off-Mom	A
7207SYZQE	DPDT	On-Off-Mom	A
7211SYZQE	DPDT	On-On-On	A
7213SYZQE	DPDT	On-On-Mom	A
7215SYZQE	DPDT	Mom-On-Mom	A
7101P3YZQE	SPDT	On-None-On	B
7103P3YZQE	SPDT	On-Off-On	B
7105P3YZQE	SPDT	Mom-Off-Mom	B
7107P3YZQE	SPDT	On-Off-Mom	B
7201P3YZQE	DPDT	On-None-On	B
7203P3YZQE	DPDT	On-Off-On	B
7101SYCQE	SPDT	On-None-On	C
7103SYCQE	SPDT	On-Off-On	C
7105SYCQE	SPDT	Mom-Off-Mom	C
7107SYCQE	SPDT	On-Off-Mom	C
7201SYCQE	DPDT	On-None-On	C
7203SYCQE	DPDT	On-Off-On	C
7205SYCQE	DPDT	Mom-Off-Mom	C
7101MD9ABE	SPDT	On-None-On	D
7103MD9ABE	SPDT	On-Off-On	D
7105MD9ABE	SPDT	Mom-Off-Mom	D
7107MD9ABE	SPDT	On-Off-Mom	D
7201MD9ABE	DPDT	On-None-On	D
7203MD9ABE	DPDT	On-Off-On	D
7101MD9AV2BE	SPDT	On-None-On	E
7103MD9AV2BE	SPDT	On-Off-On	E
7107MD9AV2BE	SPDT	On-Off-On	E
7201MD9AV2BE	DPDT	On-None-On	E
7205MD9AV2BE	DPDT	Mom-Off-Mom	E

**T SERIES TINY TOGGLE SWITCHES**



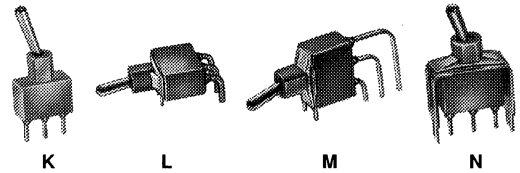
**Figs. F & G Rating:** 3 Amps at 120 V AC or 28 V DC—models with ON-NONE-ON function; all others 2 Amps at 120 V AC or 28 V DC (UL). **Mounting Hole:** .195" (4,95) dia. **Figs. H, I & J Rating:** 0.4 VA max. at 20 V AC or DC max. Epoxy seal. Spacing 0.1". **Toggle:** Brass, chrome plated. **Case:** UL 94V-0.

C&K Part No.	No. Poles	Switch Function	Fig.
T101SHZQE	SPDT	On-None-On	F
T103SHZQE	SPDT	On-Off-On	F
T105SHZQE	SPDT	Mom-Off-Mom	F
T107SHZQE	SPDT	On-Off-Mom	F
T108SHZQE	SPDT	On-None-Mom	F
T201SHZQE	DPDT	On-None-On	F
T203SHZQE	DPDT	On-Off-On	F
T101SHCQE	SPDT	On-None-On	G
T103SHCQE	SPDT	On-Off-On	G
T105SHCQE	SPDT	Mom-Off-Mom	G
T201SHCQE	DPDT	On-None-On	G
T203SHCQE	DPDT	On-Off-On	G
T101MH9ABE	SPDT	On-None-On	H
T103MH9ABE	SPDT	On-Off-On	H
T105MH9ABE	SPDT	Mom-Off-Mom	H
T107MH9ABE	SPDT	On-Off-Mom	H
T108MH9ABE	SPDT	On-None-Mom	H

**T SERIES TINY TOGGLE SWITCHES**

C&K Part No.	No. Poles	Switch Function	Fig.
T201MH9ABE	DPDT	On-None-On	H
T203MH9ABE	DPDT	On-Off-On	H
T205MH9ABE	DPDT	Mom-Off-Mom	H
T101MH9AVBE	SPDT	On-None-On	I
T103MH9AVBE	SPDT	On-Off-On	I
T105MH9AVBE	SPDT	Mom-Off-Mom	I
T107MH9AVBE	SPDT	On-Off-Mom	I
T108MH9AVBE	SPDT	On-None-Mom	I
T201MH9AVBE	DPDT	On-None-Off	I
T101MH9V3BE	SPDT	On-None-On	J
T103MH9V3BE	SPDT	On-Off-On	J
T201MH9V3BE	DPDT	On-None-Off	J

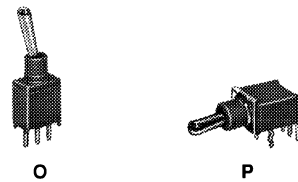
**E SERIES PC-MOUNTED SEALED TOGGLE SWITCHES**



**Toggle:** Brass, chrome plated with internal o-ring seal. **Case & Bushing:** UL 94V-0. **Rating:** 0.4 VA max. at 20 V AC or DC max. **Contacts & Terminals:** Copper alloy with gold plate over nickel plate, epoxy seal, spacing: .185 (4,70) typ. **Switch Support:** Brass or steel, tin plated.

C&K Part No.	No. Poles	Switch Function	Fig.
E101SD1CBE	SPDT	On-None-On	K
E103SD1CBE	SPDT	On-Off-On	K
E105SD1CBE	SPDT	Mom-Off-Mom	K
E107SD1CBE	SPDT	On-Off-Mom	K
E201SD1CBE	DPDT	On-None-On	K
E203SD1CBE	DPDT	On-Off-On	K
E205SD1CBE	DPDT	Mom-Off-Mom	K
E201SD1CBE	DPDT	On-On-On	K
E201SD1CBE	DPDT	Mom-On-Mom	K
E101MD1ABE	SPDT	On-None-On	L
E103MD1ABE	SPDT	On-Off-On	L
E105MD1ABE	SPDT	Mom-Off-Mom	L
E107MD1ABE	SPDT	On-Off-Mom	L
E201MD1ABE	DPDT	On-None-On	L
E101MD1AV2BE	SPDT	On-None-On	M
E103MD1AV2BE	SPDT	On-Off-Mom	M
E105MD1AV2BE	SPDT	On-None-On	M
E107MD1AV2BE	SPDT	On-Off-On	M
E201MD1AV2BE	DPDT	Mom-Off-Mom	M
E211MD1AV2BE	DPDT	On-On-On	M
E101MD1V3BE	SPDT	On-None-On	N
E201MD1V3BE	DPDT	On-None-On	N

**ET SERIES SEALED TINY TOGGLE SWITCHES**

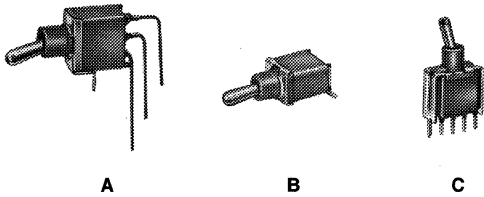


**Rating:** 0.4 VA max. at 20 V AC or DC max. Epoxy seal, spacing 0.1" (2,54) typ. **Toggle:** Brass, chrome plated with internal o-ring seal.

C&K Part No.	No. Poles	Switch Function	Fig.
ET01SD1CBE	SPDT	On-None-On	O
ET02SD1CBE	SPST	Off-None-On	O
ET03SD1CBE	SPDT	On-Off-On	O
ET05SD1CBE	SPDT	Mom-Off-Mom	O
ET07SD1CBE	SPDT	On-Off-Mom	O
ET08SD1CBE	SPDT	On-None-Mom	O
ET21SD1CBE	DPDT	On-None-On	O
ET01MD1ABE	SPDT	On-None-On	P
ET03MD1ABE	SPDT	On-Off-On	P
ET05MD1ABE	SPDT	Mom-Off-Mom	P
ET07MD1ABE	SPDT	On-Off-Mom	P
ET08MD1ABE	SPDT	On-None-Mom	P
ET21MD1ABE	DPDT	On-None-On	P

# Toggle & Pushbutton Switches

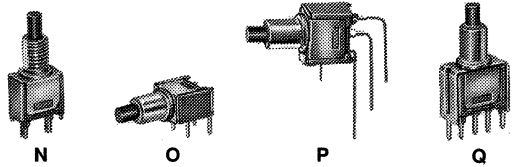
## ET SERIES SEALED TINY TOGGLE SWITCHES



**Rating:** 0.4 VA max. at 20 V AC or DC max. Epoxy seal, Spacing: .100" (2,54) typ.  
**Toggle:** Brass, chrome plated with internal o-ring seal. Mom = momentary.

C&K Part No.	No. Poles	Switch Function	Fig.
ET01MD1AVBE	SPDT	On-None-On	A
ET02MD1AVBE	SPST	Off-None-On	A
ET03MD1AVBE	SPDT	On-Off-On	A
ET01MD1SAKE	SPDT	On-None-On	B
ET03MD1SAKE	SPDT	On-Off-On	B
ET05MD1SAKE	SPDT	Mom-Off-Mom	B
ET07MD1SAKE	SPDT	On-Off-Mom	B
ET01MD1V3BE	SPDT	On-None-On	C
ET03MD1V3BE	SPDT	On-Off-On	C
ET05MD1V3BE	SPDT	Mom-Off-Mom	C

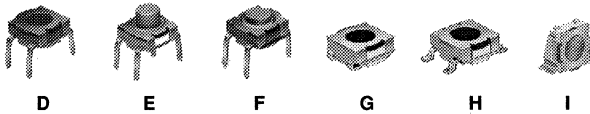
## TP SERIES TINY PUSHBUTTON SWITCHES



**Fig. N Rating:** 1 Amp at 120 V AC or 28 V DC. **Figs. O, P & Q Rating:** 0.4 VA max. at 20 V AC or DC max. **Hardware:** Nut, locking ring, lockwasher. **Mounting Hole:** .195" (4,95) dia. Mom = momentary.

C&K Part No.	No. Poles	Switch Function	Fig.
TP11SHZQE	SPST	Off-Mom	N
TP12SHZQE	SPDT	On-Mom	N
TP21SHZQE	DPST	Off-Mom	N
TP11SH9ABE	SPST	Off-Mom	O
TP12SH9ABE	SPDT	On-Mom	O
TP21SH9ABE	DPST	Off-Mom	O
TP11SH9AVBE	SPST	Off-Mom	P
TP12SH9AVBE	SPDT	On-Mom	P
TP21SH9AVBE	DPST	Off-Mom	P
TP11SH9V3BE	SPST	Off-Mom	Q
TP12SH9V3BE	SPDT	On-Mom	Q

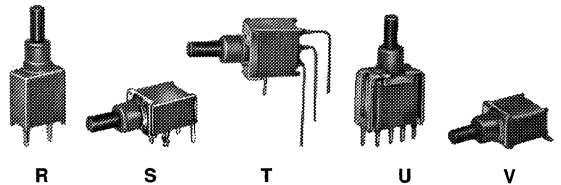
## KT SERIES SEALED MINIATURE TACT SWITCHES



**Housing:** .245" (6,22) x .251" (6,38). **Rating:** 1.0 VA max. at 50 V AC or DC max.  
Models with J, S, or SA options are surface mount.

C&K Part No.	No. Poles	Switch Function	Actuator Height	Fig.
KT11B0CM	SPST	Off-Mom	Flush	D
KT11P2CM	SPST	Off-Mom	.093 (2,36)	E
KT11P3CM	SPST	Off-Mom	.044 (1,12)	F
KT11B0JM	SPST	Off-Mom	Flush	G
KT11P2JM	SPST	Off-Mom	.093 (2,36)	G
KT11P3JM	SPST	Off-Mom	.044 (1,12)	G
KT11B0SM	SPST	Off-Mom	Flush	H
KT11P2SM	SPST	Off-Mom	.093 (2,36)	H
KT11P3SM	SPST	Off-Mom	.044 (1,12)	H
KT11B0SAM	SPST	Off-Mom	Flush	I

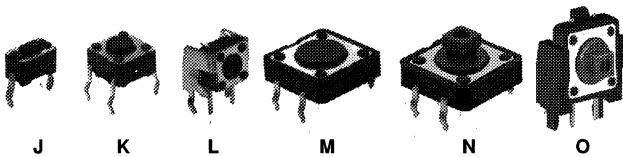
## EP SERIES SEALED TINY PUSHBUTTON SWITCHES



**Rating:** 0.4 VA max. at 20 V AC or DC max. Epoxy seal, spacing: .100" (2,54) typ.

C&K Part No.	No. Poles	Switch Function	Fig.
EP11SD1CBE	SPST	Off-Mom	R
EP12SD1CBE	SPDT	On-Mom	R
EP11SD1ABE	SPST	Off-Mom	S
EP12SD1ABE	SPDT	On-Mom	S
EP11SD1AVBE	SPST	Off-Mom	T
EP12SD1AVBE	SPDT	On-Mom	T
EP11SD1V3BE	SPST	Off-Mom	U
EP12SD1V3BE	SPDT	On-Mom	U
EP11SD1SAKE	SPST	Off-Mom	V

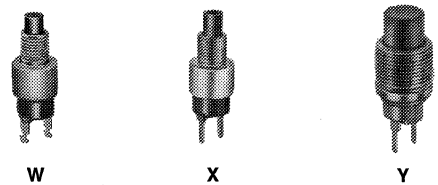
## PTS SERIES SUB-MINIATURE TACTILE SWITCHES



Tactile feel switches. SPST normally open momentary. **Rating:** 50 mA at 12 V DC.  
**Mechanical & Electrical Life:** 25,000 operations for PTS635S; 100,000 operations for PTS645S and PTS645V models; 200,000 operations for PTS125S models.

C&K Part No.	Operating Force	Switch Dimensions L x W x H	Actuator Color	ESD PIN	Fig.
PTS635SL43	130	.236 x .138 x .169	Black	No	J
PTS645SL43	130	.236 x .236 x .169	Black	No	K
PTS645SL50	130	.236 x .138 x .169	Black	No	K
PTS645SL70	130	.236 x .236 x .169	Black	No	K
PTS645TL43	130	.236 x .236 x .169	Black	Yes	K
PTS645VL43	130	.295 x .256 x .124	Black	No	L
PTS125SM31	160	.472 x .472 x .169	Gray	No	M
PTS125SJM73	160	.472 x .472 x .169	Gray	No	N
PTS125VJM73	160	.519 x .524 x .587	Gray	No	O

## 8550 SERIES SUBMINIATURE PUSHBUTTON SWITCHES



**Rating—855X Models:** 1 Amp at 120 V AC or 28 V DC (UL). **855X Models:** 3 Amps at 120 V AC or 18 V DC (UL). **Mounting Hole—Figs. A & B:** .250" (6,35) dia. **Figs. C & D:** .469" (11,91) dia. ( ) = momentary.

C&K Part No.	No. Poles	Switch Function Open-Closed	Fig.
8551MZQE2	SPST	Off-(On)	W
8531MCQE2	SPST	Off-(On)	X
8532MCQE2	SPST	Off-(On)	X
8533MCQE2	SPST	On-(Off)	X
8534MCQE2	SPST	On-(Off)	X
8531TCQE2	SPST	Off-(On)	Y
8551TCQE2	SPST	Off-(On)	Y





# Pushbutton Switches

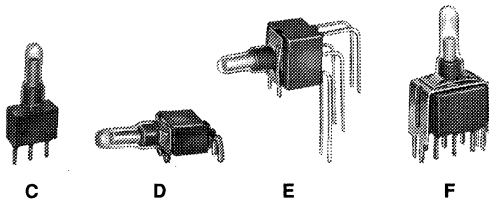
## 8600 SERIES MICROMINIATURE PUSHBUTTON SWITCHES



**Rating—All Suffix—B Models:** 0.4 VA max. at 20 V AC or DC max. **All 8632 Suffix Q Models:** 500 mA at 120 V AC or 28 V DC, 250 mA at 250 V AC (UL). **All 8633 Suffix Q Models:** 250 mA at 120 V AC or 28 V DC, 125 mA at 250 V AC. **Mounting Hole:** .172" (4,37) dia. ( ) = momentary.

C&K Part No.	No. Poles	Switch Function Open-Closed	Fig.
8631ZQD2	SPST	Off-(On)	A
8631ZBD2	SPST	Off-(On)	A
8632ZQD2	SPST	Off-(On)	A
8633ZQE2	SPST	On-(Off)	A
8633ZBE2	SPST	On-(Off)	A
8631CQD2	SPST	Off-(On)	B
8631CBD2	SPST	Off-(On)	B
8632CQD2	SPST	Off-(On)	B
8632CBD2	SPST	Off-(On)	B

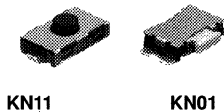
## E020 SERIES SEALED SNAP-ACTING MOMENTARY PUSHBUTTON SWITCHES



**EX21 Models—Rating:** 0.4 VA max. at 20 V AC or DC max. or 1 Amp at 20 V AC or 28 V DC. **EX25 Models—Rating:** 0.4 VA max. at 20 V AC or DC max. **Terminal Spacing:** .185" (4,70) typ.

C&K Part No.	No. Poles	Switch Function	Fig.
E121SD1CGE	SPDT	On-Mom	C
E125SD1CBE	SPDT	On-Mom	C
E221SD1CGE	DPDT	On-Mom	C
E225SD1CBE	DPDT	On-Mom	C
E121SD1A3GE	SPDT	On-Mom	D
E125SD1A3BE	SPDT	On-Mom	D
E121SD1AV2GE	SPDT	On-Mom	E
E125SD1AV2BE	SPDT	On-Mom	E
E221SD1AV2GE	DPDT	On-Mom	E
E121SD1V3GE	SPDT	On-Mom	F
E125SD1V3BE	SPDT	On-Mom	F
E225SD1V3BE	DPDT	On-Mom	F

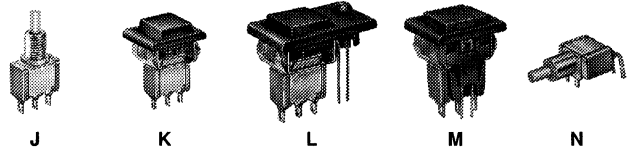
## KN SERIES ULTRA-MINIATURE TACTILE SWITCH



**Rating:** 1.0VA max. @ 5 - VDC min. SPST normally open, momentary. **Body Height:** KN11 - 1.6mm; KN01 - 1.63mm. Supplied in tape & reel packaging.

C&K Part No.	Operating Force	Operating Life
KN11B1FJM	120g	100K cycles
KN11B1DJM	200g	200K cycles
KN11B1NJM	450g	100K cycles
KN01P1DSAQ	200g	100K cycles
KN01P3LSAQ	400g	100K cycles

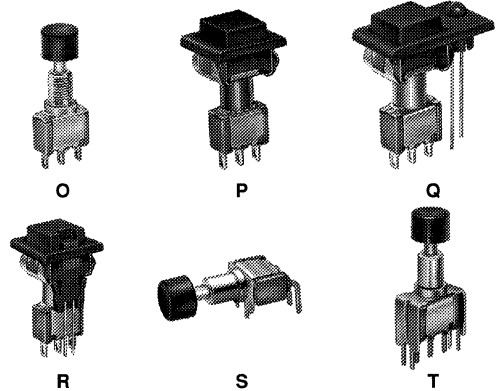
## 8020 SERIES SNAP-ACTING MOMENTARY PUSHBUTTON SWITCHES



**8 x 21 Models—Rating:** 1 Amp at 120 V AC or 28 V DC or 0.4 VA max. at 20 V AC or DC max. **8 x 25 Models—Rating:** 0.4 VA max. at 20 V AC or DC max. Epoxy seal. Terminal spacing: .185" (4,70) typ. **Hardware:** Nut, locking ring and lockwasher. Mom = momentary.

C&K Part No.	No. Poles	Switch Function Open-Closed	Fig.
8121SHZGE	SPST	On-Mom	J
8125SHZBE	SPST	On-Mom	J
8221SHZGE	DPDT	On-Mom	J
8225SHZBE	DPDT	On-Mom	J
8321SHZGE	3PDT	On-Mom	J
8325SHZBE	3PDT	On-Mom	J
8421SHZGE	4PDT	On-Mom	J
8425SHZBE	4PDT	On-Mom	J
8121J81ZGE22	SPDT	On-Mom	K
8125J81ZBE22	SPDT	On-Mom	K
8221J81ZGE22	DPDT	On-Mom	K
8225J81ZBE22	DPDT	On-Mom	K
8125J82ZBE22	SPDT	On-Mom	L
8121J85ZGE223	SPDT	On-Mom	M
8121SD9AGE	SPST	On-Mom	N
8221SD9AGE	DPDT	On-Mom	N
8125SD8ABE	SPDT	On-Mom	N
8125SD9ABE	SPDT	On-Mom	N

## 8060 SERIES PANEL MOUNTED SNAP-ACTING MOMENTARY PUSHBUTTON SWITCHES



**Rating:** 0.4 VA max. at 20 V AC or DC max. or 6 Amps at 120 V AC or 28 V DC; 3 Amps at 250 V AC (UL/CSA). Terminal spacing: .185" (4,70) typ. Mom = momentary.

C&K Part No.	No. Poles	Switch Function Open-Closed	Fig.
8161SHZGE	SPST	On-On	O
8168SHZGE	SPST	On-Mom	O
8261SHZGE	DPDT	On-On	O
8161J81ZGE22	SPST	On-On	P
8168J81ZGE22	SPST	On-Mom	P
8261J81ZGE22	DPDT	On-On	P
8161J82ZGE22	SPST	On-On	Q
8168J82ZGE22	SPST	On-Mom	Q
8261J82ZGE22	DPDT	On-On	Q
8161J86ZGE223	SPST	On-On	R
8168J86ZGE223	SPST	On-Mom	R

## 8060 SERIES PC MOUNTED ALTERNATE ACTION MOMENTARY PUSHBUTTON SWITCHES

**Rating:** 0.4 VA max. at 20 V AC or DC max. Epoxy seal. Terminal spacing: .185" (4,70) typ.

C&K Part No.	No. Poles	Switch Function Open-Closed	Fig.
8161SH9ABE	SPST	On-On	S
8168SH9ABE	SPST	On-Mom	S
8261SH9ABE	DPDT	On-On	S
8161SH9V3BE	SPST	On-On	T
8168SH9V3BE	SPST	On-Mom	T
8261SH9V3BE	DPDT	On-On	T



# Pushbutton Switches

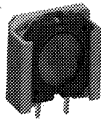
## RACON 8mm/12mm SHORT TRAVEL KEYSWITCHES



High quality, long life momentary SPST PCB mounted keyswitches are solder-proof and washer-proof. **Operating Life:** 1,000,000 cycles minimum. Keyswitches are rated at 42 V AC or DC and 100 mA. **Actuator Height:** 5mm. Other actuator heights available.

C&K Part No.	Terminal Style	Fig.
1.14100.001	Outward terminals, 8mm square	A
1.14100.002	Inward terminals, 8mm square	A
1.14100.003	SMD terminals, 8mm square	A
1.14001.001	Outward terminals, 12mm square	B
1.14001.002	Inward terminals, 12mm square	B
1.14001.003	SMD terminals, 12mm square	B

## RACON 12mm VERTICAL KEYSWITCHES



High quality, long life, PCB mounted keyswitch. **Operating Life:** Minimum 1 million cycles. **Operating Temperature:** -40°C to +80°C. **Rating:** 42 V AC or DC and 100 mA.

C&K Part No.	Function	Terminal Style
1.14001.005	Momentary, SPST	Right angle, through hole
1.14001.015	Momentary, SPST	Right angle, through hole

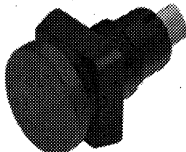
## RF 15/19 SHORT TRAVEL KEYSWITCHES



High quality, long life momentary SPST PCB mounted keyswitches available in 15mm square and 19mm square. Switches are non-illuminated. **Operating Life:** 1,000,000 cycles minimum. **Operating Temperature:** -25°C to 70°C. Gold contacts are rated to 42 V and 100 mA AC/DC, minimum power 15 W. **Actuator Height:** 9.7mm. Other actuator heights and spot- or full-illumination available.

C&K Part No.	Terminal Style	Fig.
3.14100.001	Gold contacts, 15mm square	C
3.14100.006	Silver contacts, 15mm square	C
3.14001.001	Gold contacts, 19mm square	D
3.14001.006	Silver contacts, 19mm square	D

## LUMOTAST® 25 EMERGENCY STOP SWITCH



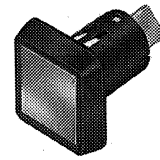
Low profile, emergency stop pushbutton for low power applications. 25 V AC or DC 1 Amp. **Operating Life:** 1.5 x 10<sup>4</sup> operations. **Operating Temperature:** -25°C to +70°C.

C&K Part No.	Function	Terminal Style
1.15154.006/0301	Push off, pull on, SPST, red button	Gold contacts

### ACCESSORIES

5.00645.036	PCB socket
5.92025.368	Multiple contact socket
5.37700.124	Flat cable, 4-pin wire, 1 meter length

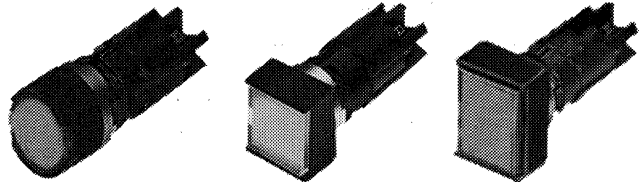
## LUMOTAST® 25 SERIES SWITCHES



SPST N.O. momentary switch function with snap-acting contacts, meets IP65 protection standard. Fits standard .638 (16.2) mounting hole dia. Bezel Color: black. Terminations accept 4 contact plug-in socket with crimp-on cable. **Rating:** 100 mA at 28 V AC or DC. **Electrical Life:** 1,000,000 operations min. illuminated. **Operating Temperature:** -25°C to °C. **Lamp:** T 1 incandescent. **Housing:** Polyimide. Other keycap colors, and LED lamps also available.

C&K Part No.	DESCRIPTION
1.15150.506	Square, momentary, SPST N.O., flush lens
1.15150.606	
1.15150.706	
<b>LENS</b>	
5.49077.011/1002	Colorless flush lens, protruding collar
5.49077.011/1306	Red flush lens, protruding collar
5.49077.011/1505	Green flush lens, protruding collar
5.49077.012/1002	Colorless protruding lens
5.49077.012/1306	Red protruding lens
5.49077.012/1505	Green protruding lens
<b>LAMPS</b>	
1.90142.001	6 Volts
1.90180.474	12 Volts
1.90180.475	28 Volts

## LUMOTAST® 3 SERIES SWITCHES



High quality, SPDT illuminated momentary and maintained pushbutton switches, meets IP65 protection standard and are VDE approved. Fit .638 (16.2) mounting hole dia., threaded mounting ring included. Three bezel styles available. **Color:** Black. Cross point double break contacts. **Rating:** 4 Amps at 250 V AC. **Electrical Life:** 10<sup>4</sup> operations min. **Operating Temperature:** 25°C to 55°C. **Lamp:** T 1 3/4 incandescent. **Housing:** Polyimide, with solder terminals. For complete assembly, order switch body, keycap and lamp separately below. Other terminal styles, keycap colors, and LED lamps available.

C&K Part No.	Function
1.15140.005	Round, momentary, SPDT
1.15140.001	Square, momentary, SPDT
1.15140.009	Rectangular, momentary, SPDT
1.15140.007	Round, maintained, SPDT
1.15140.003	Square, maintained, SPDT
1.15140.011	Rectangular, maintained, SPDT
<b>KEYCAPS</b>	
5.49275.085/1002	Keycap, round, colorless
5.49275.085/1307	Keycap, round, red
5.49275.085/1403	Keycap, round, yellow
5.49275.085/1505	Keycap, round, green
5.49275.085/1606	Keycap, round, blue
5.49275.084/1002	Keycap, square, colorless
5.49275.084/1307	Keycap, square, red
5.49275.084/1403	Keycap, square, yellow
5.49275.084/1505	Keycap, square, green
5.49275.084/1606	Keycap, square, blue
5.49275.086/1002	Keycap, rectangular, colorless
5.49275.086/1307	Keycap, rectangular, red
5.49275.086/1403	Keycap, rectangular, yellow
5.49275.086/1505	Keycap, rectangular, green
5.49275.086/1606	Keycap, rectangular, blue
<b>T 1 3/4 LAMPS</b>	
1.90133.001	6.3V Incandescent
1.90133.002	12/14V Incandescent
1.90133.003	24/28V Incandescent



# Rocker Switches

## CA SERIES SNAP-IN ILLUMINATED POWER ROCKER SWITCHES



**Rating:** 15 Amps at 125 V AC or 28 V DC; 10 Amps at 250 V AC; 1/4 HP at 125 V AC or 250 V AC (UL/CSA). **Lamp:** 125 V neon. **Mounting Hole:** 1.102" (28,00) x .866" (22,00).

C&K Part No.	No. Poles	Switch Function	Actuator Color	Housing Color	Fig.
CA04J137207Q	SPDT	Off/On	Red	Black	A
CA04J137107Q	SPDT	Off/On	Red	White	A
CA24J137207Q	DPST	Off/On	Red	Black	B
CA24J137107Q	DPST	Off/On	Red	White	B

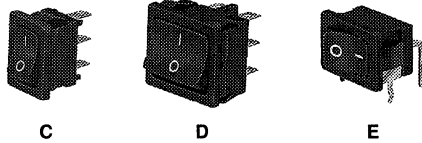
## 7000 SERIES SNAP-IN ROCKER SWITCHES



**Rating:** 5 Amps at 120 V AC or 28 V DC; 2 Amps at 250 V AC. Epoxy seal. **Mounting Hole:** .500" (12,70) x .600" (15,24).

C&K Part No.	No. Poles	Switch Function
7101J51ZQE22	SPDT	On-None-On
7103J51ZQE22	SPDT	On-Off-On
7105J51ZQE22	SPDT	Mom-Off-Mom
7107J51ZQE22	SPDT	On-Off-Mom
7108J51ZQE22	SPDT	On-None-Mom
7201J51ZQE22	DPDT	On-None-On
7203J51ZQE22	DPDT	On-Off-On
7205J51ZQE22	DPDT	Mom-Off-Mom
7207J51ZQE22	DPDT	On-Off-Mom
7208J51ZQE22	DPDT	On-None-Mom

## D SERIES MINIATURE POWER ROCKER SWITCHES



**Rating:** D10X and D20X Models: 4 Amps at 125 V AC, 2 Amps at 250 V AC (UL/CSA); 4(2) Amps at 125 V AC, 2(1) Amps at 250 V AC, T85 (VDE). D50X & D60X Models: 10 Amps at 125 V AC, 5 Amps at 250 V AC (UL/CSA); 10(6) Amps at 125 V AC, 5(3) Amps at 250 V AC, T85 (VDE). **Terminals:** 187" x .031" (4,75 x 0,79) quick connect or right angle PC with .277" (7,04) spacing.

C&K Part No. Rating at 125, 250 V AC	No. Poles	Switch Function	Fig.
D101J12S215PQF	SPDT	On-None-On	C
D103J12S215PQF	SPDT	On-Off-On	C
D105J12S215PQF	SPDT	Mom-Off-Mom	C
D108J12S215PQF	SPDT	On-None-Mom	C
D501J12S215PQF	SPDT	On-None-On	C
D503J12S215PQF	SPDT	On-Off-On	C
D508J12S215PQF	SPDT	On-None-Mom	C
D201J12S215PQF	DPDT	On-None-On	D
D203J12S215PQF	DPDT	On-Off-On	D
D601J12S215PQF	DPDT	On-None-On	D
D603J12S215PQF	DPDT	On-Off-On	D
D101J12S2APQF	SPDT	On-None-On	E
D101J12S2APQF	SPDT	On-Off-On	E

## 7000 SERIES PANEL-MOUNTED ROCKER SWITCHES



**Rating:** 5 Amps at 120 V AC or 28 V DC; 2 Amps at 250 V AC. Epoxy seal. **Mounting Hole:** .937" (23,80).

C&K Part No.	No. Poles	Switch Function
7101J1ZQE2	SPDT	On-None-On
7103J1ZQE2	SPDT	On-Off-On
7105J1ZQE2	SPDT	Mom-Off-Mom
7107J1ZQE2	SPDT	On-Off-Mom
7201J1ZQE2	DPDT	On-None-On
7203J1ZQE2	DPDT	On-Off-On
7205J1ZQE2	DPDT	Mom-Off-Mom
7207J1ZQE2	DPDT	On-Off-Mom

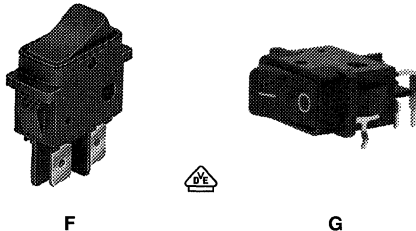
## E SERIES SEALED ROCKER SWITCHES



**Rating:** 0.4 VA max. at 20 V AC or DC max. Epoxy seal, PC mount, terminal spacing: .185" (4,70) typ. **Switch Support:** Brass or steel, tin plated.

C&K Part No.	No. Poles	Switch Function
E101J1V3BE2	SPDT	On-None-On
E103J1V3BE2	SPDT	On-Off-On
E105J1V3BE2	SPDT	Mom-Off-Mom
E107J1V3BE2	SPDT	On-Off-Mom
E201J1V3BE2	DPDT	On-None-On
E203J1V3BE2	DPDT	On-Off-On
E301J1V3BE2	3PDT	On-None-On
E303J1V3BE2	3PDT	On-Off-On

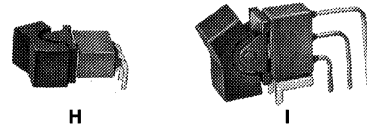
## DF SERIES POWER ROCKER SWITCHES



**Rating:** 16 Amps at 125 V AC (UL/CSA); 16(2)/250-T100, TUV. **Actuator:** Nylon, black or gray, with on-off markings. **Housing:** Nylon, black. **Movable Contacts:** Fine silver, silver plated. **Mounting Hole:** 1.029" (26,14) x .483" (12,68) for .073" (1,85) thick panel.

C&K Part No.	No. Poles	Actuator Color	Fig.
DF62J12S215PQF	DPST	Black	F
DF62J12S2APQF	DPST	Black	G

## E SERIES PC-MOUNTED SEALED ROCKER AND LEVER HANDLE SWITCHES



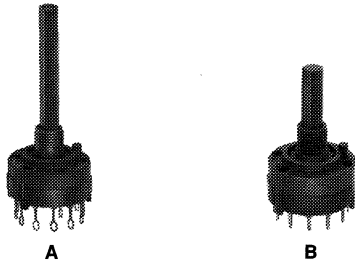
Internal o-ring seal. **Rating:** 0.4 VA max. at 20 V AC or DC max. Epoxy seal. Terminal spacing: .185" (4,70) typ.

C&K Part No.	No. Poles	Switch Function	Fig.
E101J1ABE2	SPDT	On-None-On	H
E103J1ABE2	SPDT	On-Off-On	H
E105J1ABE2	SPDT	Mom-Off-Mom	H
E107J1ABE2	SPDT	On-Off-Mom	H
E201J1ABE2	DPDT	On-None-On	H
E101J1AV2BE2	SPDT	On-None-On	I
E103J1AV2BE2	SPDT	On-Off-On	I
E105J1AV2BE2	SPDT	Mom-Off-Mom	I



# Rotary, Slide & Snap-Acting Switches

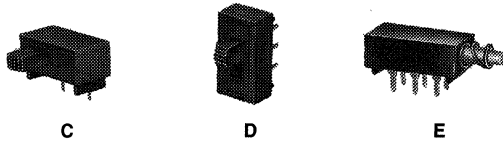
## A SERIES ROTARY SWITCH



Housing dia.: 1.031" (26,19). **Rating:** Carry-5 Amps continuous. Switch-250 mA max. at 125 V AC or DC; 150 mA at 250 V AC or DC. **Hardware:** Nut, lockwasher, stop ring.

C&K Part No.	No. Poles	No. Positions	Fig.
A11215RNZQ	SP	12	A
A20615RNZQ	DP	6	A
A30415RNZQ	3P	4	A
A40315RNZQ	4P	3	A
A11215RNCQ	SP	12	B
A20615RNCQ	DP	6	B
A30415RNCQ	3P	4	B
A40315RNCQ	4P	3	B

## L SERIES MINIATURE SLIDE SWITCHES



**Rating:** 4 Amps at 125 V AC or 28 V DC, 2 Amps at 250 V AC, 0.5 Amp at 125 V DC (UL/CSA). **Housing Length:** .760" (19,30).

C&K Part No.	No. Poles	Fig.
L102021ML04Q	SPDT	C
L202011MS02Q	DPDT	D
L212132MV02Q	DPDT-MOM	E

## POWER AND VOLTAGE-SELECT SLIDE SWITCHES

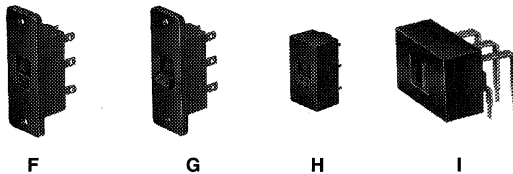
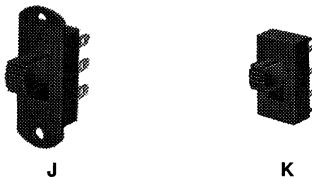


Fig. F-black, Fig. G, H & I-red. **Rating:** 10.1 Amps at 125 V AC, 5 Amps at 250 V AC (UL/CSA); 2.0 (0,5) Amps at 250 V AC. T85 (VDE). **Mounting Hole Spacing:** 1.338" (34,00).

C&K Part No.	No. Poles	Actuator Marking	Fig.
V80212SS05Q	DPDT	230/115	F
V80201SS05Q	DPDT	None	G
V80212MS02Q	DPDT	230/115	H
V80212MA08Q	DPDT	230/115	I

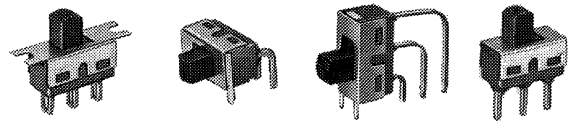
## S SERIES SLIDE SWITCHES



**Rating:** 6 Amps at 125 V AC or 28 V DC. 6 Amps at 250 V AC, 1 Amp at 125 V DC (UL/CSA). **Mounting Hole Spacing:** 1.125" (28,58).

C&K Part No.	No. Poles	Fig.
S102031SS03Q	SPDT	J
S102031MS02Q	SPDT	K
S202031SS03Q	DPDT	J
S202031MS02Q	DPDT	K

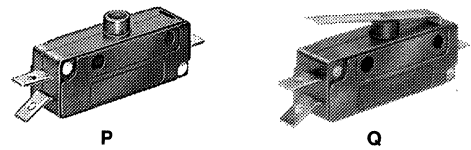
## 1000 SERIES SLIDE SWITCHES



Housing length: .500" (12,70). **Rating:** B models: 0.4 VA max. at 20 V AC or DC max. Q models: 6 Amps at 120 V AC or 28 V DC, 3 Amps at 250 V AC.

C&K Part No.	No. Poles	Switch Function	Fig.
1101M1S3ZQE2	SPDT	On-None-On	L
1101M2S3ABE2	SPDT	On-None-On	M
1101M2S3AV2BE2	SPDT	On-None-On	N
1101M2S3CBE2	SPDT	On-None-On	O
1101M2S3CQE2	SPDT	On-None-On	O
1103M2S3CBE2	SPDT	On-Off-On	O
1103M2S3CQE2	SPDT	On-Off-On	O

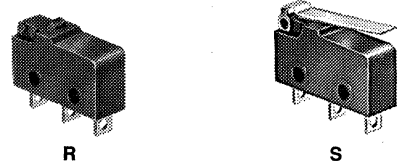
## A SERIES SNAP-ACTING SWITCHES



**Rating:** 15 Amps at 125 & 250 V AC; 3/4 HP at 125 V AC, 1 1/2 HP at 250 V AC; SPDT. Contacts are fine silver with .250" (6,35) quick-connect terminals. Mounting holes will accept pins or screws of .139" (3,53) dia. max. on 1.000" (25,40) centers. Contact separation is .020" (0,51).

C&K Part No.	Actuators	Operate Force (ounces)	Release Force (ounces)	Fig.
ASKHC2P04AC	Pushbutton	20 max.	3 min.	P
ASKHC2L04AC	Integral leaf	12 max.	1 min.	Q

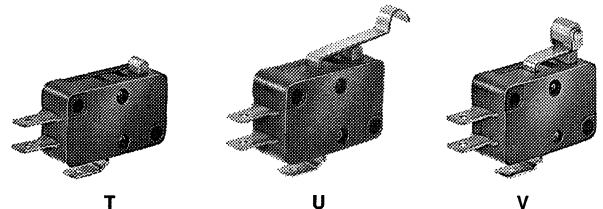
## LC SERIES SUBMINIATURE SNAP-ACTING SWITCHES



SPDT function. **Rating:** 1 Amp at 125 V AC or 30 V DC. UL recognized, CSA certified, VDE approved. **Contacts:** gold over copper alloy, with solder lug terminals. Mounting holes .068" (2,25) dia. on .375" (9,53) centers.

C&K Part No.	Actuators	Operate Force (grams)	Pretravel	Fig.
LCGGX1P00EC	Pin plunger	142	.03" (0,76)	R
LCGGX1T10EC	Standard lever	48	.14" (3,56)	S

## TM SERIES MINIATURE SNAP-ACTING SWITCHES



**Rating:** 10 Amps at 125 & 250 V AC; 1/2 HP at 125 & 250 V AC; 1/2 Amp at 125 V DC; 1/4 Amp at 250 V DC. **Mechanical Life:** 1,000,000 cycles typ. **Operating Temperature:** -67°F to +302°F (-55°C to 150°C). **Housing:** Thermoplastic or general purpose phenolic (UL 94V-0). **Actuator:** Thermoplastic (UL 94V-0). **Movable and Stationary Contacts:** fine silver. **Terminals:** Brass CDA alloy C26000.

C&K Part No.	Actuators	Operate Force (grams)	Pretravel	Fig.
TMCGD6SP0040C	Pin plunger	75	.056" (1,42)	T
TMCGD6ST1440C	Simulated roller	75	.140" (3,56)	U
TMCGD6SA1040C	Lever roller	75	.070" (1,78)	V



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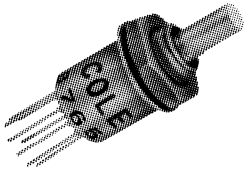
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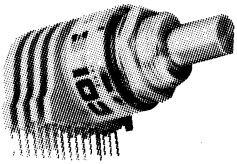
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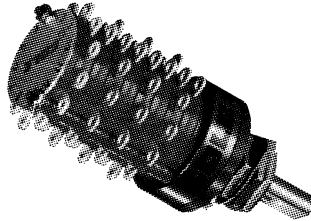
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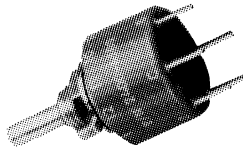
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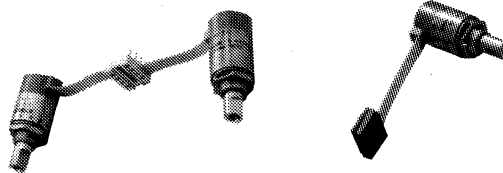
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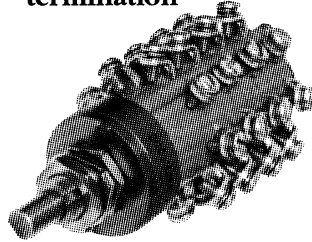
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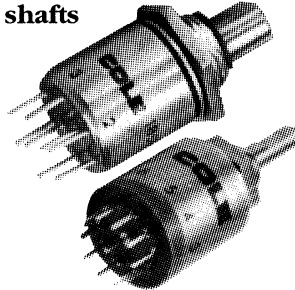
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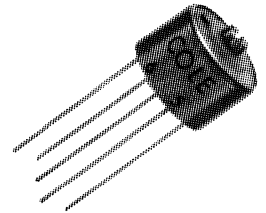
**3600 MIL-S-3786/4**  
with screw type  
termination



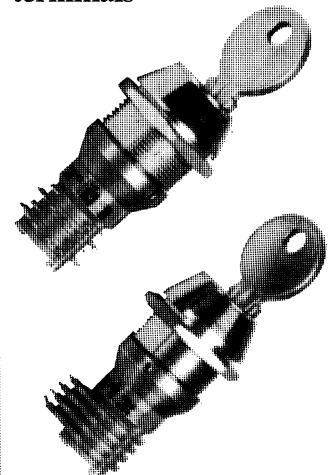
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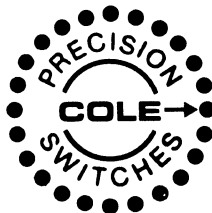


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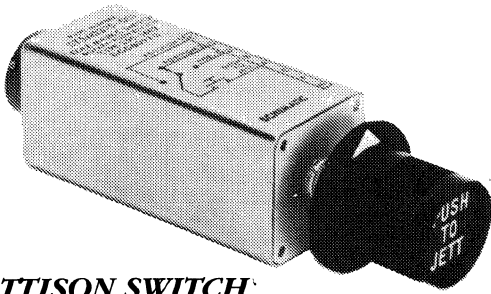
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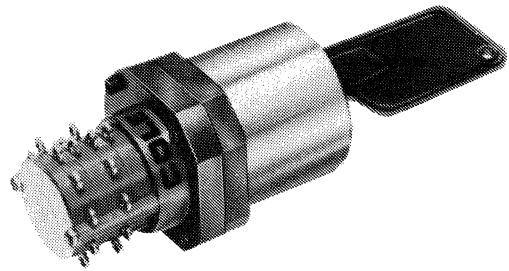
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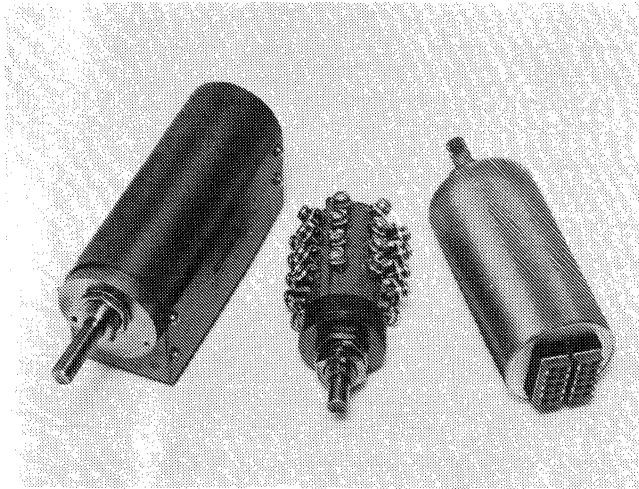
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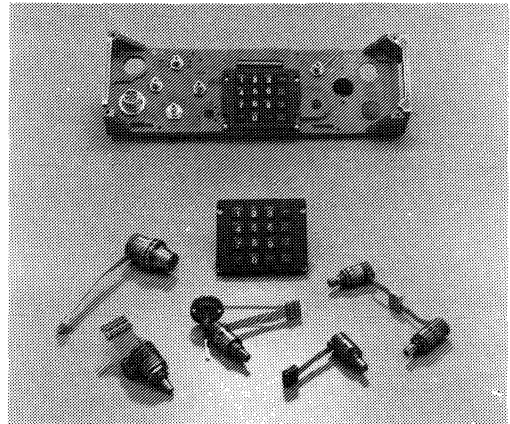
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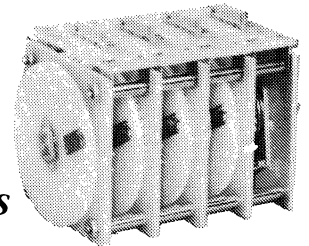
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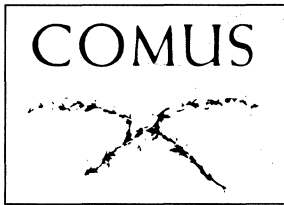
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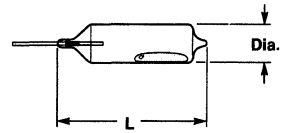
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## Mercury and Non-Mercury Switches and Sensors

### Glass Switches

Part No.	Dimensions		Max. Operate Angle	AC Ratings (Amps)			DC Ratings (Amps)			Mount Clip#
	L	D		30V	115V	230V	30V	120V	250V	
CA20-0	0.5	.16	10°	.25	.1	.05	0.1	.07	.03	1A
CA22-0	0.9	.18	1°	.3	.1	.05	0.1	.07	.03	1A
CB51-0	1.0	.32	2°	3	1	0.5	1.5	0.7	.3	3BH
*CH04-0	1.6	.35	2°	1	0.2	0.1	0.2	.15	.05	3BH
CK30-0	2.2	.45	28°-32°	20	10	5	12	8	3	7KF
CL52-0	2.6	.60	3°	20	10	5	12	8	3	9L

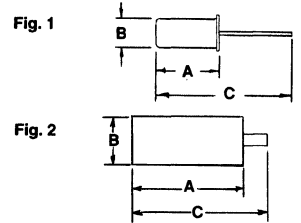


\*SPDT

### Metal Switches

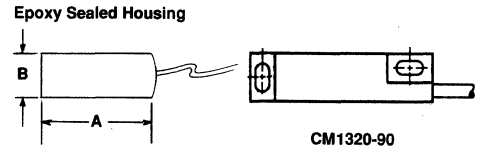
Part No.	Dimensions			Fig.	Max. Operate Angle	AC Ratings (Amps)			DC Ratings (Amps)			Mount Clip#
	A x B x C	30V	115V			230V	30V	120V	250V			
CM100-0	.38 .32 .82	1	10°	2	1	0.75	0.7	0.5	0.2	3BH		
CM225-0	.56 .32 1.2	1	20°-30°	4	2	1.5	1.7	1	0.4	3BH		
CM1000-0	1.25 .44 1.5	2	10°	20	10	5	8	5	3	T59		
CM1300-0	.40 .19 .88	1	10°	1	0.5	0.3	0.5	0.2	0.1	1A		
CM1320-0	.40 .19 1.0	1	10°	0.5	0.25	0.2	0.5	0.2	0.1	1A (2 Leads)		
**CM1800-1	.28 .18 .40	**		0.2	0.1	0.08	0.1	.07	.03	1A		

\*\*No angle specified - motion and vibration sensor



### Encapsulated Switches (Protected by a Sealed Plastic Housing Against Physical Abuse)

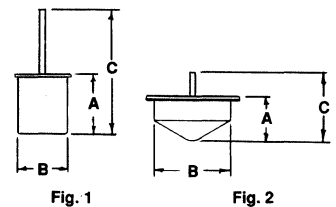
Part No.	Max. Operate Angle	Dimensions			AC Ratings (Amps)			DC Rating (Amps)	
		A	x	B	30V	115V	30V	120V	
CM210-70	15°	1.3	x	0.5	4	2	1.7	1.0	
CM1000-70	10°	1.8	x	0.55	20	10	8	5	
CM1320-70	10°	0.9	x	0.3	0.5	0.25	0.5	0.2	
CM1320-90	10°	1.9	x	0.48	0.5	0.25	0.5	0.2	



### Tip-Over Switches (Omnidirectional) - To Sense Tilting or Tip-Over in Any Direction

Part No.	Operate Angle	Dimensions			Fig.	AC Ratings (Amps)		DC Rating (Amps)	
		A	x	B x C		30V	115V	30V	120V
CM1370-1 NO	50°-70°	.40	.23	1.0	1	.5	.25	0.5	0.2
CM1445-0 NO	35°-55°	.38	.37	.81	1	2	1	0.7	0.5
CM1535-0 NC	25°-45°	.49	.77	.74	2	30	12.5	15	8
CM1725-0 NC	15°-35°	.42	.60	.66	2	2	1.5	1.0	0.6
***CM4150-1	4° (Typ)	.42	.93	.65	2	1	1	1.0	0.6

\*\*\* (1) Four N.O. contacts that close depending on direction of tilt.



Also Available As Encapsulated Switch.

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- Non Mercury Sensors for motion/vibration sensing.
- Magnet Proximity Sensors with Reed Switch contacts.
- Reed Switches in a wide range of sizes, ratings; Form A and C dry and mercury wet contacts.
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## Reed Switches

Part No.		213	211	219	225	2210	2210V	551	1025	3336	1917
Contact Form		A	A	A	A	A	A	C	Wetted	C	C
Switching Capacity	W/VA	1.0	1.0	10	10	50	100	3	50	20	60
Switching Voltage	VAC	24	24	100	100	150	200	30	350	150	400
Switching Current	A	0.1	0.1	0.5	2	2.5	2.5	.5	1	1	1
Contact Resistance	mOhm	150	150	100	80	100	80	80	50	100	100
Total Length	mm	36	36	44	44	56	55	56	54	55	70
Glass Length	mm	7	10	12	16	21	21	14	13.2	14	36
Glass Diameter	mm	1.8	1.8	2.0	2.8	2.75	2.75	2.5	2.5	2.3	5.6
Features		Ultra Miniature	Miniature Rating	Miniature Rating	Low Cost	Medium Power	High Power	Small C	Low Resistance	20W C	60W C

## High Voltage Reed Relays AVAILABLE WITH 5V, 12V, OR 24VDC COILS

Style No.		1270	1272	1274	5272	4270
Contact Form		1 A	2 A	4 A	1 A + 1 B	1 B
Switching Voltage	VDC (RANGE)	1,500 - 10,000	1,500 - 10,000	1,500 - 10,000	1,500 - 10,000	1,500 - 10,000
Dielectric Strength	VDC (RANGE)	3,000 - 14,000	3,000 - 14,000	3,000 - 14,000	3,000 - 14,000	3,000 - 14,000
Switching Capacity	W (RANGE)	30 - 50	30 - 50	30 - 50	30 - 50	30 - 50
Switching Current	A (RANGE)	1 - 3	1 - 3	1 - 3	1 - 3	1 - 3
Dimensions	mm	68 x 21 x 21	68 x 21 x 21	75 x 48 x 21	75 x 48 x 21	68 x 21 x 21
Price Range	(1-24 Pcs.)	\$14.40 - \$26.70	\$17.40 - \$35.20	\$49 - \$85	\$41 - \$54	\$16 - \$33

CALL FOR ADDITIONAL SPECIFICATIONS AND QUOTATIONS

## Reed Relays

Industry Standards DIP and SIP Types  
COILS: 5 - 12 - 24VDC CONTACTS: 1A, 2A, 1C, Mercury Wetted  
Large Selection in Stock  
Call **1-800-352-6687** For Specifications and Quotation

## Proximity Switches MAGNET OPERATED POSITION SENSORS

### Various Sizes & Shapes

RECTANGULAR  
CYLINDRICAL  
ULTRA-MINIATURE SIZE  
PCB MOUNTING

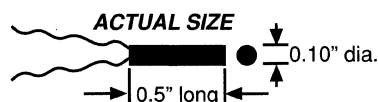
FORM A, B, AND C CONTACTS

Custom Design Requirements are Welcomed



Smallest Size  
# PRA 30/10

0.10 INCH DIAMETER  
0.48 INCH LONG



Products and specifications subject to change without notice.  
Consult Us for application assistance.

GÜNTHER Germany Virnsberger Str. 51 D 90431 Nürnberg • Phone: 0049-911-65520 • Fax: 0049-911-6552239



**LIMIT SWITCHES**

SERIES	RATING	ACTUATOR OPTIONS FOR PART NUMBER									
		FEATURES									
<b>83 800</b>  Plastic Body	5A@250 VAC  IP 55 & 65  UL Listed  cUL (CSA equiv.)	      	<b>83 800 051</b>	<b>83 801 051</b>	<b>83 802 051</b>	<b>83 803 051</b>	<b>83 805 051</b>	<b>83 806 051</b>	<b>83 807 051</b>		
		Miniature Snap-Acting Switch with SPDT - Double Break 10 million operations on Mechanical Life Used in light automation, material handling, packaging, etc.									
<b>83 820</b>  Metal Body	5A@250 VAC  IP 57  UL Listed  cUL (CSA equiv.)	    	<b>83 820 051</b>	<b>83 821 051</b>	<b>83 822 051</b>	<b>83 823 051</b>	<b>83 824 051</b>				
		Snap-Acting Switch with SPDT - Double Break 1 meter cable standard. 10 million operations on Mechanical Life Sealed switch for wet or dusty applications such as cranes, elevators, textile, woodworking,CNC, etc. requiring a high degree of accuracy									
<b>83 852</b>  Metal Body	10A@250 VAC (IP 66)  UL Listed  CSA Approved	       	<b>83 852 001</b>	<b>83 852 501</b>	<b>83 852 101</b>	<b>83 852 201</b>	<b>83 852 301</b>	<b>83 852 302</b>	<b>83 852 303</b>	<b>83 852 304</b>	<b>83 852 601</b>
		Snap-Acting Switch with SPDT - Double Break Positive Action. 30 million operations on Mechanical Life Ideal where reduced size is required for standard applications such as light industrial applications, gates, doors, etc.									
<b>83 853</b>  Plastic Body	10A@250 VAC (IP 66)  UL Listed  CSA Approved	       	<b>83 853 001</b>	<b>83 853 501</b>	<b>83 853 101</b>	<b>83 853 201</b>	<b>83 853 301</b>	<b>83 853 302</b>	<b>83 853 303</b>	<b>83 853 304</b>	<b>83 853 601</b>
		Same as 83 852 but used where price is sensitive or where double-insulated plastic body is preferred									
<b>83 862</b>  Metal Body	10A@250 VAC (IP 66)  UL Listed  CSA Approved	       	<b>83 862 001</b>	<b>83 862 501</b>	<b>83 862 101</b>	<b>83 862 201</b>	<b>83 862 301</b>	<b>83 862 302</b>	<b>83 862 303</b>	<b>83 862 304</b>	<b>83 862 601</b>
		Snap-Acting Switch with SPDT - double break Positive Action 30 million operations on Mechanical Life Heavy duty switch used in heavy industry such as industrial furnaces, conveyors, machine tools, trains, etc.									
<b>83 730</b>  Metal Body	5A@250 VAC (IP 56 & 66)	  	<b>83 732 315</b>	<b>83 731 319</b>	<b>83 733 314</b>						
		Snap-Acting Switch SPDT 1 million operations on Mechanical Life Oil tight, water tight, dust-proof, applications of limited space.									

Products and specifications subject to change without notice.  
 Consult factory for application assistance.

Crouzet Corporation 3237 Commander Dr., Carrollton, TX 75006-2506 • Tel: 972-250-1647 • 1-800-677-5311 • Fax: 972-250-3865



# SNAP-ACTION SWITCHES

## Miniature & Sub-Miniature

Crouzet's line of snap-action switches includes standard miniature and sub-miniature switches, double-break, waterproof, positive break, splashproof, and other "specialty" switches. Most switch types are available from stock in substantial quantities. For complete information, please request our Switch catalog.



PRESENTATION	TYPE	RATING	MOVEMENT DIFFERENTIAL in. (mm.)	OPERATING FORCE oz. (gms.)	ACTUATORS
1.09x.40x.62 (27.8x10.2x15.8)	83 161.____	.1 to 15.1A 250 VAC	.01 (.35)	.9 to 10 (25.2 to 300)	161V 161A 161B 161E 161C 161L
.78x.25x.38 (19.8x6.4x9.6)	83 170.____	.1 to 10A 250 VAC	.006 (.15)	1.8 to 5.3 (50 to 150)	170A flat 170E roller 170F roller form 170D screw 170EL lateral roller
1.17x.65x.71 (29.6x16.4x18)	83 101.0 83 104.0 83 106.0 83 109.0 83 112.0	10A 250 VAC	.019±.008 (.05±0.2)	14.4 (400)	A B BB D E F Lever P1 G O V V2 V3 V4
1.09x.39x.62 (27.8x10x15.8)	83 160.7	6A 250 VAC Pos. Action	N/A	14.1 (400)	153A 153B 153E 153
.80x.25x.39 (20.4x6.4x10)	83 132.0 83 133.0 83 134.0	5A 250 VAC	.013±.004 (.35±0.1)	5.6 (160)	54A 54A2 54B 54D 54E 54E(lever)
1.09x.39x.72 (27.8x10x18.3)	83 137.0	5A 250 VAC	10 <sup>±4</sup>	.17 (12)	
SEALED  .94x.34x1.26 (24x8.8x32)	83 139.0	5A 250 VAC	.013±.004 (.35±0.1)	8.99 (250)	139A 139E
SEALED  1.97x1.54x.45 (50x39x11.4)	83 123.0 83 731.3 83 732.3 83 733.3	5A 250 VAC	.004 to .008 (.1 to .2)	19.06 to 53.9 (530 to 1500)	
SEALED  .78x.25x.62 (19.8x6.4x15.8)	83 181.0 83 183.0 83 186.0 83 180.0	.1 to 10A 250 VAC	.004 (.1)	9 to 12 (250 to 340)	170A flat 170E roller 170F roller form 170D screw 170EL lateral roller

## Digital Switches & Readouts

	BASE P/N	HEIGHT	WIDTH	CODE	BOARD	COLOR	CONNECTIONS	ENDCAPS
Thumbwheel	84210	1.30 in.	.31 in.	MO1=Decimal MO2=BCD MO3=BCD & Complement	/L=Long  /C=Short 	NN= Black Case & Black Wheel	S Direct Soldering 	79 211 759 for a pair
Rocker	84211 84212 84213 84214 84218	1.30 in. 2.28 in. 1.30 in. .95 in. .94 in.	.39 in. .49 in. .39 in. .30 in. .30 in.	MO7=BCD Complement			X3 Pins for P.C. board Soldering 	79 211 847 79 211 947 79 214 147 79 214 283 79 214 285 for a pair
<b>VOLTAGE</b>								
LED Readout	84217	1.30 in.	.39 in.	A8=BDC A10=Hexi-decimal	.0=5V .1=12V .3=24V		X2 Pins for Wire Wrapping 	79 211 847 for a pair

.1 to .50 Volt and .1 to 100mA - 84210 to 84214 and 84218  
Part # example: 84215 A1.0/LNNS - 6 piece with 1 79 211 847(end cap pair)

Products and specifications subject to change without notice.  
Consult factory for application assistance.

Crouzet Corporation 3237 Commander Dr., Carrollton, TX 75006-2506 • Tel: 972-250-1647 • 1-800-677-5311 • Fax: 972-250-3865

**CTS®**  
**ELECTROCOMPONENTS**

**Surface Mount DIP Switches**

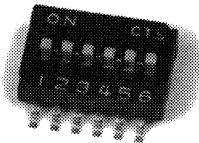
CTS offers a wide selection of surface mount DIP switches to choose from.

CTS SMT DIP switches perform in dozens of configurations: medium and low-profile actuators side actuated, auto-placeable, top/bottom sealed and more.

For applications where PCB space is limited, our 218 Series half-pitch DIP switches can minimize consumption of your valuable board space.

**CTS® SMT DIP SWITCH FEATURES:**

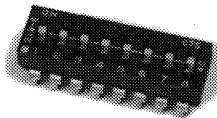
- Gold plated contacts, solder coated terminals
- High Temperature materials compatible with IR and vapor phase SMT assembly processes
- Standard Gull-wing leads. "J" bend terminals available on select products (218/219)
- Available with removable tape seal to withstand IR solder temperatures and board washing (204/218/219)



**218 Half-Pitch**

**Contact Resistance:** 100 milliohms maximum after 1,000 cycles switching 25mA @ 25VDC  
**Actuation Life:** 1,000 cycles switching 25mA @ 25VDC  
**Nonswitching Rating:** 100mA or 50VDC  
**Insulation Resistance:** 100 megohms minimum across open switches  
**Dielectric Strength:** 300VDC maximum for 1 minute  
**Switch Capacitance:** 10 pF maximum between adjacent closed switches  
**Temperature Range:** -40°C to +85°C operating  
**Allowable IR Solder Time:** Up to 30 seconds at 260°C

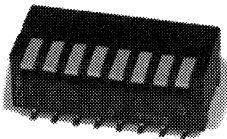
Overall Length Dimension (mm)	Number of Switch Positions
3.71	2
6.25	4
8.79	6
11.33	8
13.87	10



**219 Series**

**Contact Resistance:** 25 milliohms maximum initial 50 milliohms maximum after 2,000 cycles switching 100mA @ 20VDC  
**Actuation Life:** 2,000 cycles switching 100mA @ 20VDC  
**Nonswitching Rating:** 100mA or 50VDC  
**Insulation Resistance:** 1,000 megohms minimum across open switches  
**Dielectric Strength:** 500VDC minimum for 1 minute  
**Switch Capacitance:** 5 pF maximum between adjacent closed switches  
**Temperature Range:** -40°C to +85°C operating  
**Allowable IR Solder Time:** Up to 60 seconds at 260°C

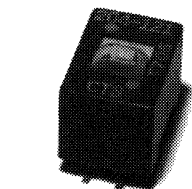
Overall Length Dimension (mm/in)	Number of Switch Positions
6.55/.258	2
9.09/.358	3
11.63/.458	4
14.17/.558	5
16.71/.658	6
19.25/.758	7
21.79/.858	8
24.33/.958	9
26.87/1.058	10
31.95/1.258	12



**193 Series Side Actuated**

**Contact Resistance:** 50 milliohms maximum initial 100 milliohms maximum after 7,000 cycles switching 50mA @ 24VDC  
**Actuation Life:** 7,000 cycles switching 50mA @ 24VDC  
**Nonswitching Rating:** 100mA or 50VDC  
**Insulation Resistance:** 1,000 megohms minimum across open switches 1,000 megohms minimum between adjacent switches  
**Dielectric Strength:** 500VDC minimum for 1 minute between adjacent switches  
**Switch Capacitance:** 5 pF maximum between adjacent closed switches  
**Temperature Range:** -40°C to +85°C operating  
**Allowable IR Solder Time:** Up to 60 seconds at 260°C

Overall Length Dimension (mm/in)	Number of Switch Positions
7.26/.286	2
9.80/.386	3
12.34/.486	4
14.88/.586	5
17.42/.686	6
19.96/.786	7
22.50/.886	8
25.04/.986	9
27.58/1.086	10
32.66/1.286	12



**204 Series Multi-Function**

**Contact Resistance:** 50 milliohms maximum initial 100 milliohms maximum after 10,000 cycles switching 50mA @ 24VDC  
**Actuation Life:** 10,000 cycles switching 50mA @ 24VDC  
**Nonswitching Rating:** 100mA or 50VDC  
**Insulation Resistance:** 1,000 megohms minimum across open switches  
**Dielectric Strength:** 500VDC minimum for 1 minute  
**Switch Capacitance:** 5 pF maximum between adjacent closed switches  
**Temperature Range:** -40°C to +85°C operating  
**Allowable IR Solder Time:** Up to 60 seconds at 260°C

No. of Pos.	Overall Length			
	204 SPST	204 SPDT	204 DPST	204 DPDT
1		7.26/.286	7.26/.286	12.34/.486
2	7.26/.286	12.34/.486	12.34/.486	22.50/.886
3	9.80/.386	17.42/.686	17.42/.686	32.66/1.286
4	12.34/.486	22.50/.886	22.50/.886	
5	14.88/.586	27.58/1.086	27.58/1.086	
6	17.42/.686	32.66/1.286	32.66/1.286	
7	19.96/.786			
8	22.50/.886			
9	25.04/.986			
10	27.58/1.086			
12	32.66/1.286			

**ORDER INFORMATION**

**204** -- **X** **X** **XX**  
 Series      Number of Poles (204)      Number of Throws (204)      Number of Positions

**X**  
**Actuator Length**  
 LP - Low Profile Standard on 218 Option on 204 SPST/204 SPDT/219  
**M** - Medium Length  
 Option on 193/219 and 204SPST & SPDT

**OPTIONS**

**S** **T**  
**Bottom Epoxy Seal**      **Top Tape Seal**  
 Avail. on 204      Avail. on  
 Bottom Seal      204/218/219  
 Standard on  
 218/219/193

# CTS® ELECTROCOMPONENTS

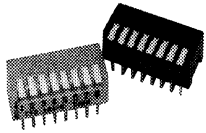
# Through-Hole DIP Switches

CTS offers a wide variety of premium and economy grade through-hole DIP switches in the following configurations: multi-function, auto-insertable, right angle and more.

## CTS THROUGH-HOLE DIP SWITCH FEATURES:

- Gold plated (206/209/194) and non-gold plated economy contacts (195/208/210)

- Dual in-line terminal spacing of .300" X .100" centers (All products except 206RA)
- Auto-insertable compatible with Amistar, DynaPert, Universal, Netco and other machines (Series 209/210)
- Contact wiping on make and break



**Series 194/195  
Side Actuated**

### Contact Resistance:

**Initial:** 50 milliohms (194) - 100 milliohms (195) maximum

**End of Life:** 100 milliohms (194) - 500 milliohms (195) maximum

**Actuation Life:** 7,000 cycles switching 50mA @ 24VDC (194) - 2,000 cycles switching 50mA @ 24VDC (195)

**Nonswitching Rating:** 100mA or 50VDC

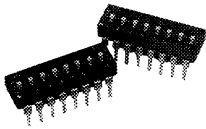
**Insulation Resistance:** 1,000 megohms minimum between insulated terminals

**Dielectric Strength:** 500VAC minimum for 1 minute

**Switch Capacitance:** 5 pF maximum between adjacent closed switches

**Temperature Range:** -40°C to +85°C

Overall Length Dimension (mm/in)	Number of Switch Positions
7.26/.286	2
9.80/.386	3
12.34/.486	4
14.88/.586	5
17.42/.686	6
19.96/.786	7
22.50/.886	8
25.04/.986	9
27.58/1.086	10
32.66/1.286	12



**Series 209/210  
Auto-Insertable**

### Contact Resistance:

**Initial:** 25 milliohms (209) - 100 milliohms (210) maximum

**End of Life:** 50 milliohms (209) - 500 milliohms (210) maximum

**Actuation Life:** 2,000 (209) - 1,000 (210) cycles switching 100mA @ 20VDC

**Nonswitching Rating:** 100mA or 50VDC

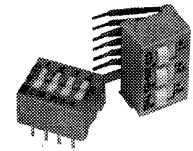
**Insulation Resistance:** 1,000 megohms minimum between insulated terminals

**Dielectric Strength:** 500VDC minimum for 1 minute

**Switch Capacitance:** 5 pF maximum between adjacent closed switches

**Temperature Range:** -40°C to +85°C

Overall Length Dimension (mm/in)	Number of Switch Positions
6.55/2.58	2
9.09/.358	3
11.63/.458	4
14.17/.558	5
16.71/.658	6
19.25/.758	7
21.79/.858	8
24.33/.958	9
26.87/1.058	10
31.95/1.258	12



**Series 206/206RA  
Multi-Function/  
Right Angle  
Switch**

### Contact Resistance:

**Initial:** 25 milliohms maximum

**End of Life:** 100 milliohms maximum at end of life

**Actuation Life:** 10,000 cycles switching 50mA @ 24VDC

**Nonswitching Rating:** 100mA or 50VDC

**Insulation Resistance:** 1,000 megohms minimum between adjacent closed switches

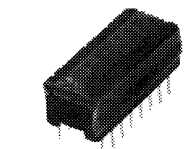
**Dielectric Strength:** 500VDC minimum for 1 minute

**Switch Capacitance:** 5 pF maximum between adjacent closed switches

**Temperature Range:** -40°C to +85°C

\* Available in SPST, SPDT, DPST, DPDT and 4PST configurations

No. of Pos.	Overall Length			
	204 SPST	204 SPDT	204 DPST	204 DPDT
1		7.26/.286	7.26/.286	12.34/.486
2	7.26/.286	12.34/.486	12.34/.486	22.50/.886
3	9.80/.386	17.42/.686	17.42/.686	32.66/1.286
4	12.34/.486	22.50/.886	22.50/.886	
5	14.88/.586	27.58/1.086	27.58/1.086	
6	17.42/.686	32.66/1.286	32.66/1.286	
7	19.96/.786			
8	22.50/.886			
9	25.04/.986			
10	27.58/1.086			
12	32.66/1.286			



**Series 208  
Economy SPST**

### Contact Resistance:

**Initial:** 100 milliohms maximum

**End of Life:** 500 milliohms maximum after 2,000 cycles switching 50mA @ 15VDC

**Actuation Life:** 2,000 cycles switching 50mA @ 15VDC

**Nonswitching Rating:** 100mA or 50VDC

**Insulation Resistance:** 1,000 megohms minimum between insulated terminals

**Dielectric Strength:** 500VDC minimum for 1 minute

**Switch Capacitance:** 5 pF maximum between adjacent closed switches

**Temperature Range:** -40°C to +85°C

Overall Length Dimension (mm/in)	Number of Switch Positions
7.26/.286	2
9.80/.386	3
12.34/.486	4
14.88/.586	5
17.42/.686	6
19.96/.786	7
22.50/.886	8
25.04/.986	9
27.58/1.086	10
32.66/1.286	12

## ORDER INFORMATION

**206** -- **X** **X** **XX**  
Series Number of Poles (206) Number of Throws (206) Number of Positions

**(RA)**  
Add for right angle 206 only

**X**  
**Actuator Length**  
LP - Low Profile  
Option on 208/209/210 and SPST 206/206RA  
M - Medium Length  
Option on 194/195/208/209/210 and all 206/206RA product

**S**  
**Bottom Epoxy Seal**  
Avail. on 194/195/206/206RA/208  
Bottom Seal  
Standard on 209/210

**T**  
**Top Tape Seal**  
Avail. on 194/195/206/206RA/208/209/210

## OPTIONS



# Switch To CW

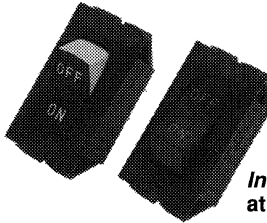
**If you are looking for the highest quality switches ... exceptional service ... fast delivery of samples and finished product ... and very competitive pricing ... you've found the right supplier!**

From your initial contact through the delivery of your finished switches, you will discover that CW is a different breed of switch company. The difference is our uncompromising craftsmanship and dedication to developing and manufacturing the best switches — quickly, reliably, and inexpensively. You'll find that the features and advantages of our switches will add value to your product. And if one of our standard products does not suit your requirements, you may be pleasantly surprised how our design experts can inexpensively modify a standard design to create a custom switch.

Our unique vertical integration and fully automated production are two of the keys to our high quality and responsive service. Beyond our design engineering expertise, we mold, stamp, plate, assemble, and test in-house virtually every part used in each of our products. We design and build our own molds and dies. We even design and custom build our automated assembly equipment. Our products are certified to all major agency standards and our testing laboratories are UL and Defense Logistics Agency qualified.

Our complete in-house control of the switch design and manufacturing process not only guarantees you a superior product, it ensures that your switches are delivered on-time and on-budget.

That's why so many customers have chosen to "Switch to CW!"



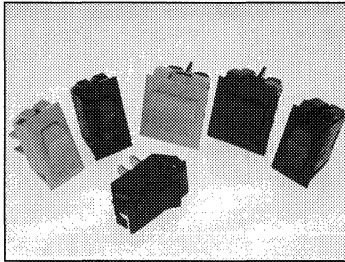
### IndicON™ Rocker Switches Tell All!!

The new IndicON™ Rocker Switch has everything you need.

- High quality & reliability
- Outstanding performance
- "ON" indication & permanent legends through molded-in contrasting color
- Great looks
- Multiple agency certifications
- Attractive price ... making it the ideal preference over illuminated (or even standard) rocker switches



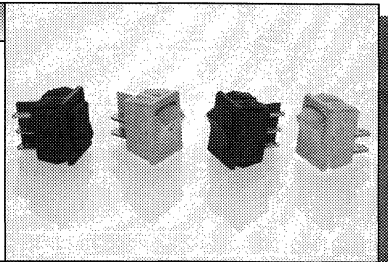
IndicON™ rocker switches show "ON" or "OFF" at a glance ... even at a distance.



### Rocker Switches

From miniature to standard full-sized switches, CW offers a comprehensive line of high-quality, attractively styled, very competitively priced rocker switches. We offer switches rated to 16A@125/250Vac in circuitries ranging from SPST through DPDT, including center-off, spring-return, and illuminated versions. A variety of color, marking, and termination options are available. Our patented unique contact sliding and rotating action ensures contact cleanliness and extended life.

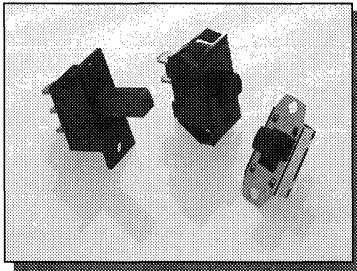
Call today with your specific needs.



## Special Featured Products for 1999

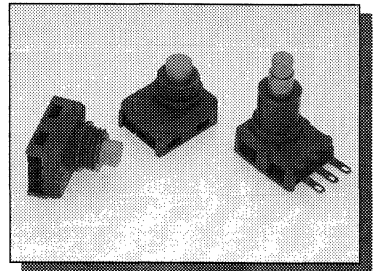
### High Current Power Slide Switch

- Rated 16A @ 125Vac
- Ideal for wide range of products
- Very economical



### New, Very Economical, Miniature GC-536 Pushbutton Switch

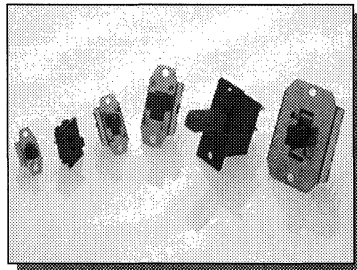
- SPDT, rated 3A at 14Vdc and 1A at 125Vac
- Unique range of termination options and simple, fast mounting
- Patent-applied-for positive switching action eliminates accidental switching
- Measures only .670" x .554" (17.02 x 14.07mm)
- Ideal for a wide variety of low voltage devices, including automotive applications



### Slide Switches

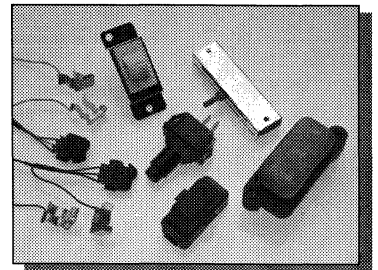
From micro-miniature, to miniature, standard, and even power slide switches, CW offers the most comprehensive line of slide switches for panel or PC board mounting. A wide variety of circuitry options is available ranging from one through four poles and one through five positions.

Switches are available in .5 to 16A @ 125Vac — including top, side, and end actuated designs. Custom cap and superstructure options makes CW slide switches extremely versatile and attractive. Call today with your specific needs.



### Custom and Other Products

CW can supply a virtually unlimited range of custom switches, wire harnesses, and assemblies. In addition, CW manufactures several lines and styles of electrical connectors. Call for complete details.

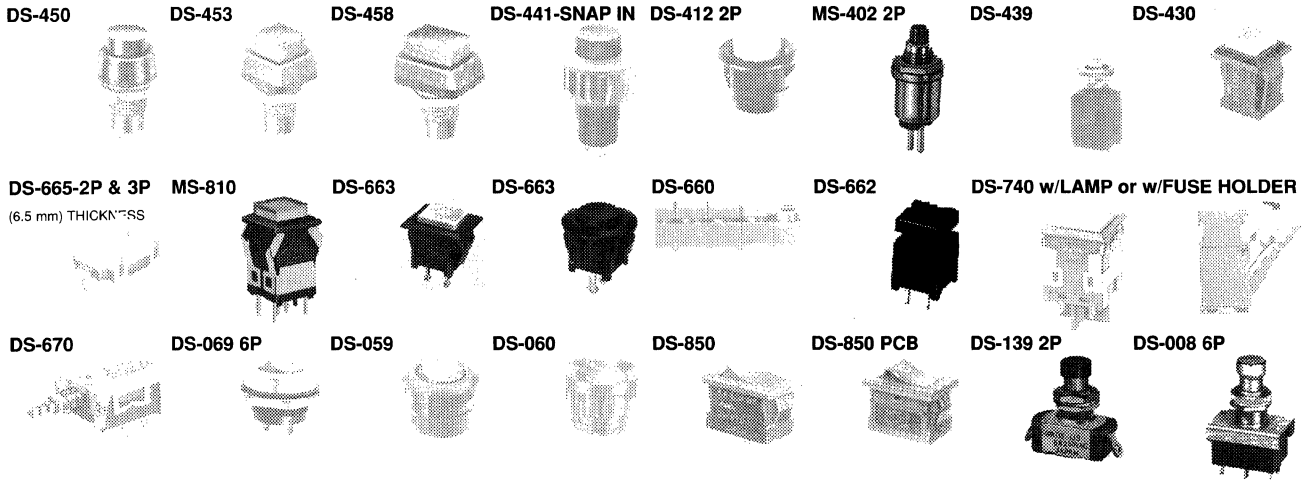


**CW Industries**  
 130 James Way, Southampton, PA 18966  
 Tel: 215/355-7080 • Fax: 215/355-1088  
 www.CWInd.com • e-mail: info@CWInd.com

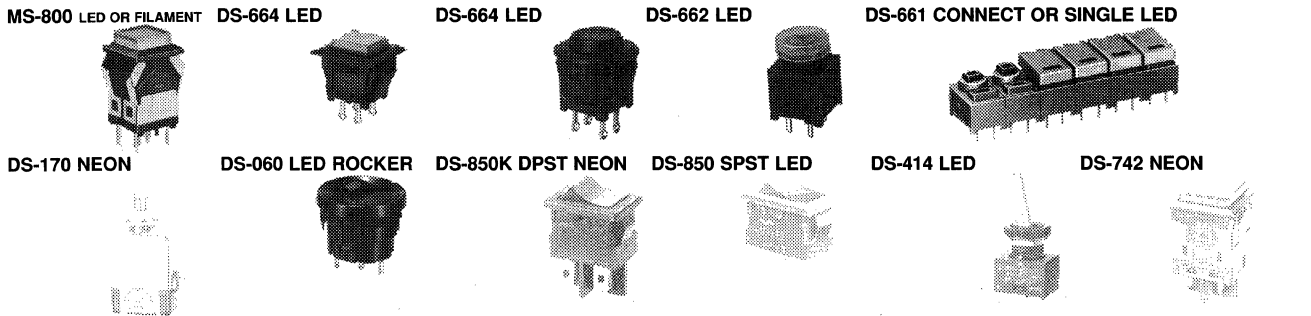
CW products are available through a nationwide network of stocking distributors and value-added assembly centers. These centers can deliver 100% pre-tested assemblies made to your specifications as well as individual components.

# HIGH QUALITY SWITCHES **DSC / MIYAMA**

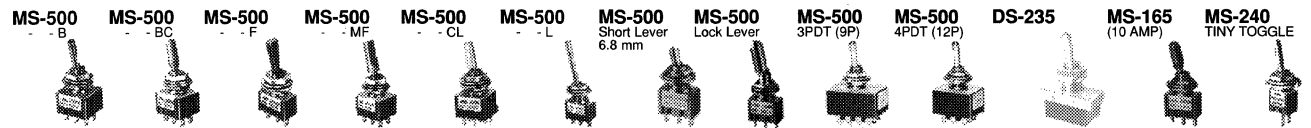
## PUSH BUTTON AND ROCKER SWITCHES (Operating Life 100,000 Cycles)



## ILLUMINATED SWITCHES. LONG LIFE (Electrical 50,000 Operations, Mechanical 100,000 Operations)



## TOGGLE SWITCHES. MS-500 Series



MODEL	DS-008-6P	DS-059	DS-060	DS-139	MS-402	DS-412	DS-430	DS-439	DS-450-475 DS-441	DS-660	DS-663	DS-670	DS-850	
TYPE	PUSH BUTTON	ROCKER	ROCKER	PUSH B	PUSH B	PUSH B	PUSH B	PUSH B	PUSH B	PUSH B	PUSH B	PUSH B	ROCKER	
MOUNTING HOLE	12.2	20.4	20.4	12.2	5.2	17.8	12.4X11.2	8.2	10.2	10.1	15.0/13X12	HOLE 20.0	13X19.6	
LENGTH UNDER PANEL	29.0	14.5	13.5	23.0	8.2	14.0	14.5	18.2	14.5	7.8	11.0	21X15X6.5	29.3X18	13.5
FUNCTION	DPDT 6P ON-ON	SPST 2P ON-OFF SPDT 3P ON-ON DPST 4P ON-OFF DPDT 6P ON-ON	SPST ON-OFF  LOW PROFILE FRAME 3mm	SPST 2P ON-OFF	SPST OFF-(ON)	SPST OFF-(ON)	SPST OFF-(ON)  DS-431 SPST ON-(OFF)	SPST ON-OFF CAN SEE POSITION	SPST OFF-ON OFF-(ON)	SPST OFF-(ON)	SPST OFF-(ON)  ROUND SQUARE	SPST OFF-(ON)  SPDT 3P ON-ON OFF-ON-ON	SPST 2P DPST 4P ON-OFF SPDT 3P ON-ON ON-OFF-ON DPST 4P 10A ON-OFF	
KNOB COLOR	CHROM	R/BK	R/BK	R/BK	R/BK	R/WH	R/BK/W	R/BK/W/Y/B	R/W/B/SILV	R/BK/W	R/BLK/W	BLK/BEIGE	BK/W	
RATING	10A 125VAC	5A 125VAC 3A 250VAC	5A 125VAC 3A 250VAC	6A 250VAC	0.5 125 VAC	3A 125VAC	1A 125VAC	3A 125VAC	3A 125VAC 1A 250VAC	1A 125VAC	1A 125VAC	1A 125VAC DC5V 20mA	3A 125VAC 15A 125VAC	5A 125VAC 10A 125VAC

MODEL	DS-060	DS-170	DS-414	MS-661 (0.4VA DS-661 (1A/125V))	DS-662	DS-664	DS-742-740	MS-800 LED	DS-850K	MS-165	DS-235	MS-240	MS-500	
TYPE	ROCKER	ROCKER	TOGGLE	PUSH B	PUSH B	PUSH B	FILEMENT PUSH B	LED PUSH B	LED/NEON ROCKER	TOGGLE	TOGGLE	TOGGLE	TOGGLE	
MOUNTING HOLE	20.4	12.0	12.3	10.1X15.5	11.6X11.6	16X14/16.9	24X24	12.2X12.2	19X13	6.2	12.2	5.2	6.2	
LENGTH UNDER PANEL	13.5	36.5	14.0	9.0	12.0	13.7	28.5	18.0	14.5	10.4	29.0	7.0	10.4	
FUNCTION	SPST ON-OFF	SPST 2P 10A ON-OFF NEON LAMP w/RESISTOR	SPST 2P ON-OFF SPDT ON-ON	SPST 2P CLIC OFF-(ON) LED MS-661 0.4VA 20mV-28V 0.1mA-50mA	SPST 2P OFF-(ON) ALSO w/o LED	SPST OFF-ON OFF-(ON) ROUND AND SQUARE ALSO w/o LED	w/LAMP 6V,12,28V SPST 2P OFF-ON ON-OFF ON-(OFF) DA-740 WITH FUSE HOLDER w/ LAMP	DPST OFF-(ON) NEON ON-(OFF) SPDT ON-ON DS-810 w/o LED	LED SPST 2P ON-OFF NEON 125V&250V SPST ON-ON ON-OFF	SPST 2P ON-OFF 10A/125VAC SPDT 3P ON-ON 10A ON-OFF-ON 6A	SPST 2P ON-OFF	SPST 2P ON-OFF SPDT 3P ON-ON DPDT 6P ON-ON	SPST 2P ON-OFF SPDT 3P ON-ON 3PDT 6P 4PDT 12P	ON-OFF ON-ON ON-OFF-ON ON-OFF-(ON)
KNOB COLOR	R/G/Y		RED	R/G/Y	R/G/Y	R/G/Y	R/Y/G/W/BL	R/G/Y	R/G/Y	R/BK/W/Y	NICKEL	R/BW/Y	R/BK/W/Y/BL/SILV	
RATING	5A 125VAC	10A 125VAC	3A 125VAC	1A 125VAC	3A 125VAC	3A 125VAC	3A 125VAC 10A 125VAC	0.1A 30VDC	5A 125VAC	3A 125VAC	6A 125VAC	3A 125VAC	6A 125VAC	

### DIRECT SOUND CORPORATION

The Park Square Bldg., 31 St. James Street. Ste. 901, Boston MA 02116. Phone: (617) 542-9700, Fax (617) 542-0607. TOLL-FREE-1-800-372-1616, FAX 1-800-354-3317.

EEM 1999

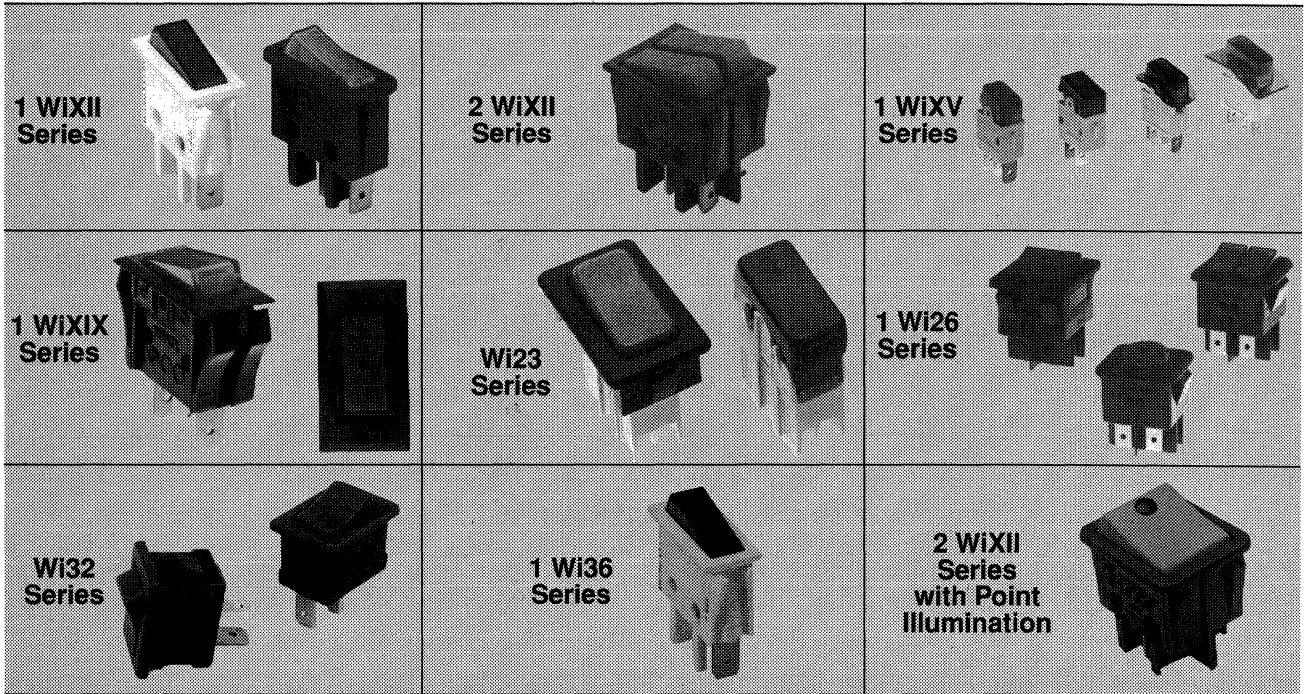
For manufacturers' sales offices, see yellow pages

B-1511



# Electrical Control Components

**ROCKER SWITCHES** You get good looks plus beautiful performance in these quality-crafted rocker switches. Choose from a wide range of designer colors and styles. All switches rated at 16 amps @ 125/250 Vac. Higher current ratings also available.



**SPECIFICATIONS**

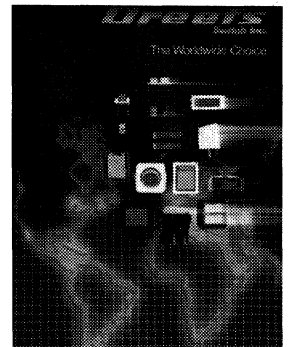
- 25A 125Vac INDUCTIVE
- 16A 250Vac INDUCTIVE
- 3/4 H.P. @ 250Vac
- 16(4)A/250Vac
- 10(2)A/380Vac
- 6A/250Vac
- Dielectric strength: 2500V RMS (minimum)
- E.S.D. Rating: 16KV (typ)
- Welded solid silver contacts
- Inrush: 80 amperes (typ)
- Contact bounce: 1 msec. (typ)
- Contact gap: 3mm (minimum)
- Over-surface clearance: 4 mm (minimum)
- Body material: Nylon Type 6/6
- Temp Rating: 105°C

- Single Pole
- Single or double throw
- Weld-breaking mechanism
- Maintained or momentary
- .250" Quick-connect terminals
- Illuminated or non-illuminated
- Splashguard available
- Externally isolated terminals
- Standard housing with Lock-in tabs for positive mounting
- Serrated clips for easy removal
- Snap-in installation
- Matching panel indicator styles
- Wide range of colors available
- High-brightness, long-life neons and incandescents

**OPTIONS**

- Dry circuit type
- Au plated contacts
- High inrush - up to 125 amperes (typ)
- Screw, PC, extended PC, or .187" Q.C. type terminals
- Special colors
- Custom graphics
- Custom circuits

**FOR MORE DETAILED INFORMATION REQUEST OUR CATALOG**



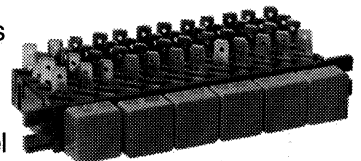
**ROTARY SWITCHES**

The elegantly simple design and rugged construction of this switch make it the designer's choice for long life and trouble-free operation. The cam-action switching mechanism imparts a crisp, tactile feedback indicating positive detent.



**PUSHBUTTONS**

The unique terminal arrangement and building block technique used in the design of these pushbuttons allows great versatility in combining switching functions along a single shaft. For instance, power control as well as logic level switching are easily accommodated within one switch housing.



**DREEFS CONTROLS INC.**

1850 Northwestern Ave., Gurnee, IL 60031  
Tel: 847-662-7667 • Fax: 847-662-0906



**Dreefs** CONTROLS Inc.



# Electrical Control Components

## POWER ENTRY CONTROL by: KAUTT & BUX

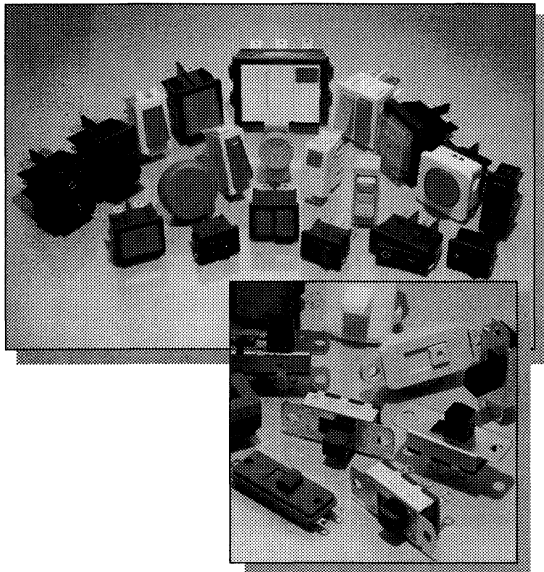


Kautt & Bux has long been a top name in the world production of controls for electric appliances.

Besides the standard range of products used successfully in millions of appliances every day, Kautt & Bux develops and produces special elements that can be adapted to individual customer requirements.

Customized products are available using state-of-the art CAD systems to meet individual applications. All products are guaranteed to be of excellent quality at all stages of production and are DIN/ISO 9001 certified.

## Rocker and Pushbutton Switches from DNA



From deceptively simple to ingeniously sophisticated, DNA Group's extensive line of switches sets the standard for quality and reliability where it counts most, in the hand of your customer. DNA has excelled in a demanding market place by giving you more of what you want. Our switches, made for the power tool consumer products, electronic and appliance industries give you more choices, more options and more consistent quality. Rapid response in technical, tooling and service areas has become DNA's trademark. And we back every product with world famous competitive pricing and a strong commitment to serve each customer as if you were our only customer.

## A World Of Possibilities . . .

**KAUTT & BUX**

**defond manufacturing ltd.**



### DREEFS CONTROLS INC.

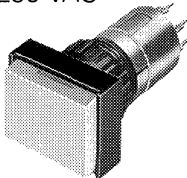
1850 Northwestern Ave., Gurnee, IL 60031  
Tel: 847-662-7667 • Fax: 847-662-0906

# e a o ■

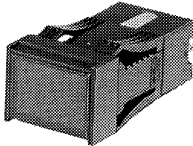
## General Purpose Switches

EAO general purpose switches cover a number of models and applications ranging from power to low level. Like all the EAO switches, they feature ISO 9001, CE mark, UL, CSA, and important international approvals.

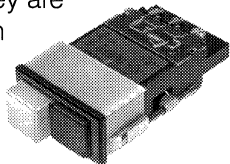
**Series 01 and 31** switches are rated from 5 A at 250 VAC to low level. They mount in 16 mm holes and offer momentary or maintained action and illumination.



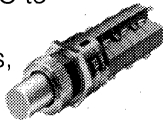
**Series 41** switches feature two lamps used with a single or split lens assembly. They snap into the front of the panel and are rated 5 A max.



**Series 02/03** rugged power switches handle 10 A at 380 VAC. They are available with a 2-lamp split lens and offer momentary, maintained, and combined actions.



**Series 11/21** models can handle from 5 A at 250 VAC to low level. Lighted and unlighted units, choice of buttons and front panel nuts, momentary or maintained actions are all available.

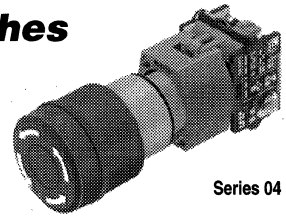


**Series 18/19** miniature switches mount in 8 mm holes and offer snap action low level contacts. Series 18 can be flush mounted for modern panel look.



## Emergency Stop Switches

Emergency stop switches installed on equipment exported to Europe after January 1996 must satisfy the new Euro-Community EN 418 safety specification. EAO's Series 04 and Series 61 emergency stop switches meet this standard. They are designed for "fool-proof" operation and also eliminate the possibility of stopping the emergency action by lodging a foreign body behind the actuator.



Series 04

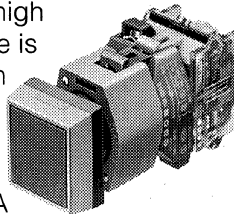
In operation, EAO emergency stop switches are used to instantly shut down a machine or other equipment with a simple push on the actuator. For security, reactivation of the switch requires twisting the actuator by hand or, for even more security, unlocking with a key.

## Oil & Watertight Switches

When it's important to provide reliable operation under severe environmental conditions, EAO oil & watertight switches meet IP 65 and NEMA 4 & 13 sealing.

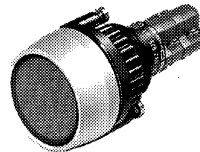
### Series 04

Heavy duty, high inrush service is available with 22.5 mm pushbuttons and levers. Rated to 10 A at 600 VAC. Many actuators, lenses, colors, and contact blocks are available.



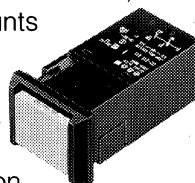
### Series 14

Mounting in the same 22.5 mm hole and with identical front panel appearance this series of pushbuttons and levers offers 5 A to low level service.



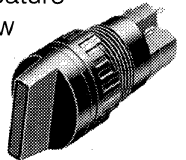
### Series 22

With a modern rectangular lens and choice of three bezels, the pushbutton mounts completely from the front of the panel. Choose momentary or maintained action, and screw or QC termination.



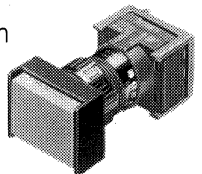
### Series 51/52

Pushbuttons (Series 51) and rotary switches (Series 52) both mount in industry standard 16 mm holes. They feature 5 A/250 VAC to low level service and mount in panels up to 0.255 in. thick. The rotary switches are lighted and available in 2- and 3-position models.



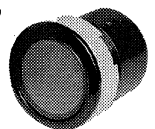
### Series 61

A versatile 16 mm modular switch with constant back-of-panel depth for all components. Rated from 6 A to low level, pushbuttons and rotaries offer many styles, shapes, colors, and features.



### Series 84

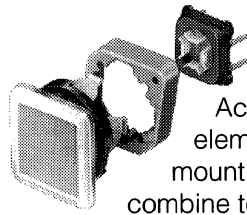
With its award-winning flush panel mount design, this switch offers full lens LED illumination, low level ratings, 22.5 mm panel or PCB mounting, your choice of terminations, and a selection of lenses. In addition, Series 84 components can be combined with Series 92 elements for more applications.



## PCB Switches

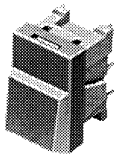
### Series 92

Versatile panel mounted PCB pushbutton switches replace complex membrane systems. Actuators, PCB elements, and mounting flanges combine to form a reliable flush panel mount unit featuring sealed, illuminated, and reliable switching.



### Series 96

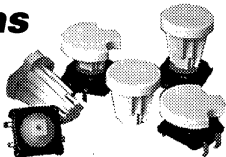
Sealed PCB switches offer a consistent tactile feel, DIP modular mounts, 5-million operations, and your choice of momentary or maintained action. Available with up to two LEDs and a wide selection of caps and colors, the switch has gold SPDT contacts for low levels.



## Systems

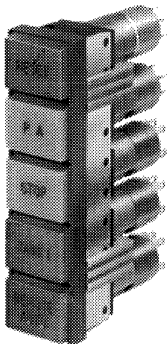
### Series 70

Use switch elements and four different key caps to design membrane-type systems. Elements feature gold contacts for more than 5-million operations and one or two LEDs for illumination. Select cap colors, shapes, and styles to make a custom switch panel.



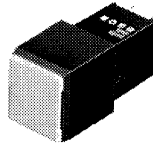
### Series 30

Interlocking units provide up to 12 stations in one assembly. Six different systems and 6 options for flexibility. Choose a master keylock release and lock if desired.



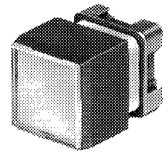
### Series 97

PCB switches with LED illumination feature momentary or maintained action, gold contacts, 5-million operations, and one or two poles. Several lens styles including overhanging are available in various colors.



### Series 99

Switches install on PC board for flow soldering. You can choose tactile or non-tactile action, lens style, and illumination. Available as single, double, or triple width units with 1, 2, or 3 switch elements and a single lens assembly.



## Keylocks

EAO Switch offers a full line of keylock selectors for almost every application.

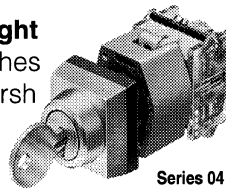
### Oil & Watertight

keylock switches find use in harsh industrial situations.

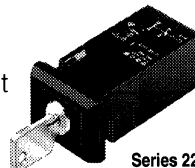
They include the **Series 04** for high inrush service and front panel-matching **Series 14** for moderate to low level service.

**Series 22** two-position units handle 10 A at 380 VAC.

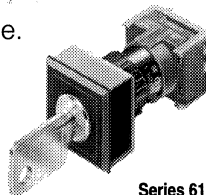
The modular 16 mm **Series 61** offers a large choice of actions and contact elements.



Series 04



Series 22



Series 61

**General Purpose** keylocks are economically priced and feature a variety of user benefits.

**Series 15** 2-position keylocks are rated up to 5 A at 250 VAC and mount in a standard 3/4-inch hole.

The compact units have a low profile chrome bezel and are only 1.6 inches deep.

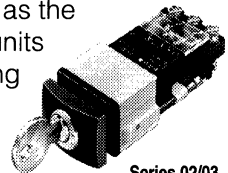
**Series 32** low cost keylocks are available with round, square, or rectangular bezels



Series 15

### Push-to-Operate

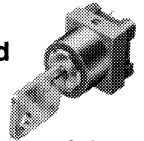
keylocks such as the **Series 02/03** units serve as locking pushbuttons and can be locked in "on" or "off" positions.



Series 02/03

### Printed Circuit Board

keylock, **Series 99**, provides 2- and 3-positions, maintained action, and gold contacts.



Series 99

## Contact EAO

We have established a wide ranging communications system so you can tell us about your requirements and we can support you better with catalogs, information, quotes, and evaluation samples.

### EAO Switch Corporation

198 Pepe's Farm Road  
Milford CT 06460

Tel: 203 877-4577

Fax: 203 877-3694

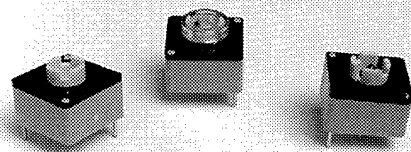
**Internet** for news, products, literature requests, lists of sales representatives and distributors:  
<http://www.eaoswitch.com>

**E-mail:** [info@eaoswitch.com](mailto:info@eaoswitch.com)

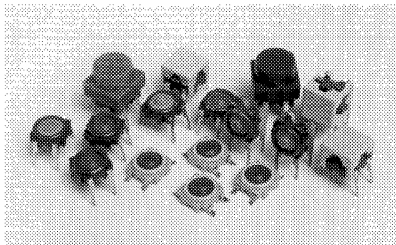
**Fax-Back:** Call from your fax machine for instant data sheets:  
1-800-FAX'S-EAO (1-800-329-7326)

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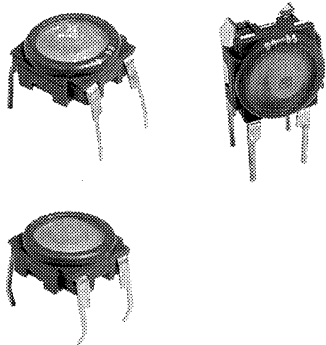
ISO 9001  
CERTIFIED CE

## Tactile action key switches



### MICRO COSMOS

Subminiature 7.6 mm square key switches are available in several models to meet most switching requirements. Automatic and manual insertion plus surface mount versions offer PCB assembly versatility. Right angle terminals allow board edge mounting. And a special unit with a silicone rubber membrane provides increased tactile action when required. Accessories include buttons for through-hole front panel mounting. Switches are available with standard silver contacts or heavy gold contacts for low level operation. Three different switching actions provide a choice depending on the intended application. MICRO-COSMOS tactile key switches are sealed for soldering and immersion cleaning and provide 1-million operations.



### CUSTOM KEYPADS

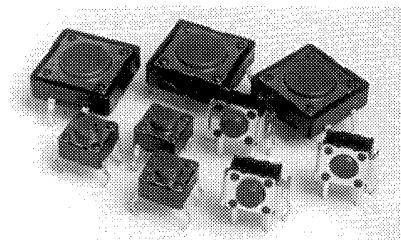
Users can build their own keypads and keyboards using MICRO-COSMOS and COSMOS key switches. The resulting units offer flexibility, graphic appearance, and front panel sealing found with membrane systems, combined with rugged dependable tactile key switches. Assemblies can be illuminated, modified, and field repaired if necessary.

### COSMOS

Dependable 1-pole 2-position key switch modules offer a distinctive tactile feel in a compact 12.3 x 12.3 mm square matrix and feature 1-million operations. Illuminated models combine LEDs with a selection of lens styles for panel use or under membrane-type overlays. Silver or gold plated contacts and terminals are sealed for wave soldering and immersion solvent cleaning. Accessories include covers and legends.

### TACT ECO

Low cost tactile key switches are available with flat, right angle, and SMT mounting, 6 and 12 mm size, and several actuator heights. The switches feature heavy silver plated contacts, 500,000 operations, special construction to prevent solder flux build-up, and sealing for wave soldering. Select TACT

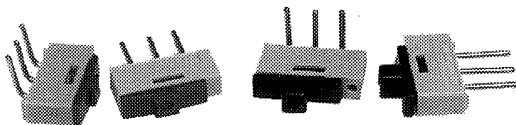


ECO tactile key switches when cost is a concern and rugged dependability is a requirement.

## Subminiature slide switches

### 1K2

Replace PCB jumpers, wire interconnects, and large selector switches with the SPDT 1K2 switch. Offering standard or extended slide actuators, these miniature switches use gold plated contacts for operation in harsh environments. With more than 10,000 operations, the units find application in both slide switch and changeover applications. Straight and angle PCB mounting pins offer mounting



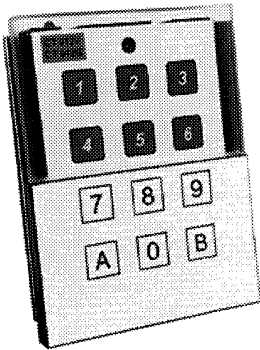
flexibility. Both the base and feet are sealed for wave soldering.

### INTERDIL

One pole, one throw PCB mount switches feature gold contacts for more than 3,000 operations and a rating of 12 V at 500 mA. Measuring only 7 x 10 x 3 mm, the switches can be side or end stacked and feature a visible position indicating actuator.

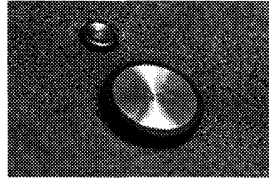
## Touch Sensitive Switching

New proximity switching devices are based on disruption of a high frequency signal by touching a sealed surface. The new switches are vandal-proof and can be operated wearing



Demonstration keypad has laminate on bottom and glass front top cover.

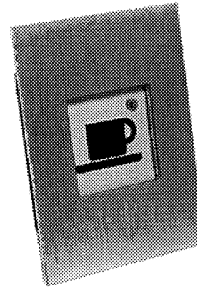
gloves. A wide range of models include: individual touch sensitive switches, 12-key standard and 16-key hexadecimal matrix circuit keypads, and PC keyboards. Individual switches have



One metal-front switch with LED.

caps to allow mounting through metal panel cutouts and are equipped with signal LEDs. All the touch sensitive switch devices can be supplied to operate through glass or other

dielectric panels for unusual applications and security in hostile environments. Features include adjustable touch force, excellent cleanability, almost unlimited operating life, and the ability to use custom graphics.

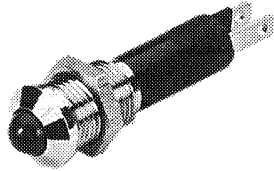


A single touch sensitive switch with an LED behind glass in a vending machine panel.

They have no contacts, no movable mechanical parts, and no easy-to-damage membranes.

## LED Indicators

EAO offers a complete line of rugged, industrial quality LED indicators. Series 17 indicators are available in 6, 8, 14, 16, and 22 mm mountings, with exterior, interior, flat front, and standard reflectors, voltages from 12 VDC to 230 VAC, and a choice of bright chrome or black bezels.



In addition to the standard red, green, yellow, blue, and white LED, a series of sunlight readable models are offered. Special bi- and tri-color LEDs provide color changes in one unit.

## Contact EAO

We have established a wide ranging communications system so you can tell us about your special requirements and we can support you better with product catalogs, technical information, quotes, and evaluation samples.

### EAO Switch Corporation

198 Pepe's Farm Road  
Milford CT 06460

Tel: 203 877-4577

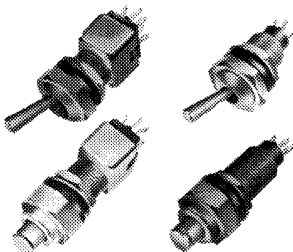
Fax: 203 877-3694

**Internet** for news, applications, full line catalog, literature and sample requests, lists of sales representatives and distributors:  
<http://www.eaoswitch.com>

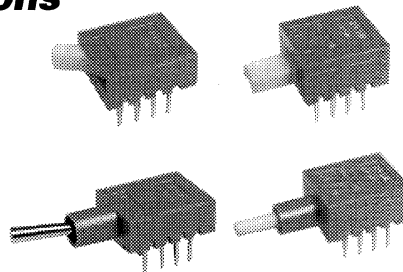
**E-mail:** [info@eaoswitch.com](mailto:info@eaoswitch.com)

**Fax-Back:** Call from your fax machine for instant data sheets:  
1-800-FAX'S-EAO (1-800-329-7326)

## Toggles & Pushbuttons



**DJET** miniature sealed switches provide dependable snap action. They feature a choice of solid gold contacts for low level applications or silver contacts for higher loads, actuator isolation, up to 100,000 operations, and front-face seals.





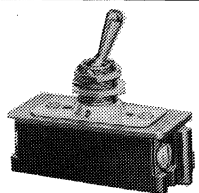
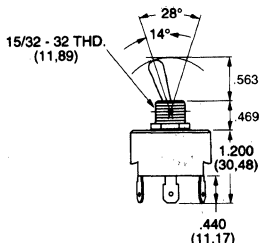
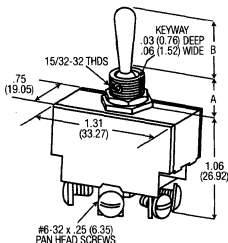
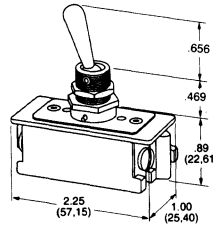
**COQUINTER** modular switches use standard DIP mounting at 12.7 mm pitch. With heavy gold plated contacts, they offer up to three active positions, 20,000 operations, and can be washed down after soldering operations by using an optional cover.

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# EATON CORPORATION SWITCHES

## Commercial Controls Division



<p><b>GENERAL PRODUCT GUIDE</b></p>			
<p><b>Product name:</b></p>	<p><b>GENERAL PURPOSE TOGGLE SWITCHES AC RATED</b></p>	<p><b>MILITARY AC AND AC/DC RATED</b></p>	<p><b>INDUSTRIAL TOGGLE SWITCHES AC/DC RATED</b></p>
<p><b>Ratings:</b></p>	<p>6AMPS @ 125VAC, 3AMPS @ 250 VAC, 15AMPS 3/4HP @ 125VAC, 10AMPS 3/4HP @ 250VAC, 20AMPS 3/4HP @ 125VAC, 10AMPS 3/4HP @ 250VAC, 30AMPS @ 125VAC, 25 Amps @ 250VAC, Ratings Listed for 125VAC Apply at 28VDC, as well</p>	<p>Per MIL-S-83731 or JAN-S-23 Equivalent</p>	<p>15AMPS @ 125VAC &amp; VDC, 10AMPS @ 250VAC &amp; VDC 16AMPS @ 125VAC &amp; VDC, 8AMPS @ 250VAC &amp; VDC, 16AMPS 1HP @ 125VAC &amp; VDC, 20AMPS @ 125VAC &amp; VDC, 10AMPS @ 250VAC &amp; VDC, 10AMPS 1 1/2HP @ 125VDC, &amp; VDC, 10AMPS 1 HP @ 250 VAC, 20AMPS 1 1/2HP @ 250VAC &amp; VDC</p>
<p><b>Circuits:</b></p>	<p>SPST, SPDT, DPST, DPDT, 3PST, 3PDT, 4PST, 4PDT Maintained and Momentary Action</p>	<p>SPST, SPDT, DPST, DPDT, SP3T, 4PST, 4PDT Maintained and Momentary Action. Quick-Make/ Quick-Break Wiping Action (Medium Duty) Slow-Break Butt Action (Heavy Duty)</p>	<p>SPST, DPST, DPDT Maintained Contact Action</p>
<p><b>Actuator:</b></p>	<p>Bright Nickel-Plated Lever is Standard Thermoplastic Lever is available for lighted toggles.</p>	<p>Bright Nickel or Locking Toggle Standard</p>	<p>Standard Lever Series - Bright Nickel Plated Brass</p>
<p><b>Mounting:</b></p>	<p>Threaded Bushing, .344" or .468" Dia., 32 Threads/Inch</p>	<p>Threaded Bushing, .468" Diameter, (.562" Dia., Locking) 32 Threads/Inch</p>	<p>Threaded Bushing, .344" or .468" Dia., 32 Thread/Inch</p>
<p><b>Terminal:</b></p>	<p>1/4" Spade, Screw, and Solder Lug</p>	<p>Screw and Solder Lug</p>	<p>Screw</p>
<p><b>Lighting:</b></p>	<p>14VDC, 28VDC, and 110VDC Neon</p>	<p>None</p>	<p>None</p>
<p><b>Options:</b></p>	<p>Lever Seal, Reversing Jumpers, Wire Leads, PC Terminals, Dead Back Cover (2-Pole Only), "ON-ON-ON" Circuit, Double Momentary (3 &amp; 4 Pole Only)</p>	<p>Lever Seals on JAN-S-23 Types</p>	<p>Spade Terminals, T Ratings, Different/Special Markings, Dust Resistant Lever Seals.</p>
<p><b>Agency Approvals:</b></p>	<p>UL Recognized. CSA Certified.</p>	<p>Not Applicable</p>	<p>UL Recognized. CSA Certified.</p>
<p><b>Dimensions:</b></p> <p><b>Call for our complete catalog: 1-800-962-0820</b></p>	 <p>15/32 - 32 THD. (11.89) 28° 14° .563 .469 1.200 (30.48) .440 (11.17)</p>	 <p>KEYWAY .03 (0.76) DEEP .06 (1.52) WIDE B A 15/32-32 THDS 1.31 (33.27) 1.06 (26.92) 75 (19.05) #.6-32 x .25 (6.35) PAN HEAD SCREWS</p>	 <p>.656 .469 .89 (22.61) 2.25 (57.15) 1.00 (25.40)</p>



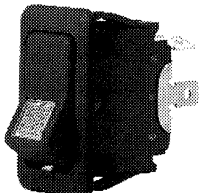
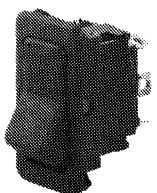

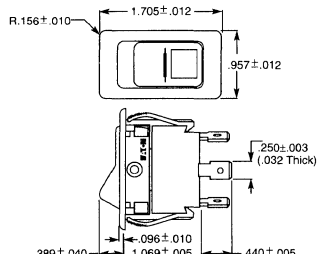
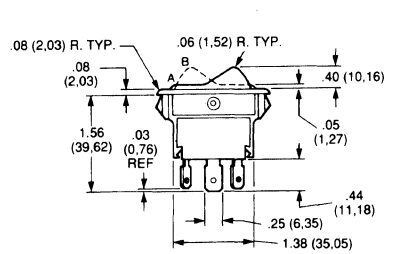
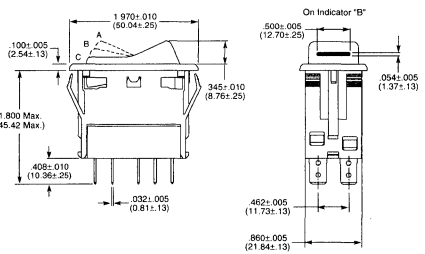
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For complete catalog or location of your nearest sales office call 1-800-962-0820 or Fax 1-414-449-6118

# EATON CORPORATION SWITCHES

## Commercial Controls Division



		
<p><b>EURO/SR ROCKER SWITCH</b></p>	<p><b>FULL SIZE EURO-LOOK ROCKER SWITCHES</b></p>	<p><b>NEW GENERATION ROCKER (NGR)</b></p>
<p>15AMPS @ 125VAC 10AMPS @ 250VAC 3/4 HP @ 250VAC 15AMPS @ 28VDC</p>	<p>15AMPS @ 125VAC 15AMPS @ 28DC</p>	<p>15AMPS @ 125VAC 10AMPS @ 250VAC 15AMPS @ 28VDC</p>
<p>SPST, SPDT, DPST, DPDT Maintained and Momentary Action</p>	<p>SPST, SPDT, DPST, DPDT Maintained and Momentary Action</p>	<p>SPST, SPDT, DPST, DPDT Maintained and Momentary Action</p>
<p>Heavy Duty Thermoplastic Rocker</p>	<p>Heavy Duty Thermoplastic Rocker Actuator Two-Face, Contoured, Paddle and Recessed Label, Rocker Styling</p>	<p>Heavy Duty Thermoplastic Rocker Two-Face, Recessed Label, Paddle, Locking and Laser-Etched Rocker Styling</p>
<p>Snap-In Mount</p>	<p>Snap-In Mount</p>	<p>Snap-In Mount</p>
<p>1/4" Spade, Screw, and Solder Lug 6 Terminals</p>	<p>1/4" Spade, Screw, and Solder Lug 6 Terminals</p>	<p>1/4" Spade 10 Terminals</p>
<p>14VDC, 18VDC, 28VDC, 125V Neon, 250V Neon</p>	<p>14VDC, 18VDC, 28VDC 125V Neon, 250V Neon</p>	<p>(Illuminated versions only) 14VDC, 28VDC, Replace Lamps from Front Lamp and LED versions</p>
<p>Sealing, Rocker Color, Hot Stamped or Pad Printed Legends, Dry Circuit Capabilities, Special Ratings, Custom Circuits, Reversing Jumpers, PC Terminals, Industry Standard Connector, Dead Back Cover with Wire Leads, Panel Plugs</p>	<p>Sealing, Rocker Style and Color, Hot Stamped or Pad Printed Legends, Dry Circuit Capabilities, Special Ratings, Custom Circuits, Reversing Jumpers, PC Terminals, Industry Standard Connector, Dead Back Cover with Wire Leads, Gang-Mounting, Panel Plugs</p>	<p>Sealing, Rocker Style and Color, Pad Printed or Laser-Etched legends, Dry Circuit Capabilities, Special Ratings, Reversing Jumpers, Keyed Connector, Gang Mounting, Panel Plugs, Companion Indicator</p>
<p>Consult Customer Service</p>	<p>Consult Customer Service</p>	<p>Consult Customer Service</p>
		



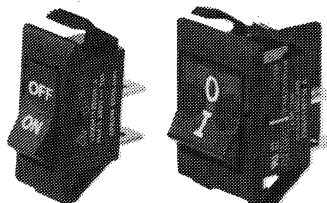
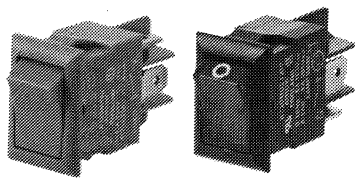
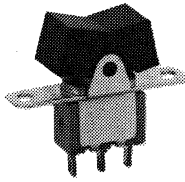
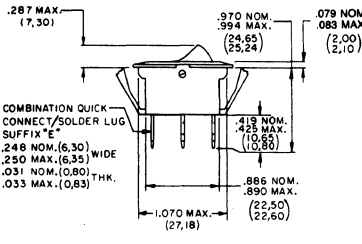
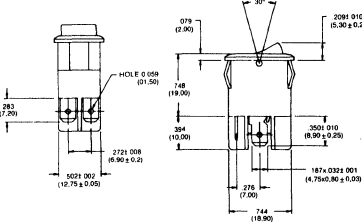
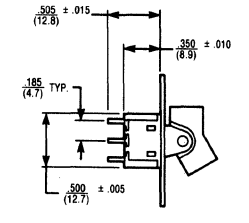
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# EATON CORPORATION SWITCHES

## Commercial Controls Division



<p><b>GENERAL PRODUCT GUIDE</b></p>			
<p><b>Product name:</b></p>	<p><b>MIDSIZE SNAP-IN ROCKER SWITCHES AC RATED, ILLUMINATED AND NON-ILLUMINATED</b></p>	<p><b>MINIATURE SNAP-IN ROCKER SWITCHES AC RATED, ILLUMINATED AND NON-ILLUMINATED</b></p>	<p><b>MINIATURE ROCKER, TOGGLE AND PADDLE SWITCHES AC RATED</b></p>
<p><b>Ratings:</b></p>	<p>1500 Series: 10AMPS @ 125VAC, 10AMPS @ 250VAC 15AMPS @ 125VAC, 10AMPS @ 250VAC 22AMPS 1HP @ 125VAC, 1600 Series: (not shown) 16AMPS 1HP @ 250VAC 10(2)AMPS @ 250VAC 10(4)AMPS @ 250VAC 16(4)AMPS @ 250VAC 10AMPS @ 28VDC 8AMPS @ 14V(T)</p>	<p>8AMPS @ 125VAC, 6AMPS @ 250VAC 6(4)AMPS @ 250VAC 10 AMPS @ 125VAC 10 AMPS @ 250VAC Make: 100AMPS Peak Inrush @ 250VAC for 4 Milliseconds</p>	<p>6AMPS @ 125VAC 3AMPS 250VAC 6AMPS @ 28VDC</p>
<p><b>Circuits:</b></p>	<p>SPST, SPDT, DPST, DPDT Maintained and Momentary Action</p>	<p>SPST, SPDT, DPST, DPDT, Maintained and Momentary Action</p>	<p>SPST, SPDT, DPST, DPDT, 3PST, 3PDT, 4PST, 4PDT. ON-ON-ON Circuit Availability, One and Two Pole Only. Maintained and Momentary Action</p>
<p><b>Actuator:</b></p>	<p>Non-Illuminated: High-Grade Nylon-66 Contoured Rocker. Illuminated: Heavy Duty Polycarbonate Contoured Rocker</p>	<p>Non-Illuminated: High-Grade Nylon-66 Contoured Rocker. Illuminated: Heavy Duty Polycarbonate Contoured Rocker</p>	<p>Rocker: Small, Standard, or Large Heavy Duty Nylon. Paddle: Small, Standard, or Large Tapered, Heavy Duty Nylon</p>
<p><b>Mounting:</b></p>	<p>Snap-In Mount</p>	<p>Snap-In Mount</p>	<p>Rocker &amp; Paddle: Snap-In Mount, Screw Mount</p>
<p><b>Terminal:</b></p>	<p>1/4" Quick Connects, Solder Lug</p>	<p>.187" Quick Connects, Solder Lug, PCB</p>	<p>Quick Connect, Solder Lug, Wire Wrap (various), PC (various)</p>
<p><b>Lighting:</b></p>	<p>6VDC, 12VDC, 24VDC, 125 Neon, 250 Neon</p>	<p>125 Neon, 250 Neon</p>	<p>None. Optional Bezel with LED Available</p>
<p><b>Options:</b></p>	<p>Legend Stamping, Independent Lamp , Special Circuits, Special Colors, Hi-Lite Rocker</p>	<p>Legend Stamping, Special Colors, Matching Indicator, Sealed</p>	<p>Sealing, Washable, Legend Stamping, Special Colors, Rockers and Paddles, Dry Circuit Capability</p>
<p><b>Agency Approvals:</b></p>	<p>UL Recognized. CSA Certified, VDE Listed European Agency Listings, (Consult Customer Service)</p>	<p>UL Recognized. CSA Certified, VDE Listed European Agency Listings, (Consult Customer Service)</p>	<p>UL Recognized. CSA Approved</p>
<p><b>Dimensions:</b></p>	 <p>COMBINATION QUICK CONNECT/SOLDER LUG SUFFIX "E" .248 NOM.(.6,30) .250 MAX.(.6,35) WIDE .031 NOM.(.0,80) HK. .033 MAX.(.0,93)</p>	 <p>HOLE Ø .059 (Ø1,50)</p>	




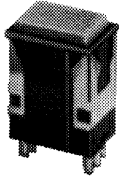

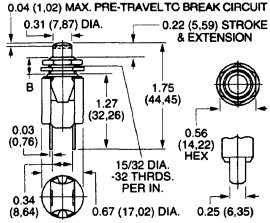
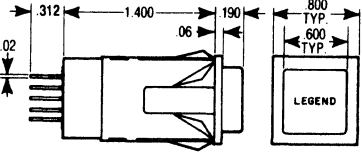
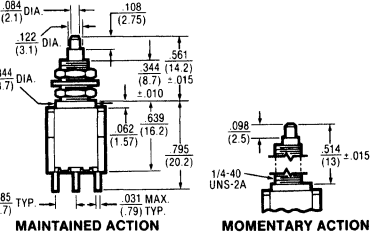
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# EATON CORPORATION SWITCHES

## Commercial Controls Division



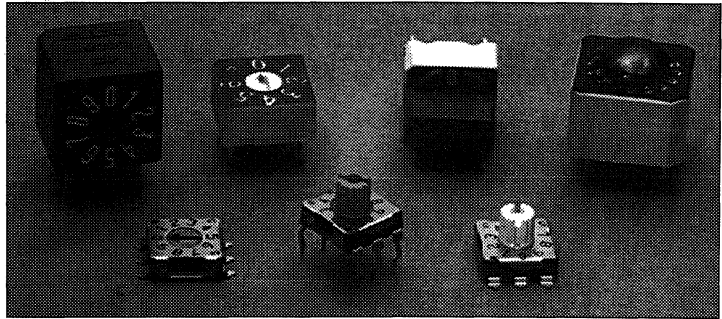
		
<p><b>GENERAL PURPOSE PUSHBUTTON SWITCHES AC RATED</b></p>	<p><b>ILLUMINATED PUSHBUTTON SWITCH AC RATED</b></p>	<p><b>MINIATURE PUSHBUTTON SWITCH (SENSITIVE SNAP-ACTION, STANDARD &amp; SUB-MINIATURE) AC RATED</b></p>
<p>3/4AMPS @ 125VAC/VDC                  1/4AMPS @ 250 VAC/VDC                  3AMPS @ 1/10HP @ 125VAC                  1AMP @ 250VAC                  6AMPS @ 125VAC, 3AMPS @ 250VAC                  15AMPS 1/3HP @ 125VAC                  10AMPS 1/3HP @ 250VAC                  15AMPS 1/4HP @ 125VAC                  10AMPS 1/2HP @ 250VAC</p>	<p>5AMPS @ 125VAC                  5AMPS @ 250VAC                  10AMPS @ 125VAC                  5AMPS @ 250VAC                  1AMPS @ 125VAC &amp; VDC</p>	<p>Sensitive Snap-Action                  5AMPS @ 125VAC or 28 VDC                  1AMP @ 125VAC or 28 VDC                  0.4 VA @ 28V max. (AC or DC)                  Standard                  6AMPS @ 125VAC or 28 VDC                  3AMPS @ 250VAC                  0.5VA @ 28V max. (AC or DC)                  Subminiature                  1AMP @ 6 VDC or 12 VDC                  0.5AMPS @ 28 VDC or 125VAC</p>
<p>SPST, SPDT, DPST.                  Momentary and Alternate Action</p>	<p>SPDT, DPDT,                  Maintained and Momentary Action</p>	<p>Sensitive Snap-Action: Momentary (COM, NO, NC), SP &amp; DP                  Standard: SPDT, Maintained and Momentary                  Subminiature: Momentary</p>
<p>Bright Nickel-Plated Steel or High-Grade Plastic.                  Phenolic Snap-On Buttons are Available for Some Models</p>	<p>5/8" Square or 5/8"x1" Rectangular                  5/8"x1" Rectangular Split Legend                  High-Grade Polycarbonate Lens.                  Translucent matte, deadfront, clear, and Filtered Styles.</p>	<p>Sensitive Snap-Action: .450", .780" &amp; .900" Square, .200", .310" &amp; .375" Round. Optional Decorative Face-nuts for Round Caps.                  Standard: .200", .310", &amp; .375" Round.                  Optional Decorative Face-nuts.                  Subminiature: .250" Round.</p>
<p>Threaded Bushing, .468" Diameter, 32 Thread/Inch. Keyway, in Some Series Provides Anti-Rotation Feature. Snap-In Mount, Flush Mount, Nest Mount</p>	<p>Snap-In Mount</p>	<p>Direct Panel Mount, Right-Angel PCB Mount, Vertical PCB Mount, Snap-In Mount (.600" x .500" Panel Cut-Out) with LED Option, Raised or Flush Cap with Snap-In Mount</p>
<p>1/4" Spade, Screw, Solder Lug, Wire Leads</p>	<p>.110" Fast-On/Solder Lug</p>	<p>Solder Lug, PC Terminals</p>
<p>None</p>	<p>5VDC, 6VDC, 6.3VDC, 14VDC, 28VDC                  T-13/4 Incandescent</p>	<p>Optional Bezel with LED available.</p>
<p>Dead-Back Construction, Special Color Buttons, .187" Spade, .110" Tab or PC Terminals, Special Hardware, Special Operating Pressure, Special Finish, Various Bushing Lengths</p>	<p>Legend Stamping, Special Colors, Matching Indicators, Sealing Barriers</p>	<p>Legend Stamping, Special Hardware</p>
<p>UL Recognized, CSA Certified.</p>	<p>UL Recognized, CSA Certified.</p>	<p>UL Recognized, CSA Certified.</p>
		

**EATON** "THE POWER OF RELIABILITY" 4201 N. 27th Street, Milwaukee, WI 53216.  
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# EECO SINCE 1947, EECO SWITCH... THE LEADER IN ELECTRO-MECHANICAL SWITCH TECHNOLOGY

## EECO MICRO-DIP® ... The Original Rotary DIP Switch

EECO's MICRO-DIP® offers direct decimal-to-binary conversion in a miniature, PCB mounted package. Typical applications include alarm systems, temperature controls, and addressing SCSI computer peripherals. Only EECO offers four models to meet any design requirements.



**4700 Series Surface Mount Switch:** Using the latest high temperature materials the 4700 Series is a true SMT switch. Available in 10 or 16 position versions, with flush or extended actuators, the 4700 Series is a space saving 0.100" tall.

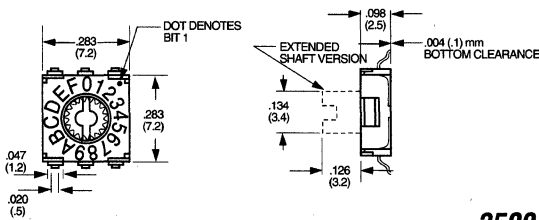
**4500 Series Switch:** The 4500 Series is a through-hole version of the 4700 SMT switch. The compact dimensions and ultra low profile require minimal packaging space.

**3500 Series Switch:** Our most popular model, the 3500 Series is offered in top or right angle mountings, flush or extended shaft versions, and three knob options. Color coded for quick identification, made from high temperature plastics, and fully sealed for automated processes. **LIFETIME WARRANTY!!**

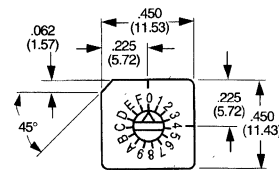
**2300 Series Switch:** The world's only DOUBLE POLE binary coded rotary DIP switches. Ideal for CMOS applications, the 2300 Series offers a unique output arrangement in which all four outputs are always connected to one of the two commons. 10 and 16 position double pole models, process seals and our exclusive **LIFETIME WARRANTY!!**

Features	4700 Series	4500 Series	3500 Series	2300 Series
Codes	10, 16	10, 16	8, 10, 16	10, 16
Double Pole Codes				10, 16
Mounting	Top	Top	Top, RA	Top, RA
Actuators	Flush, Extended	Flush, Extended	Flush, Extended	Flush
Permanent Seal	•	•	•	
Process Seal				•
UL 94 V-0 Plastics	•	•	•	•

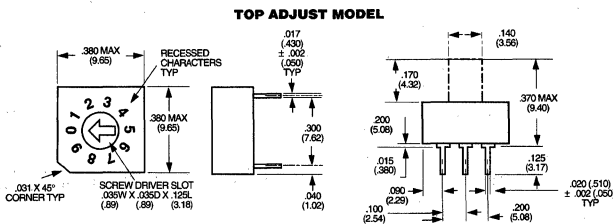
### 4700 SERIES



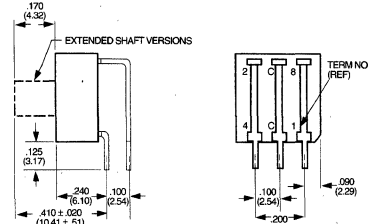
### 2300 SERIES



### 3500 SERIES



### SIDE ADJUST MODEL



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# EECO SINCE 1947, EECO SWITCH...THE LEADER IN ELECTRO-MECHANICAL SWITCH TECHNOLOGY

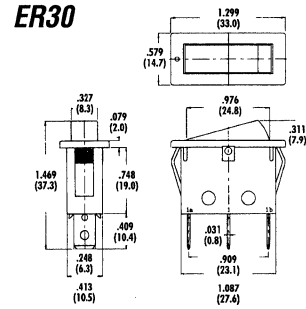
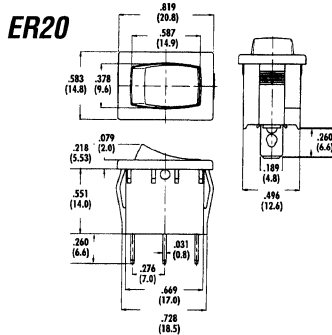
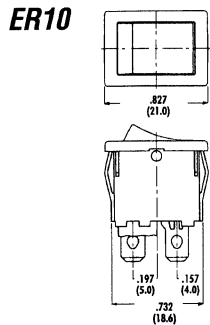
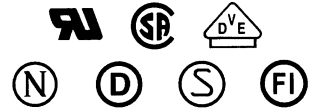
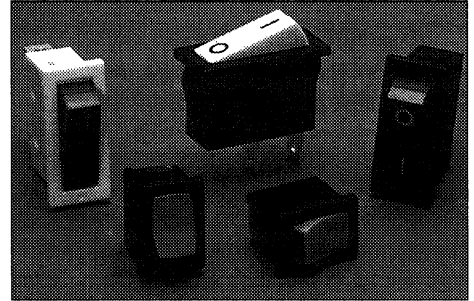
## EECO ER SERIES ROCKER SWITCHES

*EECO's ER Series rocker switches offer the features and options for any On-Off switching application.*

**ER10 Series:** This miniature rocker switch is available in SPST and DPST models. Rated 6A @ 250 VAC, with optional 12V to 250V lamps for illuminated rockers. Standard and right angle models for any application.

**ER20 Series:** Miniature rocker switch available in 9 On-Off SPST configurations. Options include LED illumination and standard or right angle mounting styles. Standard rating 6A @ 250 VAC, 8 A @ 250 VAC models are also available.

**ER30 Series:** A standard size rocker switch perfect for appliances. Available in 9 On-Off SPST models. Options include 12 V to 250V lamps for illumination. Standard rating 10A @ 250 VAC, 15 A models also available.

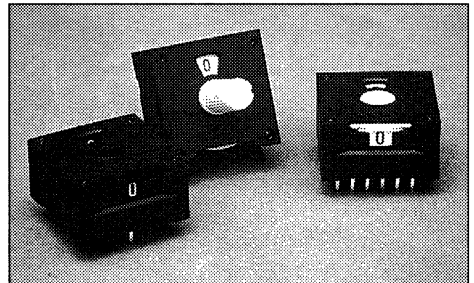


## EECO STRIPSWITCH®

*EECO's STRIPSWITCH is a PCB mounted miniature thumbwheel switch. Available in 10 and 16 position models, the STRIPSWITCH offers a direct decimal-to-binary conversion in an easy to use package.*

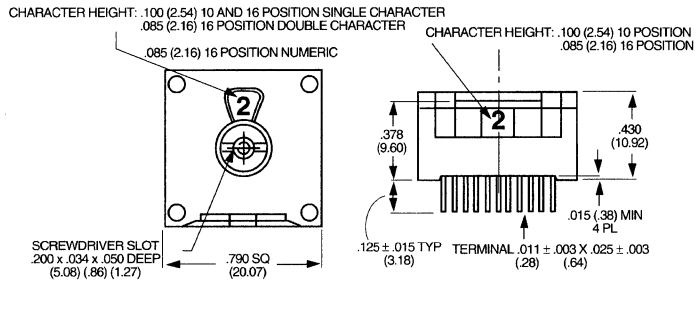
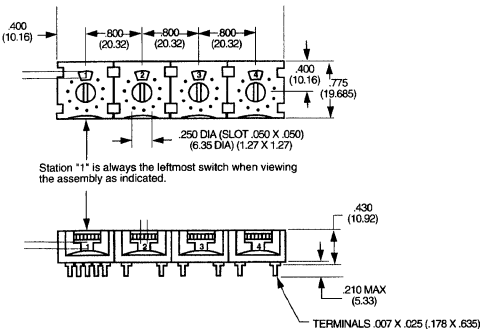
**2100 Series:** The innovative design of the 2100 Series permits up to 4 individual switches to be mounted on a single terminal board. Flush or optional extended shafts, stop pins or custom legends make the 2100 Series a popular choice in many applications.

**2700 Series:** The 2700 Series STRIPSWITCH is a fully sealed model suitable for automated soldering and cleaning processes.



### 2100 SERIES

### 2700 SERIES



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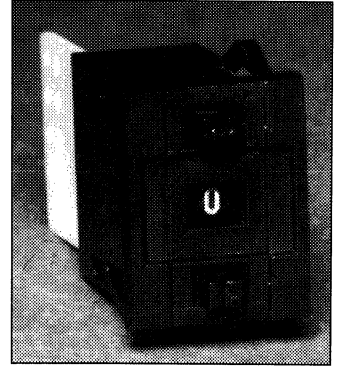
# EECO SINCE 1947, EECO SWITCH...THE LEADER IN ELECTRO-MECHANICAL SWITCH TECHNOLOGY

## EECO THUMBWHEEL SWITCHES

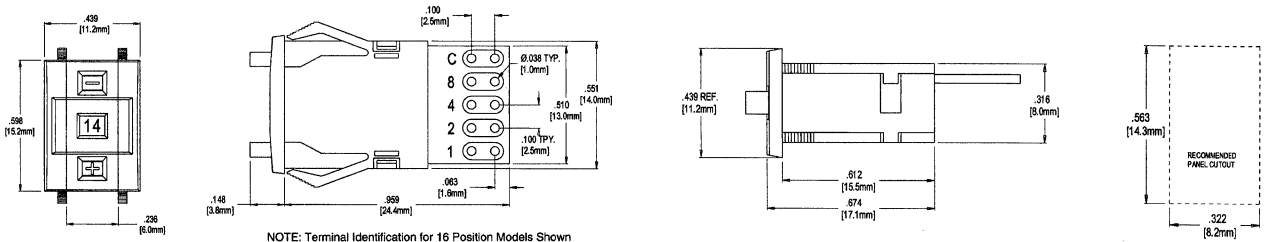
EECO Switch specializes in coded switches. The EECO thumbwheel catalog includes everything from miniature to military grade. Options such as lighting, RFI shielding and custom legends available on most series.

### NEW!! 1500 Series SCSI ADDRESS SWITCH

**1500 Series:** The 1500 Series is an efficient, low cost means of addressing SCSI peripherals such as tape and disk drives. The 1500 Series is available in 8 and 16 position versions, with either flush or extended actuators to reduce the chance of accidental setting changes.



### 1500 SERIES



### OTHER MODELS

**1000/1100/1200 Series:** These are low cost, miniature thumbwheel and pushwheel switches. Penset and lockset models reduce the chance of accidental actuation.

**1300/1400 Series:** A larger version of the 1000-1200 family, the 1300 and 1400 Series are offered in 10 and 16 position models, with a choice of thumbwheel, pushwheel or lockset actuators.

**1776/1976 Series:** These industrial grade switches are available in gloss or matte finish, and offer a wide range of optional features. The 1776 is .500" wide, while the 1976 is a slim .350". Over 50 electrical codes available.

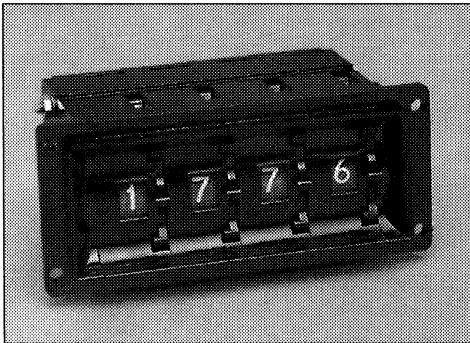
**1800 Series:** The versatile 1800 Series switch combines low cost with a large, easy to use package size.

**2000 Series:** A large, industrial grade thumbwheel with optional seals for harsh environments.

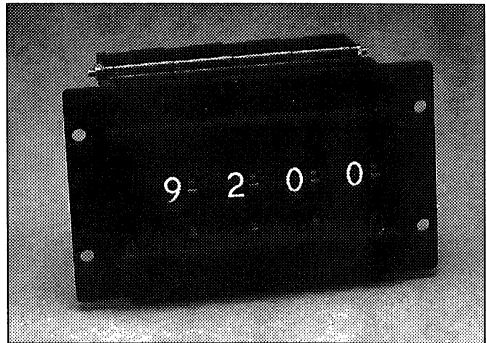
**7000 Series:** The 7000 Series is a military grade thumbwheel, offering the best seal in the industry against moisture and dirt.

**9200 Series:** Offering the same features as the 2000 Series, the 9200 Series switch is .600" wide for easy use.

### 1776 SERIES



### 9200 SERIES



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# **EECO** SINCE 1947, EECO SWITCH...THE LEADER IN ELECTRO-MECHANICAL SWITCH TECHNOLOGY

## **EECO MEMBRANE KEYPADS**

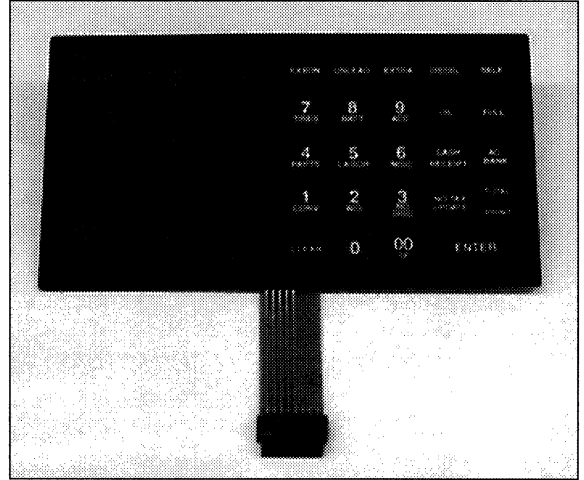
EECO SWITCH has manufactured high quality MEMBRANE KEYPADS and assemblies for over 18 years. And our experience in switch design sets us apart from other membrane suppliers. EECO SWITCH is one of the few manufacturers of both electro-mechanical switches and membrane keypads. Most membrane suppliers in the marketplace are primarily label designers and printers. They may know printing, but they don't know switch design and manufacturing. As a switch manufacturer, EECO SWITCH can offer expertise in both high quality switch design and graphics layout. This is why EECO SWITCH manufactures membrane keypads for major medical equipment manufacturers worldwide. They rely on EECO SWITCH for the quality and reliability their equipment demands.

EECO SWITCH engineers will design and manufacture a membrane keypad to meet YOUR demanding applications.

We offer:

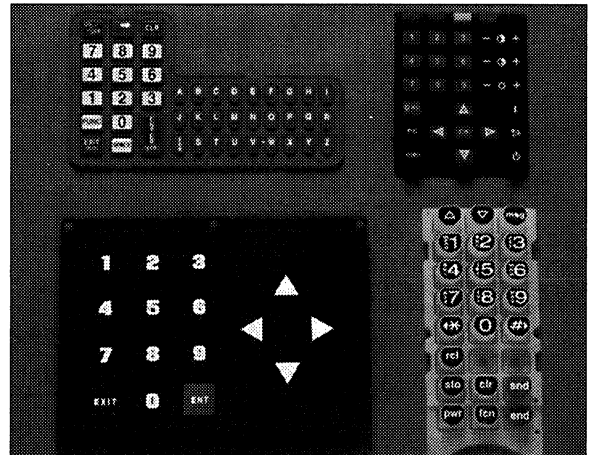
- Superior switch circuit design
- LED illumination
- Custom graphic design
- Custom embossing
- ESD shielding
- Metal or polymer domes for tactile feedback
- Fiber optic illumination
- Dead-face illuminated graphics

When your project calls for a custom membrane keypad, call the Switch Experts at EECO SWITCH first!



## **CUSTOM ELASTOMER KEYPAD PRODUCTS**

Does your new project need an ELASTOMER KEYPAD for the operator interface? Then look to the Switch Experts at EECO SWITCH to design the perfect elastomer keypad for you. EECO SWITCH offers an endless variety of colorful, durable elastomer keypads to meet any design requirement. Our engineers are the switch experts and can help you specify the right material, key travel, layout and graphics for your product. We can also offer a combination of our elastomer and membrane switch expertise to create a complete keypad assembly for you. EECO SWITCH is one of the few manufacturers of electro-mechanical switches and elastomer keypads. Our elastomer keypads are found in the most demanding applications worldwide. Rely on EECO SWITCH for the quality and reliability you demand. Why trust your elastomer keypad design to anyone else? When your project calls for a custom ELASTOMER KEYPAD, call the Switch Experts at EECO SWITCH first!



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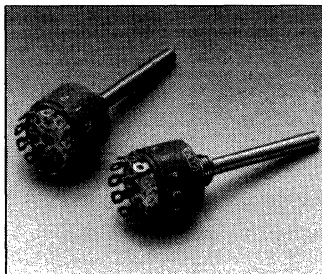
# High Quality Switches For Low Voltage Applications

All ELMA products are available off-the-shelf and **COMPETITIVELY PRICED**. For complete information or our free catalog call, write or fax today.

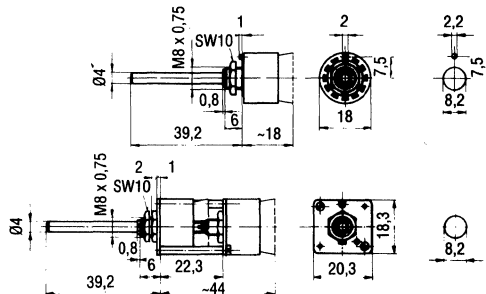
## Type 01

Type 01 switches are used when high quality and low cost are primary considerations. The type 01 can be panel or PCB mounted.

- Positions: 1-12
- Poles: 1-8
- Switch Mode: Shorting and non-shorting
- Contacts: Silver or 120 micro inch gold
- Mechanical Life: Greater than 600K detents
- Temperature Range: -40 to +85 deg. C
- Contact Resistance: < 10 milli Ohm
- Indexing Angle: 30, 36, and 60 deg.



TYPE 01

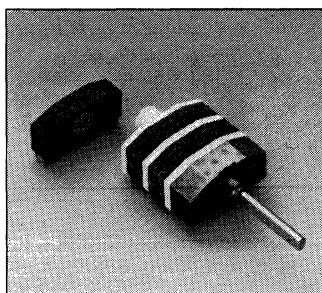


SW = Key spanner

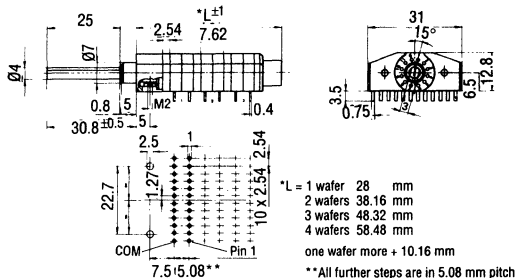
## Type 08

The type 08 is perfect for PCB applications which require a large number of poles or a low overall height. It is intended for PCB use only.

- Positions: 1-12
- Poles: 1-100 and more...contact factory
- Switch Mode: Shorting and non-shorting
- Contacts: Silver or 120 micro inch gold
- Mechanical Life: Greater than 600K detents
- Temperature Range: -40 to +85 deg. C
- Contact Resistance: < 20 milli Ohm
- Indexing Angle: 30 deg.



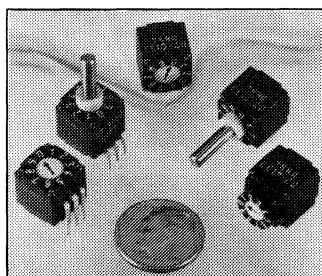
TYPE 08



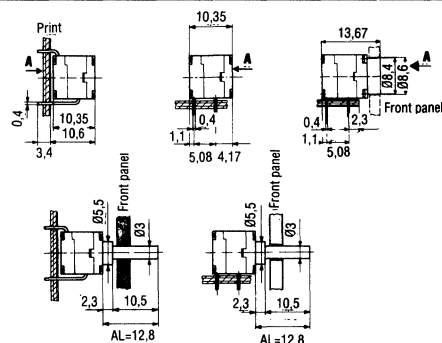
## Type 07 Coded

The type 07 coded switches are the best made, highest quality, longest lasting coded switches in the world...and we can prove it. Please call for test results.

- Positions: 1-16
- Coding: BCD, BCD Compliment, HEX, HEX Compliment, Gray Code
- Switch Mode: Shorting and non-shorting
- Contacts: 80 micro inch gold
- Mechanical Life: Greater than 320K detents for HEX
- Temperature Range: -40 to +85 deg. C
- Contact Resistance: < 10 milli Ohm
- Indexing Angle: 22.5 and 36 deg.



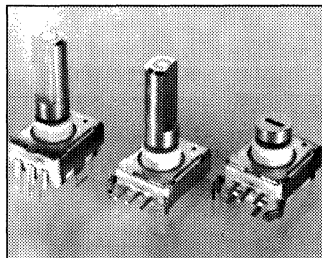
TYPE 07 ROTARY BCD



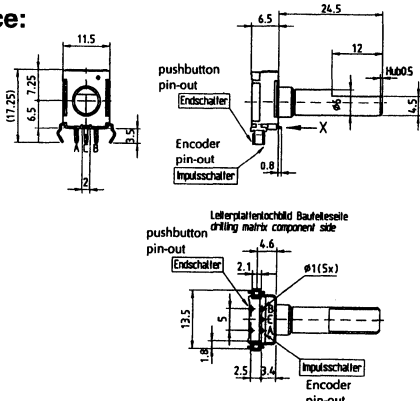
## Type E-27, Optical Encoder Reliability at Mechanical Encoder Price:

Elma E27 is the new sub-miniature mechanical encoder switch designed specifically for applications requiring extended life. E27 is the first low cost mechanical encoder to achieve 100,000 cycle rotation life. This technology breakthrough will enable users to benefit from greatly extended encoder life without the prohibitively high cost of optical encoders.

- Integrated push-button switch.
- Digital output up to 30 detents per rotation.
- This sub-miniature compact encoder is completely sealed and washable for modern assembly techniques.
- Available in horizontal and vertical configurations
- E27 encoders can be fitted with application specific shaft configurations, quickly and inexpensively.



TYPE E27 Horizontal



See Section 2400 (Panel Hardware-Bezels, Dials, Knobs, etc.), see Section 1400 (Cabinet Enclosures), see Section 2460 (Lamps & Lights), see section 5150 (Keyboard & Keypads) for additional products.

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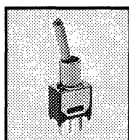
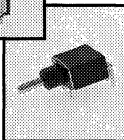
<http://www.e-switch.com>

## TOGGLE & ROCKER/PADDLE SWITCHES



**100 Series**

- 5A @ 120V AC, 2A @ 250V AC, 0.4VA @ 20V AC
- Multiple actuators
- Solder Lug, Quick Connect, PC Pin, and Rt. Angle PC Pin terminations
- Internal O-ring sealed versions
- Silver or Gold term.
- SPDT or DPDT



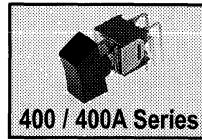
**200 Series**

- 3A @ 120V AC, 1A @ 250V AC, 0.4VA @ 20V AC
- Multiple actuators
- Solder Lug, PC Pin, and Rt. Angle PC Pin terminations
- Internal O-ring sealed versions
- Silver or Gold term.
- SPDT or DPDT



**300 / 300A Series**

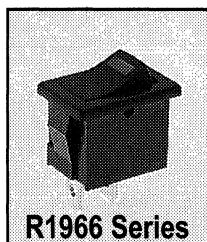
- 5A @ 120V AC, 2A @ 250V AC, 0.4VA @ 20V AC
- Multiple actuators
- Multiple terminations
- Panel mount versions
- Sealed styles (300A)



**400 / 400A Series**

- 3A @ 120V AC, 1A @ 250V AC, 0.4VA @ 20V AC
- Multiple actuators
- Multiple terminations
- Panel mount versions
- Sealed styles (400A)

## ROCKER SWITCHES



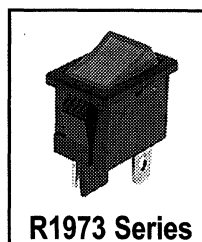
**R1966 Series**

- 15A @ 125V AC, 6A @ 250V AC
- Multiple markings
- LED lighted versions
- Solder Lug, Faston, PC Pin, and Rt. Angle PC Pin
- UL, CSA, VDE, Semko, Nemko, Demko, Fimko
- SPST or SPDT



**R3070 Series**

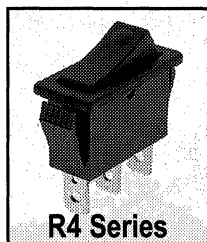
- 15A @ 125V AC, 10A @ 250V AC
- Multiple markings
- LED, Neon, and Incandescent lighted versions
- Solder Lug and Faston terminations
- UL, CSA
- SPST or SPDT



**R1973 Series**

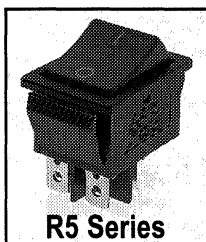
- 9A @ 125V AC, 6A @ 250V AC
- Multiple markings
- LED, Neon, and Incandescent lighted versions
- Faston and Rt. Angle PC Pin terminations
- UL, CSA, VDE, Semko, Nemko, Demko, Fimko
- SPST or DPST

## ROCKER SWITCHES



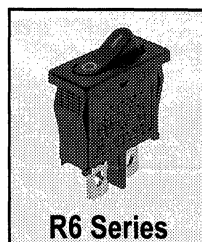
**R4 Series**

- 15A @ 125V AC, 10A @ 250V AC
- Multiple markings
- LED, Neon, and Incandescent lighted
- Faston termination
- UL, CSA, VDE, Semko, Nemko, Demko, Fimko
- SPDT



**R5 Series**

- 15A @ 125V AC, 10A @ 250V AC
- Multiple markings
- LED, Neon, and Incandescent lighted
- Faston termination
- UL, CSA, VDE, Semko, Nemko, Demko, Fimko
- DPDT



**R6 Series**

- 4(1A) @ 250V AC
- 2A @ 250V AC
- 6A @ 250V AC
- Multiple markings
- Faston or PC Pin terminations
- UL, CSA, VDE, Semko, Nemko, Demko, Fimko
- SPST or SPDT

## POWER PUSHBUTTON SWITCHES - LIGHTED



**D16 Series**

- 1A @ 250V AC, 2A @ 250V AC, 4A @ 250V AC, 5A @ 250V AC
- SPST, DPST, 3PST or 4PST circuits
- LED, Neon, and Incandescent bulbs
- Momentary or Latching versions
- UL approved



**D16 Series Sealed**

- 1A @ 250V AC, 2A @ 250V AC, 4A @ 250V AC, 5A @ 250V AC
- SPST, DPST, 3PST or 4PST circuits
- LED, Neon, and Incandescent bulbs
- Momentary or Latching versions
- UL approved
- Sealed to IP65 stds



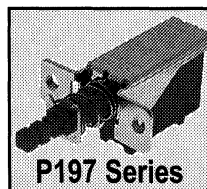
**P16 Series**

- 1A @ 250V AC, 2A @ 250V AC, 4A @ 250V AC, 5A @ 250V AC
- SPST, DPST, 3PST or 4PST circuits
- LED, Neon, and Incandescent bulbs
- Momentary or Latching versions
- UL approved
- P16 Series = Socket Style termination
- L16 Series = Pilot Indicator only



**L16 Series**

## POWER PUSHBUTTON SWITCHES



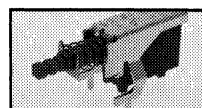
**P197 Series**

- 5A @ 125V AC, 5A @ 250V AC
- Panel mount avail.
- Solder Lug or PC Pin termination
- UL, CSA, VDE, Semko, Nemko, Demko, Fimko
- SPST



**P227 Series**

- 7A @ 125V AC, 4A @ 250V AC
- Panel mount avail.
- Solder Lug or PC Pin termination
- UL, CSA, VDE, Semko, Nemko, Demko, Fimko
- DPDT or DPST



- PC mount bracket
- UL, CSA, VDE, Semko, Nemko, Demko, Fimko
- SPST



- PC mount bracket
- UL, CSA, VDE, Semko, Nemko, Demko, Fimko
- DPDT or DPST

7153 Northland Dr., Brooklyn Park, MN 55428 (612) 504-3525 Fax: (612) 531-8235 [info@e-switch.com](mailto:info@e-switch.com)



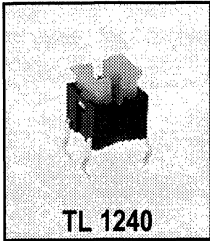
# E-SWITCH®

A Division of Electronic Components Groupe, Inc.

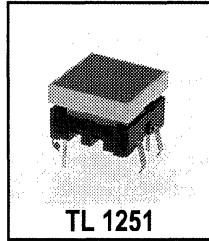
For complete specifications, contact us at 612-504-3525, or visit our online catalog:

<http://www.e-switch.com>

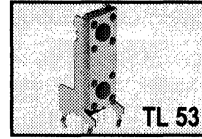
## LIGHTED TACT SWITCHES & TACT ASSEMBLIES



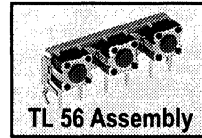
- 50mA @ 12V DC
- 160 gf operating force
- Various caps available with clear lenses and choice of colors
- Red, Green, or Yellow LEDs avail.
- SPST



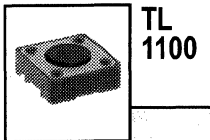
- 50mA @ 12V DC
- 300 gf max. operating force
- Entire top surface is back lit for high brilliance
- Red, Green, or Yellow LEDs avail.
- 8 mm height
- SPST



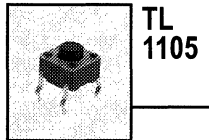
- 50mA @ 12V DC
- Choice of 100 gf, 160 gf, or 260 gf operating forces
- 10 mm or 15 mm key pitch available
- Various actuator lengths available
- Assemblies include up to 9 switches per chassis
- SPST



## TACTILE PUSHBUTTON SWITCHES



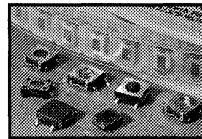
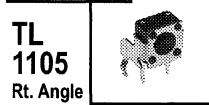
- 50mA @ 12V DC
- 160 gf or 260 gf operating forces
- Various actuator lengths and styles
- SPST; rt angle avail.



- 50mA @ 12V DC
- 100 gf, 160 gf, or 260 gf op. forces
- Various caps avail.
- Gold or Silver termination options
- Multiple actuator lengths available, including square snap-on head
- SPST



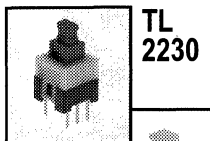
- 50mA @ 12V DC
- 130 gf, 180 gf, or 260 gf op. forces
- Various term. styles
- SPST



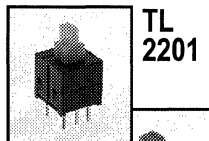
- 50mA @ 12V DC
- Multiple operating forces available.
- Gold or Silver termination options
- Multiple surface mount (SMT) styles in tape and reel
- Radial lead versions include rt. angle style
- SPST



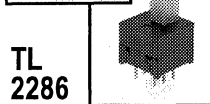
## PUSHBUTTON SWITCHES



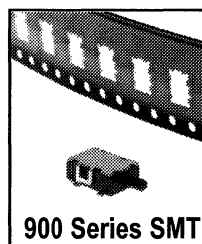
- 0.1A @ 30V DC
- 140gf operating force
- Moment. or Latching
- Multiple cap options
- DPDT



- 0.1A @ 30V DC
- 180 gf operating force
- Moment. or Latching
- Various actuator styles and lengths
- Various termination options
- DPDT (2201) or 4PDT (4201)

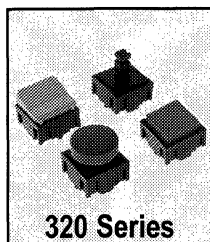


- 0.1A @ 30V DC
- 200gf operating force
- Moment. or Latching
- Multiple actuator lengths; caps avail.
- DPDT

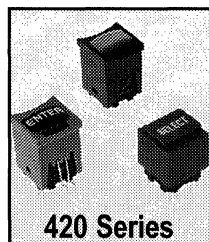


- 100mA @ 12V DC
- 51 gf maximum operating force
- Gull wing SMT termination
- Tape and reel packaging
- Ultra-miniature size
- SPST

## PUSHBUTTON SWITCHES



- 25mA @ 50V DC
- Momentary action
- Non-Shorting (BBM)
- Silver or Gold plated contacts
- Multiple cap styles and colors
- 0.7mm travel stroke
- SPDT, SPST



- 250mA @ 120V DC
- Silver or Gold Contacts
- LED Lighted versions with multiple color LEDs
- Momentary or Latching versions
- Multiple button and cover options
- DPDT

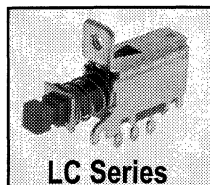


- 12mA @ 24V
- Momentary action
- LED lighted avail.
- Multiple cap colors and styles
- SPDT

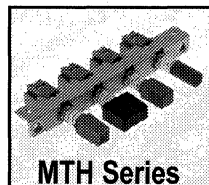


- 10mA @ 35V DC
- 10mA @ 100V AC
- Tactile feel
- Multiple cap colors and styles
- SPST

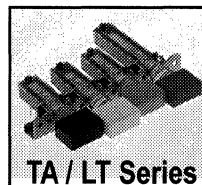
## PUSHBUTTON SWITCHES & INTERLOCKED ASSEMBLIES



- 0.3A @ 30V DC
- Moment. or Latching
- Solder Lug or PC Pin terminations
- Low profile and panel mount styles
- Multiple shaft styles
- 3.5 mm travel stroke
- SPDT or DPDT



- 0.1A @ 30V DC
- Individual mounting brackets available
- Momentary or Latching
- Shorting (MBB) or Non-Shorting (BBM)
- UL94V0 mtl. avail.
- 2, 4, or 6 poles



- 0.5A @ 100V AC, 0.2A @ 250V AC, 1A @ 25V DC
- Moment. or Latching
- Std. or 'Light Touch' operating forces
- Silver or Gold contacts
- UL94V0 mtl. avail.
- Short. or Non-Short.
- Up to 16 poles

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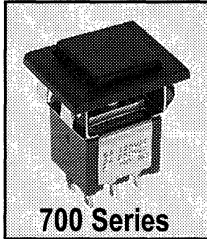
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<http://www.e-switch.com>

## SNAP-ACTING PUSHBUTTON SWITCHES



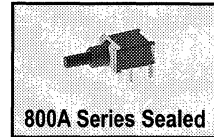
700 Series

- 1A @ 120V AC, 0.4VA @ 20V AC
- Multiple cap options
- Solder Lug, Quick Connect, PC Pin, and Rt. Angle PC Pin terminations
- Panel mount versions available
- Silver or Gold term.
- SPDT or DPDT
- Sealed styles (700A)

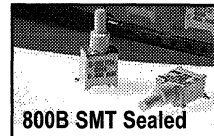


800 Series

- 3A @ 120V AC, 1A @ 250V AC, 0.4VA @ 20V AC
- Multiple cap options
- Solder Lug, PC Pin, and Rt. Angle PC Pin terminations
- Panel mount versions available
- Silver or Gold term.
- SPST or SPDT



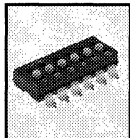
800A Series Sealed



800B SMT Sealed

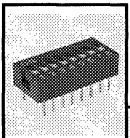
- 1A @ 120V AC, 0.4VA @ 20V AC
- Snap-in bracket available
- PC Pin, and Rt. Angle PC Pin terminations
- Internal O-ring seal
- Silver or Gold term.
- SMT versions in tape and reel (800B)
- UL94V0 materials
- SPST

## DIP SWITCHES



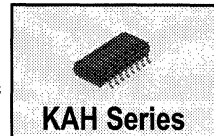
KAW Series

- Switch: 25mA @ 24VDC
- Carry: 100mA @ 50VDC
- PC Pin or Gull Wing SMT termination
- Recessed or extended actuators
- Std. or tape and reel packaging
- Top tape seal avail.
- SPST 1-12 pos. (KAW)
- SPST 2-10 pos. (KAL)



KAS Series

- Switch: 25mA @ 24VDC
- Carry: 100mA @ 50VDC
- PC Pin or Rt. Angle PC Pin (KAS only)
- Recessed or extended actuators
- Top Side 'OFF' and Top Side 'ON' styles
- Top tape seal avail.
- UL94V0 materials
- SPST 2-12 pos.

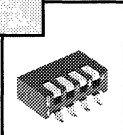


KAH Series

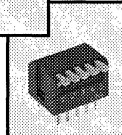
- Switch: 25mA @ 24VDC
- Carry: 100mA @ 50VDC
- 1/2 pitch size with gull wing SMT term.
- Top tape seal avail.
- UL94V0 materials
- SPST 4 pos., 8 pos.



KAL Series



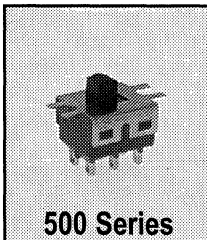
KAP Series



KAT Series

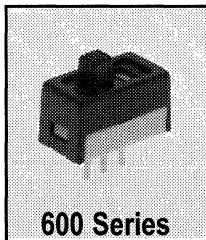
- Switch: 25mA @ 24VDC
- Carry: 100mA @ 50VDC
- PC Pin termination
- UL94V0 materials
- Tri-State circuit: 4 pos., 8 pos., 9 pos., and 10 pos.

## SLIDE SWITCHES



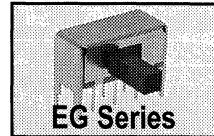
500 Series

- 6A @ 120V AC, 3A @ 250V AC, 0.4VA @ 20V AC
- Solder Lug, Quick Connect, PC Pin, and Rt. Angle PC Pin terminations
- Mounting Ears avail.
- Multiple actuators
- Silver or Gold term.
- SPDT or DPDT



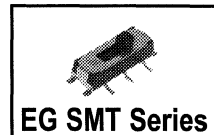
600 Series

- 6A @ 120V AC, 3A @ 250V AC, 0.4VA @ 20V AC
- Various termination spacing options
- Recessed, Extended or Side actuators
- Silver or Gold term.
- SPDT or DPDT



EG Series

- Multiple ratings avail.
- Right angle versions
- SMT versions in tape and reel
- Short. or Non-Short.
- Multiple actuators
- Multiple operating forces
- SPDT, SP3T, DPDT, DP3T, DP4T, DP6T, 4PDT, 4P3T, 4P4T, 6PDT, 6P3T, 6P4T, 8PDT, 8P3T, 8P4T



EG SMT Series

## KEYLOCK SWITCHES



Barrel Keys

- Multiple ratings avail.: 0.2A @ 125V AC / 0.4A @ 250V AC; 1A @ 125V AC / 0.5A @ 250V AC; 2A @ 125V AC / 1A @ 250V AC; 3A @ 125V AC / 1.5A @ 250V AC; 4A @ 125V AC / 2A @ 250V AC
- (continued next column)



Std. Keys

- Up to 5 (five) key positions per lock with up to 20 lock configurations
- Multiple key styles
- Up to 50,000 key combinations
- Various materials available
- Multiple indexing: 45°, 60°, or 90°
- SP or DP versions

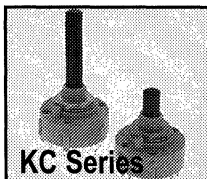


KO Series



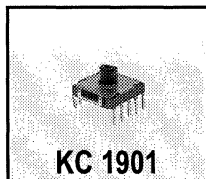
KO Series

## ROTARY SWITCHES & LEVER SWITCHES



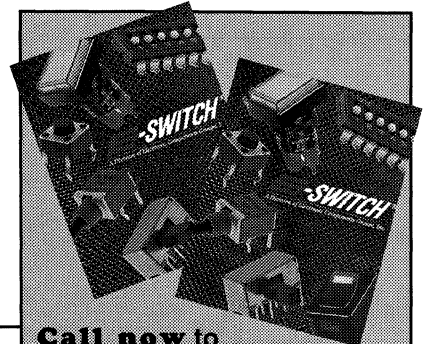
KC Series

- 350mA @ 110V AC, 150mA @ 250V AC
- Solder Lug or PC Pin
- Up to 12 positions
- Shorting (MBB) or Non-Shorting (BBM)
- Silver or Gold term.
- SPST, DPST, 3PST, or 4PST versions



KC 1901

- 0.1A @ 16V DC
- Contact resistance: 100mΩ Max.
- PC Pin termination
- Various actuator lengths available
- Circuit: 1 common, 9 positions



Call now to receive the 190 page, color E-Switch catalog, featuring complete specifications and order information for the entire E-Switch product line: 612-504-3525.

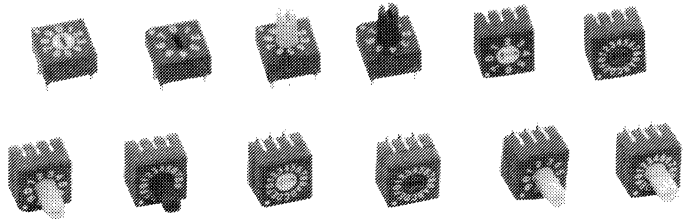
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# DIP SWITCHES/REED RELAYS

AN ISO-9001 COMPANY  
**ROTARY DIP SWITCHES**

Mounting	Actuator	Position	Part No.
Surface	Flat	8, 10, 16	ERD1(08, 10, 16)RM
Thru-Hole	Flat	8, 10, 16	ERD1(08, 10, 16)RS
Thru-Hole	Shaft	8, 10, 16	ERD2(08, 10, 16)RS
Rt. Angle	Flat	8, 10, 16	ERD1(08, 10, 16)RR
Thru-Hole	Shaft	8, 10, 16	ERD2(08, 10, 16)RR



## DIP SWITCHES

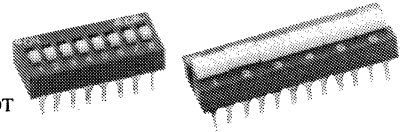
**CONTACT RATING:** Switching-50mA @ 24VDC. Non-Switching-100mA, 50VDC;  
**CONTACT RESISTANCE:** 100mΩ Max. @ 5VDC, 10mA.  
**TEMPERATURE RATING:** Operating-25°C to +70°C, Storage-40°C to +85°C;  
**OPERATING FORCE:** 800gf-cm Max.  
**HUMIDITY:** 95% RH, 40°C for 96Hrs.

**VIBRATION:** Per MIL-STD-202F, Method 204D  
**SOLDERABILITY:** After flux 230±5°C for 5±0.5 second 95% coverage.  
**SOLDERING HEAT:** 260±5°C for 5±1 second. All UL-94V-0 fire retardant plastics used.  
**OPERATING LIFE:** 2000 to 3000 operations.

## TOP SLID DIP SWITCHES: EDG/EDS Series

**EDG/EDS**

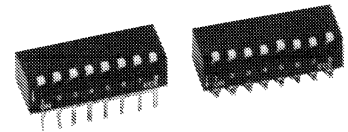
**Actuator & Sealing:** S: Standard; ST: Standard and Sealed.  
 L: Low Profile; LT: Low Profile and Sealed.  
**# of Position:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15  
**Contact Form:** 1: SPST; 2: DPST; 3: SPDT; 4: 3PST; 5: 4PST; 6: DPDT  
**EDG:** Gold Plated Contact; **EDS:** Silver Plated Contact



## PAINO DIP SWITCHES: EPG/EPS/EPD Series

**EPG/EPS/EPD**

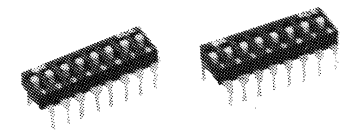
**Actuator & Sealing:** A: Top Side "OFF"; AT: Same as "A" + w/Tape Sealed.  
 B: Top Side "ON"; BT: Same as "B" + w/Tape Sealed.  
**# of Position:** 2, 3, 4, 5, 6, 7, 8, 9, 10, 12  
**Contact Form:** 1: SPST; 2: DPST; 3: SPDT; 4: 3PST; 5: 4PST; 6: DPDT  
**EPG:** Gold Plated Contact; **EPS:** Silver Plated; **EPD:** SMT



## AUTO INSERT: EAM Series

**EAM**

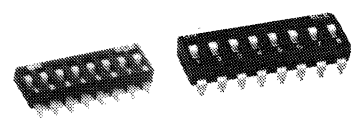
**Actuator & Sealing:** L: Low Profile; LT: Same as "L" + w/Tape Sealed.  
 E: Extended Actuator; ET: Same as "E" + w/Tape Sealed.  
**# of Position:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12  
**Contact Form:** 1: SPST  
**EAM:** Auto Insert & End Stackable



## SURFACE MOUNT: ESD/ESL Series

**ESD/ESL**

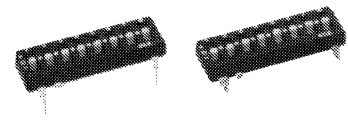
**Actuator & Sealing:** L: Low Profile; LT: Same as "L" + w/Tape Sealed.  
 E: Extended Actuator; ET: Same as "E" + w/Tape Sealed.  
**# of Position:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12  
**Contact Form:** 1: SPST  
**ESD:** Gull-wing Lead; **ESL:** J-wing Lead



## TRI-STATE: ETD/ETA/ETS Series

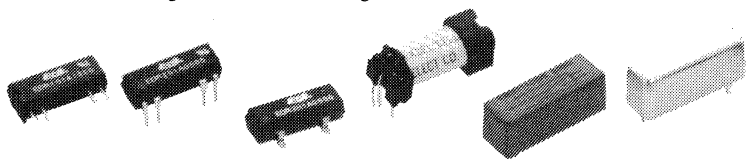
**ETD/ETA/ETS**

**Actuator & Sealing:** L: Low Profile; LT: Same as "L" + w/Tape Sealed.  
 E: Extended Actuator; ET: Same as "E" + w/Tape Sealed.  
**# of Position:** 4, 5, 6, 7, 8, 9, 10, 12  
**Contact Form:** 1: SPST  
**ETD:** Bottom Epoxy Sealed; **ETA:** Auto Inserting; **ETS:** Surface Mounting



## REED RELAYS

Type	Contact Form	Nominal Voltage
DIP	1A, 2A, 1B, 1C	5, 12, 24
SMT	1A, 2A, 1B, 1C	5, 12, 24
SIP	1A	5, 12, 24



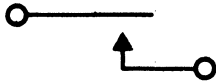
**EXCEL CELL ELECTRONIC (USA), CORP.**  
 One Gatehall Dr., Plaza Level  
 Parsippany, NJ 07054  
 Visit our website for complete product lines  
 Call, fax or E-mail us for complete catalog and detailed specifications.

Phone: (973) 984-8885  
 Fax: (973) 984-8099  
 E-mail: [ece@ece-usa.com](mailto:ece@ece-usa.com)  
<http://www.ece-usa.com>

AN ISO-9001 COMPANY

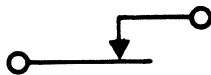
**A**

Make  
SPST-NO



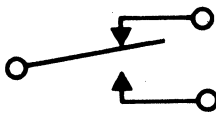
**B**

Break  
SPST-NC



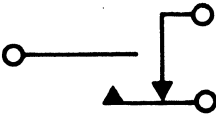
**C**

Break, Make  
(Transfer)  
SPDT



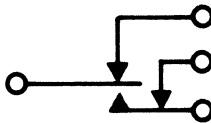
**D**

Make, Break  
(Continuity  
Transfer)



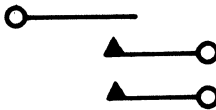
**E**

Break,  
Make,  
Break



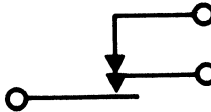
**F**

Make,  
Make



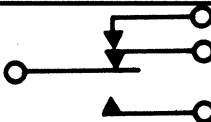
**G**

Break,  
Make



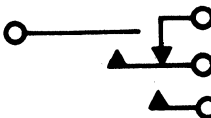
**H**

Break,  
Break,  
Make



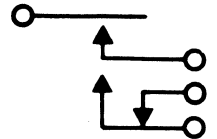
**I**

Make,  
Break,  
Make



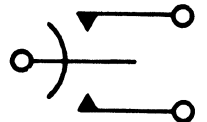
**J**

Make,  
Make,  
Break



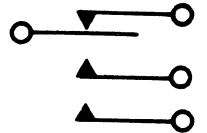
**K**

Center off  
SPDT



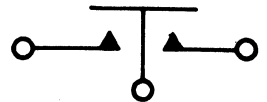
**L**

Break,  
Make,  
Make



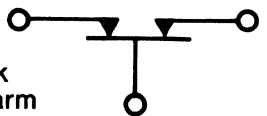
**U**

Double make  
Contact  
on arm



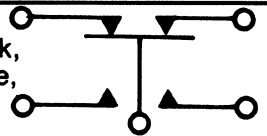
**V**

Double break  
Contact on arm



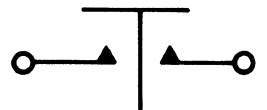
**W**

Double break,  
Double make,  
Contact  
on arm



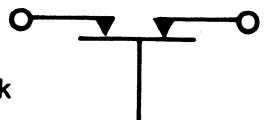
**X**

Double  
make



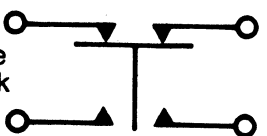
**Y**

Double break



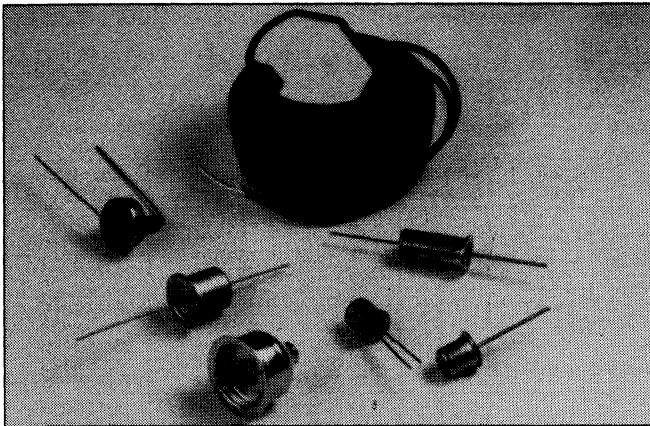
**Z**

Double make  
Double break  
SPDT-DB





# Mercury and Mercury-Free Tilt and Motion Switches and Assemblies



Fifth Dimension Inc. offers a broad range of low cost tilt and motion switches, available in small and large quantities and suited to a broad range of commercial, industrial and high-reliability applications such as aerospace, consumer appliances, automotive, health/medical, military, motion control, security and toys. They may be activated by tilt, shock motion, acceleration, vibration, impulse, and centrifugal force and can be custom designed to meet your specifications. Reliability and ruggedness are ensured by hermetically sealed, welded steel cases.

## Miniature Mercury Tilt Switches

	Omnidirectional (NO)			Omnidirectional (NC)		Miniature Omnidirectional (NC)		Single Plane	Omnidirectional Snap Action (NC)
Dimensions									
Part Number	TS7-0	TS7-0J	TS7-10	TS7B-0	TS7B-10	TS8	TS68D	TS66D	STS411
Operating Angle (°) (to close from 0°)	16±8	18±8	6±5	25±12 (3)	25±12 (3)	7±5 (3)	40±20	1.5±3	42±6 (3)
Operating Angle (°) (to open from 0°)	12±8	12±8	4±5	35±12 (3)	35±12 (3)	13±10 (3)	60±20	-2±3	55±6 (3)
Switching Hysteresis (°)	4±4	6±4	2±3	5 max.	15 max.	6±5	20	2 Typ.	13±5
Load Current (resistive) @ 115 VAC (amps)	0.5	0.5	0.5	0.5	0.5	0.2	0.2	0.1	1.0
Load Current (resistive) @ 12 VDC (amps)	1.0	0.5	1.0	1.0	1.0	0.5	0.5	1.0	2.0
Typical Contact Resistance @ 1mA (ohms)	0.3	0.7	0.5	0.15	0.50	0.25	0.25	0.5	0.1
Speed of Response (relative) (1)	0	0	2	0	2	0	N/A	0	1
Contact Jitter (relative) (2)	4	5	2	3	2	3	3	4	0

### NOTES:

1. Depends on damping fluid selected to reduce jitter. Rated on a scale of 0 to 5 with 5 being most heavily damped (longest response time).
2. Jitter is the tendency to change state 3° from the operating point. Rated on a scale of 0 to 5 with 5 being most susceptible to vibrations.
3. Values shown apply when plane of leads is parallel to plane of rotation; see data sheet for other values.

## Miniature Motion Switches

**Low-G Impulse Switch** (PN 21638-X): Normally open with momentary closure when specified G-level is exceeded; non-latching; mercury. Available in sensitivities from 0.2 to 1.0 G measured with a 50msec half-sine impulse. Mountable in any position.

**Motion switches** (PN 21680-701, 702): Detect vibrations; **non mercury**. Sensitivity < 0.1G measured with a 50msec half-sine impulse. Available with 1 or 2 mounting leads; mountable in any position.



# Fifth Dimension

801 New York Avenue, Trenton, NJ 08638

Tel: 609-393-8350, Fax: 609-599-9508

**NEW**

**5D**

**Mercury FREE Switch**

Our new tilt Switch offers a breakthrough in miniature switching technology. Switching at 2 amperes for more than 100,000 operations. Fifth Dimension's new Mercury Free Switch has the performance and price of a mercury switch without the environmental concerns.

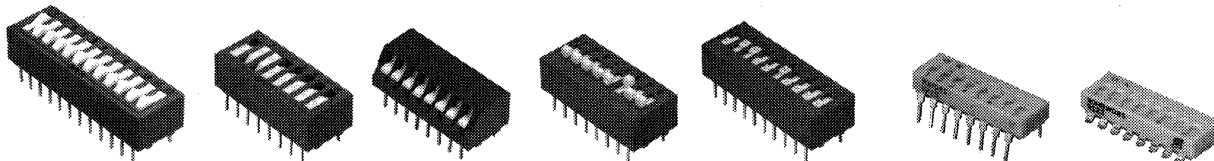
**NEW Environmentally Friendly, Patent Pending Switch From Fifth Dimension**



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# SPST DIP Switches

## SINGLE POLE/SINGLE THROW DIP SWITCHES



Raised Rocker      Recessed Rocker      PIANO-DIP®      Raised Slide      Recessed Slide      Machine Insertable      Surface Mount

### ROCKER DIP SWITCHES—SERIES 76

#### Raised and Recessed Rockers and PIANO-DIP®

Rated to make and break 1 mA, 5 Vdc; or 50 mA, 30 Vdc; or 150 mA, 30 Vdc for 10,000 operations per position. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate. Width is .380" (9,65mm); height is .315" (8,0mm) for raised rocker style, .267" (6,27mm) for recessed style, .301" (7,65mm) for the PIANO-DIP®. Piano-Dip® standard is up-off. Contact Grayhill for up-on.

### SLIDE DIP SWITCHES—SERIES 78

#### Raised and Recessed Slide Types

Rated to make and break 1 mA, 5 Vdc; or 50 mA, 30 Vdc; or 150 mA, 30 Vdc for 10,000 operations. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate. Width is .380" (9,65mm); height is .315" (8,0mm) for raised slides and .265" (6,73mm) for recessed slides.

### MACHINE INSERTABLE, MIDIP® SWITCH—SERIES 90

Compatible with leading TO-116 IC insertion equipment. Rated to make and break 10 mA, 30 Vdc; or 10 mA, 50 mVdc for 2,000 operations per position. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate. Terminals are molded (sealed) into base. Top seal is polyimide film. Width is .290" (7,37mm) max.; height above board is .180" (4,57mm) max.

### SURFACE MOUNTABLE SWITCHES—SERIES 90HBW

Compatible with surface mount assembly, including up to 260°C. Rated to make and break 100 mA, 6Vdc; or 10 mA, 50 mVdc for 2,000 operations per position. Contacts are copper alloy, gold plated 10 microinches minimum over nickel. Non-conductive parts are UL94V-0 rated plastic; top seal is polyimide film. Width is .290" (7,37mm) max.; height above board is .190" (4,83mm) max.

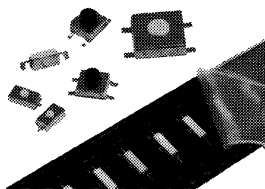
### MILITARY QUALIFIED DIP SWITCHES

Switch part numbers containing the letter M are qualified to MIL-S-883504 and may be ordered by the appropriate "M" number.

### TOP SEAL OPTION

Add S to part number. Part numbers with suffix S are supplied with tape seal as standard.

### SERIES 95 TACTILE SWITCH



Series 95 offers excellent tactile feedback in these miniature switches in perpendicular and flush or offset right angle mounts. 95B04 part numbers are .138" x .275". Mounting terminals add .0825" length to each side for right angle types, .0205" for perpendicular types. 95B06 part number is .260" x .260". 95B12 part numbers are .450" x .450". Switches are rated for 100 mA resistive, 5 Vdc. 25,000 cycles of operation for 95B04, 100,000 for 95B06, and 1,000,000 for 95B12. All types are offered in tape and reel packaging. Switches per reel: 2000 for 95B04, 1000 for 95B06 and 750 for 95B12.

Part Number	Circuitry	Mounting Style
95B04A2GWR	N.O.	Perpendicular—Gull Wing
95B04A2FAR	N.O.	Right Angle Offset Mount
95B04A2RAR	N.O.	Right Angle Flush Mount
95B06C3GWR	N.O.	Perpendicular—Gull Wing
95B12A3GWR	N.O.	Perpendicular—Gull Wing

Switch Type	No. of Stations	Length Inch (mm)	Part No.* Standard	Part No.* Military	
Raised Rocker Type	2	0.28 (7,1)	76SB02	76MSB02S	
	3	0.38 (9,7)	76SB03	76MSB03S	
	4	0.48 (12,2)	76SB04	76MSB04S	
	5	0.58 (14,7)	76SB05	76MSB05S	
	6	0.68 (17,3)	76SB06	76MSB06S	
	7	0.78 (19,8)	76SB07	76MSB07S	
	8	0.88 (22,4)	76SB08	76MSB08S	
	9	0.98 (24,9)	76SB09	76MSB09S	
	10	1.08 (27,4)	76SB10	76MSB10S	
	12	1.28 (32,5)	76SB12	76MSB12S	
	Recessed Rocker Type	2	0.28 (7,1)	76RSB02	76MRSB02S
		3	0.38 (9,7)	76RSB03	76MRSB03S
4		0.48 (12,2)	76RSB04	76MRSB04S	
5		0.58 (14,7)	76RSB05	76MRSB05S	
6		0.68 (17,3)	76RSB06	76MRSB06S	
7		0.78 (19,8)	76RSB07	76MRSB07S	
8		0.88 (22,4)	76RSB08	76MRSB08S	
9		0.98 (24,9)	76RSB09	76MRSB09S	
10		1.08 (27,4)	76RSB10	76MRSB10S	
12		1.28 (32,5)	76RSB12	76MRSB12S	
PIANO-DIP® Side Actuated Rocker Type		2	0.28 (7,1)	76PSB02	76MPSB02S
		3	0.38 (9,7)	76PSB03	76MPSB03S
	4	0.48 (12,2)	76PSB04	76MPSB04S	
	5	0.58 (14,7)	76PSB05	76MPSB05S	
	6	0.68 (17,3)	76PSB06	76MPSB06S	
	7	0.78 (19,8)	76PSB07	76MPSB07S	
	8	0.88 (22,4)	76PSB08	76MPSB08S	
	9	0.98 (24,9)	76PSB09	76MPSB09S	
	10	1.08 (27,4)	76PSB10	76MPSB10S	
	12	1.28 (32,5)	76PSB12	76MPSB12S	
	Raised Slide Type	2	0.28 (7,1)	78B02	78MB02S
		3	0.38 (9,7)	78B03	78MB03S
4		0.48 (12,2)	78B04	78MB04S	
5		0.58 (14,7)	78B05	78MB05S	
6		0.68 (17,3)	78B06	78MB06S	
7		0.78 (19,8)	78B07	78MB07S	
8		0.88 (22,4)	78B08	78MB08S	
9		0.98 (24,9)	78B09	78MB09S	
10		1.08 (27,4)	78B10	78MB10S	
12		1.28 (32,5)	78B12	78MB12S	
Recessed Slide Type		2	0.28 (7,1)	78RB02	N/A
		3	0.38 (9,7)	78RB03	N/A
	4	0.48 (12,2)	78RB04	N/A	
	5	0.58 (14,7)	78RB05	N/A	
	6	0.68 (17,3)	78RB06	N/A	
	7	0.78 (19,8)	78RB07	N/A	
	8	0.88 (22,4)	78RB08	N/A	
	9	0.98 (24,9)	78RB09	N/A	
	10	1.08 (27,4)	78RB10	N/A	
	12	1.28 (32,5)	78RB12	N/A	
	Machine Insertable Slide MIDIP®	2	0.27 (6,9)	90B02S	90MB02S
		3	0.37 (9,4)	90B03S	90MB03S
4		0.47 (11,9)	90B04S	90MB04S	
5		0.57 (14,5)	90B05S	90MB05S	
6		0.67 (17,0)	90B06S	90MB06S	
7		0.77 (19,6)	90B07S	90MB07S	
8		0.87 (22,1)	90B08S	90MB08S	
9		0.97 (24,6)	90B09S	90MB09S	
10		1.07 (27,2)	90B10S	90MB10S	
Surface Mountable Slide Type		2	0.27 (6,9)	90HBW02S	N/A
		3	0.37 (9,4)	90HBW03S	N/A
		4	0.47 (11,9)	90HBW04S	N/A
	5	0.57 (14,5)	90HBW05S	N/A	
	6	0.67 (17,0)	90HBW06S	N/A	
	7	0.77 (19,6)	90HBW07S	N/A	
	8	0.87 (22,1)	90HBW08S	N/A	
	9	0.97 (24,6)	90HBW09S	N/A	
	10	1.07 (27,2)	90HBW10S	N/A	

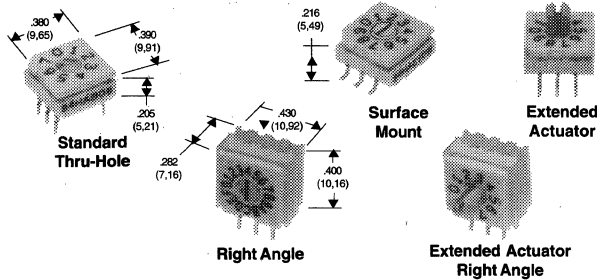
For prices, contact your local Sales Office, an authorized Distributor, or GRAYHILL. Available From Your Local GRAYHILL Distributor



# Surface Mount DIP Switches

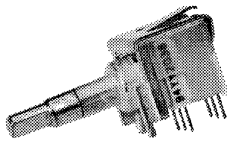
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## SERIES 94 CODED ROTARY DIP SWITCHES



**Series 94** sealed rotary DIP switches have binary output with the following positions and code types: 8 pos. Octal, 10 pos. BCD, or 16 pos. Hexadecimal. Complement codes available. Actuators are offered flush and in three extended lengths with an assortment of high temperature knobs. Rated mechanical life of 10,000 cycles (1 cycle: rotation through all positions and a complete return through all positions). Electrical ratings through 10,000 cycles: 100 mA @ 50 Vdc current carrying; 150 mΩ @ 50 mA, 50 mVdc contact resistance; 250 Vac RMS dielectric. Through hole terminals on a 0.1" (2,54 mm) x 0.3" (7,62 mm) grid. Surface mount terminals on 0.1" (2,54 mm) centers x 0.5" (12,70 mm) wide with .05" (1,27 mm) solder flats. Right angle terminals on a 0.1" (2,54 mm) x 0.1" (2,54 mm) grid. Terminals are nickel over copper alloy with 90/10 tin/lead solder plating. Maximum process temperature of 250°C for 10 seconds.

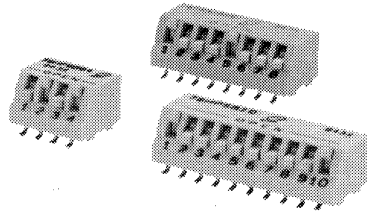
Type of Mounting	Actuator	Positions	Standard Code Part Number
Surface Mount	Flush	8, 10, 16	94HAB(08,10,16)W
	0.09	8, 10, 16	94HEB(08,10,16)W
	0.17	8, 10, 16	94HCB(08,10,16)W
	0.27	8, 10, 16	94HBB(08,10,16)W
Standard Thru-Hole	Flush	8, 10, 16	94HAB(08,10,16)
	0.09	8, 10, 16	94HEB(08,10,16)
	0.17	8, 10, 16	94HCB(08,10,16)
	0.27	8, 10, 16	94HBB(08,10,16)
Right Angle Thru-Hole	Flush	8, 10, 16	94HAB(08,10,16)RA
	0.09	8, 10, 16	94HEB(08,10,16)RA
	0.17	8, 10, 16	94HCB(08,10,16)RA
	0.27	8, 10, 16	94HBB(08,10,16)RA



**Series 94R** coded rotary switches have binary output with the following positions and code types: 8 pos. Octal, 10 pos. BCD, or 16 pos. Hexadecimal. Complement codes available. Actuator is offered with continuous rotation or with a stop between positions. Electrical ratings equal to Series 94. Rated mechanical life of 10,000 cycles (1 cycle: rotation through all positions and a complete return through all positions). Terminals are nickel over copper alloy with 90/10 tin/lead solder plating. Maximum process temperature of 250°C for 10 seconds. Rated operating temperature -40°C to 85°C. Operational torque 1.2 in-oz min. through rated life. Resistant to vibration, mechanical shock, flux cleaning, and moisture.

Code and Positions	Standard Coding Continuous Rotation	Standard Coding Stop Between 1st and Last Position
Octal 8	94RB08C	94RB08F
BCD 10	94RB10C	94RB10F
Hexadecimal 16	94RB16C	94RB16F

## SURFACE MOUNT DIP SWITCHES



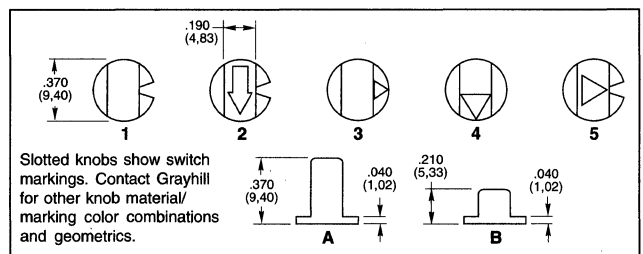
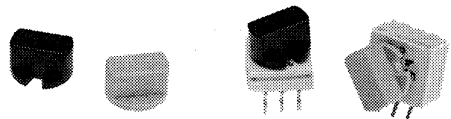
Grayhill surface mount DIP switches are compatible with SMT assembly processes up to 260°C. Switch covers and actuators are natural color thermoplastic UL94V-O rating. Shorting member is phosphor bronze, gold plated over nickel barrier; base contacts are copper alloy, gold plated over nickel barrier; terminals are copper alloy, solder plated (90/10) over nickel barrier. Contact Grayhill for tape and reel packaging.

### Series 76HP

Side operated, rocker actuated DIP switch for board edge mounting. SPST circuitry. Rated for 10,000 operations/switch position at 1 mA, 5 Vdc. Width is .380" (9,65 mm). Height is .301" (7,65 mm).

Switch Type	Number of Stations	Length in (mm)	Part Number
Series 76	2	0.28 (7,1)	76HPSB02GW
Surface Mount	4	0.480 (12,2)	76HPSB04GW
	6	0.690 (17,3)	76HPSB06GW
PIANO-DIP	8	0.880 (22,4)	76HPSB08GW
	10	1.080 (27,4)	76HPSB10GW

## SERIES 94 HIGH TEMPERATURE KNOBS For Shaft Extensions



Knob Style and Height	Knob Color	Arrow Color	Part Number
1A	Gray	N/A	947706-001
5A	Gray	Black	947706-003
1B	Black	N/A	947705-001
1B	Gray	N/A	947705-012
2B	Gray	White	947705-004
3B	Gray	Black	947705-017
4B	Gray	Black	947705-018
1B	Natural	N/A	947705-009
4B	Black	White	947705-010
5B	Gray	Black	947705-019

For prices, contact your local Sales Office, an authorized Distributor, or GRAYHILL. Available From Your Local GRAYHILL Distributor

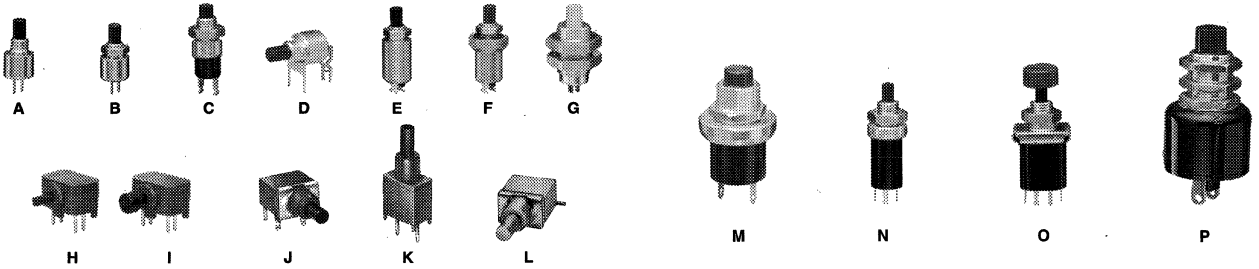


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# Pushbutton Switches

## SMALL LOW CURRENT AND MOMENTARY SWITCHES

## LOW CURRENT WIPING CONTACT SWITCHES AND HIGH CURRENT SNAP ACTION SWITCH



SPST = Single Pole/Single Throw, Momentary

SPDT = Single Pole/Double Throw, Momentary

NO or NC = Normally Open or Normally Closed

### MINIATURE, BUTT CONTACT SWITCHES—FIG. A TO I

Gold contacts provide low level switching with maximum life in minimum space. PC, sealed, right angle, and limit switch. SPST NO or NC, and SPDT types. Contact Grayhill for overtravel types.

### MINIATURE, PC MOUNT, SWITCHES; LOW LEVEL OR HIGH CURRENT OPTION—FIG. J TO L

PC Mount, right angle (Fig. J), vertical (Fig. K) thru-hole mounts, and surface mount (Fig. L) options. Contact system choices allow use at logic currents or up to 1 Amp switching. Surface mount is O-ring sealed, optional in other types, and available in tape and reel. Plunger length is 0.215". Flush plunger is also an option.

### 1 & 3 AMP WIPING CONTACT SWITCHES—FIG. M

Self cleaning contacts for use in critical contact resistance circuits. SPST NO or NC, standard, and UL recognized.

### 1/4 AMP WIPING CONTACT SWITCHES—FIG. N, O

Long wipe, double throw switches for low level switching. SPDT or DPDT circuitry. Contact Grayhill for sealed types.

### 10 AMP SNAP ACTION SWITCHES—FIG. P

Rapid make and break for higher current switching; audible click. SPST NO or NC, and SPDT types.

## ORDERING INFORMATION

Circuitry & Description (PC=PC Mount, RA=Right Angle Mount)	Fig.	Part No., Red or Natural Button	Part No. Black Button	Make & Break Current*	Life Operations	Behind Panel	Max. Width
NO	A	39-1	39-3	500 mA	1,000,000	0.315	0.253
NO, PC	A	39-401 RED	39-401 BLK	150 mA**	1,000,000	0.215	0.253
NO, Sealed	B	39-351 RED	39-351 BLK	500 mA	250,000	0.350	0.361
NO, PC, Right Angle	D	39-501 RED	39-501 BLK	150 mA**	1,000,000	0.300	0.253
NC	E	—	39-2	250 mA	250,000	0.490	0.253
NC, Sealed	F	39-352 RED	39-352 BLK	250 mA	100,000	0.529	0.361
NO, Limit	G	39-101 (Natural)	—	500 mA	500,000	0.650	0.505
NO, Overtravel, Sealed	G	39-701 (Natural)	—	150 mA	100,000	0.800	0.505
NC, Limit, Sealed	G	39-702 (Natural)	—	250 mA	100,000	0.560	0.505
SPDT PC, Right Angle, Sealed	H	39-251 RED	39-251 BLK	250 mA	500,000	0.400	0.500
SPDT, PC, RA, Wide Button, Sealed	I	39-261 RED	39-261 BLK	250 mA	500,000	0.400	0.500
NO	C	30-1	30-3	1 Amp	1,000,000	0.592	0.375
NO, UL Recognized	C	30-1UL	30-3UL	5 Amps	6,000	0.592	0.375
NO, Overtravel	C	30-15	30-37	1 Amp	500,000	0.677	0.375
NC	C	30-2	30-6	1 Amp	1,000,000	0.605	0.375
NC, UL Recognized	C	30-2UL	30-6UL	5 Amps	6,000	0.605	0.375
NO, Gold Contacts	J	—	38BT-4-H-1-N	0.4 Amp***	60,000	0.390	0.320
NO, Silver Contacts	J	—	38BT-4-H-2-N	1 Amp	60,000	0.390	0.320
NO, Gold Contacts	K	—	38BT-4-V-1-N	0.4 Amp***	60,000	0.200	0.527
NO, Silver Contacts	K	—	38BT-4-V-2-N	1 Amp	60,000	0.200	0.527
NO, Surface Mount, Gold Contacts	L	38BM-4-H-1-S	—	0.4 Amp***	60,000	0.390	0.320
NO	M	4001	10-9	1 Amp	100,000	0.965	0.800
NO, UL Recognized	M	4001UL	10-9UL	3 Amps	6,000	0.965	0.800
NC	M	4002	10-10	1 Amp	100,000	0.965	0.800
NC, UL Recognized	M	4002UL	10-10UL	3 Amps	6,000	0.965	0.800
SPDT	N	46-101 RED	46-101 BLK	250 mA	250,000	0.890	0.437
DPDT	O	46-200 RED	46-200 BLK	250 mA	250,000	0.921	0.625
NO	P	2201	7-7	10 Amps	25,000	1.239	0.880
NC	P	2202	7-8	10 Amps	25,000	1.239	0.880
SPDT	P	7-26 RED	7-26 BLK	10 Amps	25,000	1.239	0.880

\*At 115 Vac resistive except as noted. \*\*At 28 Vdc. \*\*\*At 20 Vdc.

For prices and discounts, contact a local Sales Office, an authorized Distributor, or GRAYHILL Available From Your Local GRAYHILL Distributor



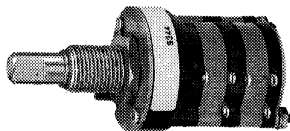


An ISO-9001 Company

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# Rotary Switches

## SERIES 42D AND 44D 1 AMP ADJUSTABLE STOP ROTARY SWITCHES



Enclosed, interchangeable with fixed stop switches. Make/break 1 amp, carry 10 amps at 115VAC, resistive. Insulation resistance: 10,000 megaohms minimum. Non-shorting contacts. 3/8-32NEF bushing projects .437 (11,10). Flatted shaft projects .874 (22,2). Behind-panel-depth: 1-deck, 1.025" (26.04); 2-deck, 1.371" (34.82).

**Series 42D:** 10-position switch, 36° indexing, 1" (25.4) diameter.  
**Series 44D:** 12-position switch, 30° indexing, 1.162" (29.51) diameter.

Type	Poles	Decks	Max. Positions
42D36-01-1-AJN	1	1	10
42D36-01-2-AJN	2	1	5
42D36-02-1-AJN	1	2	10
42D36-02-2-AJN	2	2	5
44D30-01-1-AJN	1	1	12
44D30-01-2-AJN	2	1	6
44D30-02-1-AJN	1	2	12
44D30-02-2-AJN	2	2	6

Also available in fixed stops; 45°, 60° or 90° throw, up to 6 poles, up to 12 decks and military qualified types.

## SERIES 50 AND 51 200MA, 0.5" (12,7) DIAMETER ROTARY SWITCHES



**Series 50 and 51** single-deck adjustable stop switches with non-shorting contacts. Make/break 200mA, 115VAC or 30VDC for 5,000 cycles; 100 mA for 20,000. Insulation resistance 10,000 megaohms minimum. Type number with **P** is PC mount, others solder lug. Type number with **C** is military style, others are not. **Series 50** is 36° indexing, **Series 51** is 30°. Approx. .578 (14,63) behind panel PC mount, .658 (16,71) solder lug. Shaft projects .625 (15,88).

Type	Poles	Max. Pos.	Type	Poles	Max. Pos.
50CD36-01-1-AJN	1	10	50CDP36-01-1-AJN	1	10
50CD36-01-2-AJN	2	5	50CDP36-01-2-AJN	2	5
50D36-01-1-AJN	1	10	50DP36-01-1-AJN	1	10
50D36-01-2-AJN	2	5	50DP36-01-2-AJN	2	5
51CD30-01-1-AJN	1	12	51CDP30-01-1-AJN	1	12
51CD30-01-2-AJN	2	6	51CDP30-01-2-AJN	2	6
51D30-01-1-AJN	1	12	51DP30-01-1-AJN	1	12
51D30-01-2-AJN	2	6	51DP30-01-2-AJN	2	6

Also available in fixed stops; 45°, 60° or 90° throw, up to 4 poles, military qualified and process sealed types.

## SERIES 56 200MA, 0.5" (12,7) DIAMETER ADJUSTABLE STOP ROTARY SWITCHES

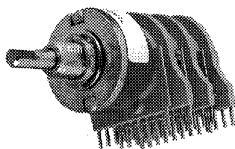


**Series 56** single-deck adjustable stop commercial grade switches with nonshorting contacts. Make and break 10,000 cycles at 200mA 30VDC resistive. Type number with **P** is PC mount others solder lug. Type number with **S** has shaft-and-panel seal, others do not. **30** indicates 30° indexing; **36**, 36° indexing. Approx. .377 (9,58) behind panel PC mount, .480 (12,91) solder lug. Shaft projects .625 (15,88).

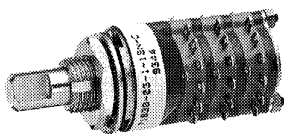
Type	Poles	Max. Pos.	Type	Poles	Max. Pos.
56D30-01-1-AJN	1	12	56DP30-01-1-AJN	1	12
56D30-01-2-AJN	2	6	56DP30-01-2-AJN	2	6
56D36-01-1-AJN	1	10	56DP36-01-1-AJN	1	10
56D36-01-2-AJN	2	5	56DP36-01-2-AJN	2	5
56SD30-01-1-AJN	1	12	56SDP30-01-1-AJN	1	12
56SD30-01-2-AJN	2	6	56SDP30-01-2-AJN	2	6
56SD36-01-1-AJN	1	10	56SDP36-01-1-AJN	1	10
56SD36-01-2-AJN	2	5	56SDP36-01-2-AJN	2	5

Also available in fixed stops, up to 4 poles.

## SERIES 71 1/4-AMP, 0.5" (12,7) DIAMETER ADJUSTABLE STOP ROTARY SWITCHES



Style AF



Style B

**Series 71** multi-deck switches are adjustable stop. Make/break 250mA for 20,000 cycles 115VAC or 30VDC. Insulation resistance: 10,000 megaohms minimum. Voltage breakdown: 500VAC minimum. Meet moisture, shock, salt spray, explosion and stop strength requirements of MIL-S-3786. **71AD** are standard style with solder lug terminals and 0.125" (3.18) diameter shaft and 1/4-32 bushing; **71BD** same but have 0.250" (6.35) diameter shaft and 3/8-32 bushing. **71ADF** are PC mount with 0.125" (3.18) diameter shaft; **71BDF** same but have 0.250" (6.35) diameter shaft. Switch diameter approx. 0.75 (19,05). **Suffix 30 or 36** indicates angle of throw by degrees. Behind-panel depth: 1-deck, 0.75" (19.05); 2-deck, 1" (25.4).

Type	Poles	Decks	Max. Positions
71AD36-01-1-AJN	1	1	10
71AD36-01-2-AJN	2	1	5
71AD36-02-1-AJN	1	2	10
71AD36-02-2-AJN	2	2	5
71AD30-01-1-AJN	1	1	12
71AD30-01-2-AJN	2	1	6

Type	Poles	Decks	Max. Positions
71AD30-02-1-AJN	1	2	12
71AD30-02-2-AJN	2	2	6
71BD36-01-1-AJN	1	1	10
71BD36-01-2-AJN	2	1	5
71BD36-02-1-AJN	1	2	10
71BD36-02-2-AJN	2	2	5
71BD30-01-1-AJN	1	1	12
71BD30-01-2-AJN	2	1	6
71BD30-02-1-AJN	1	2	12
71BD30-02-2-AJN	2	2	6
71ADF36-01-1-AJN	1	1	10
71ADF36-01-2-AJN	2	1	5
71ADF36-02-1-AJN	2	2	10
71ADF30-01-1-AJN	1	1	12
71ADF30-01-2-AJN	2	1	6
71ADF30-02-1-AJN	1	2	12
71ADF30-02-2-AJN	2	2	12
71BDF36-01-1-AJN	1	1	10
71BDF36-01-2-AJN	2	1	5
71BDF36-02-1-AJN	1	2	10
71BDF36-02-2-AJN	2	2	5
71BDF30-01-1-AJN	1	1	6
71BDF30-01-2-AJN	2	1	6
71BDF30-02-1-AJN	1	2	12

Also available with fixed stops, 45°, 60° or 90° throw; up to 6 poles; up to twelve decks and military qualified types.

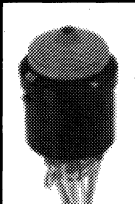

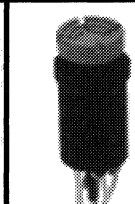
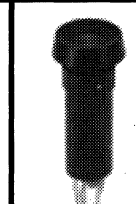




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Available through your local Grayhill Distributor

# GUARDIAN

## GUARDIAN ELECTRIC MANUFACTURING COMPANY SPECIALTY SWITCHES

- **Specialty Switch Components**  
Ready for integration into your motion control applications.
- **Commercial and Aerospace grades.**
- **Complete custom capabilities**  
available.

Product Name	Triplex 4-Way	Pushbutton Triplex	5-Way Mini	Transducer	Thumbwheel	Trigger	Slide	Rocker
								
<b>Ratings</b>	1A@28VDC Resistive .5A@28VDC Inductive	5A@28VDC Resistive 3A@28VDC Inductive	1A@28VDC Resistive	Excitation Voltage 10VDC (+/-VDC Bipolar)	Electrical working range: 0.5 watts min Total resistance: 1000 ohms +/- 10%	10A@28VDC	3A@28VDC inductive 5A@28VDC resistive	4A@28VDC inductive 7A@28VDC resistive
<b>Circuits</b>	12P4T Form C	3PDT	4P5T Form C 4-way toggle w/ push	NA	output @ center position to be: 50% +/- 2% of full scale	DPST N.O. momentary 2 position with detent	SPDT -on(momentary) -off -on(momentary)	DPDT momentary contact (N.O.)
<b>Electrical Life</b>	25,000 cycles	50,000 cycles	25,000 cycles	NA		50,000 cycles	25,000 cycles	50,000 cycles
<b>Mechanical Life</b>	50,000 cycles	1,000,000 cycles	50,000 cycles	NA	1,800,000 cycles	50,000 cycles	25,000 cycles	50,000 cycles
<b>Operating Force</b>	32oz max	24 oz max	(push mode) 3.5 lbs max (toggle mode) 1.5lbs max	3.0lbs @ point indicated	NA	2.0lbs min (1st contact) 6.0lbs min (through detent) 6.0lbs min (after detent)	NA	300 gms min 650 gms max
<b>Release Force</b>	NA	1.5 oz min	(push mode) .5 lbs max (toggle mode) .75lbs max	NA	NA	NA	NA	NA
<b>Operating Temp</b>	-55C to 85C	-65C to 125C	-55C to 85C	-54C to 85C	-54C to 85C	-54C to 85C	-54C to 85C	-54C to 85C
<b>Mounting</b>	Panel	Threaded Bushing	Panel	Panel	Screw Mount	Pin Mount	Panel	Screw Mount
<b>Terminal</b>	Wire Leads	Solder Turret	Wire Leads	Wire Leads	Solder Turret	Solder	Solder	Solder Turret
<b>Options &amp; Other Mechanical Specs.</b>	Also available in simplex and duplex configurations	NA	Also available without push mode	NA	Torq @ 5deg: 5 in/oz Torq @ 40 deg: 8 in/oz Other resistance values available	NA	Also available SPST on-off	NA
<b>Agency Approvals</b>	MIL S-8805 MIL S-9419	MIL S-8805	MIL S-8805 MIL S-9419	NA	MIL R-39023	MIL S-9487	NA	MIL S-8805

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# HASCO™ REED SWITCHES

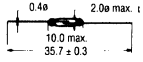
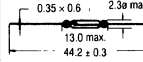
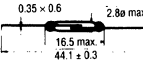
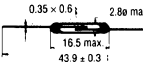
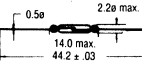
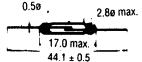
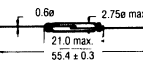
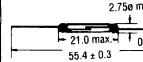
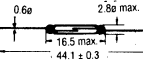
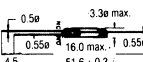
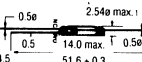
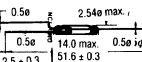
COMPONENTS INTERNATIONAL, CORP.

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**OKI** electric industry company, Ltd. 

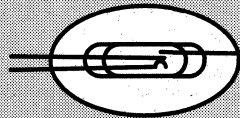
POLYMER FREE CONTACTS



							
		ORD-211	ORD-221	ORD-225	ORD-2212	ORD-228	ORD-9215
Electrical Characteristics	Contact	1A	1A (offset)	1A	1ARLS/OP>0.8	1A	1A <b>BEST VALUE!</b>
	Contact resist. (Initial) [mΩ]	100 max.	100 max.	100 max.	100 max.	100 max.	150 max.
	Breakdown voltage [DCV]	150 min.	200 min.	200 min.	150 min.	200 min.	200 min.
	Insulation resistance [Ω]	10 <sup>9</sup> min.	10 <sup>9</sup> min.	10 <sup>9</sup> min.	10 <sup>9</sup> min.	10 <sup>9</sup> min.	10 <sup>9</sup> min.
	Electrostatic cap. [PF]	0.2 max.	0.3 max.	0.3 max.	0.5 max.	0.3 max.	0.3 max.
	Contact capacity [VA]	1.0	10	10	10	10	10
	Max. conductive curr. [A]	0.3	1.0	1.0	0.5	1.0	1.0
Operating Characteristics	Max. voltage [V]	AC24/DC24	AC100/DC100	AC100/DC100	AC100/DC100	AC100/DC100	AC100/DC100
	Operate time [ms]	0.3 max.	0.3 max.	0.4 max.	0.4 max.	0.3 max.	0.4 max.
	Bounce time [ms]	0.3 max.	0.5 max.	0.4 max.	1.0 max.	0.3 max.	0.4 max.
	Release time [ms]	0.05 max.	0.5 max.	0.5 max.	0.05 max.	0.05 max.	0.05 max.
	Resonant frequency [Hz]	8600±500	2750±250	3700±300	4200±300	5300±300	3700±300
Standard Coil	Max. operating freq. [Hz]	500	500	500	500	500	500
	Coil resistance [Ω]	600	450	450	450	450	450
	No. of turns [T]	5000	5000	5000	5000	5000	5000
	Dimensions [mm]	3.3ø × 10	3.7ø × 15	3.7ø × 15	3.7ø × 15	3.7ø × 15	3.7ø × 15
Type No.	8	6	6	6	6	6	
Features (Contact material)	Ultra-miniature Rh	Miniature offset (Rh)	General purpose miniature (Rh)	Drop-out Pull-in >0.8(Rh)	General purpose miniature (Rh)	General purpose miniature (Rh)	
							
		ORD-229	ORD-2210	ORD-2211	ORT-233	ORT-551	ORT-551-1
Electrical Characteristics	Contact	1A	1A	1A	1C	1C	1C
	Contact resist. (Initial) [mΩ]	100 max.	100 max.	100 max.	100 max.	100 max.	100 max.
	Breakdown voltage [DCV]	600 min.	250 min.	200 min.	150 min.	200 min.	200 min.
	Insulation resistance [Ω]	10 <sup>10</sup> min.	10 <sup>10</sup> min.	10 <sup>9</sup>	10 <sup>9</sup> min.	10 <sup>9</sup> min.	10 <sup>9</sup> min.
	Electrostatic cap. [PF]	0.5 max.	0.5 max.	0.3 max.	1.5 max.	1.5 max.	1.5 max.
	Contact capacity [VA]	50	AC70/DC50	3.4W	3	3	3
	Max. conductive curr. [A]	2.5	2.5	2.5	0.5	0.5	0.5
Operating Characteristics	Max. voltage [V]	AC300/DC350	AC150/DC200	AC100/DC100	AC30/DC30	AC30/DC30	AC30/DC30
	Operate time [ms]	0.6 max.	0.5 max.	0.6 max.	1.0 max.	1.0 max.	1.0 max.
	Bounce time [ms]	0.5 max.	0.5 max.	0.4 max.	(NC) 1.5 max. (NO) 1.0 max.	(NC) 1.5 max. (NO) 1.0 max.	(NC) 1.5 max. (NO) 1.0 max.
	Release time [ms]	0.05 max.	0.05 max.	0.05 max.	0.5 max.	0.5 max.	0.5 max.
	Resonant frequency [Hz]	2500±250	2500±250	4600±500	6000±4000	6000±4000	6000±4000
Standard Coil	Max. operating freq. [Hz]	500	500	500	200	200	200
	Coil resistance [Ω]	500	500	450	500	550	550
	No. of turns [T]	5000	5000	5000	5000	5000	5000
	Dimensions [mm]	4.6ø × 21	4.6ø × 21	3.7ø × 15	4.6ø × 21	4.6ø × 10	4.6ø × 10
Type No.	3	3	6	3	10	10	
Features (Contact material)	High breakdown voltage (Rh)	High power (Rh)	High inrush 3A 3.4W Lampload (Rh)	Miniature transfer (Rh)	Ultra Miniature transfer (Rh)	Ultra Miniature transfer (Rh)	

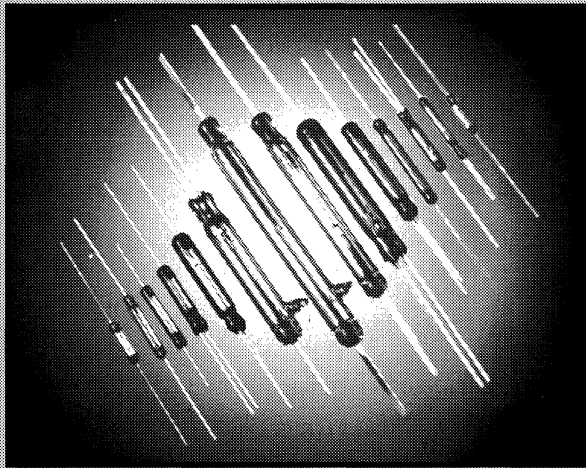
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**Hasco has the largest stock of the most used reed switches. They range in a variety of sensitivities. Our reeds can be cut and bent to meet your specifications. They are also available encapsulated in plastic with or without wire.**



# Hermetic Switch, Inc.

## MAGNETIC REED SWITCHES



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THE WORLD'S  
SMALLEST THROUGH  
THE INDUSTRY'S  
MOST POWERFUL!**

MODEL	FORM	MAX D.C. WATTS	MAX D.C. AMPS	MAX D.C. VOLTS	STOCK AMP-TURN PULL-IN RANGE	OVERALL LENGTH INCHES	MAX GLASS DIA. INCHES	MAX GLASS LENGTH INCHES	SPECIAL FEATURES
<b>MICRO-MINIATURE</b>									
HSR-003	A	.25	.01	30	5-20	1.050	.055	.210	WORLD'S SMALLEST
HSR-042	A	4	.20	100	10-35	1.850	.090	.370	
HSR-370	C	3	.10	30	15-35	1.490	.072	.485	
<b>MINIATURE</b>									
HSR-V100RF	A	10	1.0	220RMS	15-40	2.190	.110	.800	HIGH VOLTAGE RF SMALL GLASS DIAMETER
HSR-1015	A	10	.50	200	15-40	2.190	.101	.800	
HSR-520	C	3	.25	100	15-45	2.000	.125	.600	
<b>STANDARD</b>									
HSR-190	A	15	1.0	250	40-80	3.230	.210	2.100	FULL SIZE ECONOMICAL
HSR-780	A	25	1.5	500	60-100	3.200	.215	2.000	
HSR-630	C	25	1.0	150	40-80	3.390	.210	1.350	
<b>HIGH POWER</b>									
HSR-134	A	100	3.0	50	60-100	3.390	.210	1.300	POWER SWITCHING IN 100 TO 200 WATT RANGE
HSR-V207	A	200	3.0	2500	100-150	3.230	.210	2.100	
HSR-V933	C	100	3.0	1000	60-100	2.810	.210	1.400	
<b>HIGH VOLTAGE</b>									
HSR-790	A	50	2.5	1000	60-100	3.230	.215	2.000	UP TO 15,000 VDC DIELECTRIC
HSR-V7K	A	50	3.0	5000	60-125	3.230	.210	2.100	
HSR-V15K	A	50	3.0	10000	120-170	3.230	.210	2.100	

Custom Finishing Available On All Models.

**ASK FOR OUR CATALOG FEATURING REED SWITCHES AND PROXIMITY SENSORS INCLUDING OVER 60 STANDARD MODELS**



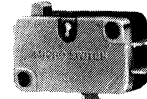
**Hermetic Switch, Inc.**



P.O. Box 1325 • 3100 Highway 92 South • Chickasha, OK 73023 • PHONE: (405) 224-4046 • FAX (405) 224-9423  
www.hermeticswitch.com

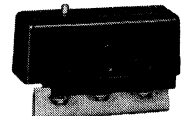
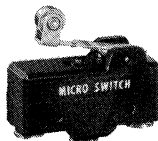
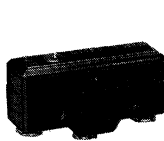
# Honeywell

## MICRO SWITCH SUBMINIATURE/MINIATURE BASIC SWITCHES



Listing	UX40E30A01	UM50E70A01	11SX21-T	11SM1-T	V3-101-D8	V7-1C17D8
Package Size (in.)	.197 x .236 x .50	.43 x .25 x .78	.35 x .20 x .50	.49 x .25 x .78	.63 x .40 x .78	.63 x .40 x 1.14
Actuator	Pin plunger					
Terminals	Quick-connect		T solder		D8 QC	
Mounting Centers	.256	.37	.19	.38	.88	
UL/CSA Rating	3A 125 VAC	5A 250 VAC	5A 250 VAC		11A 1/3 HP 277 VAC	15A 1/2 HP 277 VAC
Circuitry	SPDT					
Operating Force (oz.)	5.3		2.5 to 5	3 to 5	8	5.3
Differential Travel (in.)	.005	.004	.002	.004	.006-.016	.002-.010
Temp. Range, (°F)	-13 to 185		-65 to 250	-65 to 180		-40 to 180
Housing Material	Thermoplastic		General purpose phenolics			Polyester
OPTIONS Request Catalog 10	Wide choice of lever styles. Low energy .1a rating, solder term	Wide choice of lever styles. .1A, .3A, SEMKO, VDE, PCB, solder terms. Op. Force choice	Pin, integral, auxiliary leaf and lever, overtravel plunger actuators. Many terminal variations. SPST NO or NC crtry.			
			400° temp. 7A rating. Gold contacts. Low force, low DT. MIL-S-8805	400° temp. 11A rating. Gold contacts. Low force, low DT. MIL-S-8805, BEAB, TV-2.	600° temp. 25A rating. Gold contacts. Low/high force. MIL-S-8805, TV-3, 4, 5.	350° temp. 21A rating. Gold alloy contacts. Low/high force. VDE approvals

## MICRO SWITCH STANDARD BASIC SWITCHES



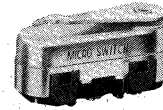
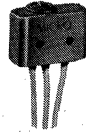
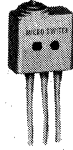
Listing	BZ-2R-A2	BZ-2RW822-A2	BZ-2RD-A2	BZ-2RQ1-A2	DT-2R-A7
Package Size (in.)	.95 x .69 x 1.94	1.19 x .69 x 1.94	1.09 x .69 x 1.94	1.79 x .69 x 1.94	
Actuator	Pin	Roll lever	Overtravel plunger		Pin
Terminals	Screw				
Mounting Centers (in.)	1				
UL/CSA Rating	15A 480 VAC 1/2A 125 VDC				10A-250 VAC
Circuitry	SPDT				DPDT
Operating Force (oz.)	9-13	6 max.	9-13		12-20
Differential Travel (in.)	.0004-.002	.003-.020	.0004-.002		.040-.060
Temp. Range, (°F)	-65 to 180				180
Sealing	Neoprene or elastomer sealed plunger avail.		Sealed plunger avail.		
Housing Material	General purpose phenolics			Arc resistant melamine	Gen. purpose phenoic
OPTIONS Request Catalog 10	Wide choice of actuators, terminals. Manual reset versions. Special circuitry available.				Choice of actuators
	22A rating. 250° and 400° temp. Alloy contacts. Low force/low DT versions. MIL-S-8805 listings.				

# Honeywell

## MICRO SWITCH SEALED AND HIGH TEMPERATURE BASIC SWITCHES

Specially adapted basic switches include: SE/XE environment-proof switches which protect subminiature SM/SX basic switches within a sealed housing; HM hermetically sealed switches are interchangeable in operating point

with the SM switches; HS hermetically sealed switches which parallel the size and mounting scheme of the standard basic switches; and HT high temperature switches for use up to +1000°F.

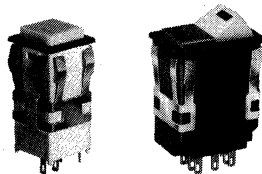


Listing	1XE1	1SE1	11HM1	1HS1	1EN1-6
Package Size (in.)	.75 x .32 x .62	.75 x .34 x .88	.72 x .25 x .79	1.18 x .67 x 1.96	2.30H x 1.0 Dia.
Actuator	Pin		Integral level		Pin plunger
Terminals	Leadwire 1'		Solder	Screw	Leadwire 6'
Mounting Centers (in.)	.19	.38	.37	1	—
Electrical Data	7A-28 VDC 115, 250 VDC	5A-28 VDC 125, 250 VAC	3A-28 VDC 1A-115, 400 Hz	25A-28 VDC 1A-115 VAC	4A-28 VDC 3A-125, 250 VAC
Circuitry	SPDT				DPDT
Operating Force	5-17 oz.		7 oz.	10-22 oz.	6-12 lbs.
Differential Travel (in.)	.005	.004	.006	.020	
Temp. Range, (°F)	-65 to 221°		-85 to 250°	-67 to 180°	-65 to 185°
Sealing	Environment MIL-S-8805		Hermetic	Hermetic MIL-S-8805	Environment MIL-S-8805
Housing Material	Aluminum		Stainless steel	Monel	Stainless steel
OPTIONS Request Catalog 10 (Catalog 80 for ENs)	Aux. leaf actuators. SPST ctry. 300° temp. longer leads. Solder term. UL/CSA listing.	Aux. leaf or lever actuator. SPST ctry. 500° temp. UL/CSA listing.	Aux. leaf or lever actuator. MIL-S-8805 listing. 300° & 500° temp. Leadwire termination.	Leadwire termination. Roller lever actuators. 250° & 300° temp. UL/CSA listing.	Roller plungers, rotary roller, and linkage levers, leadwire, screw or connector term. 257° temp.

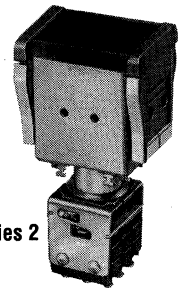
## MICRO SWITCH MANUAL SWITCHES

Many options in colors, legending, shapes, sizes, and mounting available as well as power, electronic or solid state switching. AML's comprehensive line blends with other panel components for total display harmony.

Series 2 provides modular assembly with 1 to 4 section display. Many other pushbutton lines are available. Request Catalog 30 or Catalog 80 for military qualified products.



AML Series



Series 2

Because of the many variations of these products a listing is not being given.

Panel Area	Pushbuttons: .80" (20,5 mm) square. PB's, paddles, and rockers: .80" x 1.20" (20,5 x 30,5 mm).		1.0 x 1.41" (2,5 x 35,8 mm) .86" x 1.35" (21,8 x 34,3 mm)	
Display	Pushbuttons: .59" (15,0mm) square and .59 x .99" (15,0 x 25,0 mm). Transmitted, projected, and dead front full and split color. Rockers: Full and split color rockers, with lens. Paddles: Full and split color covers, with lens.		.85 x 1.08" (21,6 x 27,4 mm) buttons.	
Illumination	Incandescent T-1-3/4 lamps—6, 14, 28 v LEDs—2.4, 5, 10, 15 V. Neon lamps—125, 250 V		Incandescent T-1-3/4 lamps—6, 14, 28 V.	
Behind Panel Depth (max.)	1.7" (43,1 mm)		3.28" (83,3 mm)	
Mounting	Snap-in individual, strip, matrix, sub-panel PC board mounting		Snap-in flange mount and units with mounting barriers for individual or strip mount.	
Termination	Solder, quick-connect, PC board, push-on		Solder, quick-connect and screw terminals.	
Sealing	Optional panel seal for pushbuttons.			
SPECIAL FEATURES	Keylock switches available for controlled access applications.			
Electrical Data	Solid State: 5 or 6-16 VDC	Electronic Control: Up to 3 A., 125 VAC	Power Duty Push buttons: Up to 10 A., 125/250 VAC	Power Duty Rockers, Paddles: Up to 15 A., 125/250 VAC
				1-20 A., 125, 250, 480 VAC, depending on switch module specified.
Circuitry	Current Sinking	1, 2, or 4 Form C	2 Form X	1 or 2 Form A
AGENCY LISTINGS	UL, CSA, CEE (European approvals being obtained as needed, from individual countries), MIL-S-22885		UL, CSA. For MIL-S-22885 versions, refer to Catalog 80.	

# Honeywell

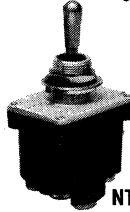
## MICRO SWITCH TOGGLE SWITCHES

We offer a wide selection of size, circuitry, capacity, sealing and toggle action. Plus a great array of levers, paddles and rockers that offer positive

tactile feedback in a variety of colors. Request Catalog 30. ET toggles feature magnetically held on action. Request Catalog 80.



TL Series

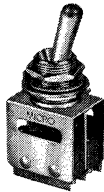


NT Series



TS Series

<b>Panel Area</b>	2-pole: 1.32 x .89 in.		2-pole: 1.31 x .75 in.
<b>Mounting</b>	15/32 in. bushing		15/32 in. bushing
<b>Sealing</b>	Bushing and cover-to-case		Bushing
<b>Electrical Data</b>	Up to 15 a., 125, 250, 277 VAC. Also 28/115/250 VDC and 115/230 VAC per MIL-S-3950 ratings. 1, 2 or 4-pole, 2 or 3 positions mom. and maint. action.	Up to 15 a., 125, 250 or 277 VAC. 1, 2 or 4-pole, 2 or 3 positions mom. and maint. action.	Up to 15 a., 125, 250, 277 VAC. 1 or 2-pole, 2 or 3 positions mom. and maint. action.
<b>Termination</b>	Screw, solder IWTS		Screw, solder, quick-connect
<b>Temperature (°F)</b>	-85 to 160		-65 to 160
<b>Agency Listings</b>	UL CSA MIL-S-3950	SA CSA	UL CSA



AT Series



ET Series



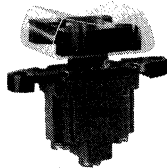
TW Series

<b>Panel Area</b>	Depends on basic switches	1.0 in. dia.	2-pole: .57 x .53 in.
<b>Mounting</b>	1/4 or 15/32 in. bushing	15/32 or 5/8 in. bushing	1/4 or 15/32 in. bushing
<b>Sealing</b>	Bushing*	Environment	Bushing
<b>Electrical Data</b>	Up to 15 a., 125 or 250 VAC. 1-10 poles, 2 or 3 positions mom. and maint. action, optional hermetic sealed	Up to 7 a. res., 28 VDC. 1 or 2-pole, 2 or 3 positions magnetically maintained toggle/action.	5 a. res., 30 VDC, 125 VAC. 1 or 2-pole, 2 or 3 positions mom. and maint. action.
<b>Termination</b>	Solder, screw, quick-connect	Solder, leadwire	Solder or IWTS
<b>Temperature (°F)</b>	Depends on basics	-85 to 160	
<b>Agency Listings</b>	UL CSA MIL-S-8805/26&/98	MIL-S-5594	MIL-S-83731

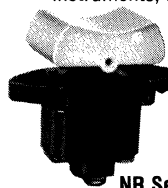
## MICRO SWITCH ROCKER SWITCHES

### TYPICAL APPLICATIONS

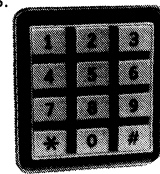
- On control panels of road graders, pavers, cranes, earthmovers, buses, emergency and farm vehicles, and other heavy duty equipment.
  - Refrigeration units on over-the-road trucks.
  - Food and beverage processing control panels and other industrial equipment.
  - Paper/wood processing equipment.
- Request Catalog 30



TP Series



NR Series



SLP1 Series

<b>Panel Area</b>	2-pole: 2.13 x .89 in.		Depends on Matrix
<b>Mounting</b>	3-hole flush or above panel		Front or rear panel
<b>Sealing</b>	Bushing and cover-to-case		Optional panel seal
<b>Electrical Data</b>	Up to 15 a., 125 or 250 VAC. 1 or 2-pole, 2 or 3 positions mom. and maint. action.	Up to 15 a., 125, 250 or 277 VAC. 1 or 2-pole, 2 or 3 positions mom. and maint. action.	30mA at 12 VDC X-Y or common bus wiring
<b>Termination</b>	Screw		Connector
<b>Temperature (°F)</b>	160°F (71°C), -65°F (-54°C)	160°F (71°C), -40°F (-40°C)	150°F (65°C), -40°F (-40°C)
<b>Agency Listings</b>	UL CSA	SA	N/A

**HALL EFFECT KEYBOARDS** Available. Request SD literature.

## SALES AND SERVICE

For application assistance, current specifications, pricing or name of nearest MICRO SWITCH Authorized Distributor, contact a nearby sales office. Or call: 1-800-537-6945 USA 1-800-737-3360 Canada 1-815-235-6847 International

**FAX: 1-815-235-6545 USA**  
**Internet:** <http://www.honeywell.com/sensing/>  
**Email:** [info@micro.honeywell.com](mailto:info@micro.honeywell.com)



# IDEC Selection Guide Oiltight Pushbuttons

IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211  
 Telephone: (408) 747-0550, Fax: (408) 744-9055, Catalog Requests: 800-262-IDEC  
 In Canada: (604) 946-1271, Fax: (604) 946-0368

## TWTD Series $\phi 1-13/64"$ (30mm) Pushbuttons NEMA Type 4, 4X, 13 (Watertight/Oiltight/Corrosion Resistant)

### Non-Illuminated Pushbuttons

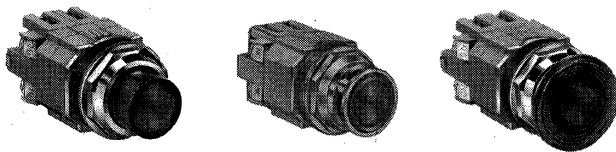


Flush Button

Mushroom

Mushroom Button  
w/Full Shroud

### Illuminated Pushbuttons (LED & Incandescent)

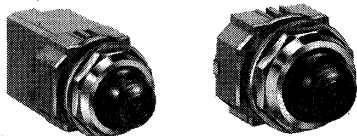


Extended Lens  
Full Voltage

Extended Lens  
w/Full Shroud  
Full Voltage

Mushroom Lens  
Full Voltage

### Pilot Lights (LED & Incandescent)



Dome Lens  
Transformer Type

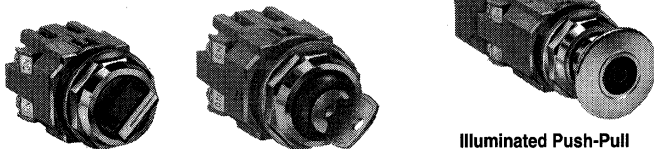
Dome Lens  
Full Voltage

### Special Function Pushbuttons



Non-Illuminated  
Pushlock Turn Reset

### Selector Switches



Knob Selector

Key Selector

Illuminated Push-Pull  
Transformer Type

### General Specifications

Contact Resistance: 50m $\Omega$ , maximum (initial value)

Insulation Resistance: 100M $\Omega$ , minimum,  
Between live/dead parts

Dielectric Strength: 2,500V AC 1 minute  
Between live/dead parts

#### Mechanical Life (Minimum Operations):

Pushbuttons & Lighted Pushbuttons:  
Momentary: 5,000,000 operations  
Others: 500,000 operations

Unlighted & Lighted Selector Switches:  
500,000 operations

#### Electrical Life (Minimum Operations):

500,000 operations (except pilot lights)  
Operating Frequency: 30 operations/minute  
Duty Rated: 40%

Approvals: UL Listed, CSA Certified, & Demko

### NEMA Ratings

Lighted Pushbuttons	Type
Non-Lighted Pushbuttons	1, 2, 3, 3R,
Pilot Lights	4, 4X, 5, 12, 13
Lighted Selector Switches	
Non-Lighted Selector Switches	
Keylock Operated Switches	Type
	1, 2, 3R, 5, 13

### Contact Ratings

Rated Operational Current:	AC (Induct.)	DC (Resist.)
	120V/6A	120V/2A
	240V/3A	240V/1.1A
	480V/1.5A	480V/0.4A
	600V/1.2A	12V/4A
		24V/4A

Rated Thermal Current: 10A

Minimum Switching Capacity: 5mA @ 3V AC/DC

Rated Insulation Voltage: 600V AC/DC

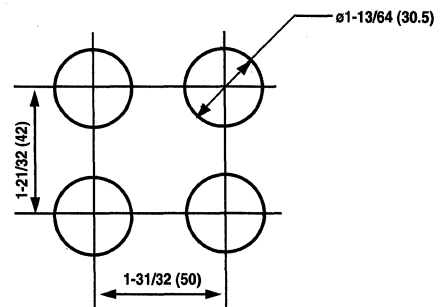
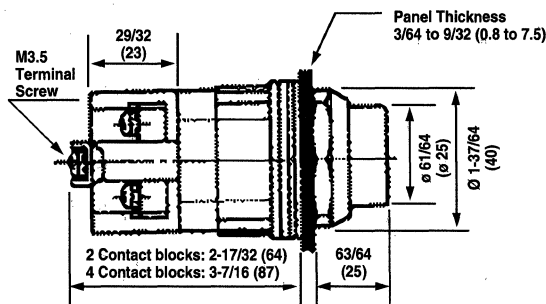
UL Rating: 600V, maximum (Heavy Pilot Duty)

### Panel Cut-Out Dimensions in inches (mm)

Note: Panel cut-out dimensions applicable for all pushbutton operators. Mushroom button with full shroud requires wider spacing between switches.

### Dimensions Dimensions in inches (mm)

#### Illuminated Pushbutton, Full Voltage Type, Extended Lens



For Complete Information On IDEC's  
Oiltight Control Units, See Catalog No. U900.





# IDEC Selection Guide Oiltight Pushbuttons

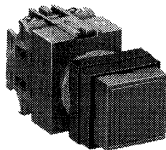
IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211  
 Telephone: (408) 747-0550, Fax: (408) 744-9055, Catalog Requests: 800-262-IDEC  
 In Canada: (604) 946-1271, Fax: (604) 946-0368

## TW Series $\phi 7/8"$ (22mm) Miniature Pushbuttons NEMA Type 4, 4X, 13 (Watertight/Oiltight/Corrosion Resistant)

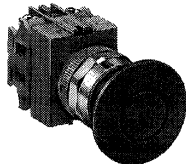
### Non-Illuminated Pushbuttons



Extended Button

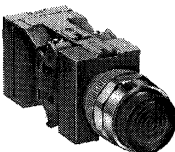


Square Extended

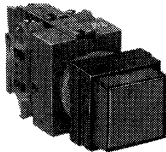


Mushroom Button

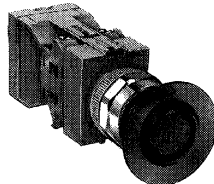
### Illuminated Pushbuttons - LED & Incandescent



Extended Lens  
Transformer Type

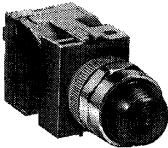


Square  
Extended Lens  
Full-Voltage

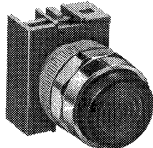


Mushroom Lens  
Transformer Type

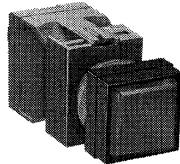
### Pilot Lights - LED & Incandescent



Dome Lens  
Transformer Type

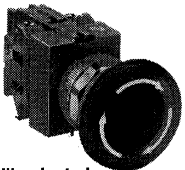


Flush Lens  
Full Voltage



Square Lens  
Transformer Type

### Special Function Pushbuttons

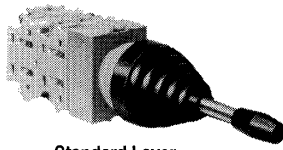


Illuminated  
Pushlock Turn Reset  
Full Voltage



Knob Selector  
(Keylock Selector  
also available)

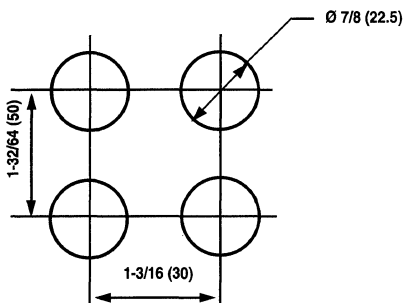
### Monolever Switches



Standard Lever

### Panel Cut-Out Dimensions in inches (mm)

Note: Panel cut-out dimensions applicable for all pushbutton operators.  
 Mushroom button with full shroud requires wider spacing between switches.



### General Specifications

Contact Resistance: 50m $\Omega$ , maximum (initial value)

Insulation Resistance: 100M $\Omega$ , minimum,  
 Between live/dead parts

Dielectric Strength: 2,500V AC 1 minute  
 Between live/dead parts

#### Mechanical Life (Minimum Operations):

Pushbuttons & Lighted Pushbuttons:  
 Momentary: 5,000,000 operations  
 Others: 500,000 operations

Unlighted & Lighted Selector Switches:  
 500,000 operations

#### Electrical Life (Minimum Operations):

500,000 operations (except pilot lights)  
 Operating Frequency: 30 operations/minute  
 Duty Rated: 40%

Approvals: UL Listed, CSA Certified, & TUV Approved

### NEMA Ratings

Lighted Pushbuttons	Type
Non-Lighted Pushbuttons	1, 2, 3, 3R,
Pilot Lights	4, 4X, 5, 12, 13
Lighted Selector Switches	
Non-Lighted Selector Switches	
Keylock Operated Switches	Type
	1, 2, 3R, 5, 13

### Contact Ratings

Rated Operational Current:	AC (Induct.)	DC (Resist.)
	120V/6A	120V/2A
	240V/3A	240V/1.1A
	480V/1.5A	480V/0.4A
	600V/1.2A	12V/4A
		24V/4A

Rated Thermal Current: 10A

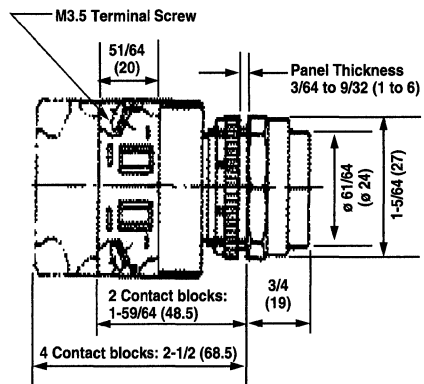
Minimum Switching Capacity: 5mA @ 3V AC/DC

Rated Insulation Voltage: 600V AC/DC

UL Rating: 600V, maximum (Heavy Pilot Duty)

### Dimensions Dimensions in inches (mm)

Non-Illuminated Pushbutton, Extended Button



For Complete Information On IDEC's  
 Oiltight Control Units, See Catalog No. U900.



# IDEC Pushbuttons Miniature and Euro Style

IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211  
 Telephone: Corporate Office: (408) 747-0550, Fax: (408) 744-9055  
 Catalog Requests : 800-262-IDEC  
 In Canada: Telephone: (604) 946-1271, Fax: (604) 946-0368

## A Series Pushbuttons, Selector & Keylock Switches

Dimensions in inches (mm).

### Features

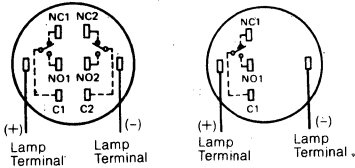
- Compact .630" (16mm) diameter mounting
- Switching from 3A, 250V AC/DC maximum down to 1mA, 5V AC/DC
- Oiltight IP65 or enclosed IP40 construction
- 1 Form C and 2 Form C contact configuration
- Pushbutton units available in non-illuminated and illuminated models
- Round, square and rectangular lens/buttons available in standard and large size
- Choice of LED and incandescent lamp
- Momentary or alternate switch action
- Keylock and selector switch available in 2 and 3 positions



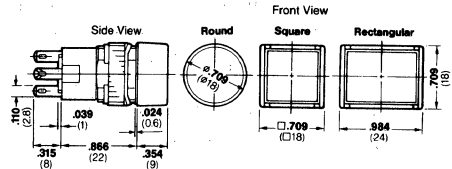
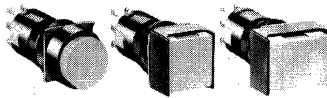
### Contact Ratings

**Contact Configuration:** 1 or 2 Form C  
**Contact Material:** Gold-clad Silver  
**Maximum Switching Load:** 3A, 250V AC/DC  
**Minimum Switching Load:** 1mA, 5V AC/DC

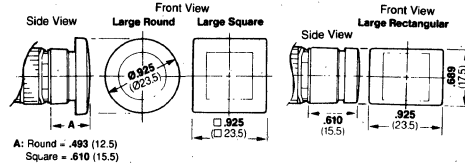
### Terminal Arrangements



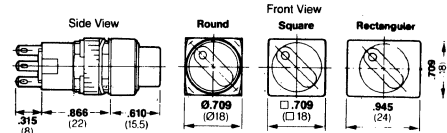
### Standard Lens/Buttons



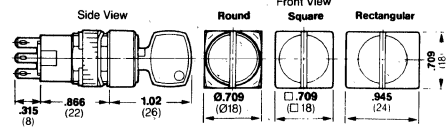
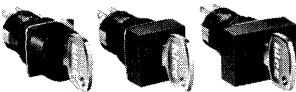
### Large Lens/Buttons



### Selector Switches



### Keylock Switches



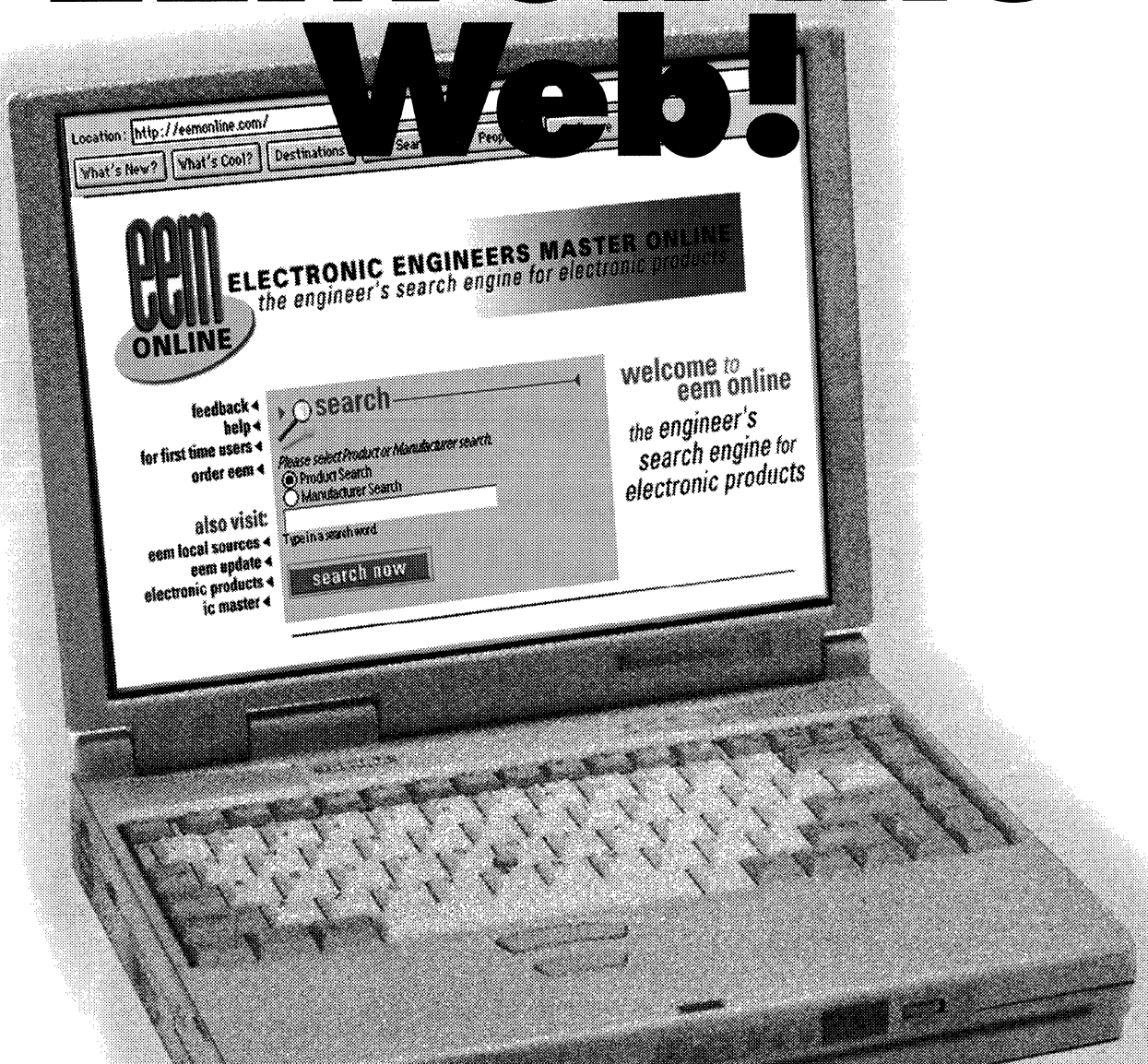
## HW Series Oiltight Control Units

- Removable Contact Blocks
- Finger-Safe Contacts
- Tamperproof Construction
- Positive Action Operation
- World Wide Approvals
- E-Stops Compliant with EN418
- MTBF < 1 Fault per 10 Million Operation Cycles (3V DC, 5 mA)
- IP65 (from front of panel)
- IP 20 (with HW-F type contacts)
- NEMA 4X
- UL listed, CSA approved, TUV certified, and CE marked



	Non-illuminated Pushbutton	Emergency Stop Illuminated & Non.	Pilot Lights	Illuminated Pushbuttons	Selector Switches
	Flush	Non-Illuminated E-Stop	Dome Lens	Extended w/ Full shroud	Knob Operator
	40mm Mushroom	Illuminated E-Stop	Flush Lens	40mm Mushroom	Illuminated Knob
	Square Extended	Push-Lock Key-Reset E-Stop	Square Flush	Square Extended	Key Operator

# Bookmark EEM on the Web!



<http://eemonline.com>



**Hearst Business Communications, Inc./UTP Division**

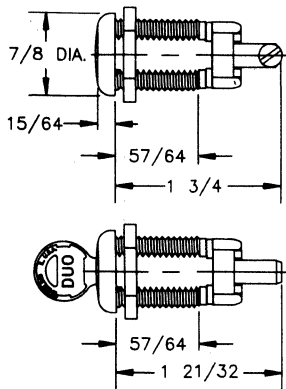
645 Stewart Avenue, Garden City, NY 11530 • Tel: 516.227.1300 • FAX: 516.227.1901

# SWITCHLOCKS

**Illinois Lock Company** A DIVISION OF THE EASTERN COMPANY

## LQ1

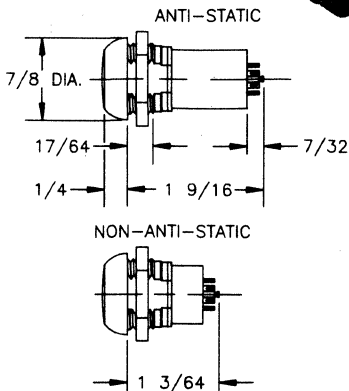
ELECTRICAL RATINGS  
5 Amps @ 115 VAC  
5 Amps @ 24 VAC



AVAILABLE WITH T.E. 'DUO' HIGH SECURITY MECHANISM.

## LQ17CC

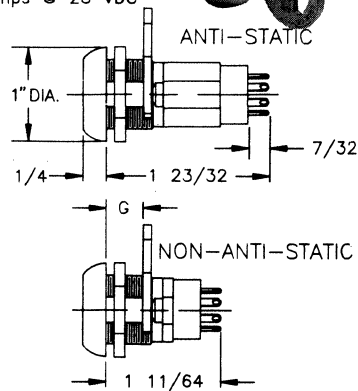
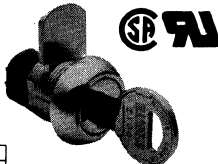
ELECTRICAL RATINGS  
200 m.A. @ 28 VDC  
150 m.A. @ 115 VAC



STANDARD & 20KVDC ANTI-STATIC CENTER COMMON SWITCHES

## LQ20

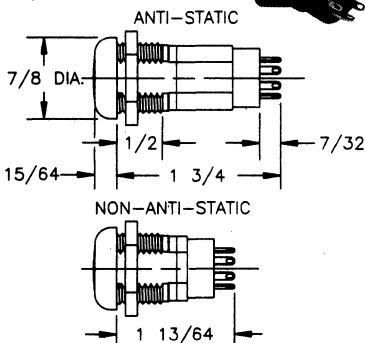
ELECTRICAL RATINGS  
4 Amps @ 125 VAC  
2 Amps @ 250 VAC  
4 Amps @ 28 VDC



STANDARD & 20KVDC ANTI-STATIC ROTARY SLIDE SWITCHES

## LQ23

ELECTRICAL RATINGS  
4 Amps @ 125 VAC  
2 Amps @ 250 VAC  
4 Amps @ 28 VDC



STANDARD & 20KVDC ANTI-STATIC ROTARY SLIDE SWITCHES

## LQ21

ELECTRICAL RATINGS  
4 Amps @ 125 VAC  
2 Amps @ 250 VAC  
4 Amps @ 28 VDC

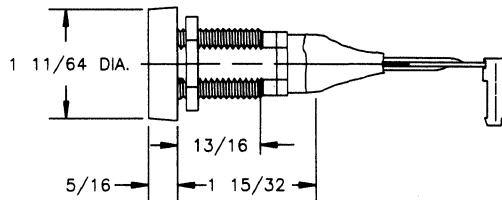
SWITCHLOCK WITH ILLUMINATED POSITION INDICATORS  
GREEN, RED, YELLOW, & ORANGE L.E.D.'S

AVAILABLE WITH:  
\* 36°, 45°, OR 90° INDEXING  
\* MAINTAINING-MOMENTARY OR DOUBLE-MOMENTARY  
\* HARNESSING TO YOUR SPECIFICATIONS  
\* UP TO 4 L.E.D.'S

OR  
ELECTRICAL RATINGS  
200 mA @ 28 VDC  
150 mA @ 115 VAC

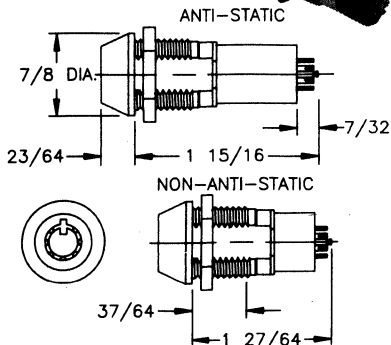
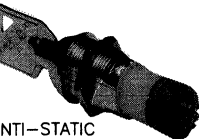


**NEW!**  
NOW AVAILABLE WITH  
BI-COLOR L.E.D.'S



## LQ13CC

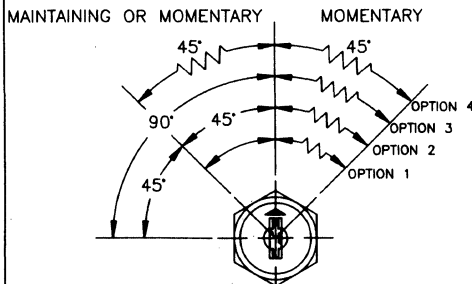
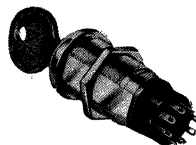
ELECTRICAL RATINGS  
200 mA @ 28 VDC  
150 mA @ 115 VAC



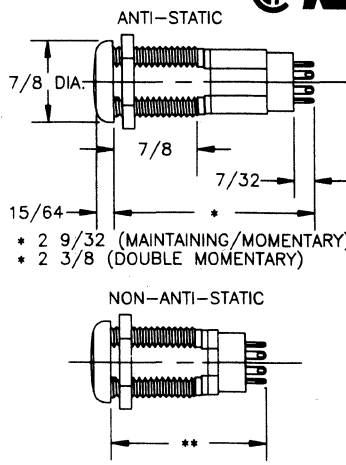
STANDARD & 20KVDC ANTI-STATIC CENTER COMMON SWITCHES

## LQ14

ELECTRICAL RATINGS  
4 Amps @ 125 VAC  
2 Amps @ 250 VAC  
4 Amps @ 28 VDC



STANDARD & 20KVDC ANTI-STATIC ROTARY SLIDE SWITCHES



\*\* 1 3/4 (MAINTAINING/MOMENTARY)  
\*\* 1 27/32 (DOUBLE MOMENTARY)

# SWITCHLOCKS

**Illinois Lock Company** A DIVISION OF THE EASTERN COMPANY

VERSATILE SWITCHLOCK LINE OFFERING VARYING LEVELS OF SECURITY ALONG WITH A WIDE RANGE OF ELECTRICAL RATINGS IN A CONVENIENT SNAP TOGETHER UNIT.

**ALL NEW!!!**



A



H



Y



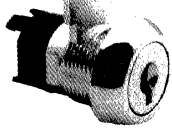
LQ25 5 TUMBLER MECHANISM.  
SINGLE BITTED KEY.



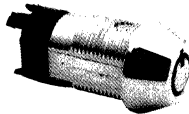
LQ26 4 TUMBLER MECHANISM.  
SINGLE BITTED KEY.



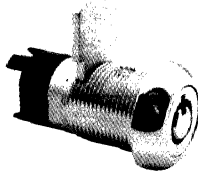
LQ27 6, 8, OR 10 TUMBLERS.  
DOUBLE BITTED KEY.



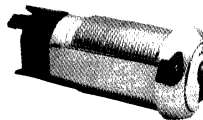
LQ28 CAM/SWITCHLOCK.  
4 TUMBLER MECHANISM.  
SINGLE BITTED KEY.



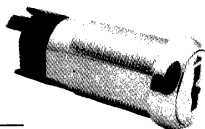
LQ29 7 PIN TUMBLERS.  
TUBULAR KEY.



LQ30 CAM/SWITCHLOCK.  
7 PIN TUMBLERS.  
TUBULAR KEY.



LQ31 MAINTAINING/MOMENTARY  
OR DOUBLE MOMENTARY.  
5 TUMBLER MECHANISM.  
SINGLE BITTED KEY.



LQ32 THE 'DUO' MECHANISM.  
FEATURING A 14 TUMBLER  
SECURITY MECHANISM  
WITH A TRIPLE BITTED KEY.

## ELECTRICAL RATINGS

### A SERIES

CONTACT RATING: Switch—2.5 AMPS  
⊙ 125 V AC or 28 V DC; 150 mA  
⊙ 250 V AC or DC (UL/CSA).

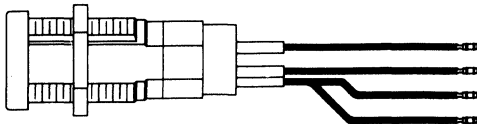
### H SERIES

CONTACT RATING: 12 AMPS ⊙ 125 V AC  
or 28 V DC; 6 AMPS ⊙ 250 V AC; 1 AMP  
⊙ 125 V DC (UL/CSA).

### Y SERIES

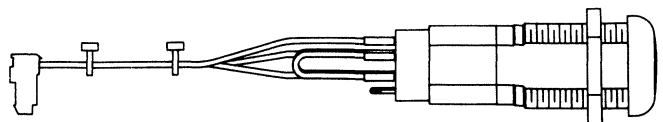
CONTACT RATING: 4 AMPS ⊙ 125 V AC  
or 28 V DC; 2 AMPS ⊙ 250 V AC  
(UL/CSA).

LET **Illinois Lock Company** BE YOUR HARNESS SUPPLIER.



SEND US YOUR REQUIREMENTS AND YOU CAN  
RECEIVE YOUR SWITCHLOCK QUOTATION WITH  
AND WITHOUT THE WIRE HARNESS.

WORLD'S LARGEST SELECTION OF SWITCHLOCKS FOR  
STANDARD AND OEM APPLICATIONS.



# ELECTRONIC PRODUCTS

THE ENGINEER'S MAGAZINE OF PRODUCT TECHNOLOGY

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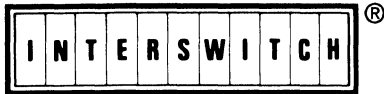
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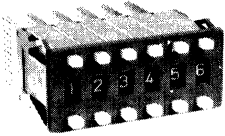
So for useful, easy-to-find product information, visit  
**<http://electronicproducts.com>**



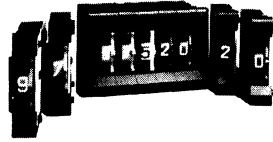
QUALITY PRODUCTS FROM PURDY ELECTRONICS

# RDS Rotary DIP Code Switch, Thumbwheel Switches & Immersion Proof Key Pad

## Thumbwheel Switches



Type D&Z Pushbutton

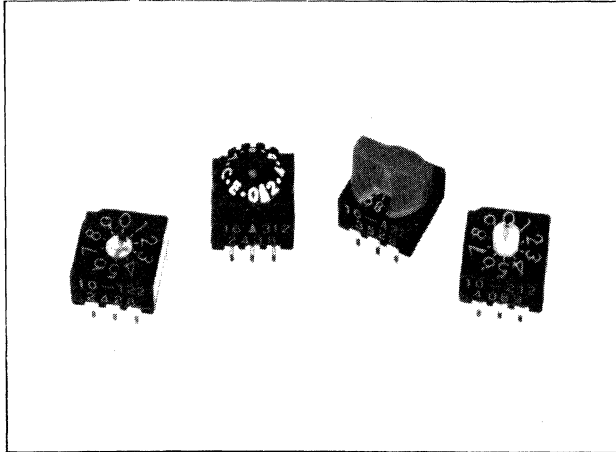


Type U

Available Switches (dimensions in millimeters)

	Series A	B	D	E	G	H	L	M	N	P	R	S	U	V	Z
Front Mounting			•		•	•		•				•	•	•	•
Rear Mounting	•			•			•		•	•					
Width	11	12.5	7.62	16	20	10	8	8	7	10	20	10	8	8	7.62
Height	39	58	24	18	76	33	18	33	18	24.2	33	33	33	26.5	15
Mounting Depth	63.6	67.1	33.5	31.5	79	38	31.5	38	31.5	38.25	38	38	40	32.5	24
Spacer 2.54 mm			•								•				
Spacer 2.7 mm						•						•			

## Type RDS Rotary DIP Code Switch



### DESCRIPTION

The new INTERSWITCH RDS rotary DIP switches embody many new improved features and at a reduced cost! This new model features molded-in contacts ultrasonic welded body to base and an "O" ring around the rotor shaft. These features insure an absolute seal to fluxes, flux gasses and cleaners. (Acceptable solvents are isopropyl alcohol, ethyl alcohol, toluene, benzene, tricyclic, chloroform, freon; acetone and methanol solvents are not acceptable.) Detent action is positive and firm assuring reliable settings.

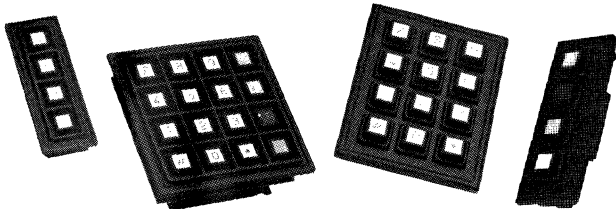
### SPECIFICATIONS

**Current rating and voltage:** Non switching 125 mA at 30 VDC; Switching 125 mA at 30 VDC **Contact resistance:** 100 milliohms maximum **Insulation resistance:** 1000 megohms at 250 VDC for 1 minute minimum. **Durability:** 20,000 actuations. **Positions:** 10 and 16. **Temperature rating:** -25°C (-13°F) to 85°C (185°F). **Body:** Glass-filled polyamide (UL94V-0). **Contacts:** Copper alloy, selective gold plating over nickel. **Rotor control:** Polyacetal. **Rotor switch element:** Glass epoxy, gold over nickel plated circuits.

Order Number	Description	No. of Pos.
<b>Flat Type</b>		
RDS10-112	BCD Real Code	10
RDS10-122	BCD Complement	10
RDS10-132	EECO-BCD Real Code	10
RDS10-142	EECO-BCD Complement	10
RDS16-112	Hexadecimal Real	16
RDS16-122	Hexadecimal Complement	16
RDS16-132	EECO-Hexadecimal Real	16
RDS16-142	EECO-Hexadecimal Complement	16
<b>Shaft Type</b>		
RDS10-212	BCD Real Code	10
RDS10-222	BCD Complement	10
RDS10-232	EECO-BCD Real Code	10
RDS10-242	EECO-BCD Complement	10
RDS16-212	Hexadecimal Real	16
RDS16-222	Hexadecimal Complement	16
RDS16-232	EECO-Hexadecimal Real	16
RDS16-242	EECO-Hexadecimal Complement	16

Order Number	Description	No. of Pos.
<b>Indicator Type</b>		
RDS10-312	BCD Real Code	10
RDS10-322	BCD Complement	10
RDS10-332	EECO-BCD Real Code	10
RDS10-342	EECO-BCD Complement	10
RDS16-312	Hexadecimal Real	16
RDS16-322	Hexadecimal Complement	16
RDS16-332	EECO-Hexadecimal Real	16
RDS16-342	EECO-Hexadecimal Complement	16
<b>Knob Type</b>		
RDS10-412	BCD Real Code	10
RDS10-422	BCD Complement	10
RDS10-432	EECO-BCD Real Code	10
RDS10-442	EECO-BCD Complement	10
RDS16-412	Hexadecimal Real	16
RDS16-422	Hexadecimal Complement	16
RDS16-432	EECO-Hexadecimal Real	16
RDS16-442	EECO-Hexadecimal Complement	16

## The New Interswitch Keypads 1 x 4, 3 x 4 and 4 x 4



**KNM 2 Series KNM 2, Immersion Proof (IP 67 Protection) with Flush Keys 1 x 4, 3 x 4, and 4 x 4 Keypads**

**KNM 3 Series KNM 3, Immersion Proof (IP 67 Protection) with Raised Keys 1 x 4, 3 x 4 and 4 x 4 Keypads**

### FEATURES

- immersion proof, IP 67 rated
- superb tactile feel
- long life, 5,000,000 operations
- magnetic return (no springs, no domes, no membranes)
- dual gold plated contacts
- individual addressable keytops
- contact resistance (0.15 Ω)

### APPLICATIONS:

- shipboard/naval
- remote outdoor communication systems (telephones, etc.)
- geophysical
- wherever extreme, rugged, environmental conditions are encountered.

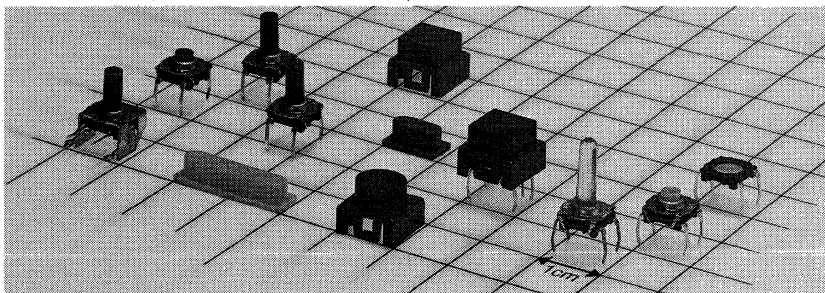
### TECHNICAL DATA

**Mechanical:** *Housing:* Crastin/silicon rubber  
*Key Travel:* 1.35 mm *Actuating Force:* 2.2 N ± 0.4 N  
*Termination:* Solder pins  
*Service Life (at nominal load):* 5 × 10<sup>6</sup> operations  
**Electrical:** *Contact:* n.o. contact (5μ Ni/2μ Au)  
*Operating Voltage:* max. 50 V ≅ *Test Voltage:* 500 V ≅  
*Nominal Current (resistive load):* max. 125 mA ≅  
*Contact Rating:* max. 2 W *Contact Resistance:* < 150 mΩ  
*Insulation Resistance:* > 10<sup>9</sup> MΩ *Bouncing Time:* < 5 ms  
**Environmental:** *Application Class (DIN 40040):* GSF  
*Operating Temperature Range:* -40°C to +70°C  
*Storage Temperature Range:* -40°C to +70°C  
*Relative Humidity:* 75% annual average, 95% 30 days  
*Protection Type:* IP 67

# ITT Cannon

## SWITCH PRODUCTS

### Key switches and Push Button Switches



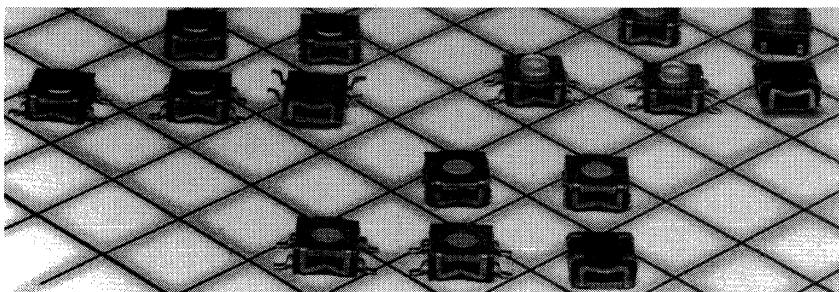
#### KSA SERIES

##### High Volume - Key Switches

The KSA family of Ultra-Miniature key switches are designed for applications needing compact PC board spacing. Furthermore, reduced processing cost and sim-

pler material handling are direct results of the innovative KSA design. Constructed in a standard IC dimension, the KSA can be auto insertable and is available sealed to an EIA standard for soldering and washing.

- Sealed to flux
- Straight terminals for auto insertion
- Silver or Gold contacts
- Sealed for soldering and immersion cleaning per EIA 448-2 optional
- Bent terminals for board retention
- .200 x .300 (5.08 x 7.62) footprint size for compact designs
- ESD terminal for component protection
- Custom actuator lengths available, please consult factory.



#### KSC SERIES

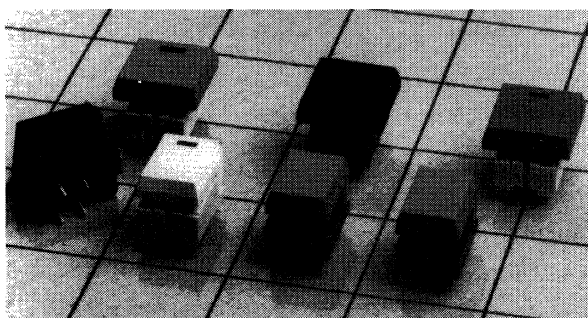
##### Surface mount Key switches

The KSC family of ultra low profile SPST key switches are designed for surface mounting technology (SMT). The KSC is the first surface mount key switch

to sustain all the major (SMT) soldering processes. The KSC is also compatible with most automatic insertion equipment for reduced manufacturing assembly costs.

- Positive tactile feedback

- With or without raised actuator
- Operating force 160, 300, or 500 grams
- Silver or Gold contacts
- Tin plated terminals for easy soldering
- Gull wing or J-type terminal
- Conform to main soldering methods for surface mounted components
- Can be used with Major Automatic "Pick & Place" Machines
- Package is thermoformed tape on reel of 2000 pieces



#### DIGITAST

##### High Performance - Key Switches

Digitast is a versatile modular electronic component specially designed for use with dual in-line packages. The switch has vibra-

- Two standoffs for ease of cleaning and parallel mounting
- Long life: over 5 million operations momentary action

tion free, short smooth travel through it's pivoting cap design.

- Short travel .120 (3.00mm)
- Over center spring contact system
- Dual in line package dimensions

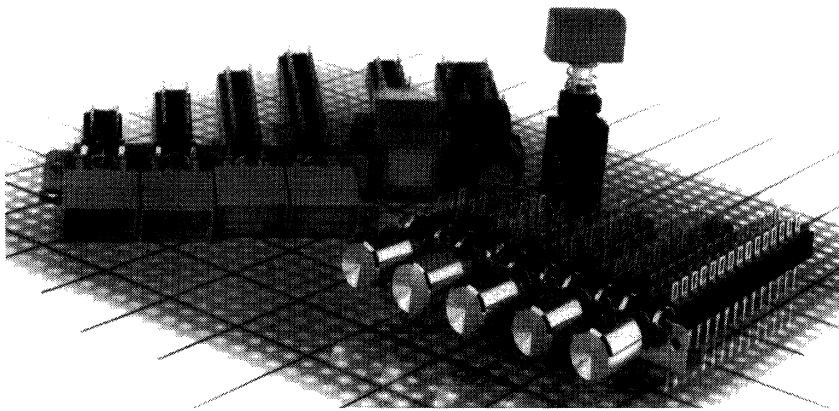
- Gold contacts
- Push/push action
- Custom caps available
- Tactile feel
- "Outstanding Design" award winner
- Double or triple caps for keyboard use
- Sealed terminals standard
- Incandescent STFB option
- Legending, 27 Cap styles
- SPDT contacts, ESD protection



# ITT Cannon

## SWITCH PRODUCTS

### Key switches and Push Button Switches



#### F SERIES

##### Miniature Push Button Switches

F Series Push Button Switches form a versatile system of modules, and with almost infinite variations cover

a wide range of applications.

- Constant coil spring tension at the contact points provide positive self-cleaning action
- Up to 16 poles per module
- Terminal styles optional
- Mounting frames (chassis) with maximum 23 positions and six variations of spacing
- Configurations with illuminated push buttons
- Configurations with lampless status indicators
- Custom designs
- Plunger extensions
- Enclosed housing
- Choice of power switches
- Line switches UL, CSA and VDE recognized and certified

Technical Data	Digitast	KSA Silver	KSA Gold	KSC	F Series
<b>Electrical Data</b>					
Contact arrangement	SPDT	SPST	SPST	SPST	2PDT-16PDT
Contact material	Cu/Zn*	silver	gold	silver	silver
Switching current max.	10mA	50 mA	10 mA	50 mA	0.4A
Switching current min.		1 mA	1 mA	1 mA	
Switching voltage max.	24V DC	50 V	50 V	50 V	125 V
Switching voltage min.		20 mV	20 mV	20 mV	
Switching power max.	240 mW	1 VA	0.2 VA	< 1VA	50 W
Operating life	5,000,000	500K-1000K		500,000	100,000
Contact resistance initial	≤ 50 mΩ max.	50 mΩ	50 mΩ	100 mΩ	Typ <10mΩ
Insulation resistance min.	≥10 <sup>9</sup> Ω	100K MΩ	100K MΩ	10 <sup>9</sup> MΩ	≥1 x 10 <sup>9</sup> Ω
Dielectric strength min. Vrms 1 min.		300 Vrms	300 Vrms	250Vrms	**
Contact bounce max.	≤2.5 ms	1 ms	1 ms	≤1 ms	

#### Mechanical Data

Keycap travel	≤ .118 (3.00)	.019 to .023 (0.5 ±0.2)		0.25 to 0.4	
Operating force	150 grams	130-150 grams		160 grams	10 oz min
Function	Momentary Push/push	Momentary		Momentary	Momentary Push/push
Mounting	PC Board pins	PC Board pins		PC Board pins	PC/solder lugs
Illumination	Visible indication by LED	N/A		N/A	Incandescent LED

#### Environmental Data

Operating Temperature Range	-25°C to +85°C	-25°C to +85°	-40°C to +125°	-40°C to + 90°C	-20°C to +70°C
Storage Temperature Range				-55°C to +90°C	-40°C to +70°C
Soldering				+255°C/5 sec	+255°C/5 sec

\* alloy gold plated \*\* F series Dielectric Strength - frame to adjacent contacts, 1500 V - Contact gap, 1500 V - Between general use changeovers, 2500 V

ITT Schadow, Inc. 8081 Wallace Road, Eden Prairie, MN 55344 • Tel: (612) 934-4400 • Fax: (612) 934-9121

# TW Switches

An Illinois Toolworks Company

7301 W. Ainslie Street  
Harwood Heights, IL 60656-3512

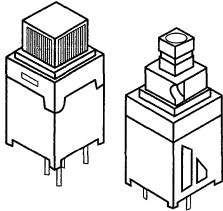
(800) 544-3354

e-mail: [customer\\_service@itwswitches.com](mailto:customer_service@itwswitches.com)

## Pushbuttons

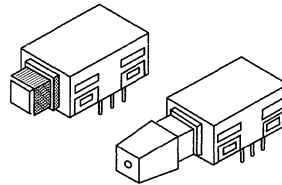
### Series 39

Series 39 miniature pushbutton is a SPST-NO-DB that is offered in momentary or maintained actions and with or without lighting.



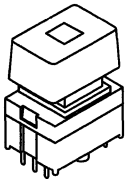
### Series 39 Mr. Clean®

Series 39 Mr. Clean® wave solderable switch features separate base and snap-on body for contamination-free assembly.



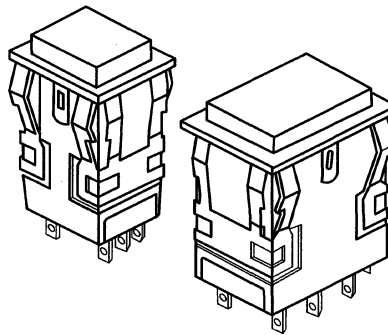
### Series 37

Series 37 is a DPDT switch that comes in a variety of cap styles and colors.



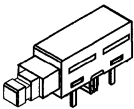
### Series 50

Series 50 solid state, electromechanical lighted or LED switch is momentary or 2 level maintained action and is available in a selection of bright colors and display options.



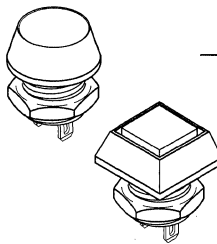
### Series 39-7

Series 39-7 ultra-miniature switch is IR process compatible and is available as momentary or maintained positions.



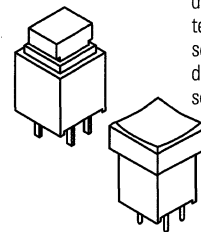
### Series 59

Series 59 SPST momentary action switch is panel sealed to IP67, comes in three button colors and is heat and impact tolerant.



### Series 60

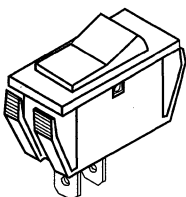
Series 60 dataswitch has PCB terminals is .39" square and is designed for flow soldering.



## Rockers

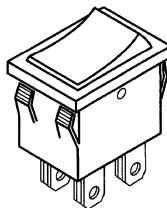
### Series 163

Series 163 single pole lighted and non-lighted switches are reliable, compact, attractive and features snap-in panel mounting.



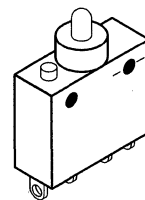
### Series 372

Series 372 high inrush mini-rocker features a snap-in panel mount and can reliably switch an inrush current of 200A.



### Series 65

Series 65 miniature and sub-miniature sealed switches provide the ruggedness and reliability to meet demands of industrial and military applications.

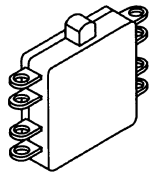


## Sealed

For technical and ordering information about these featured switches as well as our complete line of switching products, consult an authorized distributor or ITW Switches directly.

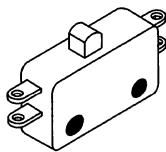
## Basic Snap-Action

### Type 26



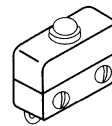
Type 26 sub-miniature switch with DPDT-DB contacts provides the option of controlling up to 4 isolated circuits.

### Type 16



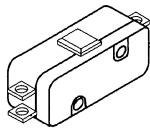
Type 16 sub-miniature snap-action switch features the highly reliable Butterfly® double-break momentary mechanism.

### Type 18



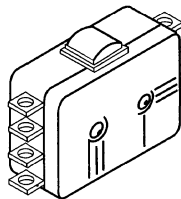
Type 18 sub-miniature switch features the highly reliable Butterfly® double-break mechanism and is available in two actuator styles.

### Type 11



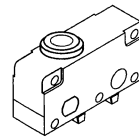
Type 11 miniature switch is available in standard, low force momentary or reset action and in a wide variety of terminals and actuators.

### Type 22



Type 22 miniature double-break switch contains two individual switching elements which function simultaneously.

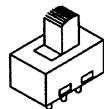
### Series 19N



Series 19N sub-miniature switch is fully sealed and can withstand wide temperature ranges.

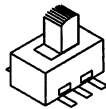
## Slide

### Series 124



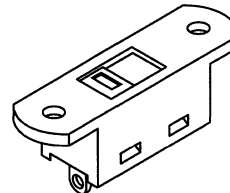
Series 124 Mr. Clean® mini slide switch features a two-part design for process compatibility.

### Series 224



Series 224 Mr. Clean® mini slide switch features a two-part design and is constructed for surface mount applications.

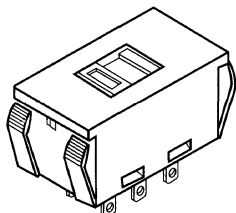
### Series SY



Series SY single pole selector is compact, hand or screwdriver actuated and has International approvals.

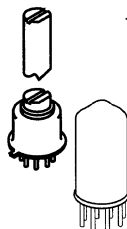
## Circuit Board Products

### Series SE



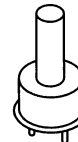
Series SE quick connect, double pole switch has handle markings to indicate voltage selected and an electrical life of approximately 10,000 cycles.

### Series 030



Series 030 sub-miniature rotary has multiple positions in a TO-5 can and has an optional vinyl protective boot.

### Series 034



Series 034 TO-5 miniature PCB mount is SPST-NO momentary and is available in a wide range of actuator lengths.

### Authorized ITW Switches Distributors

Advacom, Inc.  
(800) 678-0509

AESCO Electronics  
(800) 362-0022

Astrex, Inc.  
(800) 633-6360

Cal Switch  
(800) 225-7924

Electric Switches  
(800) 421-8855

Electronic Expeditors  
(800) 558-8547

Hawk Electronics, Inc.  
(800) THE-HAWK

Newark Electronics  
(800) 4-NEWARK

Powell Electronics  
(800) 235-7880

Richey Electronics  
(800) NOW-RCHY

RS Electronics  
(800) 859-3443

Sager Electronics  
(800) SAGER 800

Voyager Electronics  
(612) 571-7766

# ITW Switches

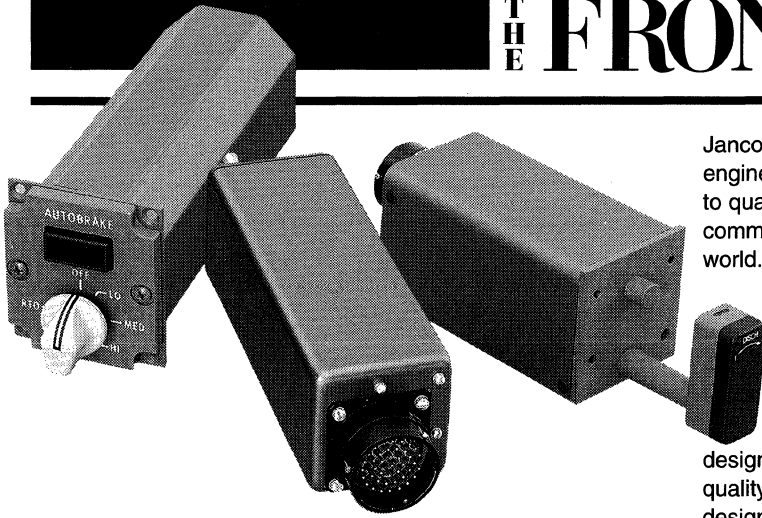
An Illinois Toolworks Company

7301 W. Ainslie Street  
Harwood Heights, IL 60656-3512

(800) 544-3354

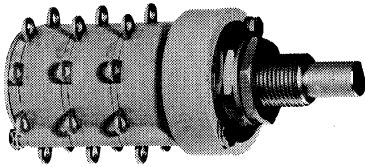
e-mail: [customer\\_service@itwswitches.com](mailto:customer_service@itwswitches.com)

# THE FRONT LINE IN



Janco MIL Spec, QPL switches and switching systems are engineered for maximum reliability. This total dedication to quality has earned Janco a "seat" on virtually every commercial/military aircraft and spacecraft in the free world. Our extensive experience with unique switching requirements has found application in the medical and industrial equipment arenas. This brief overview of our proven standard product line provides basic specifications from which our custom switching systems are developed. New to our product line is a series of custom potentiometers which are designed and manufactured with the same dedication to quality and reliability as our switches. Let Janco engineers design a switching system or potentiometer to meet your critical application needs! Call the factory.

## SERIES A/4M



### Miniature Rotary Selector Switches

- Qualified to MIL-S-3786/4
- Life 10,000/25,000 Cycles
- Make & Break up to 5 Amp.  
115 VAC/28 VDC, Carry 10 Amp.

#### Options

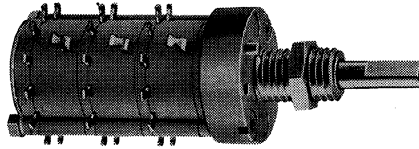
- Flux Proof
- Non-Magnetic
- 2500 VAC Dielectric Withstand
- Ruggedized for Extreme Environments
- "Plug-in" Module Adaption
- Screw Type Termination
- Submersible

Index	Positions	Poles/Deck
15°	24	1,2,3,4,6
20°	18	1
22.5°	16	1,2,4
30°	12	1,2,3,4,6
36°	10	1,2
45°	8	1,2
60°	6	1
90°	4	1

## SERIES AA

Designed for maximum versatility, Series AA switches feature Series A configuration and performance with adjustable stops.

## SERIES B/13M



### Micro-Miniature Rotary Selector Switches

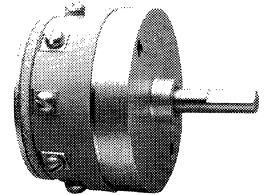
- Qualified to MIL-S-3786/13
- Life 10,000/25,000 Cycles
- Make & Break up to .25 Amp.  
115 VAC/28 VDC, Carry 8 Amp.

#### Options

- Flux Proof
- Ruggedized for Extreme Environments
- "Plug-in" Module Adaption
- Submersible

Index	Positions	Poles/Deck
30°	12	1,2,3
36°	10	1,2
45°	8	1,2

## SERIES C

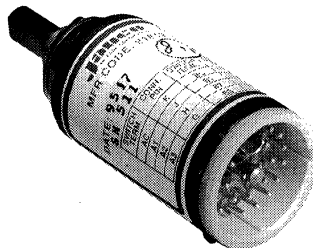


### Power Rotary Switches

- Built to MIL-S-6807
- Life 10,000 Cycles
- Make & Break up to 15 Amp.  
115 VAC/28 VDC, Carry 25 Amp.
- "Plug-in" Module Adaption
- Screw Type Termination
- Ruggedized Construction

Index	Positions	Poles/Deck
22.5°	16	1
30°	11	1,3
36°	9	1
45°	7	1,2
90°	4	1,2

## SERIES AD/BD



### Quick Disconnect "A", "B", & "E" Series Rotary Switches

- Eliminates Soldering
- Coded Outputs Available
- Can be Adapted for Flex Circuit Applications
- Reduced Installation Time



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# SWITCHING TECHNOLOGY

## General Specifications

- All Switches and Potentiometers Meet or Exceed Environmental Condition Requirements of MIL-S-3786 and MIL-S-22710
  - Explosion Proof / MIL-STD-202 • Salt Spray / MIL-STD-202
  - Sand and Dust / MIL-STD-202 • Shock High Impact / MIL-STD-202
  - Shock Medium / MIL-STD-202 • Vibration / MIL-STD-202
  - Moisture Resistance / MIL-STD-202 • Altitude to 70,000 Feet
  - Thermal Shock / MIL-STD-202 • Panel Seal
- All Switches Offer Maximum Protection Against RFI/EMI
- All Switches and Potentiometers Are Totally Enclosed
- Combination Switch/Potentiometers with Concentric Shafts

## Options

- 2500 VAC Dielectric Withstand
- Non-Magnetic
- Momentary Spring Return
- Isolated Push/Pull to Turn
- Solenoid Driven
- Solenoid Latched
- Ruggedized for Extreme Environments
- Adjustable Stops
- Keylock
- Switch/Potentiometer Combinations
- Concentric Shaft
- Night Vision Compatible (Pushbutton)
- Stackable Stand Alone Potentiometers

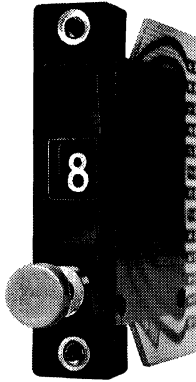
## SERIES D/M

### Pushbutton Rotary Switches

- Qualified to MIL-S-22710/18/23/30
- Life 50,000 Cycles
- Make & Break up to .125 Amp. 115 VAC/28 VDC, Carry 3 Amp.
- Numerous Coded Outputs Available

### Options

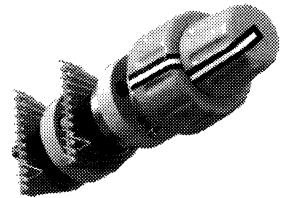
- NVIS Compatible (Night Vision Imaging System)
- Custom Coded Outputs
- Submersible



	MIL-S-22710/23			MIL-S-22710/30	MIL-S-22710/18		
	30°	36°	45°	22.5°	30°	36°	45°
<b>Max. Positions</b>	12	10	8	16	12	10	8

## SERIES E

### Miniature/Micro Miniature Printed Circuit Rotary Selector Switches



Index	Max. Positions
SERIES EA, EB, EC	
15°	24
18°	20
22°	16
30°	12
36°	10
45°	8
SERIES ED, EE, EF	
30°	12
36°	10
45°	8

- Built to MIL-S-3786; 22710
- Life 250,000 Cycles (EF Series)
- Make & Break up to .125 Amp. 115 VAC/28 VDC, Carry 3 Amp.
- Numerous Coded Outputs Available

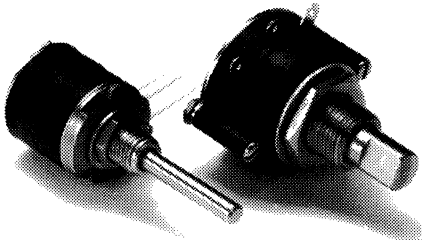
### Options

- Ruggedized for Extreme Environments
- Flex Circuit "Plug-in" Termination
- Custom Coded Outputs
- Switch/Potentiometer Combinations

## POTENTIOMETERS

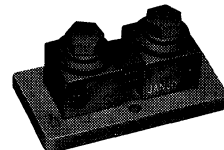
### Custom Potentiometers

- Switch/Potentiometer Combinations
- Custom Configurable Resistances
- Concentric Shafts (3 max.)
- Meets Environmental Requirements of MIL-S-3786
- Custom Configurable Stops
- Stand Alone Pots Available



## Other Products

### Electrical Hardware Products for Aircraft



- External Ammeter Shunts MIL-S-61
- Flexible Bus Assemblies
- Bus Bars ■ Bonding Jumpers

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**Janco**  
 AN ESOP CORPORATION



# THE SIMPLE SOLUTION

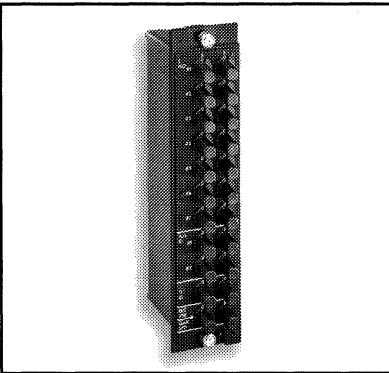
## JANCO: 50 YEARS

## OF SWITCHING SYSTEM

## DESIGN LEADERSHIP

**EXAMPLE:**

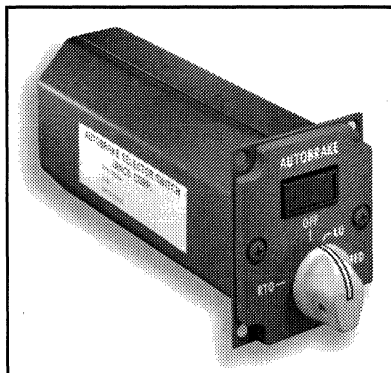
**COLLISION  
AVOIDANCE SYSTEM  
SWITCH PANELS**



Janco's collision avoidance system control panels allow air traffic control to identify aircraft by receiving a pre-selected coded signal from each aircraft in the vicinity. Envelope size is critical due to limited space, and the design allows for access by authorized ground crew personnel only. The panel shown incorporates 22 "EB45" Series rotary switches and related components in a single, integrated panel mounting, tamper-proof case. Each binary-coded rotary switch sets an individual number of a pre-determined code using a unique knob design which allows only the selected number to appear.

**EXAMPLE:**

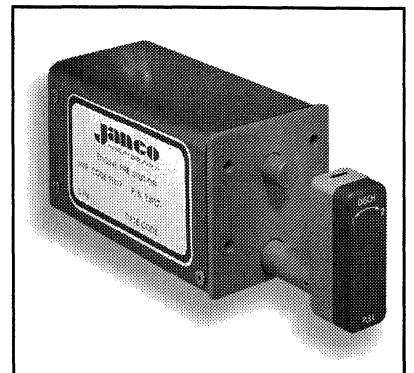
**AUTOBRAKE/  
ANTI-SKID SYSTEM  
CONTROL SWITCHES**



Janco manufactures autobrake/anti-skid system control switches that are designed to activate on touchdown. The braking systems determine the amount of braking pressure necessary to enable the aircraft to stop in a given distance or runway length without the tires skidding. Used by major OEMs, these control switches utilize specially designed "A" Series rotary switches with a solenoid "hold-in" latching circuit. An inductive load circuit automatically activates the solenoid as the switch is manually rotated to the desired position for optimum braking. The assemblies are line replaceable and incorporate a number of other advanced features.

**EXAMPLE:**

**ENGINE FIRE  
SHUT-OFF SWITCHES**



Major OEMs from around the world depend on Janco for the manufacture of these multi-function switch modules, which when activated shut off fuel supply to a specific aircraft engine and activate the fire extinguishing system. These modules incorporate numerous safety features and take advantage of a rugged, plug-in module assembly. The fuel flow to the engine is shut off by pulling the shaft to the "out" position actuating a 10 pole snap-action "A" Series switch, then releasing extinguishing material by rotating the shaft and actuating a 2-pole momentary "C" Series switch. Typically units incorporate hidden legends and a variety of other state-of-the-art capabilities.



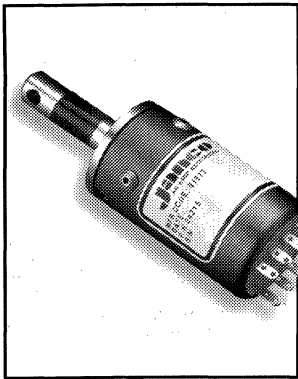
Janco Corporation, Box 3038 • 3111 Winona Ave., Burbank, CA 91504  
Phone: (818) 846-1800 • Fax: (818) 842-3396

# TO COMPLEX SWITCHING PROBLEMS

For over a half of a century, Janco has been answering the challenge of reducing increasingly complex switching functions into simpler, more manageable solutions. Janco is uniquely qualified to answer that challenge – and is the single most experienced designer and manufacturer of advanced switching systems control modules. The aerospace related examples listed below represent just a few of the ways that Janco is helping companies increase reliability, reduce weight and space requirements, and improve the serviceability of complex switching systems.

## EXAMPLE:

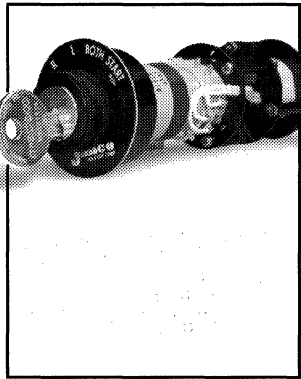
### LANYARD PULL-PIN SWITCHES



Janco also manufactures specialty switches for highly demanding applications. Utilized in a drone, this lanyard pull-pin switch is comprised of two sections. The shaft and lanyard assembly is attached to the aircraft and the switch body resides in the drone. Upon release of the drone, the shaft and switch separate, actuating the electrical systems of the drone. The switch utilizes a unique sealing method to assure performance in the most demanding environments.

## EXAMPLE:

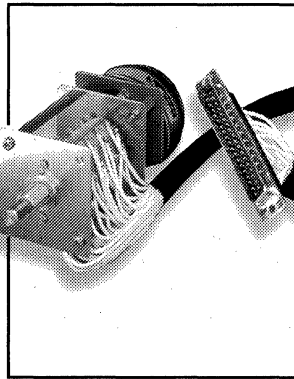
### ENGINE START SWITCHES



Janco engine start switches are used for rotary and fixed wing general aviation, commercial, and military aircraft applications. Switches can be designed to incorporate a wide range of design features. The Mooney engine start switch shown here features a high-security keylock combined with a MIL-SPEC qualified electrical switching mechanism to provide enhanced security and reliability. Janco solenoid held engine start switches are used extensively by Boeing and other leading aircraft manufacturers.

## EXAMPLE:

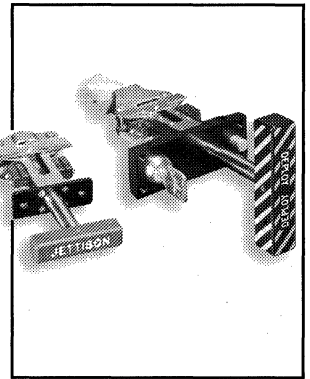
### RUNWAY LIGHTING CONTROL SWITCHES



Janco is the company to turn to for remote controlled switching systems. The airport runway lighting control switch shown here turns on and controls the brightness of runway approach lights on airports and aircraft carriers. Activated by either the approaching pilot or tower, the system consists of a bi-directional solenoid actuated "A" series rotary switch.

## EXAMPLE:

### PARACHUTE RELEASE SYSTEM SWITCHES



Janco is also relied on for new generations of switches that are improving the safety of critical operations. These pictured switching modules play a critical role in a new spin recovery system utilized for certification testing of aircraft.

**CALL TODAY TO DISCUSS YOUR APPLICATION REQUIREMENTS WITH OUR ENGINEERING DEPARTMENT...GET A PRELIMINARY DESIGN APPROACH WITHIN 24 HOURS.**

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<p><b>81-Series</b></p>		<p><b>81-Series</b></p> <p>Rating: 20A/125VAC T65°C UL/CSA 16(6)A/250V T125°C Euro</p> <p>Colors: Black, Brown and White. Others available on request.</p> <p>Functions: SPST, SPDT, Momentaries, Illuminated AC</p> <p>Direct Cross To: Arco, DNA, Dreefs, Marquardt</p>
<p><b>82-Series</b></p>		<p><b>82-Series</b></p> <p>Rating: 20A/125VAC T65°C UL/CSA 16(6)A/250V T125°C Euro</p> <p>Colors: Black, Brown and White. Others available on request.</p> <p>Functions: DPST, DPDT, Momentaries, Illuminated AC</p> <p>Direct Cross To: Carling®, DNA, Dreefs, Marquardt</p>
<p><b>83-Series</b></p>		<p><b>83-Series</b></p> <p>Rating: 20A/125VAC T65°C UL/CSA 16(6)A/250V T125°C Euro</p> <p>Colors: Black, Brown and White. Others available on request.</p> <p>Functions: 2 x SPST, 2 x SPDT, Momentaries, Illuminated AC</p> <p>Direct Cross To: DNA, Dreefs, Marquardt</p>
<p><b>A3-Series</b></p>		<p><b>A3-Series</b> <b>-Waterproof Push Buttons</b></p> <p>Rating: 20A/125VAC T65°C UL/CSA 16(6)A/250V T125°C Euro</p> <p>Colors: Black and White. Others available on request.</p> <p>Functions: SPST, SPDT, SPNO</p>
<p><b>A4-Series</b></p>		<p><b>A4-Series</b> <b>-Waterproof Push Buttons</b></p> <p>Rating: 20A/125VAC T65°C UL/CSA 16(6)A/250V T125°C Euro</p> <p>Colors: Black and White. Others available on request.</p> <p>Functions: DPST, DPDT, DPNO Illuminated AC</p>



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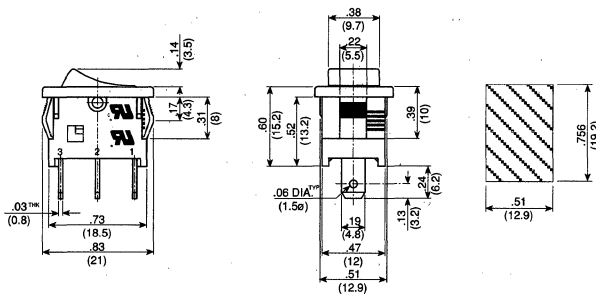


<p><b>8A-Series</b></p>	<p><i>2-color double shot rocker optional</i></p>	<p><b>8A-Series</b></p> <p>Rating: 20A/125VAC T65°C UL/CSA 16(6)A/250V T125°C Euro</p> <p>Colors: Black, Brown and White. Others available on request.</p> <p>Functions: SPST, SPDT, Momentaries, Illuminated AC</p> <p>Direct Cross To: <b>CARLING®</b>, Arrowhart, Arcoelectric, C&amp;K</p>														
<p><b>C2-Series</b></p>	<table border="1"> <thead> <tr> <th>DIM</th> <th>DIM (mm)</th> </tr> </thead> <tbody> <tr> <td>D</td> <td>.02-.05 (0.5-1.2)</td> </tr> <tr> <td></td> <td>.05-.08 (1.2-2)</td> </tr> <tr> <td></td> <td>.08-.12 (2-3)</td> </tr> <tr> <td>L</td> <td>.75 (19.0)</td> </tr> <tr> <td></td> <td>.76 (19.3)</td> </tr> <tr> <td></td> <td>.77 (19.6)</td> </tr> </tbody> </table>	DIM	DIM (mm)	D	.02-.05 (0.5-1.2)		.05-.08 (1.2-2)		.08-.12 (2-3)	L	.75 (19.0)		.76 (19.3)		.77 (19.6)	<p><b>C2-Series</b></p> <p>Rating: 13A/125VAC T65°C UL/CSA 10(4)A/250V T125°C Euro</p> <p>Colors: Black and White. Others available on request.</p> <p>Functions: SPST, DPST, Illuminated AC</p>
DIM	DIM (mm)															
D	.02-.05 (0.5-1.2)															
	.05-.08 (1.2-2)															
	.08-.12 (2-3)															
L	.75 (19.0)															
	.76 (19.3)															
	.77 (19.6)															
<p><b>L4-Series</b></p>	<table border="1"> <thead> <tr> <th>DIM</th> <th>DIM (mm)</th> </tr> </thead> <tbody> <tr> <td>D</td> <td>.02-.05 (0.5-1.2)</td> </tr> <tr> <td></td> <td>.05-.08 (1.2-2)</td> </tr> <tr> <td></td> <td>.08-.12 (2-3)</td> </tr> <tr> <td>L</td> <td>.75 (19.0)</td> </tr> <tr> <td></td> <td>.76 (19.3)</td> </tr> <tr> <td></td> <td>.77 (19.6)</td> </tr> </tbody> </table>	DIM	DIM (mm)	D	.02-.05 (0.5-1.2)		.05-.08 (1.2-2)		.08-.12 (2-3)	L	.75 (19.0)		.76 (19.3)		.77 (19.6)	<p><b>L4-Series</b></p> <p>Rating: 15A/125VAC T65°C UL/CSA 16(4)A/250V T125°C Euro</p> <p>Colors: Black, Brown and White. Others available on request.</p> <p>Functions: SPST, DPST, Momentaries, Illuminated AC</p>
DIM	DIM (mm)															
D	.02-.05 (0.5-1.2)															
	.05-.08 (1.2-2)															
	.08-.12 (2-3)															
L	.75 (19.0)															
	.76 (19.3)															
	.77 (19.6)															
<p><b>L5-Series</b></p>		<p><b>L5-Series</b></p> <p>Rating: 15A/125VAC T65°C UL/CSA 16(4)A/250V T125°C Euro</p> <p>Colors: Brown. Others available on request.</p> <p>Functions: SPST, DPST, Momentaries</p>														
<p><b>V8-Series</b></p>		<p><b>V8-Series</b></p> <p>Rating: 10A/125VAC T65°C UL/CSA 16(4)A/250V T125°C Euro</p> <p>Colors: Black and White. Others available on request.</p> <p>Functions: SPST, SPDT, DPST, DPDT, Momentaries, Illuminated AC</p>														

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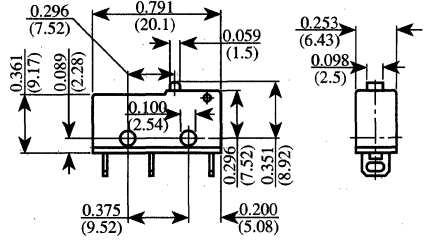
P.O. Box 25110, Portland, Oregon 97298 ♦ (503)297-8878 ♦ (800)824-9374 ♦ FAX: (503)297-8879  
 www.lambind.com **Stock to 6 weeks ARO** sales@lambind.com

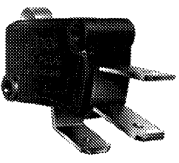
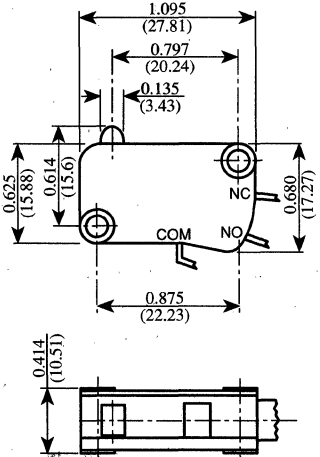


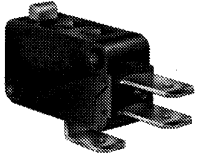
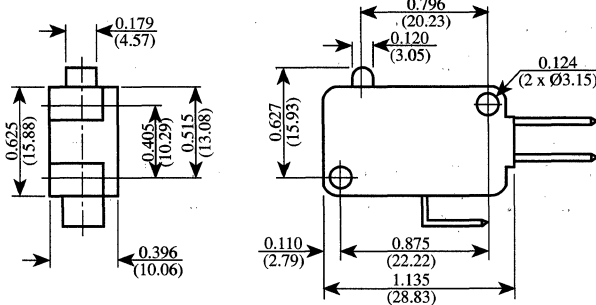
<p><b>R1-Series</b></p> 		<p><b>R1-Series</b></p> <p>Rating: 11A, 13A/125VAC              Temperature: 65°C/ UL &amp; CSA              Colors: Black and White. Others available on request.              Functions: SPST, SPDT, Momentaries              Direct Cross To: Alco, Arco, C&amp;K, <b>CARLING®</b>, DNA, Marquardt</p>
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LAMB INDUSTRIES, INC. / **OTEHALL** ISO 9002



<p><b>290-Series</b></p> 		<p><b>290-Series</b></p> <p>Rating: 2A, 6A,              Temperature: -30° to 125°C              Contacts: Fine silver, or 5 micron gold cross point contacts.              Terminals: Brass, silver plated 2.8mm Fast-on, solder, PC, and right angle              Actuators: Plain and roller levers, standard or formed.              Mechanical life: 5 million operations.</p>
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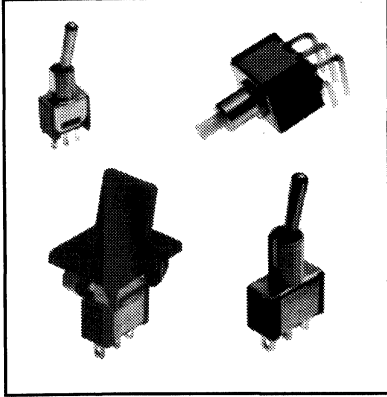
<p><b>380-Series</b></p> 		<p><b>380-Series</b></p> <p>Rating: 10A to 15A/250VAC 1/2 HP              Temperature: T85°C, 125°C avail.              Contacts: Fine silver. Gold avail.              Contact gap: .025" (.65mm)              Terminals: Brass, silver plated .187" or .250" Fast-on, solder and screw              Actuators: Plain and roller levers, standard or formed.              Mechanical life: 10 million operations.</p>
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<p><b>340 / 390-Series</b></p> 		<p><b>340 / 390-Series w/Wiping Contacts</b></p> <p>Rating: 16(4)A to 25(4)A/250VAC              Temperature: T85°C              Contacts: Fine silver, or silver cad.              Contact gap: .039" (1.0mm)              Terminals: Brass, silver plated .187" or .250" Fast-on              Actuators: Plain and roller levers, standard or formed.              Mechanical life: 10 million operations.</p>
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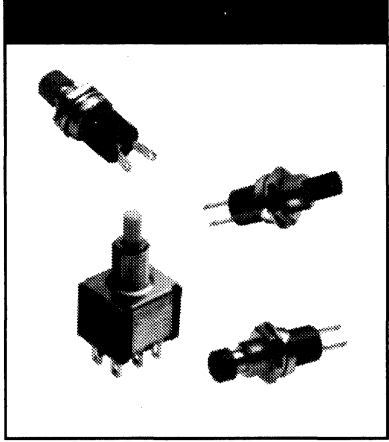
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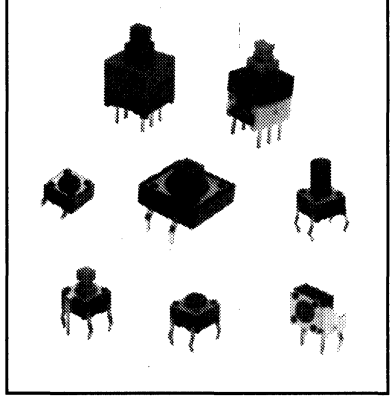
**Toggles; Sealed, Rocker, Paddle & Tiny**



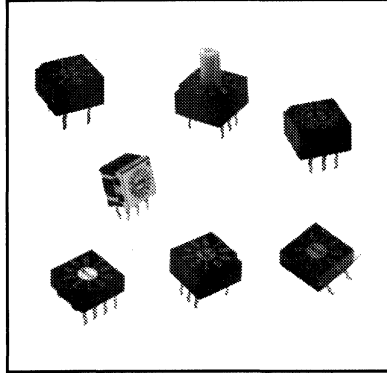
**Push Buttons**



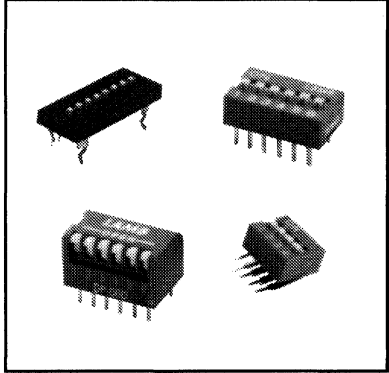
**Tactiles; SMT, Right Angle, Sealed**



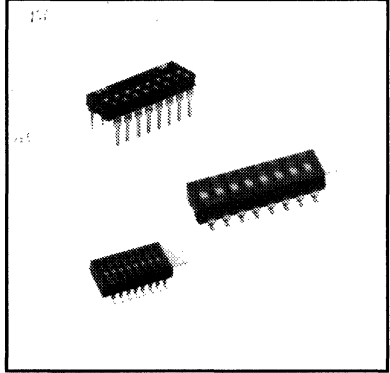
**Miniature DIP Rotaries, SMT & Right Angle**



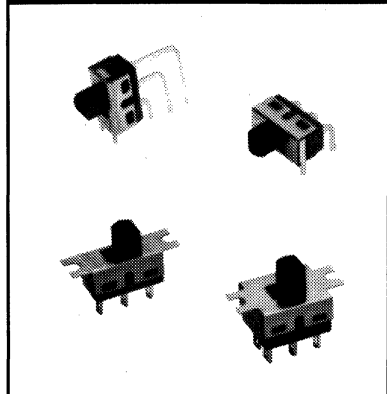
**DIPs; Piano, Right Angle, Tri-State**



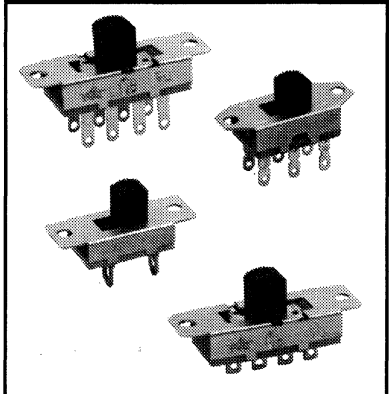
**Auto Insertable Surface Mount**



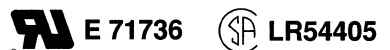
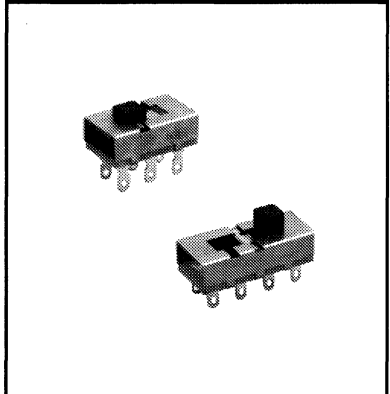
**6A UL Approved Slides**



**11A UL/CSA Approved Slides**



**13A UL/CSA Approved Slides**

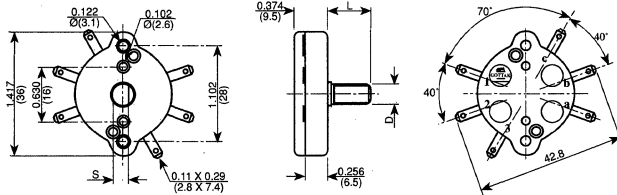
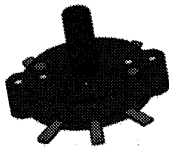


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**3SH-SERIES**

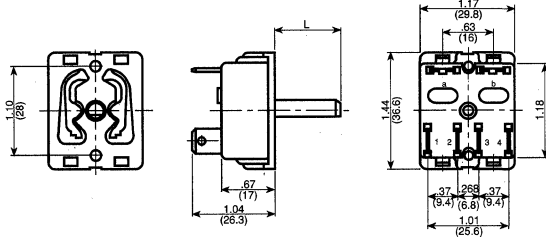
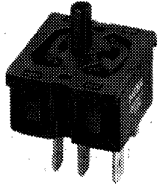


**SPECIFICATIONS:**

- Rating: 3A 1/4HP 240 VAC
- Indexing at 40°
- Maximum 4 circuits
- Ambient temperature rating of 125°C



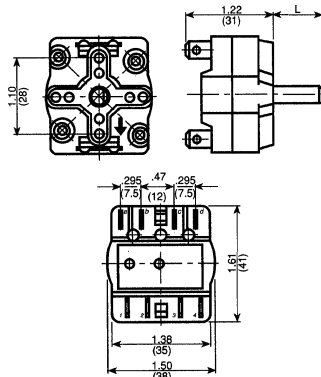
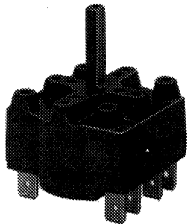
**X-02-SERIES**



**SPECIFICATIONS:**

- Rating: 10(3)A/250V~ 1/4 HP/125V~
- Indexing at 36°, 45°, 60°, 72° or 90°
- Maximum 4 circuits
- Ambient temperature rating of 125°C

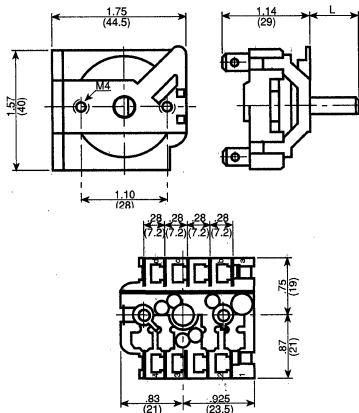
**4 RH-SERIES**



**SPECIFICATIONS:**

- Rating: 16A or 12A/250V~, 8A or 6A/380V~, 1 HP/120V~, 2 HP/240V~ (UL)
- From 2 to 12 positions. Stop cam available to limit shaft rotation in any index position
- Maximum 4 circuits
- Ambient temperature rating of 70°C or 85°C

**46 RCTH-SERIES**



**SPECIFICATIONS:**

- Rating: 16A or 12A/250V~, 8A or 6A/380(400)V~, 1 HP/120V~, 2 HP/240V~ (UL)
- From 2 to 12 positions. Stop cam available to limit shaft rotation in any index position.
- Maximum 4 circuits.
- Ambient temperature rating of 125°C.



# LAMB INDUSTRIES, INC.

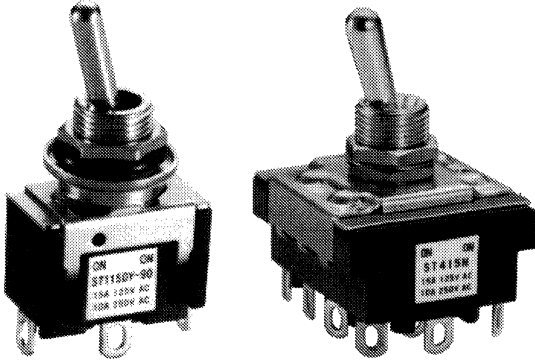
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## ST-SERIES



LAMB INDUSTRIES, INC. / SATORI ELECTRIC CO., LTD.

## Power Toggle Switches



### SPECIFICATIONS:

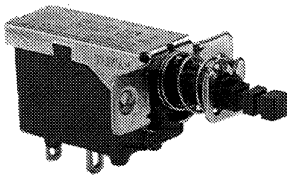
- |  |                                     |
|--|-------------------------------------|
| <input type="checkbox"/> Rating                | 3-25A/125VAC 30VDC,<br>1-15A/250VAC |
| <input type="checkbox"/> Dielectric Strength   | 1,500V AC for 1 minute              |
| <input type="checkbox"/> Insulation resistance | 1,000MΩ min. @ 500V DC              |
| <input type="checkbox"/> Contact resistance    | 20mΩ max.                           |
| <input type="checkbox"/> Mechanical life       | 30,000-100,000 cycles min.          |
| <input type="checkbox"/> Electrical life       | 20,000-30,000 cycles min.           |

E70886

LR46918

## PS-SERIES

## Power Switches

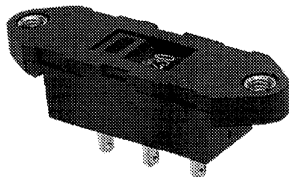


### SPECIFICATIONS:

- |  |                             |
|--|-----------------------------|
| <input type="checkbox"/> Electrical ratings (013): | 5A / 30A 250V~ μ T85; TV-5  |
| <input type="checkbox"/> Electrical ratings (014): | 8A / 128A 250V~ μ T85; TV-8 |
| <input type="checkbox"/> Insulation resistance:    | >500MΩ DC 500V              |
| <input type="checkbox"/> Withstand voltage:        | AC 2,000V for 1 minute      |
| <input type="checkbox"/> Contact resistance:       | <50mΩ                       |
| <input type="checkbox"/> Mechanical life:          | 500,000 cycles              |
| <input type="checkbox"/> Electrical life:          | 10,000 cycles               |
| <input type="checkbox"/> Operating force:          | 500 ± 200gf                 |
| <input type="checkbox"/> Soldering temp.:          | 255°C max. 5 seconds        |
| <input type="checkbox"/> Ambient temp. used:       | -25°C to +65°C              |
| <input type="checkbox"/> Ambient humidity used:    | <85% RH                     |

## VS-SERIES

## Voltage Select Switches



### SPECIFICATIONS:

- |   |                             |
|---|-----------------------------|
| <input type="checkbox"/> Electrical ratings:    | 10A / 30A 250V~ μ T85; TV-5 |
| <input type="checkbox"/> Insulation resistance: | >500MΩ DC 500V              |
| <input type="checkbox"/> Withstand voltage:     | AC 2,000V for 1 minute      |
| <input type="checkbox"/> Contact resistance:    | <50mΩ                       |
| <input type="checkbox"/> Mechanical life:       | 500,000 cycles              |
| <input type="checkbox"/> Electrical life:       | 10,000 cycles               |
| <input type="checkbox"/> Operating force:       | 500 ± 200gf                 |
| <input type="checkbox"/> Soldering temp.:       | 255°C max. 5 seconds        |
| <input type="checkbox"/> Ambient temp. used:    | -25°C to +65°C              |
| <input type="checkbox"/> Ambient humidity used: | <85% RH                     |

For complete information on any of our switch products, please request a catalog at  
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-or-

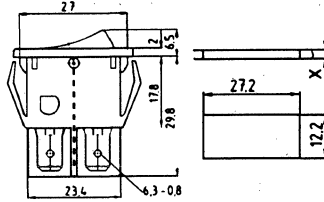
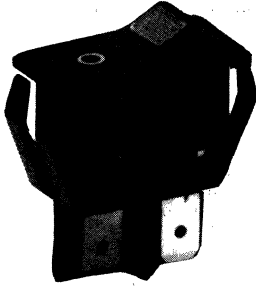
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# MARQUARDT

# Rocker Switch

## 1550 DUETTE™ SERIES

### DOUBLE POLE ROCKER SWITCH IN A SINGLE POLE HOUSING

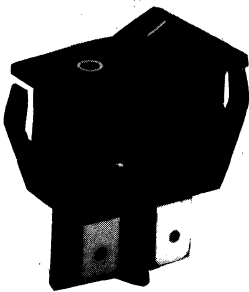


SUITABLE FOR PANEL THICKNESS X=0.8-5 mm

**ILLUMINATED**  
R38 16A-125V-250V AC, 1 HP 125V AC, 2 HP 250V AC  
R144 16A-125V AC, 1 HP  
R145 16A-250V AC, 2 HP

Circuit	Function	Terminal	Catalog Number
SPST	ON-OFF	6.3 (.250)	<b>1550.3102</b> R145 (Black Base, Red Lens, 220V Bulb)
SPST	ON-OFF	6.3 (.250)	<b>1550.3120</b> R144 (Black Base, Red Lens, 110V Bulb)
DPST	ON-OFF	6.3 (.250)	<b>1555.3102</b> R145 (Black Base, Red Lens, 220V Bulb, White Marking O on Rocker)
DPST	ON-OFF	6.3 (.250)	<b>1555.3108</b> R145 (Black Base, Green Lens, 220V Bulb, White Marking O on Rocker)
DPST	ON-OFF	6.3 (.250)	<b>1555.3109</b> R144 (Black Base, Green Lens, 110V Bulb, White Marking O on Rocker)
DPST	ON-OFF	6.3 (.250)	<b>1555.3120</b> R144 (Black Base, Red Lens, 110V Bulb, White Marking O on Rocker)

**Technical Data**  
Rocker and housing: thermoplastic  
Contacts: silver  
Terminals: silver-plated, brass  
Up to 120A Inrush capability with special contacts  
Mechanical-life endurance: 50,000 operations  
Electrical-life endurance: 10,000 cycles  
Ambient temperature: T 100



**Switch Functions**  
Series 1550 include SPST and DPST switches with or without indicator lamp.

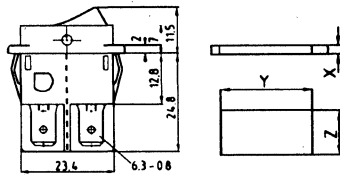
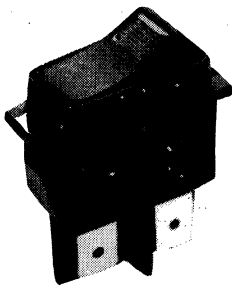
**Ratings**  
Switches without indicator lamp with plug-in terminals or solder terminals:  
16(4)A-250V~ T100  
16A-250V AC, 1/2 HP  
16A-125-V AC, 1/4 HP  
With PC terminals:  
10(4)A-250V~ T100

With indicator lamp:  
16(4)A-250V~ T100  
16A-250V AC, 1/2 HP  
16A-125V AC, 1/4 HP

**NON-ILLUMINATED**

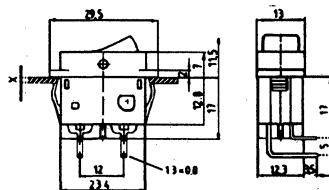
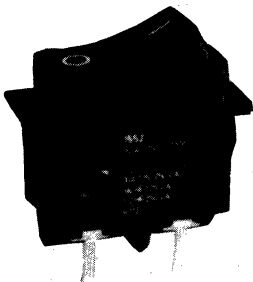
Circuit	Function	Terminal	Catalog Number
SPST	ON-OFF	6.3 (.250)	<b>1551.3102</b> R38 (Black Base & Rocker)
SPST	ON-OFF	6.3 (.250)	<b>1551.3103</b> R38 (Black Base & Rocker, White O,I Marking for Vertical Mounting)
DPST	ON-OFF	6.3 (.250)	<b>1552.3102</b> R38 (Black Base & Rocker, White O,I Marking for Vertical Mounting)
DPST	ON-OFF	6.3 (.250)	<b>1552.3104</b> R38 (Black Base & Rocker, White O,I Marking for Horizontal Mounting)

## 1550 SUB PANEL SERIES



X	Y	Z
0.75 ... 1.25	26.2 <sub>-0.1</sub>	12.4 <sup>+0.1</sup>
1.25 ... 2	26.4 <sub>-0.1</sub>	12.4 <sup>+0.1</sup>
2 ... 3	26.8 <sub>-0.1</sub>	12.4 <sup>+0.1</sup>

**ILLUMINATED**



Circuit	Function	Terminal	Catalog Number
SPST	ON-OFF	6.3 (.250)	<b>1550.3604</b> R145 (Black Base, Orange Lens, 220V Bulb)
DPST	ON-OFF	6.3 (.250)	<b>1555.3604</b> R145 (Black Base, Orange Lens, 220V Bulb, White Marking O on Rocker)
DPST	ON-OFF	6.3 (.250)	<b>1555.3624</b> R144 (Black Base, Orange Lens, 110V Bulb, White Marking O on Rocker)
SPST	ON-OFF	6.3 (.250)	<b>1551.3602</b> R38 (Black Base & Rocker)
DPST	ON-OFF	6.3 (.250)	<b>1552.3602</b> R38 (Black Base & Rocker, White Marking O,I Vertical Mounting on Rocker)
DPST	ON-OFF	Right Angle PC	<b>1552.4602</b> R38 (Black Base & Rocker, White Marking O,I Vertical Mounting on Rocker)
DPST	ON-OFF	Right Angle PC	<b>1552.4606</b> R38 (Black Base & Rocker, White Marking O,I Horizontal Mounting on Rocker)

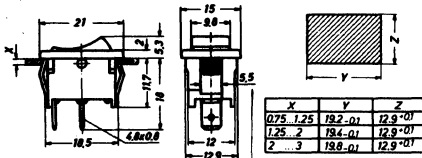
**NON-ILLUMINATED**

SUB-PANEL VERSIONS AVAILABLE WITH STABILIZER PINS 248.103.011

# MARQUARDT

# Rocker Switch

## 1800 SERIES



**SINGLE POLE** R30 6A-125V-250V AC, 1/4 HP 125V, 1/2 HP 250V AC **†††** R58 6A-125V-250V AC, 1/8 HP  
 R50 10A-125V-250V AC, 1/3 HP 125V, 1/2 HP 250V AC R73 10A-125V AC, 1/3 HP  
 R52 6A-125V, 4A-250V AC, 1/10 HP 125V-250V AC R87 6A-250V, 1/2 HP

**Technical Data**

Mechanical-life endurance:  
 ST, DT: 100,000 operations  
 DT with off-position: 50,000  
 Electric-life endurance:  
 ST, DT: 6(4)A: 50,000 ST, DT: 10(4)A: 10,000  
 Snap in Fixing for a wall thickness (X) of 0.75 ... 3 mm  
 recommended cut-out (YxZ), see table

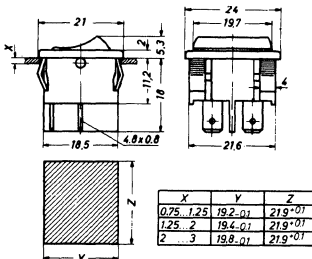
**Materials**

Rocker and housing: thermoplastic  
 Contacts: Ag/Cu silver-plated Terminals: silver-plated  
 Ambient temperature: T 85

Circuit	Function	Terminal	Catalog Number
SPST	ON-OFF	4.8 (.187)	<b>1800.1106</b> (Black Base, Red Lens, 30mA-16V Bulb, 6A-12V DC)
SPST	ON-OFF	4.8 (.187)	<b>1800.1115</b> (Black Base, Green Lens, 30mA-16V Bulb, 6A-12V DC)
SPST	ON-OFF	Solder	<b>1801.0101</b> R30 (White Base & Rocker)
SPST	ON-OFF	Solder	<b>1801.0102</b> R30 (Black Base & Rocker)
SPST	ON-OFF	Solder	<b>1801.0118</b> R30 (White Base & Rocker, White Marking O,I Vertical Mounting)
SPST	ON-OFF	Solder	<b>1801.0121</b> R50 (Black Base & Rocker)
SPST	ON-OFF	Solder	<b>1801.0132</b> R50 (Black Base & Rocker, White Marking O,I Horizontal Mounting)
SPST	ON-OFF	Solder	<b>1801.0136</b> R50 (Black Base & Rocker, White Marking O,I Vertical Mounting)
SPST	ON-OFF	Solder	<b>1801.0149</b> R30 (Black Base & Rocker, Red Marking O,I Horizontal Mounting)
SPST	ON-OFF	4.8 (.187)	<b>1801.1102</b> R30 (Black Base & Rocker)
SPST	ON-OFF	4.8 (.187)	<b>1801.1108</b> R30 (Black Base & Rocker, White Marking O on Edge of Rocker)
SPST	ON-OFF	4.8 (.187)	<b>1801.1110</b> R30 (Brown Base & Rocker)
SPST	ON-OFF	4.8 (.187)	<b>1801.1119</b> R30 (Black Base & Rocker, Red Marking Bar on Edge of Rocker)
SPST	ON-OFF	4.8 (.187)	<b>1801.1121</b> R50 (Black Base & Rocker)
SPST	ON-OFF	4.8 (.187)	<b>1801.1139</b> R30 (Black Base & Rocker, White Marking O,I Horizontal Mounting)
SPST	ON-OFF	4.8 (.187)	<b>1801.1146</b> R30 (Black Base & Rocker, White Marking O,I Vertical Mounting)

Circuit	Function	Terminal	Catalog Number
SPST	ON-OFF	4.8 (.187)	<b>1801.1148</b> R50 (Black Base & Rocker, White Marking O,I Horizontal Mounting)
SPST	ON-OFF	4.8 (.187)	<b>1801.1162</b> (Black Base & Rocker, 10A-14V DC, "T" Rating)
SPST	ON-OFF	4.8 (.187)	<b>1801.1183</b> R30 (Black Base & Rocker, White Marking ON, OFF Vertical Mounting)
SPNO	MOM ON-OFF	4.8 (.187)	<b>1801.1202</b> R52 (Black Base & Rocker)
SPNO	MOM ON-OFF	4.8 (.187)	<b>1801.1206</b> R52 (Black Base & Rocker, 6A-14V DC)
SPDT	ON-ON	Solder	<b>1803.0121</b> R50 (Black Base & Rocker)
SPDT	ON-ON	4.8 (.187)	<b>1803.1102</b> R30 (Black Base & Rocker)
SPDT	ON-ON	4.8 (.187)	<b>1803.1121</b> R50 (Black Base & Rocker)
SPDT	ON-ON	4.8 (.187)	<b>1803.1122</b> R50 (Brown Base & Rocker)
SPDT	ON-MOM ON	4.8 (.187)	<b>1803.1202</b> R52 (Black Base & Rocker)
SPDT	ON-OFF-ON	Solder	<b>1808.0102</b> R58 (Black Base & Rocker)
SPDT	MOM ON-OFF-MOM ON	Solder	<b>1808.0302</b> R58 (Black Base & Rocker)
SPDT	ON-OFF-ON	4.8 (.187)	<b>1808.1102</b> R58 (Black Base & Rocker)
SPDT	ON-OFF-MOM ON	4.8 (.187)	<b>1808.1202</b> R58 (Black Base & Rocker)
SPDT	MOM ON-OFF-MOM ON	4.8 (.187)	<b>1808.1302</b> R58 (Black Base & Rocker)

## 1802 SERIES



**DOUBLE POLE** R30 6A-125V-250V AC, **†††** 1/4 HP 125V, 1/2 HP 250V AC  
 R50 10A-125V-250V AC, 1/3 HP 125V, 1/2 HP 250V AC  
 R56 6A-125V AC, 1/4 HP R58 6A-125V-250V AC, 1/8 HP  
 R73 10A-125V AC, 1/3 HP R87 6A-250V AC, 1/2 HP

**Technical Data**

Mechanical-life endurance: ST, DT: 100,000 operations  
 DT with off-position: 50,000  
 Electric-life endurance:  
 ST, DT: 6(4)A: 50,000 cycles ST, DT: 10(4)A: 10,000 cycles  
 Snap in Fixing for a wall thickness (X) of 0.75 ... 3 mm  
 recommended cut-out (YxZ), see table  
 Ambient temperature: T 85

**Materials**

Rocker and housing: thermoplastic  
 Contacts: Ag/Cu silver-plated Terminals: silver-plated  
 Windows: red, green, amber transparent thermoplastic

Circuit	Function	Terminal	Catalog Number
DPST	ON-OFF	Solder	<b>1802.0102</b> R30 (Black Base & Rocker, Red Marking O on Edge of Rocker)
DPST	ON-OFF	Solder	<b>1802.0121</b> R50 (Black Base & Rocker, Red Marking O on Edge of Rocker)
DPST	ON-OFF	4.8 (.187)	<b>1802.1102</b> R30 (Black Base & Rocker, Red Marking O on Edge of Rocker)
DPST	ON-OFF	4.8 (.187)	<b>1802.1108</b> R30 (Black Base & Rocker, White Marking O,I Vertical Mounting)
DPST	ON-OFF	4.8 (.187)	<b>1802.1120</b> R50 (White Base & Rocker, Red Marking O on Edge of Rocker)
DPST	ON-OFF	4.8 (.187)	<b>1802.1121</b> R50 (Black Base & Rocker, Red Marking O on Edge of Rocker) Special European 8(8)/250V AC rating

Circuit	Function	Terminal	Catalog Number
DPST	ON-OFF	4.8 (.187)	<b>1802.1123</b> R50 (Black Base & Rocker, White Marking O,I Vertical Mounting)
DPDT	ON-ON	Solder	<b>1804.0121</b> R50 (Black Base & Rocker)
DPDT	ON-ON	4.8 (.187)	<b>1804.1121</b> R50 (Black Base & Rocker)
DPST	ON-OFF	4.8 (.187)	<b>1805.1110</b> R55 (Black Base, Green Lens, 110V Bulb, White Marking O on Edge of Rocker)
DPST	ON-OFF	4.8 (.187)	<b>1805.1121</b> R55 (Black Base, Red Lens, 110V Bulb, White Marking O on Edge of Rocker)
DPDT	ON-OFF-ON	4.8 (.187)	<b>1809.1102</b> R58 (Black Base & Rocker)
DPDT	MOM ON-OFF-MOM ON	4.8 (.187)	<b>1809.1302</b> R58 (Black Base & Rocker)

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<http://www.switches.com>

# MARQUARDT

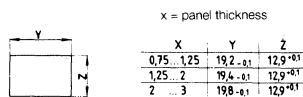
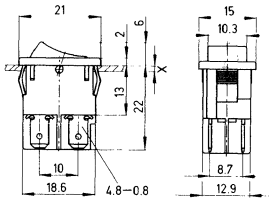


## Rocker Switch

### 1858 SERIES



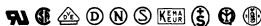
**NON-ILLUMINATED  
DOUBLE POLE,  
SINGLE THROW  
R 138 12 A 125-250V AC,  
1/3 HP 125V AC,  
1/2 HP 250 V AC**



Appliance cut-out

**Technical Data**

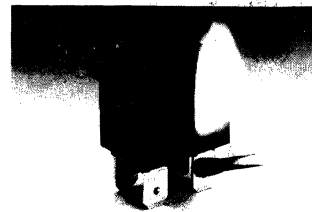
- Inrush current: 100 A capacitive 10<sup>4</sup> operations
- Mech. life endurance: ≥ 100,000 operations
- Contact resistance (new state): < 100 mΩ (12 V, 1 A DC)
- Insulation resistance (new state): > 100 MΩ (500 V DC between the open contacts)
- High voltage resistance (new state): 2000 V rms. (new state, 10mA between the open contacts)
- Contact gap: ≥ 3 mm
- Insulation spacing: ≥ 8 mm
- Ambient temperature:
  - terminal side: -20...+80°C
  - actuating side: -20...+55°C
  - no condensation
- Storage temperature: -30...+80°C
- Atmospheric humidity: max. 85%
- Actuating force: 3 N
- Flammability: rocker and housing black UL 94 V-0  
other colors UL 94 V-2
- Glow wire test: 960°C
- Material rocker and housing: Polyamid 6.6
- Temperature rise at the terminals (according to life endurance):
  - max. 30 K (UL 1054)
  - max. 55 K (EN 61058-1)
- Solderability of terminals: max. 350°C, 3 s (no pressure may be exerted on the terminals when soldering by hand)
- Push-on force of connectors: ≤ 80 N



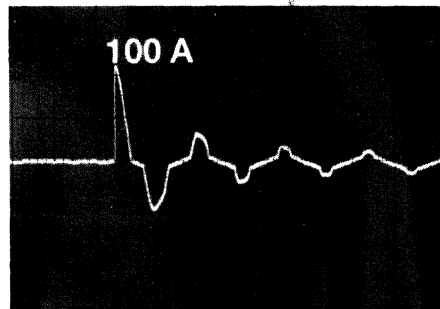
The test conditions comply with EN 61058-1, IEC 1058-1 and UL 1054.

Circuit	Function	Terminal	Catalog Number	
DPST	ON-OFF	Solder	<b>1858.0102</b>	R138 (Black Base & Rocker)
DPST	ON-OFF	Solder	<b>1858.0103</b>	R138 (Black Base & Rocker, I, O Marking for Horizontal Mounting)
DPST	ON-OFF	Solder	<b>1858.0104</b>	R138 (Black Base & Rocker, I, O Marking for Horizontal Mounting)
DPST	ON-OFF	4.8 (.187)	<b>1858.1101</b>	R138 (White Base & White Rocker)
DPST	ON-OFF	4.8 (.187)	<b>1858.0102</b>	R138 (Black Base & Rocker)
DPST	ON-OFF	4.8 (.187)	<b>1858.1103</b>	R138 (Black Base & Rocker, I, O Marking for Vertical Mounting)
DPST	ON-OFF	4.8 (.187)	<b>1858.1104</b>	R138 (Black Base & Rocker, I, O Marking for Horizontal Mounting)
DPST	ON-OFF	PC	<b>1858.2202</b>	R138 (Black Base & Rocker)
DPST	ON-OFF	PC Right Angle	<b>1858.4202</b>	R138 (Black Base & Rocker)

These switches are suitable for appliances of class II



Compliance with UL 94V-0



Inrush Current peaks up to 100Amps

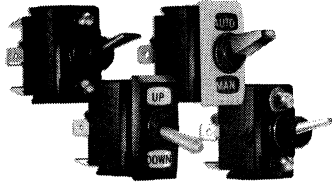


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**McGILL®**

McGILL ELECTRIC SWITCH PRODUCTS GROUP  
1320 S. MAIN ST.  
MANSFIELD, OH 44907  
(419) 525-8400 FAX (419) 525-8274

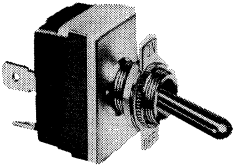
## TOGLITE™ LIGHTED TOGGLE SWITCHES



- **Broad Selection** of bat styles, colors, indicating plates and legends to fit design and functional requirements.
- **Reliable, long-life mechanisms** for exceptional performances.
- **Variety of circuit arrangements.**
- **Choice of terminals:** Screw, 1/4" quick disconnect, or solder.
- **Choice of lights:** 6V, 14V, 28V or 250V AC, 125 V AC Standard.

15 Amp 277V AC  
3/4 HP 125-277V AC  
Single Pole & Double Pole.  
Case Dimensions  
1.35" x .80"  
15/32"-32 thd. bushing  
**UL Recognized**  
**CSA Certified**

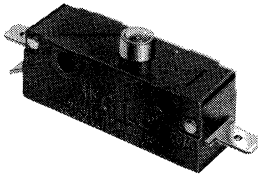
## STANDARD TOGGLE SWITCHES



- **Wide selection of circuitry, ratings, terminals.**
- **Time-proven, reliable long-life mechanism.**
- **Variety of bat styles and colors.**
- **SP, DP, 3 + 4 pole models available.**

20 A 125 V AC  
10 A 250 V AC  
1HP 125-250 V AC  
20 A 250 V AC Non-Inductive  
Also available 25 A 125-250 V AC  
Non-Inductive  
**UL Recognized**  
**CSA Certified**

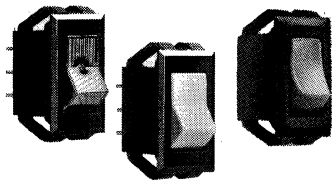
## SNAP-ACTION SWITCHES



**2600 Series**  
20 Amp 125-250V AC  
1HP 125-250V AC  
2HP 250V AC  
SPDT & SPST, NO or NC  
Less than .005" differential travel  
Operating force 20 oz. max.  
25 Amp SPST available  
20 Amp 200° C available  
Dimensions: 1-13/16" x 41/64" x 41/64"  
Standard Terminals  
.250" x .032" Quick Connect  
UL Recognized CSA Certified

**2700 Series**  
20 Amp 125-250V AC  
1HP 125-250V AC  
2HP 250V AC  
Dimensions 1-21/64" x 1-13/16" x 43/64"  
Spade Terminals .250" x .032"  
UL Recognized  
CSA Certified

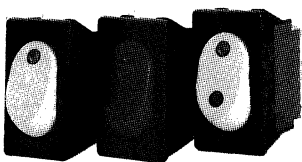
## MINIATURE ROCKER SWITCHES



- **0815 Series Rocker**
- **Choice of Stylette™**—(new softer designer lines that enhance product styling) or **standard miniature rocker switches.**
- **Choice of illuminated or solid** two surface smooth colored rocker.
- **Rocker colors available**—Light-Clear-Amber-Red-\*Green-\*Blue Non-lighted-White-Black-Red (other colors, consult factory).

- **Plastic snap-in bezels**—for fast easy installation.
- **Available in black & white bezels** (other colors consult factory)
- **Terminals**—1/4" quick disconnect- standard. Also available 16-ga. wire.
- **Lamps**—115V AC neon standard. Also available 6V AC or DC, 14V AC or DC, 28V AC or DC & 250V AC neon.

## 0852 EURO-STYLED ROCKER SWITCHES



- **Patented** sleek, rounded ultra-modern design
- **Rugged, reliable rocker mechanism** proven in millions of applications
- **Fits standard cutouts**
- **Available with splash-resistant seals**
- **.187" quick disconnect**, screw terminals, solder and wire leads optional

**Circuitry:** SPDT, DPDT  
**Types:** one-light, two-lights, non-lighted with three different rocker colors: red, white, black  
**Electrical:** 15A, 277V AC; 3/4 HP, 125-277V AC; 6-28V DC Incandescent; 115V Neon  
**Terminals:** 1/4" Quick Disconnect  
**UL Recognized CSA Certified**

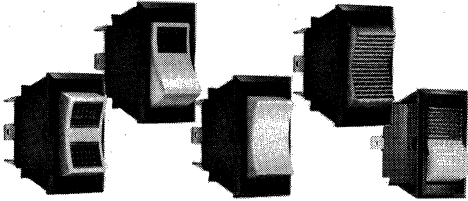
McGILL ELECTRIC SWITCH PRODUCT GROUP

engineered switches

**McGILL®**

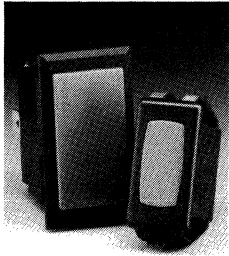
McGILL ELECTRIC SWITCH PRODUCTS GROUP  
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MANSFIELD, OH 44907  
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## LIGHTED ROCKER SWITCHES WITH SNAP-ON COLORED CAPS

**0851, 0871 and 0881 switch series standard construction features:**

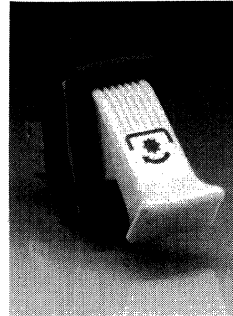
These switches have black plastic bezels for snap-in-mounting, 1/4" quick-disconnect terminals, 115V neon lamps. Available with 6-28V DC incandescent lamp consult factory. Optional splash-resistant gasket model available.

UL Recognized  
CSA Certified  
0851, 0861, 0871, 0881  
15 Amp 277V AC  
3/4 HP - 125 277V AC

**0820/0890 Series Indicator Lights**

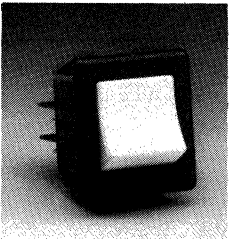
0820 miniature (.550x1.125") and 0890 standard (.830x1.450") series indicator lights offer durable performance. Choose from a wide range of translucent colors with custom colored bezel and lens options.

14V 125V AC      UL Recognized  
28V 125V AC      CSA Certified

**Lock-Out Switches**

McGill's new lock-out switch is ideal for applications where safety is critical. Activating the switch requires two separate actions - so accidental operation of equipment or vehicles is virtually impossible. Based on a proven design, the switch is available in single and double pole models in a variety of colors and can be custom imprinted.

15A 277V AC      UL Recognized  
3/4HP 125-277V AC      CSA Certified

**0825 Series 20 Amp Double Pole Rocker Switches**

McGill's new 0825 miniature rockers are available in virtually any color you need to match your panel design requirements. These switches fit standard 1x1.125" cutouts in marine and RV panels are available in double and single-throw, lighted and non-lighted models.

UL Recognized      6(6)A 250V AC;  
CSA Certified      16(6)A 250V AC  
VDE Rated

15A 277V AC  
20A 125V AC  
3/4HP 125-277V

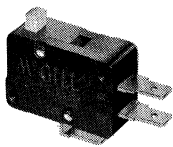
**15 A 277V AC, 20A 125V AC 3/4HP NON-LIGHTED**

Part Number	Rocker Color	Circuitry
0825-1213	Black	DPST ON/OFF
0825-1243	Black	DPDT ON/ON

**15A 277V AC, 20A 125V AC 3/4 HP LIGHTED**

Part Number	Rocker Color	Circuitry	Lamp Voltage
0825-5213	Red	DPST ON/OFF	125V Neon
0825-5214	White	DPST ON/OFF	125V Neon
0825-5216	Red	DPST ON/OFF	28V Incandescent
0825-5218	White	DPST ON/OFF	28V Incandescent
0825-5215	Red	DPST ON/OFF	14V Incandescent
0825-5217	White	DPST ON/OFF	14V Incandescent

## MINIATURE SNAP-ACTION SWITCHES



10Amp  
125-250V AC  
1/2HP 125-250V AC  
4 Amp "L" 125V AC

**McGill® 4775 Series**

Rolling Cam\* SNAP-ACTION SWITCHES. An engineering breakthrough that provides reliability, less contact bounce (1.5 msec), LIGHT OPERATING FORCE - 75gm. Max.

4777 Series available rated:  
15 Amp 125-250V AC,  
1/2HP 125-250 V AC  
25 Amp 125-250V AC,  
1HP 125V AC  
2HP 250V AC, 85°C.  
Max. Ambient Temp.

UL Recognized  
CSA Certified  
Optional UL 100,000 cycle  
listing and 20.1 Amp  
Case dimensions:  
1-3/32" x 5/8" x 13/32"

	CATALOG NUMBERS			OPERATING CHARACTERISTICS					
	SPADE TERMINALS			Operating Force Max. gm.	Release Force Min. gm.	Movement Diff. Max. In.	Pre-travel Max. In.	Total Over-Travel Min. In.	Actuator Length
ACTUATOR	SPST	SPST NO	SPST NC						
Basic plunger	4775-1100	4775-1200	4775-1300	75	10	.016	.047	.050	
Short rigid lever	4775-1120	4775-1220	4775-1320	75	9	.018	.052	.050	27/32
Long rigid lever	4775-1130	4775-1230	4775-1330	37	4	.037	.108	.090	1-3/32
Short rigid lever w/roller	4775-1140	4775-1240	4775-1340	75	9	.018	.052	.050	25/32
Long rigid lever w/roller	4775-1150	4775-1250	4775-1350	37	4	.037	.108	.090	1-11/32
Stimulated roller	4775-1160	4775-1260	4775-1360	37	5	.033	.086	.090	1-9/32

NOTE: Operating characteristics are given for lever mounted in the support farthest from the plunger. When the levers are mounted in the support closest to the plunger, multiply the given force values by .57 and the travel values by 1.76 to obtain the correct values.

4600 Series 15 Amp switches with beryllium copper mechanism also available.

FAX (419) 525-8274; PHONE (419) 525-8400

# MEDER electronic

## REED SWITCHES

### 1 - 800 - 870 - 5385

USA and Canada

For more information on switches not listed here or for **special cutting or bending** options call us 1-800-870-5385 or see our WEB PAGE: [www.meder.com](http://www.meder.com)

	<b>KSK-1A39</b> Rated Power 10W Switching Voltage 100VDC Switching Current 0.25A		<b>KSK-1A74</b> Rated Power 30W Switching Voltage 200VDC Switching Current 1A
	<b>KSK-1A40</b> Rated Power 10W Switching Voltage 200VDC Switching Current 0.5A		<b>KSK-1A81</b> Rated Power 5W Switching Voltage 90VDC Switching Current 0.5A
	<b>KSK-1A44</b> Rated Power 0.24W Switching Voltage 30VDC Switching Current 0.01A		<b>KSK-1A84</b> Rated Power 10W/VA Switching Voltage 470VAC Switching Current 0.5A
	<b>KSK-1A52</b> Rated Power 50W Switching Voltage 350VDC Switching Current 0.7A		<b>KSK-1A85</b> Rated Power 100W Switching Voltage 1kVDC Switching Current 1A
	<b>KSK-1A54</b> Rated Power 25V/A Switching Voltage 500VAC Switching Current 1.5A		<b>KSK-1A87</b> Rated Power 1W Switching Voltage 24VDC Switching Current 0.1A
	<b>KSK-1A66</b> Rated Power 10W Switching Voltage 100VDC Switching Current 0.5A		<b>KSK-1A88 HG</b> Rated Power 50W Switching Voltage 1kVDC Switching Current 2A
	<b>KSK-1A69</b> Rated Power 50W Switching Voltage 10kVDC Switching Current 3A		<b>KSK-1C94</b> Rated Power 3VA Switching Voltage 30VAC Switching Current 0.2A
	<b>KSK-1A71/3</b> Rated Power 10W Switching Voltage 200VDC Switching Current 0.5A		<b>KSK-1C97</b> Rated Power 10W Switching Voltage 100VDC Switching Current 0.5A
	<b>KSK-1A71/7</b> Rated Power 10W Switching Voltage 200VDC Switching Current 0.5A		<b>KSK-1C98</b> Rated Power 10W Switching Voltage 100VDC Switching Current 0.5A

MEDER electronic Inc. \* 338 Norwich Avenue \* Taftville, CT 06380

Tel: 860-887-9662 \* Fax: 860-887-9669 \* email: [meder@ids.net](mailto:meder@ids.net)

# SWITCHES

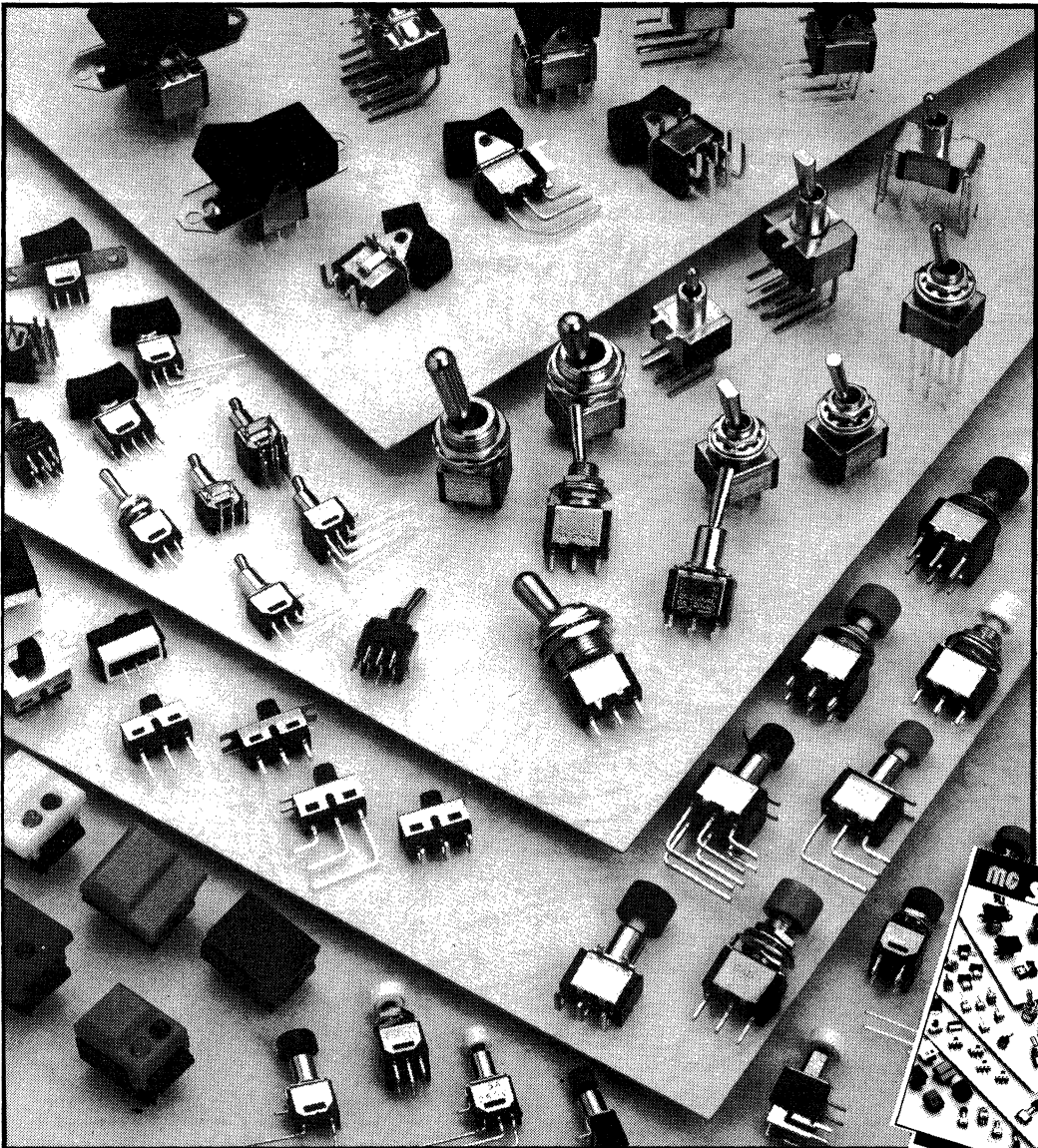
## Switch to MG

MG is aware that competition is fierce so we have compiled a line of switches of high quality but low prices to help give you the edge.

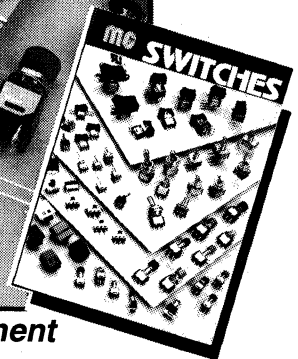
Our color catalog contains electrical specifications, switching configuration tables, dimensional diagrams and full color product photographs for each switch.



**From toggles to tact switches we have them. CALL FOR YOUR FREE COLOR CATALOG.**  
**For the discriminating customer switch to MG.**



**Ask for the OEM Sales Department**



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 (516) 582-3400 • FAX 516-582-3229

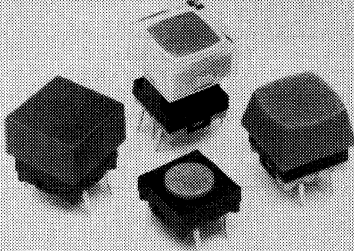
Visit us on the Internet at <http://www.mgelectronics.com>

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**NKK<sup>®</sup>  
switches**

**Series JB. Keypad**



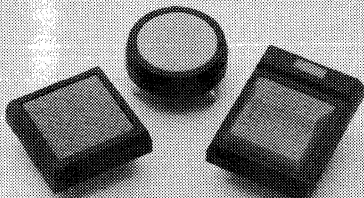
5 million-actuation, low-profile keypads. Short stroke dome contact, SPST. Short actuator 50mA or extended 125mA, both @ 24V DC max. Illuminated or non-illuminated types.

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Ask for EEM Extension.

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**NKK supports you with the industry's highest quality, best value switches—from the world's smallest washables to 50 amp powerhouses.**

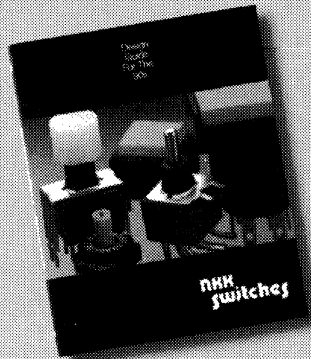
**Series JF. Keypad**



Unique, washable lighted/non-lighted designer keypad switches. Rated 50mA @ 24V DC. Round, square & sculpted actuators with choice of numerous colors. Dome contact mechanism

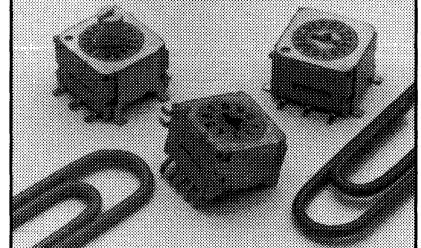
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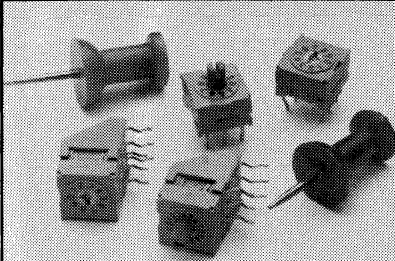
**Series ND3. Binary Surface Mt.**



Surface mount binary coded DIP rotaries. 100mA/5V DC. Gull-winged, vapor phase solderable terminals. Screwdriver or shaft-actuated. Real or complement coded, decimal or hexadecimal. Tape reel packaging.

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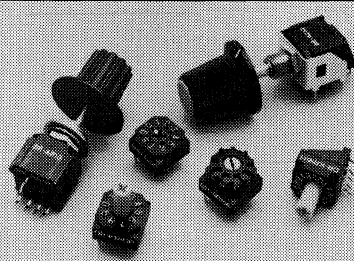
**Series ND. Binary**



World's smallest binary coded DIP rotaries. Washable thru-hole PCB. Real or complement-coded, decimal or hexadecimal. Screwdriver or shaft actuated.

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Ask for EEM Extension.

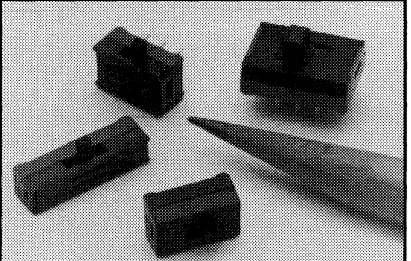
**Series DR. Binary**



Washable binary coded DIP rotaries. Screwdriver, shaft or dial actuated for PCB. Shaft actuated for panel mounting. Real or complement code. Decimal or hexadecimal.

Call 602/991-0942  
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**Series SS. Micro-Subminiature**



Micro-subminiature PCB slide switches as small as .257" x .402". Lighted or non-lighted. SPDT, SP3T & DPDT. 0.1A @ 30V DC. Top or side-actuated.

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Ask for EEM Extension.

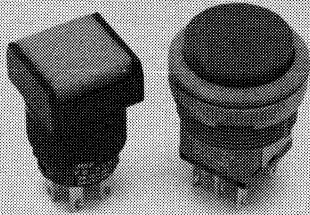
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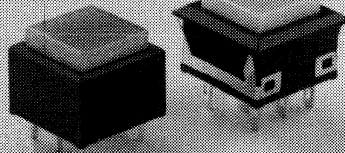
### Series LB & YB. Panel Seal



3 amp or logic level panel-sealed lighted pushbuttons. One-million actuation switch features oil, dust, and watertight panel seal that meets IP65 of IEC 529 standards. SPDT, DPDT with UL/CSA recognition.

Call 602/991-0942  
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### Series UB. Lighted



Space-saving lighted panel mount/PCB pushbuttons. Half-inch body. Momentary or alternate action. 5A 125/250V AC, 5A/30V DC or logic level. Special latchdown mechanism.

Call 602/991-0942  
Ask for EEM Extension.

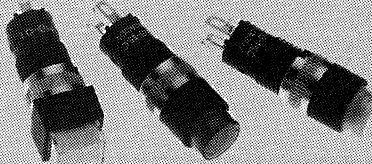
### Series KB. Lighted



1 amp & logic level lighted pushbuttons. Front panel, bushing or snap-in mounting. Adaptors for straight or right angle PCB mount. Several hi-visibility lamp choices, all relampable from front panel. SPDT, DPDT.

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Ask for EEM Extension.

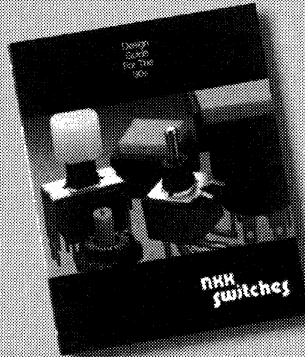
### Series HB. Lighted



Ultra small LED panel mount pushbuttons. Tiny .315" dia. body. Hi-visibility full-face or spot illuminated. Relamp from front panel. Hi-rel, snap-action contacts, UL recognized.

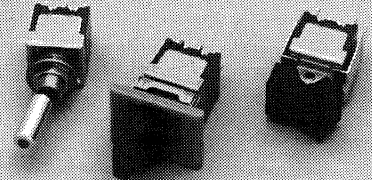
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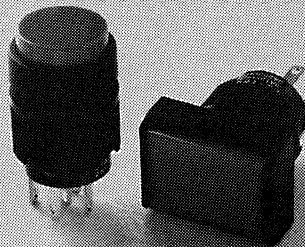
### Series M2100. Lighted



Unique! LED tip changes color with position of actuator. 6A/125V AC, 3A/30V DC & logic level ratings. LED circuit synchronous or isolated. Bushing, snap-in or flat frame mounting.

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Ask for EEM Extension.

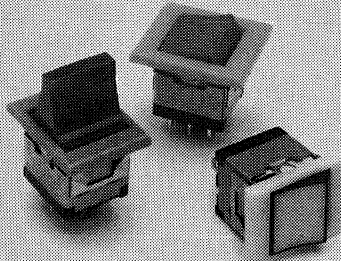
### Series YB. Lighted



Twin-seal lighted panel mount pushbuttons. 1 million mechanical actuations. Snap-in or bushing mount. Wide choice of lamps, caps, and lens types.

Call 602/991-0942  
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### Series MLW. Lighted



Power rated miniature snap-in rockers. 5 amp industry first. 3 lamp choices with easy front panel relamping, anti-jamming design. Solid, designer and spot illuminated caps. 2 bezel sizes.

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### Series LB. Lighted



3 amp, million-actuation lighted pushbuttons. SPDT, DPDT 3 amp with UL/CSA recognition or logic level. Single or bicolor LEDs. Round, rectangular, spot-LED caps. Optional PC adaptor, splash/dust covers, barriers, etc.

Call 602/991-0942  
Ask for EEM Extension.

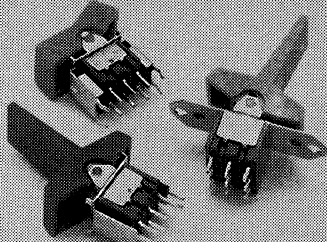
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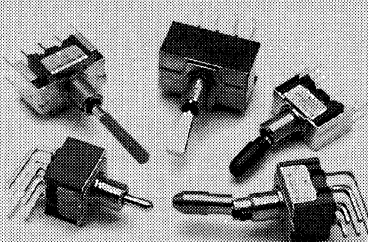
## Series M. Subminiature



Large rocker/paddle, several shapes & colors. 6 amp & logic level, bracketed PC or flat frame mount. SPDT to 4PDT in all circuits. UL/CSA recognition. Straight and reinforced terminals.

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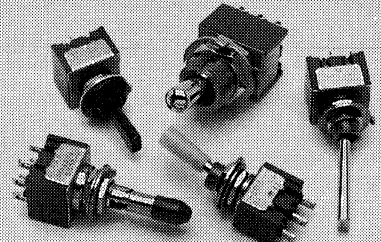
## Series M. Subminiature



Sturdy bracketed PC board switches with bushings. 6 amp. or logic-level rating. SPDT to 4PDT types in numerous circuits with straight, right angle or vertical terminations. UL/CSA recognition.

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Ask for EEM Extension.

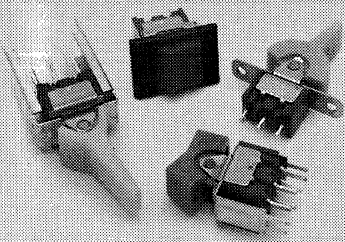
## Series M. Subminiature



Hi-reliability panel mount. Extremely versatile, hi-rel UL/CSA recognition 6 amp or logic level. SP through 4P in all circuit configurations. 1/4" 40 and 12mm bushings and seven terminal types.

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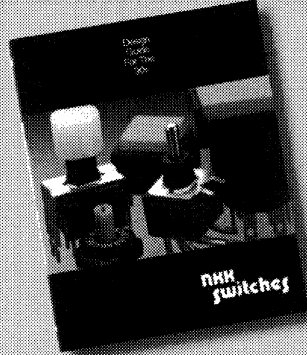
## Series M. Subminiature



Small rocker/paddle. Flat frame, snap-in or PC mount. 6 amp & logic level, SPDT to 4PDT & 3T in numerous circuits and terminations. UL/CSA recognition.

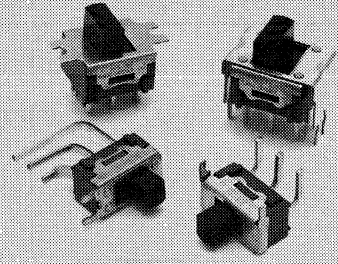
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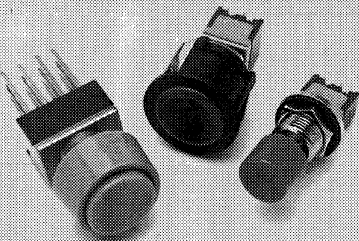
## Series MS. Subminiature



Unique 6 amp slides. Hi-rel contact & compact .500" x .469" dimensions. SPDT & DPDT with 6A/125V to logic level. Straight, right angle & vertical PC terminals. Lighted models available.

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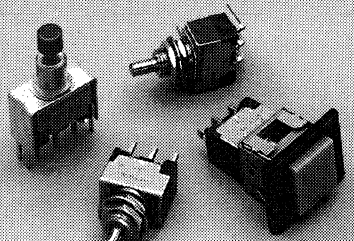
## Series MB2000. Subminiature



Large bushing 12mm panel mount. Tremendous selection. SP to 4P in momentary or alt. action. 6 amp to logic level. UL/CSA recognition. Splashproof boot. Round or rectangular shroud.

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Ask for EEM Extension.

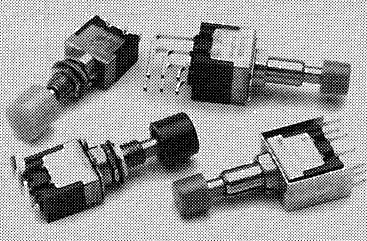
## Series MB2400. Subminiature



3 amp or logic level momentary. Hi-rel, light-touch, snap acting contacts, external insulating barriers. 1500V dielectric strength. SPDT or DPDT. UL/CSA recognition. Bushing, snap-in or PC mount.

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## Series MB2000. Subminiature



Versatile 6 amp to logic level. Solder and PC mount. SP to 4P, momentary or alt. action. UL/CSA recognition. 1/4" 40 panel mount versions. 7 cap colors.

Call 602/991-0942  
Ask for EEM Extension.

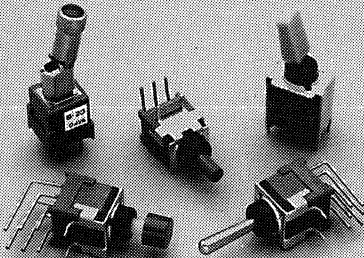
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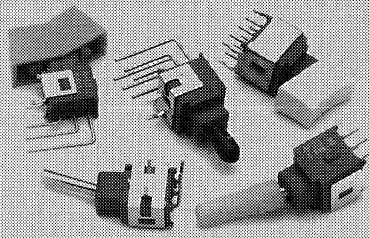
### Series B. Super-Subminiature



Anti-static PCB washables. Rating: 0.4VA max @ 28V AC/DC max. SPDT, DPDT & SP3T in 6 circuits. Straight, right angle and vertical terminations. .100" x .100" spacing. Patented STC contacts. Unique locking lever versions.

Call 602/991-0942  
Ask for EEM Extension.

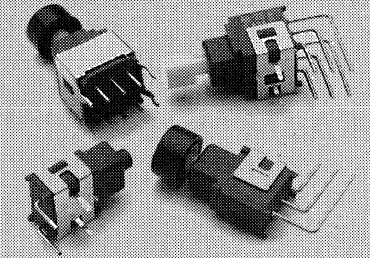
### Series A. Super-Subminiature



PCB washable toggles/rockers. Ultra-reliable STC contacts. 0.4VA max @ 28V AC/DC max. SPST, SPDT & SP3T in all circuits. Straight, right angle & vertical. 100" x .100" spaced terminations.

Call 602/991-0942  
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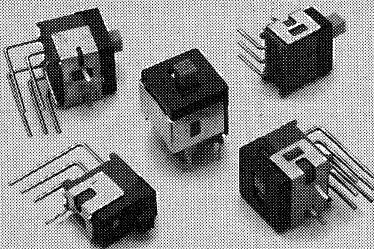
### Series AB. Super-Subminiature



PCB washable pushbuttons. Sealed for automated washing/cleaning. High-rel contacts. SPST, SPDT & DPDT in ON-OFF & ON-ON momentary circuits. Bracketed/unbracketed straight, right angle, vertical terminals.

Call 602/991-0942  
Ask for EEM Extension.

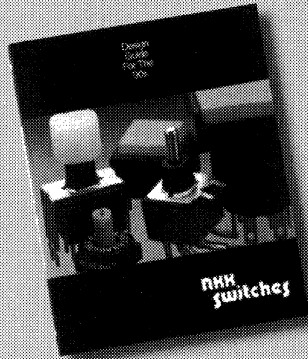
### Series AS. Super-Subminiature



High-rel PCB slides. Logic Level. Single & double pole with numerous circuit options. Straight, right angle & vertical terminals - all with support brackets. Various actuator lengths available.

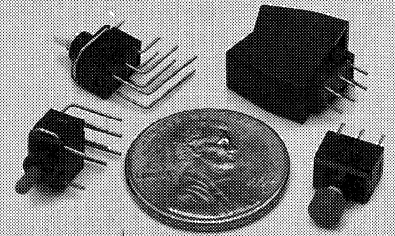
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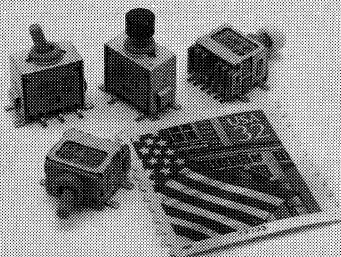
### Series G. Micro-Subminiature



World's smallest washable PCB switches. Toggles, rockers, pushbuttons & indicator lights one-third size of super-miniatures. Logic level, patented hi-rel STC contacts. 100" x .100" straight, right angle and vertical terminations.

Call 602/991-0942  
Ask for EEM Extension.

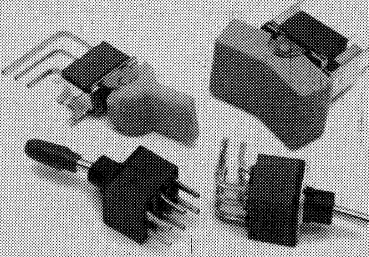
### Series G3. Surface Mount



World's smallest & most reliable surface mount toggles & pushbuttons. Patented STC contacts. Straight or right angle gull-winged mounting. Tape reel or stick tube packaging.

Call 602/991-0942  
Ask for EEM Extension.

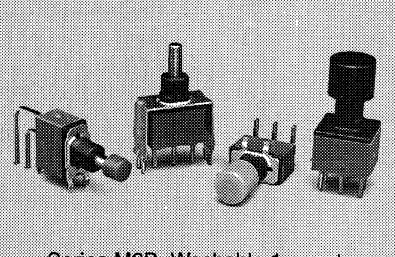
### Series M2T. Subminiature



Washable. Huge selection. 6A/125V AC to logic level UL/CSA recognition. Totally sealed for automated washing/cleaning. Anti-jamming feature.

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### Series M2B. Subminiature



Series M2B. Washable 1 amp to logic level PCB. Hi-rel, light-touch. Totally sealed construction for automated washing/cleaning. UL/CSA recognition. Vertical, right angle & straight PC with bracket.

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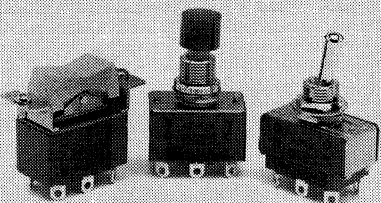


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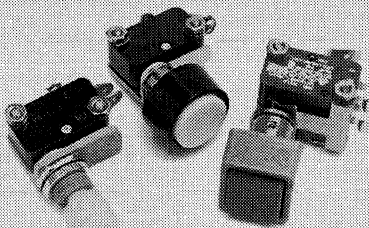
## Series S/SB/SW. Standard



S Series: bushing mounted toggles with 3A to 20A rating (res. load). SB: 3A to 15A, bushing mounted pushbuttons. SW: 3A to 20A (with res. load) rockers. Flush panel mount.

Call 602/991-0942  
Ask for EEM Extension.

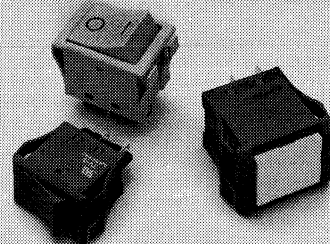
## Series SCB. Standard



Unrivaled lifespan. 5 million actuations for 10A, 1/3HP model, 1 million for hi-cap. 15A 1/2HP type. UL/CSA recognition. SP & DP. Momentary or alternate action. Numerous cap and shroud combinations.

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Ask for EEM Extension

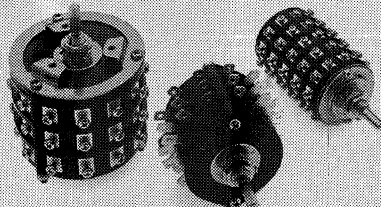
## Series JW/JP. TV Rated



JW rockers & JP pushbuttons provide high inrush current capability to prevent contact welding. JW has UL/CSA TV-8 rating; 16A 125/250V AC (res. load). JWM has UL/CSA TV-5 rating; 10A 125/250V AC (res. load).

Call 602/991-0942  
Ask for EEM Extension.

## Series HS/PS/TS. Standard



Non-shorting TS: 1 through 5 poles. 6A (res. load) rating. Shorting or non-shorting HS: 1 through 6 poles. 6A & 12A ratings. Non-shorting PS: 1 through 5 poles, 30A (res. load), 10A (inductive load).

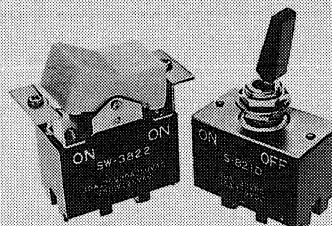
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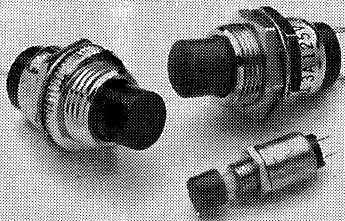
## Series S/SW High Capacity



AC/DC toggles & rockers to 50 amps. Series S toggles rated 30A/125V AC (res. load) & 50A/125V AC. SW rockers rated at 30A/125V AC. Plus, 15A/125V DC (res. load) & 5A/125V (inductive load) for hi-capacity DC applications.

Call 602/991-0942.  
Ask for EEM Extension

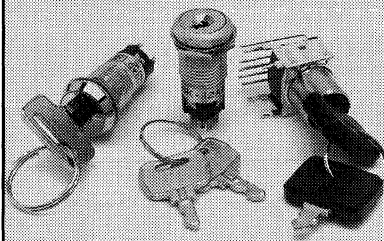
## Series FB & SB. Subminiature



Momentary panel mount. 500mA @ 125V AC (UL) & 0.4VA max @ 28V AC/DC max. SPST in normally closed or normally open. 3 amp SB UL/CSA recognized. Durable one-piece bushing/housing.

Call 602/991-0942  
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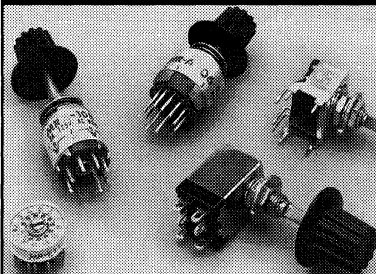
## Series SK. Keylocks



Bushing and panel mount keylocks. Self-cleaning contacts. UL/CSA recognition, bushing mounted types 3A rated SPDT. Washable, logic level types available with straight or right angle PC terminals.

Call 602/991-0942  
Ask for EEM Extension.

## Series MR. Miniature



Miniature half-inch diameter rotary switches. Logic level to 10 amp. PCB or panel mounting. 30°, 45°, 120° indexing and adjustable stop settings or continuous rotation. Washable.

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Ask for EEM Extension.

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# Rotary Switches

## Open Frame



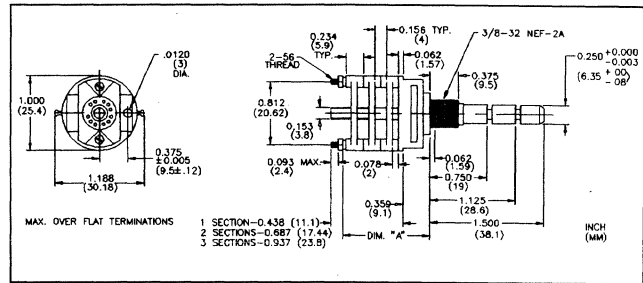
84 North Dugan Road, Sugar Grove, Illinois 60554  
 Phone: 800-625-8333 • FAX 1-800-432-9625 • WEB: www.oakgrigsby.com

### Type A (Acorn)

1 inch diameter switches with OakGrigsby patented Unidex® detent for positive action, feel and torque control. Double-wiping, self-cleaning contacts in silver plated brass, or silver alloy. Unique protective coating guards against tarnish and corrosion, extends shelf life.

#### Specifications

**Size** 1" diameter nominal, with 1 to 3 sections. Max. depth, 1.281"  
**Mounting** Clearance holes for a .375" -32 bushing and a .120" diameter locating key on a .375" radius  
**Shaft** .250" diameter (+.000 -.003); 1.50" long; grooved for break-off at .75" and 1.125" from mounting surface Unidex® dual ball, 30°  
**Indexing** 2.5 lb. pull  
**Terminal Strength** Diallyl phthalate per MIL-M-14  
**Stator Insulation** Thermoplastic  
**Rotor Insulation** Thermoplastic  
**Section Thickness** .078"  
**Contacts** Silver-plated brass or silver alloy. Protective coating extends shelf life  
**Contact Resistance** .003 to .015 ohms between adjacent clips  
**Electrical Rating** Break .5 amp at 28 volts DC, .25 amp at 110 volts AC, resistive. Carry 5 amps



### Type AM Switch Assemblies

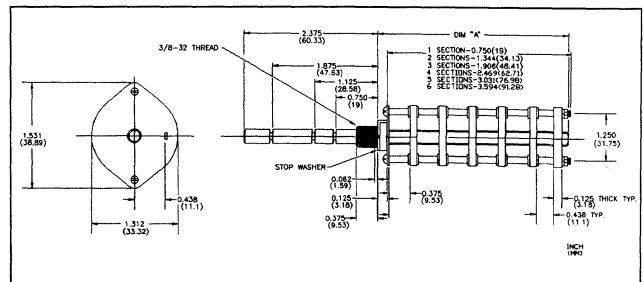
Total Poles	Active Positions	Poles/Section	Figure Numbers	Number of Sections	Catalog Number	
					Shorting	Non-Shorting
1	2-12	1	1	1	399279-AM	399280-AM
2	2-6	2	2	1	399281-AM	399282-AM
2	2-12	1	1	2	399283-AM	399284-AM
3	2-5	3	7	1	399260-AM	399261-AM
3	2-12	1	1	3	399285-AM	399286-AM

### Type JC/Type K

1.531 inch diameter switches. Double-wiping, self-cleaning, silver-plated brass contacts. Phenolic insulation. Unique protective coating guards against tarnish and corrosion, extends shelf life. Provides up to 6 sections and 12 poles.

#### Specifications

**Size** Type JC: 1.375" width x 1.531" height  
 Type K: 1.406" width x 1.531" height  
**Mounting** Clearance holes for a .375" -32 bushing and a .125" x .037" locating key on a .438" radius  
**Shaft** .250" diameter (+.000 -.003); 2.375" long; grooved at .75", 1.125", and 1.875" from switch mounting surface Hill and valley single ball type 30°  
**Indexing** 5 lb. pull  
**Terminal Strength** Type JC: Ceramic  
**Rotor Insulation** Type K: Thermoplastic or phenolic PBE-P per LP-513  
**Stator Insulation** Type JC: Ceramic. Type K: Phenolic PBE-P per LP-513  
**Section Thickness** Type JC: .125. Type K: .062"  
**Contacts** Silver-plated brass or silver alloy. Protective coating extends shelf life  
**Contact Resistance** .003 to .015 ohms between adjacent clips  
**Electrical Rating** Break 1 amp at 28 volts DC, .5 amp at 110 volts AC, resistive. Carry 5 amps



### Type JC and Type K Switch Assemblies

Total Poles	Active Positions	Poles/Section	Figure Numbers	Number of Sections	Catalog Number	
					Shorting	Non-Shorting
1	2-12	1	1	1	399468-JC	399469-JC
2	2-6	2	3	1	399476-JC	399477-JC
2	2-12	1	1	2	399470-JC	399471-JC
6	2-5	3	7	2	399696-JC	399697-JC
1	2-12	1	1	1	399418-K	399419-K
2	2-6	2	3	1	399426-K	399427-K
2	2-12	1	1	2	399420-K	399421-K

With silver-plated brass contacts and printed circuit terminals						
Total Poles	Active Positions	Poles/Section	Figure Numbers	Number of Sections	Shorting	Non-Shorting
1	2-12	1	1	1	399400-K*	399401-K*
2	2-6	2	3	1	399402-K*	399403-K*

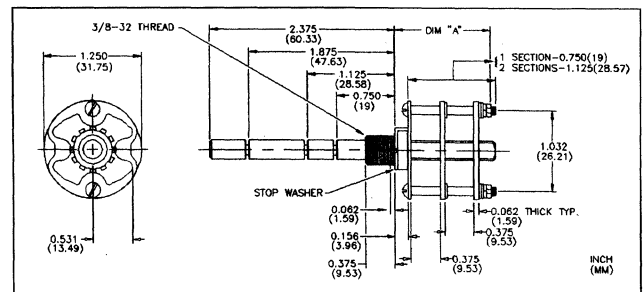
\* Available made-to-order only.

### Type F/Type FC

1.312 inch diameter switch with dual ball-type indexing for a positive feel and uniform torque. Double-wiping, silver-plated brass contacts, or silver alloy. Unique protective coating guards against tarnish and corrosion, extends shelf life. Type F, phenolic insulation; Type FC, ceramic insulation.

#### Specifications

**Size** Type F: 1.281" width x 1.312" height. Type FC: 1.25" width  
**Mounting** Clearance holes for a .375" -32 bushing and a .125" x .037" locating key on a .531" radius  
**Shaft** .250" diameter (+.000 -.003); 2.375" long; grooved at .75", 1.125", and 1.875" from switch mounting surface Hill and valley dual ball type, 30°  
**Indexing** 5 lb. pull  
**Terminal Strength** Type F: Phenolic PBE-P per LP-513 or thermoplastic  
**Rotor Insulation** Type FC: Ceramic  
**Stator Insulation** Type F: Phenolic PBE-P per LP-513. Type FC: Ceramic  
**Section Thickness** Type F: .062". Type FC: .120"  
**Contacts** Silver-plated brass, or silver alloy. Protective coating extends shelf life  
**Contact Resistance** .003 to .015 ohms between adjacent clips  
**Electrical Rating** Break 1 amp at 28 volts DC, .5 amp at 110 volts AC, resistive. Carry 5 amps



### Type F/FC Switch Assemblies

Total Poles	Active Positions	Poles/Section	Figure Numbers	Number of Sections	Catalog Number	
					Shorting	Non-Shorting
1	2-11	1	6	1	399322-F*	399323-F*
2	2-5	2	4	1	399326-F*	399327-F*
1	2-11	1	6	1	399366-FC	399367-FC
2	2-5	2	4	1	399370-FC	399371-FC
2	2-11	1	6	2	399368-FC	399369-FC
3	2-3	3	5	1	399374-FC	399375-FC

With silver-plated brass contacts and printed circuit terminals						
Total Poles	Active Positions	Poles/Section	Figure Numbers	Number of Sections	Shorting	Non-Shorting
1	2-11	1	6	1	399300-F*	399301-F*
2	2-5	2	4	1	399302-F*	399303-F*
3	2-3	3	5	1	399304-F*	399305-F*

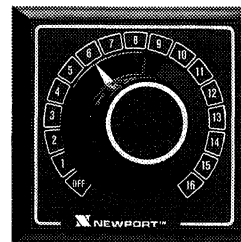
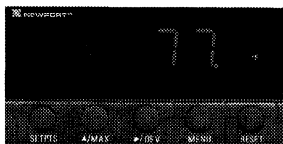
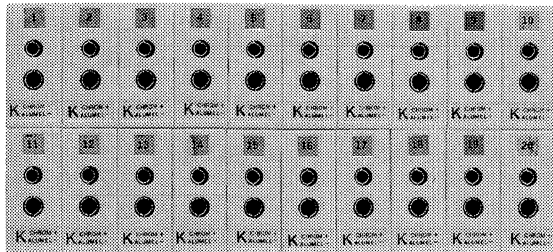
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See our website:

[www.oakgrigsby.com/products/ofindex.html](http://www.oakgrigsby.com/products/ofindex.html)  
 for figure numbers circuit configurations.

Custom Applications Available - See additional information on OakGrigsby products in Section 5500

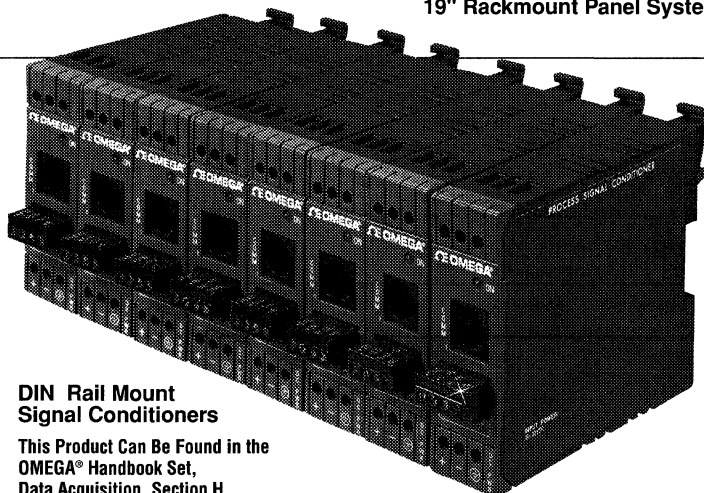
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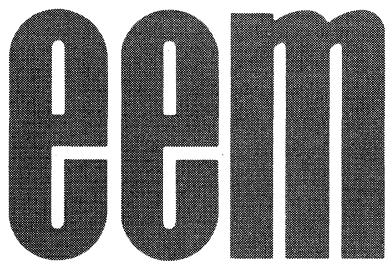
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## THERMAL CONDUCTIVITY OF DIELECTRICS AT ROOM TEMPERATURE










































Material	Thermal Conductivity, J/ (m.K)
Diamond	658
BeO	167
Graphite	117-200
Bonded SiC	42
MgO	42
Al <sub>2</sub> O <sub>3</sub>	33
TiC	33
BN	28
Mullite	6.3
Titania	3.3-4.2
Porcelain	1.7
Fused silica glass	1.5
Soda-lime glass	0.8
Cast epoxies	0.17-1.3
Wood	0.5-2.5
Melamines	0.3-0.7
Mica	0.3-0.7
Phenolics (molded)	0.17-0.67
Polyethylenes	0.33
Nylons	0.17-0.25
TFE fluorocarbons	0.25
Elastomers	0.08-0.17
Foams	0.003-0.04

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## Basic Switches

Model	<b>Z</b> Z-15H-B      Z-15G-B		<b>A</b> A20-B	<b>V</b> V-15      V-10		<b>VX</b> VX-5      VX-01	
							
Dimensions: mm (inch)	24.2 (.95)H x 49.2 (1.94)L x 17.45 (.69)W		24.2 (.95)H x 49.2 (1.94)L x 17.45 (.69)W	18.8 (.74)H x 37.8 (1.49)L x 10.3 (.41)W		18.8 (.74)H x 37.8 (1.49)L x 10.3 (.41)W	
<b>Contact ratings</b>							
Resistive load	15 A, 125 VAC 0.4 A, 125 VDC	15 A, 125 VAC 0.5 A, 125 VDC	20 A, 250 VAC 6 A, 30 VDC	15 A, 250 VAC	10 A, 250 VAC	5 A, 250 VAC	10 A, 0.1 A, 250 VAC
Max. operating current (A)	15 A	15 A	20 A	15 A	10 A	5 A	0.1 A
Min. permissible load (mA)	160 mA, 125 VDC	160 mA, 125 VDC	Consult Omron	Consult Omron	Consult Omron	Consult Omron	1 mA, 125 VAC
Operating force (OF)*	250 to 430 g	250 to 430 g	400 to 625 g	100 g, 200 g, 400 g	100 g, 200 g	25 g, 50 g	25 g, 50 g
<b>Service life</b>							
Mechanical	20 x 10 <sup>6</sup> min.	20 x 10 <sup>6</sup> min.	1 x 10 <sup>6</sup> min.	50 x 10 <sup>6</sup> min.	50 x 10 <sup>6</sup> min.	50 x 10 <sup>6</sup> min.	10 x 10 <sup>6</sup> min.
Electrical	500 x 10 <sup>3</sup> min.	500 x 10 <sup>3</sup> min.	500 x 10 <sup>3</sup> min.	300 x 10 <sup>3</sup> min.	300 x 10 <sup>3</sup> min.	500 x 10 <sup>3</sup> min.	1 x 10 <sup>6</sup> min.
<b>Mounting pitch</b>							
	25.4 mm	25.4 mm	17.45 x 25.4 mm	10.3 x 22.2 mm	10.3 x 22.2 mm	10.3 x 22.2 mm	10.3 x 22.2 mm
<b>Type of actuator</b>							
Pin plunger							
Panel mount plunger				—	—		
Panel mount roller plunger				—	—		
Leaf spring			—	—	—		
Short hinge lever	—	—					
Hinge lever							
Long hinge lever	—	—	—				
Simulated hinge roller lever	—	—	—				
Roller leaf spring			—	—	—		
Short hinge roller lever	—	—					
Hinge roller lever							
Flexible rod			—	—	—		
<b>Terminal choices</b>							
	Solder terminal, Screw terminal Quick connect terminal (#250)		Screw terminal	Solder/Quick connect terminal, (#187), Solder terminal, Quick connect terminal (#187), Quick connect terminal (#250), Screw terminal		Solder/Quick connect terminal (#187), Quick connect terminal (#187)	
<b>Remarks</b>							
	Drip-proof terminal types are also available		Handles 75 A inrush	—	—		
<b>Approved standards</b>							
	UL, CSA, SEV		UL, CSA, SEV	UL, CSA		UL, CSA, VDE	

Note: 1. \*These values are for pin plunger type.


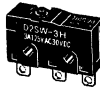
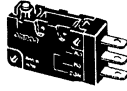

















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## Basic Switches

Model	SS			D2SW	D2VW	D2F
	SS-10	SS-5	SS-01			
						
Dimensions: mm (inch)	14.8 (.58)H x 19.8 (.78)L x 6.4 (.25)W			15.3 (.60)H x 19.8 (.78)L x 6.4 (.25)W	18.8 (.74)H x 37.8 (1.49)L x 10.3 (.41)W	6.5 (.26)H x 5.8 (.23)L x 12.8 (.50)W
<b>Contact ratings</b>						
Resistive load	10.1 A, 250 VAC	5 A, 125 VAC	0.1 A, 125 VAC	3 A, 125 VAC/30 VDC, 0.1 A, 125 VAC/30 VDC	5 A, 250 VAC/30 VDC, 0.1 A, 125 VAC/30 VDC	3A, 125 VAC 1A, 125 VAC 0.1 A, 30 VDC
Max. operating current (A)	10 A	5 A	0.1 A	3 A or 0.1 A	5 A or 0.1 A	3A, 1A, 0.1 A
Min. permissible load (mA)	160 mA, 250 VAC	160 mA, 125 VAC	1 mA, 125 VAC	Consult Omron	Consult Omron	100 mA and 10 mA, 125 VAC, 1 mA, 30 VDC
Operating force (OF)*	150 g	50 g, 100 g	25 g, 50 g, 150 g	180 g	200 g	75 g, 150 g
<b>Service life</b>						
Mechanical	10 x 10 <sup>6</sup> min.	30 x 10 <sup>6</sup> min.	30 x 10 <sup>6</sup> min.	5 x 10 <sup>6</sup> min.	1 x 10 <sup>6</sup> min.	1 x 10 <sup>6</sup> operations min. (at rated OT value)
Electrical	50 x 10 <sup>3</sup> min.	200 x 10 <sup>3</sup> min.	200 x 10 <sup>3</sup> min.	2 x 10 <sup>5</sup> min.	1 x 10 <sup>5</sup> min.	3 x 10 <sup>4</sup> operations min.
<b>Mounting pitch</b>						
	9.5 mm	9.5 mm	9.5 mm	6.4 x 9.5 mm	10.3 x 22.2 mm	—
<b>Type of actuator</b>						
Pin plunger						
Short hinge lever	—			—		—
Hinge lever						—
Long hinge lever	—			—		—
Simulated hinge roller lever						—
Short hinge roller lever	—			—		—
Hinge roller lever						—
<b>Terminal choices</b>						
	Solder terminal, Quick connect terminal (#110), PC board terminal			Quick connect terminal (#110), PCB terminals or Lead wires	Quick connect terminal (#187) or Lead wires	PCB terminal
<b>Remarks</b>						
	Split double spring mechanism assures life as long as 30 million operations.			Watertight to IP67	Watertight to IP67	—
<b>Approved standards</b>						
	UL, CSA, VDE, SEMKO, SEV			UL, CSA	UL, CSA	—

Note: 1. \*These values are for pin plunger type.

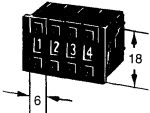
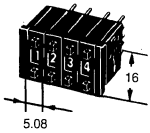


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
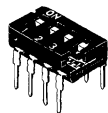
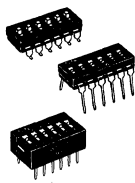
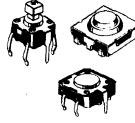


## Thumbwheel Switches

Model	A7DP-2		A7D-2	
				
(Height of displayed characters)	(3.2 mm)		(3.2 mm)	
<b>Actuator</b>	Pushbutton		Pushbutton	
<b>Configuration</b>	Pen-push type		Push type	
<b>Features</b>	For use in DC circuits, (5 to 30 VDC). Optimizes space. Can be fabricated with stoppers.		For use in DC circuits, (5 to 30 VDC). Optimizes space. Can be fabricated with stoppers.	
<b>Mounting</b>	Snap-in (front mounting) 		Snap-in (front mounting) 	
<b>Dust-proofing</b>	Provided (IP-50)		Provided (IP-50)	
<b>Switch part numbers</b>				
Color	Light gray	Black	Light gray	Black
06 Binary coded decimal	A7DP-206	A7DP-206-1	A7D-206	A7D-206-1
06 Binary coded decimal with +, - display	A7DP-206-PM	A7DP-206-PM-1	A7D-206-PM	A7D-206-PM-1
<b>End caps</b>	A7D-2M	A7D-2M-1	A7D-2M	A7D-2M-1
<b>Spacers</b>	A7D-2PA	A7D-2PA-1	A7D-2PA	A7D-2PA-1

## DIP Switches

## Mechanical Keyswitches

## Special-Purpose Basic Switches

Model	A6C	A6D <i>Available in a new sealed version.</i>	A6E/S/T	B3F/ B3SN/ B3W	D2X	D3C
						
Dimensions: mm (inch)	4.5(0.177)H x 6.6(0.259)L x 9(0.354)W	8(0.315)H x 7.1 to 27.4 (0.280 to 1.079)L x 6.6(0.260)W	For dimensions, consult Omron.	For dimensions, consult Omron.	18.6(0.732)H x 11.5(0.453)L x 8.4(0.331)W	6.0(0.236)H x 4.2(0.165)L x 8.0(0.315)W
<b>Contact ratings</b>	100 mA, 30 VDC	100 mA, 5 VDC 30 mA, 30 VDC	25 mA, 24 VDC	50 mA, 24 VDC B3SN: 30 mA, 24 VDC	0.1 A, 30 VDC	0.1 A, 30 VDC
Max. operating current (A)	100 mA	100 mA	25 mA	50 mA	0.1 A	0.1 A
Min. permissible load (mA)	10 µA, 3.5 VDC	10 µA, 3.5 VDC	Consult Omron	1 mA, 5 VDC	1 mA, 30 VDC	1 mA, 30 VDC
Operating force (OF)	15 g to 100 g	500 g	30 g	100 g, 150 g	50 g	40 g, 130 g
<b>Service life</b>						
Mechanical	1 x 10 <sup>4</sup> operations min.	5 x 10 <sup>3</sup> operations min.	1 x 10 <sup>3</sup> min.	1 x 10 <sup>6</sup> operations min., B3S and B3W: 3 x 10 <sup>5</sup> operations min.	1 x 10 <sup>6</sup> operations min. (at rated OT value)	5 x 10 <sup>4</sup> operations min.
Electrical	2 x 10 <sup>3</sup> operations min.	2 x 10 <sup>3</sup> operations min.	1 x 10 <sup>3</sup> min.	1 x 10 <sup>6</sup> operations min.	5 x 10 <sup>4</sup> operations min.	5 x 10 <sup>4</sup> operations min.
<b>Type of actuator</b>	Top, side	Top, side, raised	Top, tape sealed, raised, side	Plunger	Bi-directional paddle	Hinge lever
<b>Terminal choices</b>	PCB terminal	PCB terminal, Surface mount	PCB terminal, Surface mount (A6S)	PCB terminal, Surface mount	PCB terminal	PCB terminal

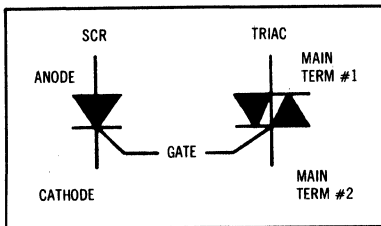
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### THYRISTORS

A thyristor is a four-layer semiconductor (pnpn) that can be switched from an OFF to an ON state. This is usually done by a voltage or current pulse to the gate terminal. The device will then continue to conduct so long as the principal current of the device flows through the thyristor's two main terminals.

In many respects a thyristor is analogous to an electromechanical latching relay. In fact, thyristors have largely replaced these relays in newer equipment designs. But, misapplications and/or failure to fully understand the parameters of these and other solid state devices often leads to catastrophic field failures.

The terminology shown on this page has been condensed from common industry data books and is intended to be a guide for the engineer.



$di/dt$ : Critical rate of rise of ON state current is the user's maximum design limit (Fig. 1).

$di_R/dt$ : Rate of decay of ON state current (Fig. 1 & 2).

$dv/dt$  (critical): Rate of rise of OFF state voltage. Lowest voltage rate of rise to cause a thyristor to turn ON.

$dv/dt$  (reapplied): Rate of rise of reapplied OFF state voltage.

$I_{FSM}$ : Nonrepetitive ON state surge current in diodes. Maximum peak value of 1/2 cycles (60 Hz) a diode can withstand up to 100 times in its lifetime.

$I_{TSM}$ : Nonrepetitive ON state surge current in thyristors. Maximum peak value of 60 Hz cycles a thyristor can withstand up to 100 times in its lifetime.

$I_{DRM}/I_{RRM}$ : Maximum peak forward/reverse leakage current at specified temperature and repetitive conditions.

$I_{GDM}$ : Continuous gate current not to trigger. Highest dc gate current that will not cause thyristor to switch from OFF to ON at a specific temperature.

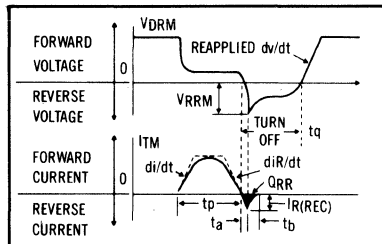


Fig. 1. Concurrent voltage and current waveforms

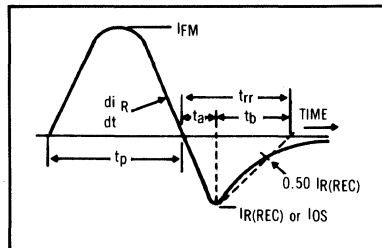


Fig. 2. Recovery current waveform

$I_{GT}$ : Continuous gate trigger current. Absolute minimum gate current required to switch thyristor from OFF to ON.

$I_H$ : Holding Current. Minimum current required to hold thyristor ON.

$I_L$ : Latching current. Minimum current required to hold thyristor ON after removal of gate drive.

$I_{R(REC)}$ : Recovery current. Peak value of reverse current during recovery or turn OFF (Fig. 1 & 2).

$I_{OS}$ : Overshoot current. See  $I_{R(REC)}$ .

$I^2t$ : Maximum ON state, short time thermal capacity of the silicon element for operations less than 1/2 cycle of 180° conduction angle.

$I_{T(AV)}$ : Average ON state current (max.)

$Q_{RR}$ : Reverse recovered charge (Fig. 1).

$R_{\theta JC}$ : Junction-to-case thermal resistance in degrees C per watt.

$T_{C(MAX)}$ : Max. allowable case temperature.

$T_{J(MAX)}$ : Maximum allowable junction temp.

$t_d$ : Delay time. Interval between a specified point at beginning of gate pulse and the instant at which the prin-

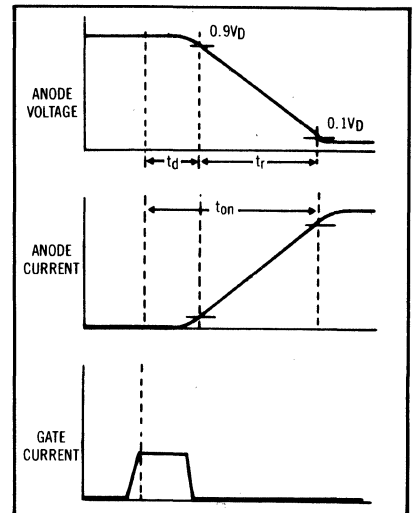


Fig. 3. Turn-on time waveforms

cipal voltage drops to a specified value. (OFF-ON) (Fig. 3)

$t_{on}$ : Turn-on time. The sum of delay time and rise time. (OFF-ON) (Fig. 3)

$t_q$ : Turn-off time. Time between principal current reaching zero and the instant thyristor can block forward voltage without turning ON. (Fig. 1)

$t_r$ : Rise time. Time between principal voltage dropping from one value to a second lower value when thyristor turns from OFF to ON. (Fig. 3)

$t_{rr}$ : Reverse recovery time. (Fig. 2)

$V_{DRM}/V_{RRM}$ : Maximum repetitive peak OFF state/reverse voltage excluding non-repetitive transients.

$V_{DSM}/V_{RSM}$ : Maximum nonrepetitive peak OFF state/reverse voltage.

$V_{FM}/V_{TM}$ : Maximum forward voltage drop at a specific forward current and case temp.

$V_{GDM}$ : Gate nontrigger voltage. Highest dc voltage that will not cause thyristor to switch from OFF to ON.

$V_{LATCH}$ : Latching voltage. Voltage required for thyristor to latch ON at a given gate current and junction temp.

$V_{TM(DYN)}$ : Dynamic ON state voltage. Transient ON state voltage of thyristor when triggered into conduction for a given load and time.

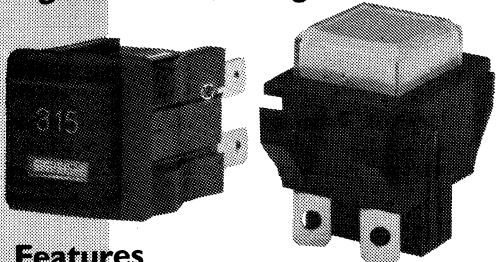




328 Industrial Avenue  
Cheshire, Connecticut 06410  
203-272-2794  
Fax 203-272-3492

## SWITCHES

### Pushbutton Switches Lighted & Non-lighted

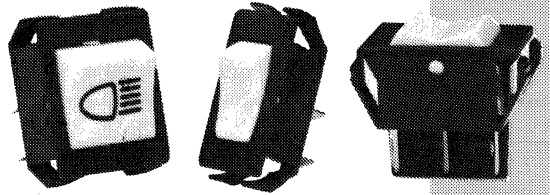


#### Features

Snap-in panel mounting with options in:

- ✓ Lighted or non-lighted styles
- ✓ LED, incandescent or neon lamps
- ✓ Single pole and double pole circuit arrangements
- ✓ Momentary or alternating actions
- ✓ 10 amps 125/250 VAC 1/4HP, UL, CSA, VDE
- ✓ Mechanical life 100,000 operations
- ✓ Custom marking available
- ✓ Size: From .750 x .750 inches to .880 x 1.10 inches

### Rocker Switches Lighted & Non-lighted

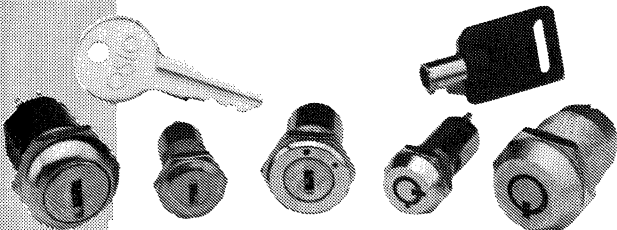


#### Features

Snap-in panel mounting with options in:

- ✓ Lighted or non-lighted styles
- ✓ LED, incandescent or neon lamps
- ✓ Single pole and double pole circuit arrangements
- ✓ Maintained or momentary actions, 2 or 3 position
- ✓ 20 amps 125/250 VAC 3/4HP, UL, CSA
- ✓ High inrush capability
- ✓ Mechanical life: 100,000 operations
- ✓ Three mounting sizes
- ✓ Weatherproof available

### Keylock Switches



#### Features

- ✓ Flat keys or tubular keys
- ✓ Single pole and double pole
- ✓ Various key operate and removal positions
- ✓ PC mount, solder or quick connect terminals
- ✓ Maintained or momentary contacts
- ✓ 4 amp 125 VAC or 28 VDC UL, CSA
- ✓ Miniature to full size available (12mm diameter to 19mm diameter)

### Switch and Circuit Breaker Combination



#### Features

- ✓ One piece design
- ✓ UL recognized 8 amp to 15 amp 125 VAC
- ✓ Lighted or non-lighted
- ✓ Snap in panel mounting
- ✓ Quick connect terminals
- ✓ Standard Panel Cut-Out
- ✓ Space Saving Component

# NEW!

- Quality Switches From Stock •
- Environmentally Protected Rocker Switches •
- Call 203-272-2794 or Fax 203-272-3492 •

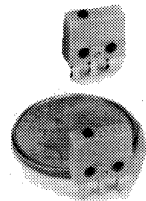
# OTTO CONTROLS® Switches for Demanding Applications

ISO 9001 Certified

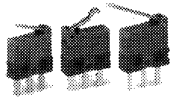
## Sub-Miniature and Miniature Basic Switches

Featuring:

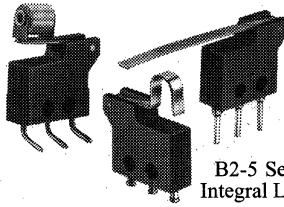
- Precision operating points
- High contact pressure
- Unique contact wiping action
- Choice of terminal styles



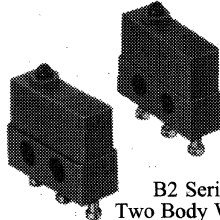
**B1 Series**  
Ultra-Small  
1 Million Cycles!



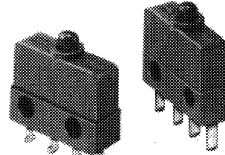
**B1-5 Series**  
Integral Levers



**B2-5 Series**  
Integral Levers



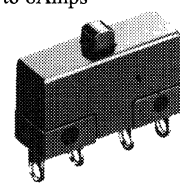
**B2 Series**  
Two Body Widths



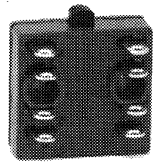
**B3 Series**  
TTL to 8Amps



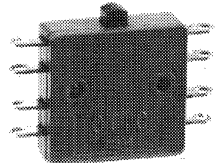
**A1-101-02 Actuator**  
for B3 series



**B5 Series**  
10 Amps



**B5-72 Series**



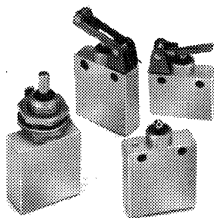
**B5-71 Series**  
10 Amps  
Double-Pole

Series	B1 Sub-Subminiature	B1-5 Integral Lever	B2 Subminiature	B2-5 Integral Lever	B3 Subminiature	B5 Miniature	B5-7 Two Pole
<b>Circuitry</b>	SPDT	SPDT	SPDT	SPDT	SPDT-DB	SPDT-DB	DPDT-DB
<b>Rating</b> ①	Resistive	2A	2A	7A	7A	8A ③	10A
	Inductive	.5A	.5A	4A	4A	5A ③	7.5A
<b>Actuation</b>	Cam	Lever	Cam	Lever	Cam	Cam	Cam
<b>Operating Force</b>	6 oz. max	2 oz. max.	4-8 ounces	2.1 oz. max	3-8 ounces	3-8 ounces	8-16 ounces
<b>Size:</b>	Length	.300	.300	.510	.580	.510	.790
	Height	.300	---	.430	---	.450	.530
	Depth	.100	.100	.156/.200	.200	.156/.200	.260
<b>Mounting Centers</b>	.150	.150	.188	.188	.281	.500	.500
<b>Terminal Styles</b> ②	1, 2	1, 2	1,2,3,4,5,7	1,2,3,4,5,7	1,2,3,4,5,6	1,6,7	6
<b>Approvals</b>	Military	—	—	M8805/4,/106,/109	—	M8805/101	M8805/7
	Commercial	—	—	UL/CSA	UL/CSA	UL/CSA	UL/CSA

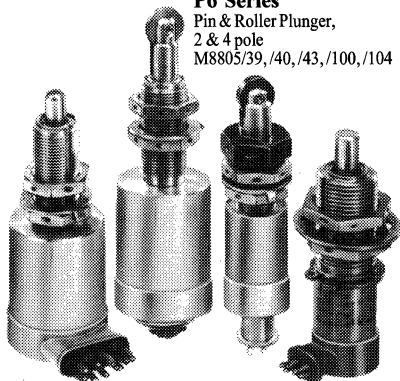
① 120/250VAC, 28VDC, silver contacts. ② Terminal Style Codes: 1. = PC pins; 2. = Turret; 3. = Double Turret; 4. = Wire Wrap; 5. = Right Angle PC; 6. = Solder Eyelet; 7. = QC Tabs. ③ SPST rating.

### Environment-Free Sealed

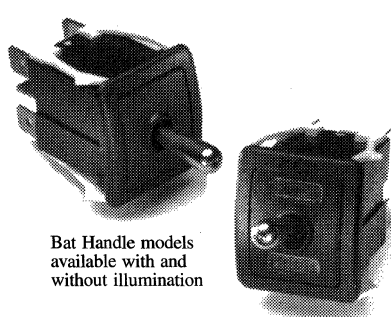
**P6-3 Series**  
Sub-Miniature  
Up to 10 Amps!



**P6 Series**  
Pin & Roller Plunger,  
2 & 4 pole  
M8805/39,/40,/43,/100,/104



### Snap-in Sealed Toggles



Bat Handle models  
available with and  
without illumination

- K4 Series**  
Single & Double Pole
- Withstands direct water spray.
  - Submersible. Designed to meet IP68.
  - Snap-in feature fits wide range of cutouts.
  - Switches up to 16 Amps.
  - UV and Solvent resistant.
  - Withstands extreme shock & vibration.
  - Custom legends available.
  - 2 & 3-position, momentary or maintained.
  - Incandescent, LED and neon illumination.

### Sub-Miniature Toggles

#### Sealed and Unsealed



**T3 Series**

15/32"  
bushing

Lever-Lock

Optional  
Button

1/4-40  
bushing

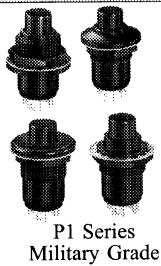
- Non-Teasible
- Shorter behind panel
- More plating choices
- More reliable
- Commercial
- MIL-S-83731
- 5 Amp., resistive
- 1 & 2 pole
- 15/32" bushing, sealed
- 1/4-40 bushing, unsealed
- Lever-Lock 15/32" bushing, sealed
- Optional Button Configurations

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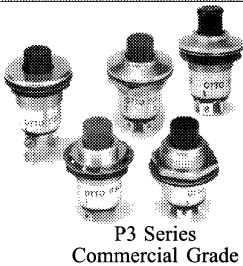
# We add value to your switch solution **OTTO** CONTROLS®

## Sealed Push Button Switches-Standard Designs

ISO 9001 Certified



**P1 Series**  
Military Grade



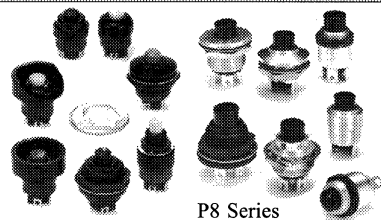
**P3 Series**  
Commercial Grade



**P3 Dome**



**P5 Series**  
Push-On Push-Off



**P7 Series**  
Sub-Subminiature



**P8 Series**  
Shorter Behind Panel than P1/P3



**P9 Dome**  
Choice of flush or protruding button

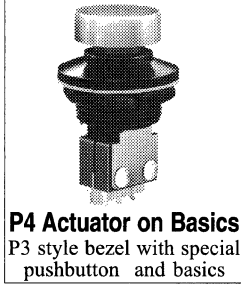
Series...	P1 MIL Grade	P3 Comm'l Grade	P3-D Dome	P5 Alternate Action	P5-D Dome Alt	P7 Sub-Miniature	P7-9 Dome	P8 Shorter P1/P3	P9 Dome
<b>Circuitry</b>	SPDT-DB	SPDT-DB	SPDT-DB	SPDT	SPDT	SPDT-DB	SPDT-DB	SPDT-DB	SPDT-DB
<b>Actuation</b>	Mom./Push-Pull	Mom./Push-Pull	Momentary	Push-On/Push-Off	Push-On/Push-Off	Momentary	Momentary	Mom./Push-Pull	Momentary
<b>Rating</b> Ⓛ Resistive	20A	20A	20A	10A	10A	5A	5A	20A	5A
<b>Mechanical Life</b>	1 million	1 million	1 million	1 million	1 million	1 million	1 million	1 million	1 million
<b>Operating Force</b>	2-5 lbs.	2-5 lbs.	2-5 lbs.	3-4 lbs.	3-4 lbs.	12 oz. - 2.2 lbs.	12 oz. - 2.2 lbs.	2-5 lbs.	12 oz. - 2.2 lbs.
<b>Typical Behind Panel</b>	.94	.94	.96	.85	1.00	.51	.47	.69	.58
<b>Terminal Styles</b> Ⓜ	1, 2	1, 2	1, 2	1, 2	1, 2	1, 3	1, 3	1, 2, 4	1, 3
<b>Approvals</b> Military	M8805/3	N/A	N/A	N/A	N/A	M8805/110	N/A	N/A	N/A
Commercial	UL/CSA	UL/CSA	UL/CSA	—	—	UL/CSA	UL/CSA	UL/CSA	UL/CSA
<b>Materials</b> Button <sup>④</sup> Case <sup>③</sup>	1	2	1	3	1	3	1	3	4

Ⓛ Ratings based on 120/250VAC, 28VDC, silver contacts. Ⓜ Terminal Style Code: 1. Solder, 2. Screw, 3. PC Pin, 4. Quick Connects Ⓝ Anodized Aluminum Case Style Code: 1= Black Anodized Aluminum; 2. = Clear Anodized Aluminum; 3.= Black/Clear Anodized Aluminum 4. Black Plastic Ⓞ Button is Nylon in choice of 9 colors.

## Some Examples of Special Purpose Designs and Assemblies



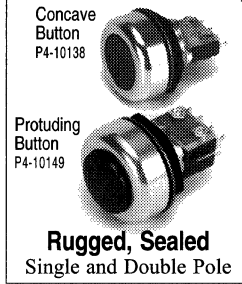
**Vandal-Proof Switch**  
Sealed, Stainless Steel Housing survives abuse



**P4 Actuator on Basics**  
P3 style bezel with special pushbutton and basics



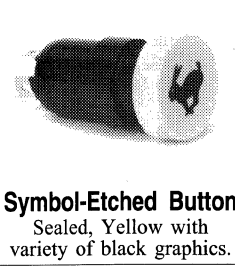
**Pendant Switch**  
Remote Switch with cable



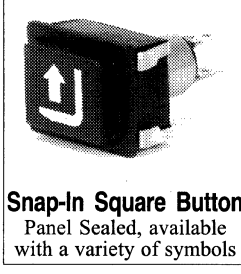
**Rugged, Sealed**  
Single and Double Pole



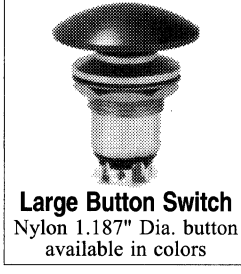
**Custom Assembly**  
Molding, switch, cable



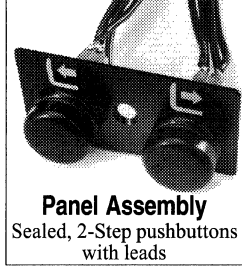
**Symbol-Etched Button**  
Sealed, Yellow with variety of black graphics.



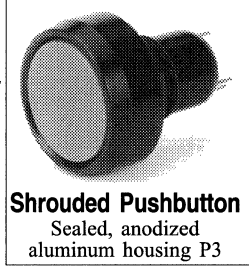
**Snap-In Square Button**  
Panel Sealed, available with a variety of symbols



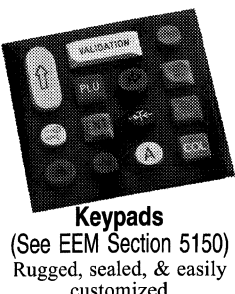
**Large Button Switch**  
Nylon 1.187" Dia. button available in colors



**Panel Assembly**  
Sealed, 2-Step pushbuttons with leads



**Shrouded Pushbutton**  
Sealed, anodized aluminum housing P3



**Keypads**  
(See EEM Section 5150)  
Rugged, sealed, & easily customized



**4-Way Toggle**  
Sealed, for Flight or Industrial Applications



**Sealed Rocker**  
1 Million Mechanical Cycles Low-level to 10 Amps



**Control Grip**  
Rugged, Multi-function



**Rugged Displays**  
2-Level viewing, Custom LCDs, Alarms, UV Resistant

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# Sealed Rocker Switches

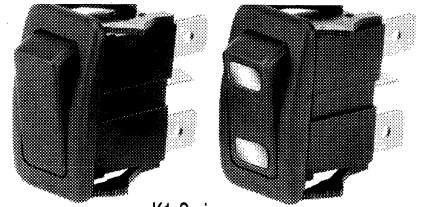
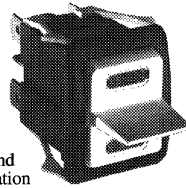
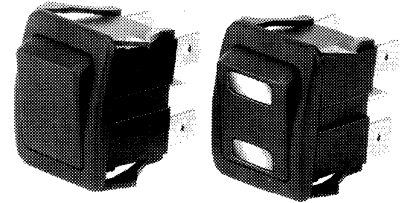
 ISO 9001  
Certified

**Low Cost, Snap-In Rocker for Wet & Dusty Environments; 1 & 2 Poles**
**Quality Features:**

- Withstands direct water spray.
- Submersible. Designed to meet IP68.
- Fits industry standard panel openings for drop-in replacement of sealed and unsealed switches.
- Snap-in feature accommodates a wide range of panel cutouts.
- Switches up to 16 Amps.
- UV and Solvent resistant.
- Withstands extreme shock & vibration.
- Custom legends available.
- 2- & 3-position, momentary and maintained action.
- Incandescent, LED and neon illumination with independent and dependent light source options.
- Choice of terminal styles: Solder, Screw, .250" Quick Connect.

## K Series

Paddle model available with and without illumination


 K1 Series  
Single Pole

 K2 Series  
Single & Double Pole

**Standard Characteristics/Ratings:**
**OPERATIONAL:**
**Mechanical Life:** 100,000 cycles, minimum

**Seal:** Waterproof, submersible to IP68.

**Temperature Range:** -30°C to +85°C

**Button & Case:** Thermoplastic

**Terminals:** Copper alloy.

**Contacts:** Fine Silver/Silver cad. oxide.

**ELECTRICAL:** (at 28 VDC or 115 VAC, 60/400 Hz.)

Load	Rating	Life (Min.)
Resistive	16A	25,000 cycles
Resistive	10A	50,000 cycles
Inductive	10A	25,000 cycles

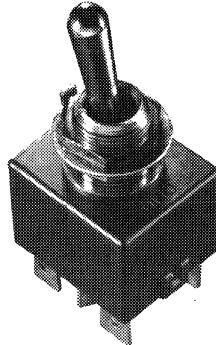
Dielectric Withstand: 1050 Vrms

# Sealed Toggle Switches

**Low Cost Toggles for Wet & Dusty Environments; 1 & 2 Poles**
**Quality Features:**

- Withstands direct water spray.
- Submersible. Designed to meet IP68.
- Switches up to 16 Amps.
- Withstands extreme shock & vibration.
- Positive detent, non-teasible contact transfer.
- 2- & 3-position, momentary and maintained action.
- Lever lockout styles available.
- Choice of terminal styles: Solder, screw, .250" Quick Connect.

## T7 Series


**Standard Characteristics/Ratings:**
**OPERATIONAL:**
**Mechanical Life:** 100,000 cycles, minimum

**Seal:** Waterproof, submersion to IP68

**Temperature Range:** -30°C to +85°C

**Bushing:** Brass, nickel plated

**Toggle Handle:** Stainless Steel

**Case:** Thermoplastic

**Terminals:** Copper alloy

**Contacts:** Fine Silver/Silver cad. oxide

**ELECTRICAL:** (at 28 VDC or 115 VAC, 60/400 Hz.)

Load	Ampers	Life (Min.)
Resistive	16A	25,000 cycles
Resistive	10A	50,000 cycles
Inductive	10A	25,000 cycles

Dielectric Withstand: 1050 Vrms

# Pendant Switches

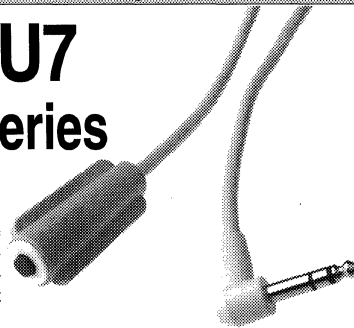
**Choose Unsealed, Moistureproof and Watertight Models**
**Quality Features:**

- Durable cables available in a choice of colors
- Switches low level 10 milliamps @ 30 millivolts
- Choice of button and handle colors
- Withstands extreme shock & vibration

The U7 Series Pendant Switches are rugged, high performance pendant switches designed for use under severe conditions found in medical, appliance, heavy equipment and industrial control applications. They are available totally sealed so the switch can withstand direct water spray and submersion.

The U7 series is offered in single and dual switch configurations with single plugs. Connector options include straight and right angle mono plugs in .250 inch, 2.5 mm and 3.5 mm sizes. Cable options include .250" diameter for 60 lbs. pull strength, .130" diameter cable for 25 lbs. pull strength and .102" diameter cable for 15 lbs. pull strength. Cables are available in a choice of five colors.

## U7 Series


**Standard Characteristics/Ratings:**
**Electrical:**

Low Level Rating 10 Milliamps

at 30 Millivolts max. D.C. or peak A.C.

Electrical Life 1,000,000 Cycles

Circuit Configuration: Normally Open

**Mechanical:**

Operating Force: 16 ounces max.

Total Travel: .095" Max.

 Seal Types Available: Unsealed,  
Moistureproof/Dusttight  
Watertight

Button and Case Material: Thermoplastic

Handle Material: PVC

Cable Jacket/Overmold Material: PVC

Twist and Flex withstand: 10,000 Cycles




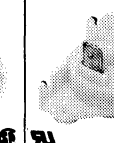
Temperature Range: -30°C to +55°C



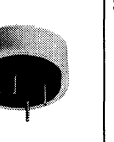
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 914-698-2026 FAX: 914-698-9456  
 800-431-2625 (OUTSIDE NY)

**PRESSURE AND VACUUM SWITCHES**  
 • AND •  
**SHOCK-PROOF SWITCHES**  
 (Shock-Proof • Water-Proof • Explosion-Proof)

**PRESSURE & VACUUM SWITCHES**

			
<b>FIGURE M</b> 1/8 NPT	<b>FIGURE C</b> CENTER SPOUT	<b>FIGURE R</b> RADIAL SPOUT	<b>FIGURE D</b> SENSITIVE SWITCH
SIZE: 2 1/4" x 2 1/4" MOUNT: USE 9/16-18 NUT	SIZE: 2 1/4" x 2 1/4" MOUNT: USE #4 SELF TAP SCREWS	SIZE: 2 1/4" x 2 1/4" MOUNT: USE #4 SELF TAP SCREWS	SIZE: 1 5/8" x 1 1/8" x 1" MOUNT: USE (2) 1/8 SCREWS

		
<b>TINYTROL®</b> 1/8NPT OR SPOUT	<b>PC MOUNT</b>	<b>MINIATURE PRESSURE SWITCH WITH LEADS</b>
<b>FIGURE E</b> TINYTROL® PRESSURE OR VACUUM	<b>FIGURE F</b> PRESSURE OR VACUUM OR DIFF	<b>FIGURE G</b> PRESSURE OR VACUUM OR DIFF PRES
SIZE: 1 1/4" x 1 1/4" x 1"	SIZE: 1" DIA.	SIZE: 1" DIA.

NOTE: 1. Above sizes Do Not Include Inlet.  
 2. Special Micros available on request including VDE approved to 25 AMP.  
 3. Fig. R, C & D connect to 1/8" ID Tube.  
 4. Switches are UL rated for 100,000 cycles.  
 5. Micro Switches Accept STD. 250° Slide on Terminal.  
 6. PC Switch Also Avail With Thread Mount. Contacts are 1 N.O or 2 N.O.

LOW COST PRESSURE SWITCHES						
SPDT	DPDT	ADJUSTABLE RANGE	250VAC RATING	APPROVAL	FIG #	
					STD	SPECIAL
PR10103A	—	1.5-7 INCH H <sub>2</sub> O	3A	UL, CSA	R	M,C
PR10306A	—	5-35 INCH H <sub>2</sub> O	5A	UL, CSA	R	M,C
PR10510A	PR20510A	20-50 INCH H <sub>2</sub> O	10A	UL, CSA	R	M,C
PM11120A	PM21120A	1-5 PSI	TO 25A	UL, CSA	M	R,C
PM11130A	PM21130A	2.5-6 PSI	TO 25A	UL, CSA	M	R,C
PM11140A	PM21140A	4-11 PSI	TO 25A	UL, CSA	M	R,C
PM11150A	PM21150A	9-18 PSI	TO 25A	UL, CSA	M	R,C
PM11160A	PM21160A	15-28 PSI	TO 25A	UL, CSA	M	R,C
PM11170A	PM21170A	25-40 PSI	TO 25A	UL, CSA	M	R,C
PM11180A	PM21180A	35-65 PSI	TO 25A	UL, CSA	M	R,C
PM11190A	PM21190A	50-100 PSI	TO 25A	UL, CSA	M	R,C
PM11195A	PM21195A	75-125 PSI	TO 25A	UL, CSA	M	R,C

LOW COST VACUUM SWITCHES						
VR10130A	—	2.5-7 INCH H <sub>2</sub> O	5A	UL, CSA	R	M,C
VR10306A	—	6-16 INCH H <sub>2</sub> O	TO 25A	UL, CSA	R	M,C
VR10510A	VR20510A	13-25 INCH H <sub>2</sub> O	TO 25A	UL, CSA	R	M,C
VR10515A	VR20515A	20-40 INCH H <sub>2</sub> O	TO 25A	UL, CSA	R	M,C
VR11120A	VR21120A	35-80 INCH H <sub>2</sub> O	TO 25A	UL, CSA	R	M,C
VR11130A	VR21130A	75-150 INCH H <sub>2</sub> O	TO 25A	UL, CSA	R	M,C
VR11140A	VR21140A	135-250 INCH H <sub>2</sub> O	TO 25A	UL, CSA	R	M,C

SENSITIVE PRESSURE SWITCH (Pressure, Vacuum or DIFF.)						
D1000A	SPST ONLY	0.3-20 INCH H <sub>2</sub> O	1A	UL	D	D
D1001A	—	2-45 INCH H <sub>2</sub> O	1A	UL	—	—

TINYTROL PRESSURE & VACUUM SWITCHES						
TNP	SPDT/SPST ONLY	.25PSIG - 65PSIG FACTORY SET	TO 25A	UL	E	—

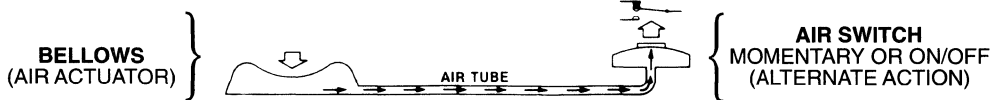
PRINTED CIRCUIT BOARD PRESSURE OR VACUUM SWITCHES						
C Series	SPST/DPST	6" WG - 65 PSI	1A	UL	F	—

MINIATURE PRESSURE & VACUUM SWITCHES						
C with leads	SPST/DPST	6" WG - 65 PSI	1A	UL	G	—

NOTE: Sensitive switch may be set for normally open or closed contacts for pressure or vacuum operation or differential pressure. (Fig. D)

**SHOCK PROOF, WATER PROOF, EXPLOSION PROOF SWITCH**

INSTEAD OF A SWITCH CONNECTED BY CABLE TO THE EQUIPMENT OR APPLIANCE, AN AIR BELLOWS IS JOINED BY TUBING TO AN AIR SWITCH CONTAINED WITHIN THE EQUIPMENT OR APPLIANCE. AIR SWITCHES ARE AVAILABLE IN MOMENTARY, ALTERNATE ACTION, OR SEQUENCING ACTIONS.



**Air Switches**

- 2HP @ 240VAC  
1HP @ 120VAC  
21 AMP @ 240VAC
- Other mounting choices.
- Acetel plastic body and mechanism ensures high mechanical stability and minimum moisture absorption.
- Other switch ratings available up to 25 Amps.

**ON/OFF TVA111A**  
Momentary TVM111A



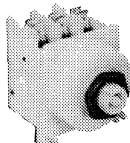
"Tinytrol® Single" SPDT

**ON/OFF TVA211A**  
Momentary TVM211A



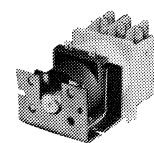
"Tinytrol Double" DPDT  
US PATENT 4,783,580

**3 or 4-Function**  
MTG311A  
MTG211A



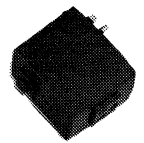
"Magictrol®" Sequencing

**3 or 4-Function**  
Solenoid for  
Distances to -100'



#E156923

**Plug-In  
Converter Box**

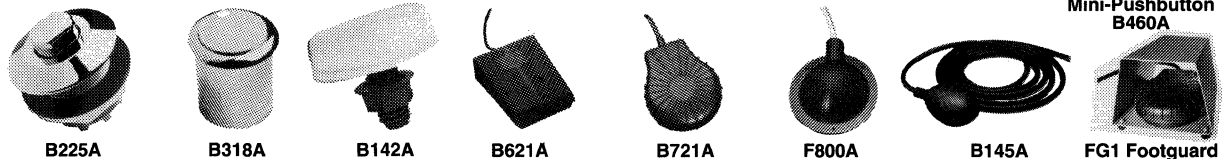


Electric Plug to  
Air Switch  
UL #E171193

**Air Actuators (Bellows) And \*Foot Switches (Bellows or Electric)**

The air actuators in any of the various forms, are not affected by water, dirt, dust or flammable gases. Only

a few of the many actuators available are shown here. Standard electrical footswitches are also available.

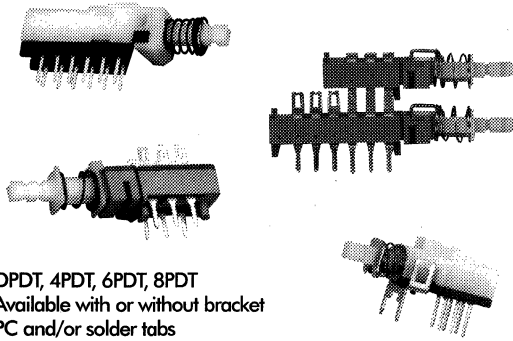




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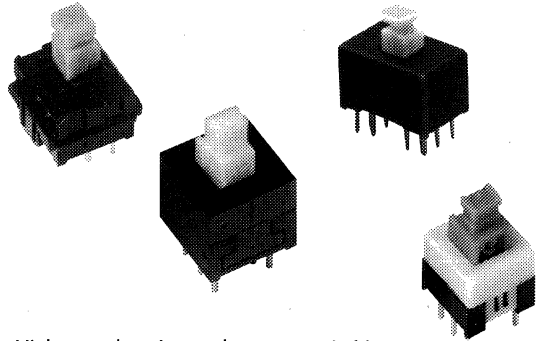
# Switches

## Push Button Type



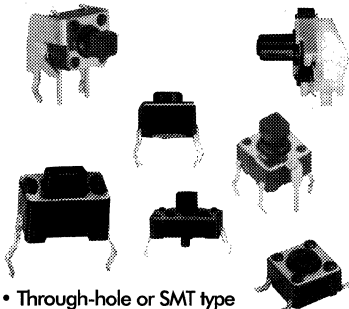
- DPDT, 4PDT, 6PDT, 8PDT
- Available with or without bracket
- PC and/or solder tabs  
(Crimped PC terminals on JFPB and JDPB series)
- High temp housing suitable for IR reflow available
- Multiple, interlocking and stacked versions
- Assorted buttons available

## Key Type



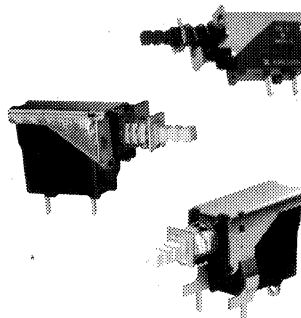
- High temp housing and actuator suitable for IR reflow available
- Momentary and self-lock versions
- DPDT and 4PDT

## Tact Type



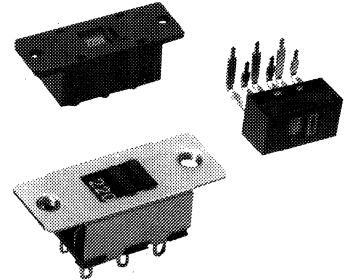
- Through-hole or SMT type
- Washable version available
- High temp housing and actuator suitable for I.R. reflow available
- Tape and reel packaging available for 6mm through hole and SMT types
- Assorted buttons available

## Power Push Button



- UL, CSA, VDE, SEMKO, NEMKO, DEMKO
- Available with or without bracket, PC or chassis mount
- Self-lock and momentary versions

## Power Slide Type



- 10A 125VAC, 5A 250VAC
- UL, CSA, VDE approved
- SPDT, DPDT, DPST
- Various Mounting configurations available



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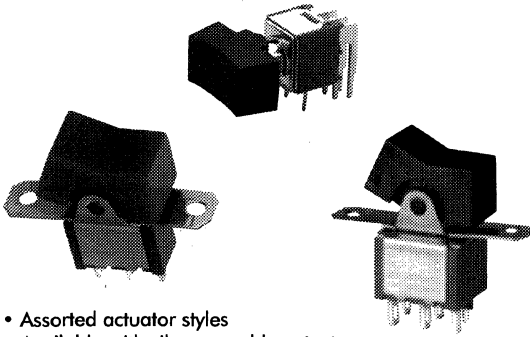
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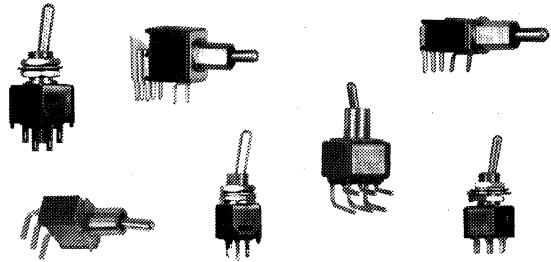
# Switches

## Mini Rocker Type Switches



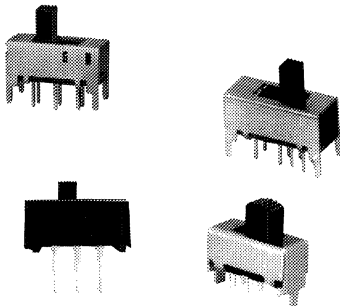
- Assorted actuator styles
- Available with silver or gold contacts
- Various circuit and mounting configurations
- High temp housing and actuator to withstand IR reflow available

## Miniature & Sub-Miniature Toggle Type



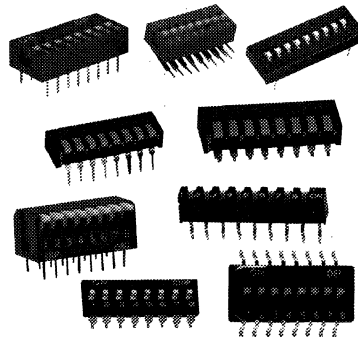
- Numerous mounting, actuator and bushing styles
- Epoxy sealed terminals and PCB washable versions available
- UL/CSA recognized

## Slide Type



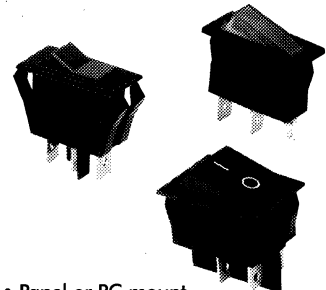
- Small and economical
- PC or solder tab terminations
- Various circuit and mounting configurations

## SIP & DIP Type

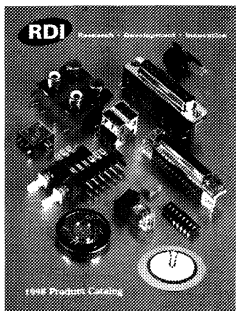


- 1.27mm and 2.54mm pitch
- Straight, right angle, piano style, and SMT styles
- Epoxy and tape sealed

## Rocker Type - Panel Mount



- Panel or PC mount
- Illuminated or non-illuminated
- UL/CSA/VDE approved
- SPST, SPDT, DPST, DPDT
- Various actuator markings and colors



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# NOMOGRAPH VOLTAGE DROP

## NOMOGRAPH OF VOLTAGE DROP ACROSS LOAD SUPPLY LEADS (as a function of wire size and load current)

### THIS NOMOGRAPH CAN BE USED TO FIND:

**Maximum current carrying capacity recommended for any standard wire size.\***

- 1) With a straight edge, connect from the wire size on Scale 2 to the point "A" on Scale 3.
- 2) Read  $I_{max}$  on Scale 1.

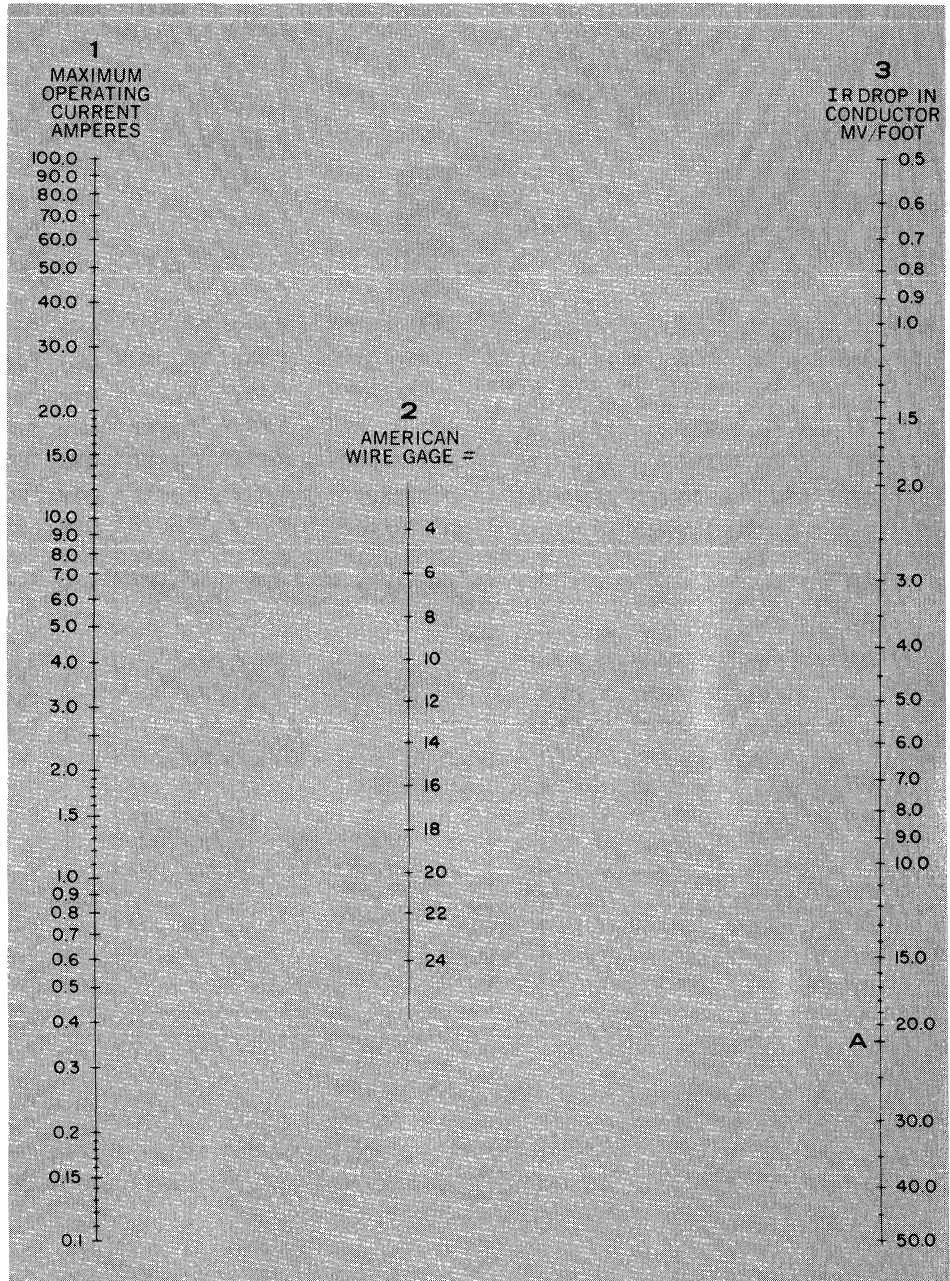
**Voltage drop in millivolts per foot for known wire size and operating current.**

- 1) With a straight edge, connect the known current on Scale 1 and the wire size on Scale 2.
- 2) Read voltage drop on Scale 3.

**Wire size required for known operating current and known maximum tolerable voltage drop across supply leads.**

- 1) Determine maximum tolerable drop in millivolts **per foot** of lead (sum of positive and negative leads).
- 2) Connect the value on Scale 3 (as determined in step 1) to the known current on Scale 1.
- 3) Read wire size on Scale 2.

\* Based on an arbitrary minimum 500 circular mils per ampere. High-temperature class insulation will safely allow higher currents.



**NOTE:** A voltage stabilized Power Supply controls the voltage across its output terminals. Hence, the wire conductors used to connect the load must be considered as part of the load. At high load currents, the voltage drop across the supply leads may appreciably degrade stabilization at the load. Kepco models equipped with the *remote error sensing* feature can automatically compensate for voltage drops of up to 500 mV across each load supply lead.



# Industrial and special switches


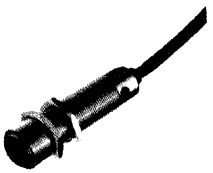
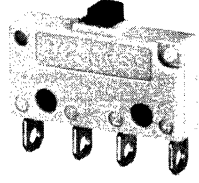



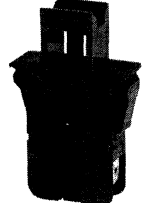
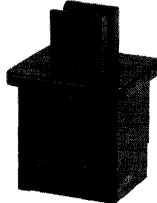


## SAIA-Burgess Electronics

Certified to ISO 9001 / QS-9000

SWITCHES • MOTORS • CONTROLLERS

SAIA-Burgess Electronics Inc., 1335 Barclay Boulevard, Buffalo Grove, IL 60089-4527

Tel.: 800-429-0365 • Fax: 847-215-9606 • E-mail: SALES@SAIA-Burgess-USA.com • WWW.SAIA-Burgess-USA.com

Limit Switches	Proximity	Snap-action	Snap-action	Snap-action
				
<b>Size mm</b> 42.5 x 42.5 x 85	VARIOUS	17.6 x 5.1 x 11.75	19.15 x 7.1 x 9.2	19.15 x 14.15 x 9.2
<b>Switching features</b> • 4 switching functions • Positive action mechanism	• Inductive • Capacitive • Linear • Fork	• Snap-action switches with double break action	• Low overall height • Extensive range of operating levers • Double pole version	• Location pegs for multi-pole use • Double pole switch • Sequenced operation
<b>AC breaking capacity (res.)</b> 250 VAC / 6A	up to 250 VAC / 05A	250 VAC / 5A	250 VAC / 2A	250 VAC 2A
<b>Terminals</b> Screw	—	Faston Solder PCB	PCB	PCB
<b>Available actuators</b> Plungers, roller plungers, roller levers, rods, wobble sticks		Plain-lever Cam follower	Plain-lever Cam follower	Plain-lever
<b>Typical ordering reference</b> PS 03 U11	DCA12/4609S	FK4T7	LPSP	LPDP
<b>Door Interlock</b> 	<b>Door Interlock</b> 	<b>Door Interlock</b> 	<b>Key Lock</b> 	<b>Key Lock Rotary</b> 
<b>Size mm</b> 30 x 12 x 41.3	40 x 17 x 66	40 x 35 x 57.5	15 x 15 x 32	Ø 19 x 39...86
<b>Features</b> • Fail-safe breaking • Single pole, double break CO	• 8 mm contact gap and 8 mm creepage and air gap • Double pole NO	• 8 mm contact gap and 8 mm creepage and air gap • Triple pole NO	Anti-tamper 2 poles max.	General purpose 12 poles max. to very high security
<b>AC breaking capacity (res.)</b> 250 VAC / 16A	400 VAC / 16.5A	380 VAC / 12A		250 VAC 2A
<b>Terminals</b> Faston 6.3 x 0.8 mm	Faston 6.3 x 0.8 mm Faston 4.8 x 0.8 mm	Faston 4.8 x 0.5 mm Faston 4.8 x 0.8 mm	Gold plated pin Ø 1 x 3.3 mm	Silver plated 4.8 x 0.8 mm
<b>Available actuators</b>	Panel mounting shroud	Panel mounting shroud	Plastic keys All alike	Knobs or 6 types of locks
<b>Typical ordering reference</b> XPS42-E2	XTD22	XSC06	E1-AA-AA-AA	P2-3FBA-201

# Snap-action switches

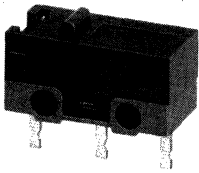
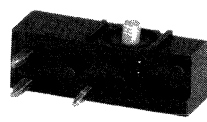
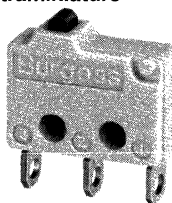
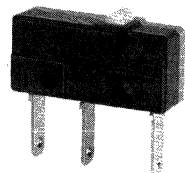
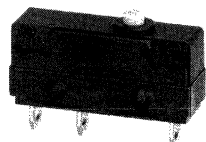
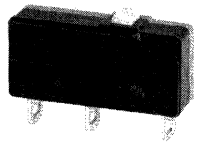
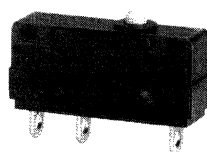
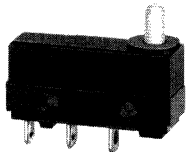
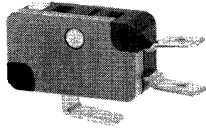
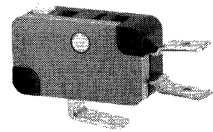
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## SAIA-Burgess Electronics

SWITCHES • MOTORS • CONTROLLERS

<b>Ultraminiature</b> 	<b>Ultraminiature</b> 	<b>Ultraminiature</b> 	<b>Subminiature</b> 	<b>Subminiature</b> 
<b>Size mm</b> 12.8 x 5.8 x 7.5	14.5 x 5.7 x 6.5	12.8 x 5.1 x 11.2	19.8 x 6.4 x 11.1	19.8 x 6.4 x 11.7
<b>Features</b> • Small size switch • Low current switch	• Side facing terminals • Sealed version	• High current rating • Long and reliable life	• High contact reliability	• Mounting holes or moulded pegs • Snap-on terminal covers • Sealed version
<b>AC breaking capacity (res.)</b> 250 VAC / 1.5A	250 VAC / 1A	250 VAC / 5A	250 VAC / 10A	250 VAC / 5A
<b>Terminals</b> Solder PCB	PCB	Faston Solder	Faston Solder PCB	Faston Solder PCB
<b>Available actuators</b> Plain-lever	Plain-lever Cam follower	Plain-lever Cam follower	Straight-, Simulated roller-, Roller-lever	Plain-lever Cam follower Roller lever
<b>Typical ordering reference</b> X5M303K2AA	F1NT8	F4T7	XCF5	V4NT7
<b>Subminiature</b> 	<b>Subminiature</b> 	<b>Subminiature</b> 	<b>Miniature</b> 	<b>Miniature</b> 
<b>Size mm</b> 19.8 x 6.4 x 11.1	19.8 x 6.4 x 11.2	20 x 6.45 x 16.3	27.8 x 10.3 x 18.55	27.8 x 10.3 x 18.55
<b>Features</b> • High contact reliability	• Movement differential 0.04 mm max. • Sealed terminals (optional)	• Long overtravel of 2.2 mm minimum • Snap-on terminal covers • Sealed versions	• Very close tolerances • High contact reliability	• Very close tolerances • High contact reliability
<b>AC breaking capacity (res.)</b> 250 VAC / 2A	250 VAC / 5A	250 VAC / 2A	250 VAC / 16A	250 VAC / 10A
<b>Terminals</b> Faston Solder PCB	Faston Solder PCB	Faston Solder	Faston Solder Screw PCB	Faston Solder Screw PCB
<b>Available actuators</b> Straight-, Simulated roller-, Roller-lever	Plain-lever Roller lever Cam follower lever	Plain-lever Cam follower Roller lever Ice break lever	Straight-lever Former lever Simulated roller lever Roller lever	Straight-lever Formed lever Simulated roller lever Roller lever
<b>Typical ordering reference</b> XCC3	V4DT7	V4LT7	XG2	XGK2

# SAIA-Burgess Electronics

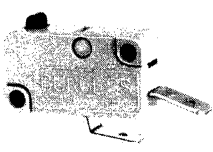
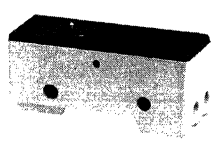
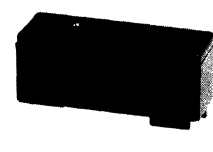
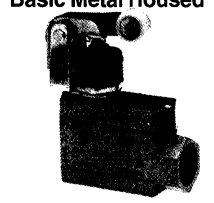
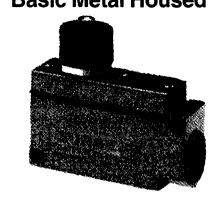
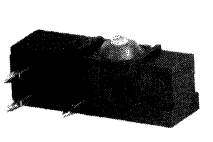
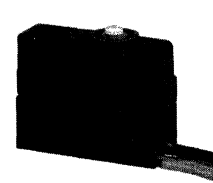
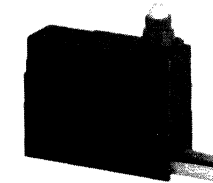

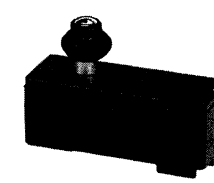
SWITCHES • MOTORS • CONTROLLERS

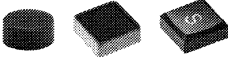
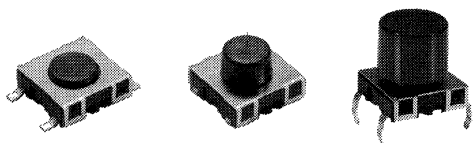
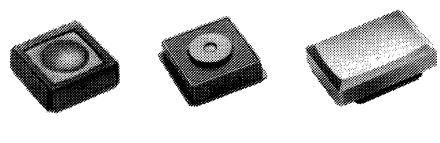
## Snap-action switches



Certified to ISO 9001 / QS-9000

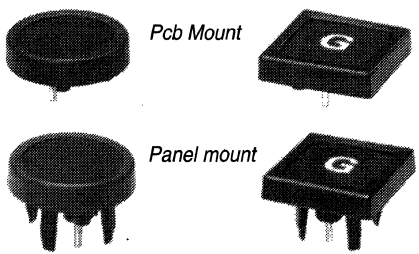
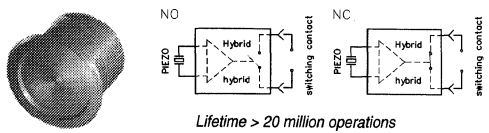
SAIA-Burgess Electronics Inc., 1335 Barclay Boulevard, Buffalo Grove, IL 60089-4527

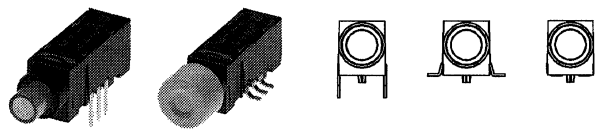
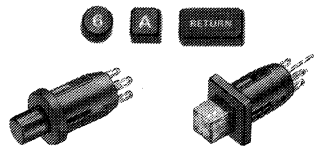
Tel.: 800-429-0365 • Fax: 847-215-9606 • E-mail: SALES@SAIA-Burgess-USA.com • WWW.SAIA-Burgess-USA.com

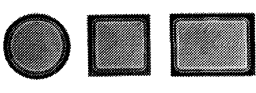
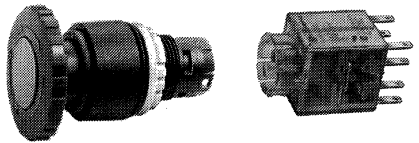
Miniature	Basic	Basic	Basic Metal Housed	Basic Metal Housed
				
<b>Size mm</b> 28 x 10.5 x 18.7	49.7 x 17.8 x 22.7	49.4 x 17.6 x 22.2	76.9 x 25.7 x 88	76.9 x 25.7 x 79
<b>Features</b> <ul style="list-style-type: none"> <li>• Contact gap &gt; 3 mm</li> <li>• High operating force</li> </ul>	<ul style="list-style-type: none"> <li>• High repeat accuracy</li> <li>• accuracy of operating position</li> </ul>	<ul style="list-style-type: none"> <li>• Small controlled movements and accurate repeat performance</li> <li>• Sealed version</li> </ul>	<ul style="list-style-type: none"> <li>• 4 switching functions</li> <li>• Positive action mechanism</li> </ul>	<ul style="list-style-type: none"> <li>• 4 switching functions</li> <li>• Positive action mechanism</li> </ul>
<b>AC breaking capacity (res.)</b> 250 VAC / 15A	480 VAC / 20A	380 VAC / 15A	250 VAC / 15A	250 VAC / 15A
<b>Terminals</b> Faston Solder Screw	Faston Solder Screw	Screw Solder tags	• Screw • Pre-wired	• Screw • Pre-wired
<b>Available actuators</b> Straight-lever Formed lever Roller-lever	Pin-, Roller-plungers, Leaf spring levers, Roller Straight-,Formed Reversing levers	Heavy-, Duty-, Pin-, Roller-, Spring- plungers Roller-, Plain-, Reverse-, Action-levers	• Spring plunger • Roller lever	• Spring plunger • Roller lever
<b>Typical ordering reference</b> VBF9 / 1633	<b>XO2</b>	<b>CR1</b>	<b>C6CTQMSA</b>	<b>C9CTQMS</b>
<b>Sealed Ultraminiature</b> 	<b>Sealed Subminiature</b> 	<b>Sealed Subminiature</b> 	<b>Sealed Miniature</b> 	<b>Sealed Basic</b> 
<b>Size mm</b> 14.5 x 5.7 x 6.5	20 x 6.45 x 17.9	20 x 6.45 x 21.6	31.7 x 10.5 x 26.7	49.4 x 17.6 x 35.6
<b>Features</b> <ul style="list-style-type: none"> <li>• Fitted with plunger cowl for additional protection</li> </ul>	<ul style="list-style-type: none"> <li>• Single, double or triple pole snap-on terminal covers</li> </ul>	<ul style="list-style-type: none"> <li>• Extremely long overtravel</li> </ul>	<ul style="list-style-type: none"> <li>• Movement differential 0.15 mm max.</li> </ul>	<ul style="list-style-type: none"> <li>• High repeat accuracy of operating position</li> </ul>
<b>AC breaking capacity (res.)</b> 250 VAC / 1A	250 VAC / 3A	250 VAC / 2A	250 VAC / 5A	380 VAC / 15A
<b>Available actuators</b> Plain-lever Cam follower	Plain-lever Cam follower Roller lever	Plain-lever Cam follower Roller lever Ice break lever	Plunger Plain-lever Roller lever	Plunger
<b>Temperature</b> -40°C to +85°C	-10°C to +85°C	-40°C to +85°C	-10°C to +70°C	-10°C to +85°C
<b>Typical ordering reference</b> F1NST8	<b>V4NS</b>	<b>V4LS</b>	<b>V3S</b>	<b>CR1S / 330</b>

Momentary action Pcb mounting SMT mounting 1 pole switching N.C. contact function	Board mount switches. Keypot styles available in various shapes, sizes, heights and colors. 	
		
<b>Series</b>	<b>SMS / PMS / PMK 1/2"</b>	<b>MTG / MCS / MTP 1/2"</b>

Momentary action Panel mounting Pcb mounting Lighted or unlighted 1 pole switching	LED or back lighted pcb key switches  <p>* Available without switching action for indication only</p>	Panel mount key switches 
	<b>Series</b>	<b>MTG / MCS / MTP 3/4"</b>

Momentary action Panel mounting Pcb mounting	 <p>Pcb Mount Panel mount</p>	<p><b>NEW</b> Vandal and explosion proof piezo switch – lighted or unlighted</p>  <p>Lifetime &gt; 20 million operations</p>
	<b>Series</b>	<b>MCS 3/4" Membrane</b>

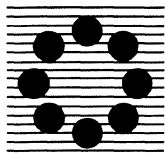
Momentary or latching action Panel, pcb or surface mounting Lighted or unlighted 1 or 2 pole switching	Pushbutton switches: lighted or unlighted with J-bend, gull-wing or through-hole terminals for pcb mounting 	Pushbutton switches for panel mounting 
	<b>Series</b>	<b>HDS / HDT</b>

Momentary or latching action Panel mounting	EMF pushbutton: power on/off, lighted or unlighted switch  <p>* Available without switching action for indication only</p>	<p><b>NEW</b> Emergency stop release – latching action meets European Directive EN 418</p> 
	<b>Series</b>	<b>EMF / AF</b>

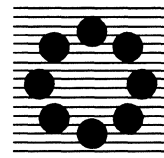
Voltage selectors (2 to 6 positions) for panel and pcb mounting: series SWA, SWM, SWZ, SWP, SWS, SWK and SWG



**For order numbers, pricing, samples and technical information contact Schurter at 707-778-6311; Fax 707-778-6401; E-mail info@schurterinc.com; Website http://www.schurterinc.com**



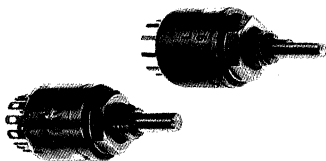
# ROTARY SWITCHES



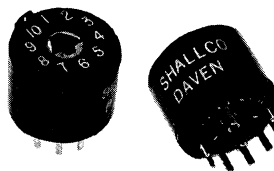
## LOW CURRENT & POWER

Shallco offers a broad selection of standard and custom rotary switches in detented and snap-action styles. Many designs have up to 40 years of reliable experience in commercial, industrial and military applications. Let us assist you in the selection and specification for new or replacement rotary switch components.

### ● SUBMINIATURE

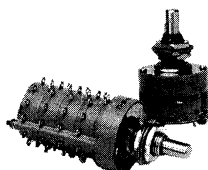


STD & BCD CODED

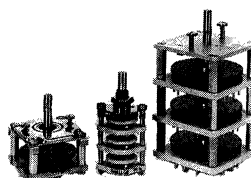


PCB ROTARY

### ● MINIATURE

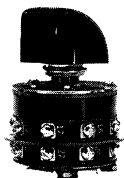


ENCLOSED

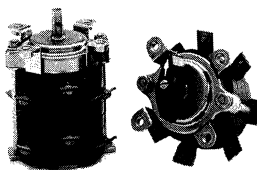


OPEN FRAME

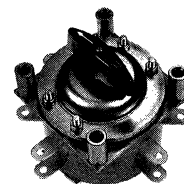
### ● POWER



10 AMPERE

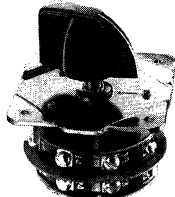


30 AMPERE

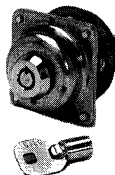


200 AMPERE

### ● CUSTOM



SPRING-RETURN



KEYLOCK



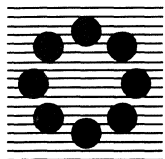
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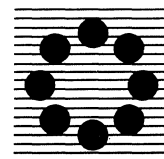
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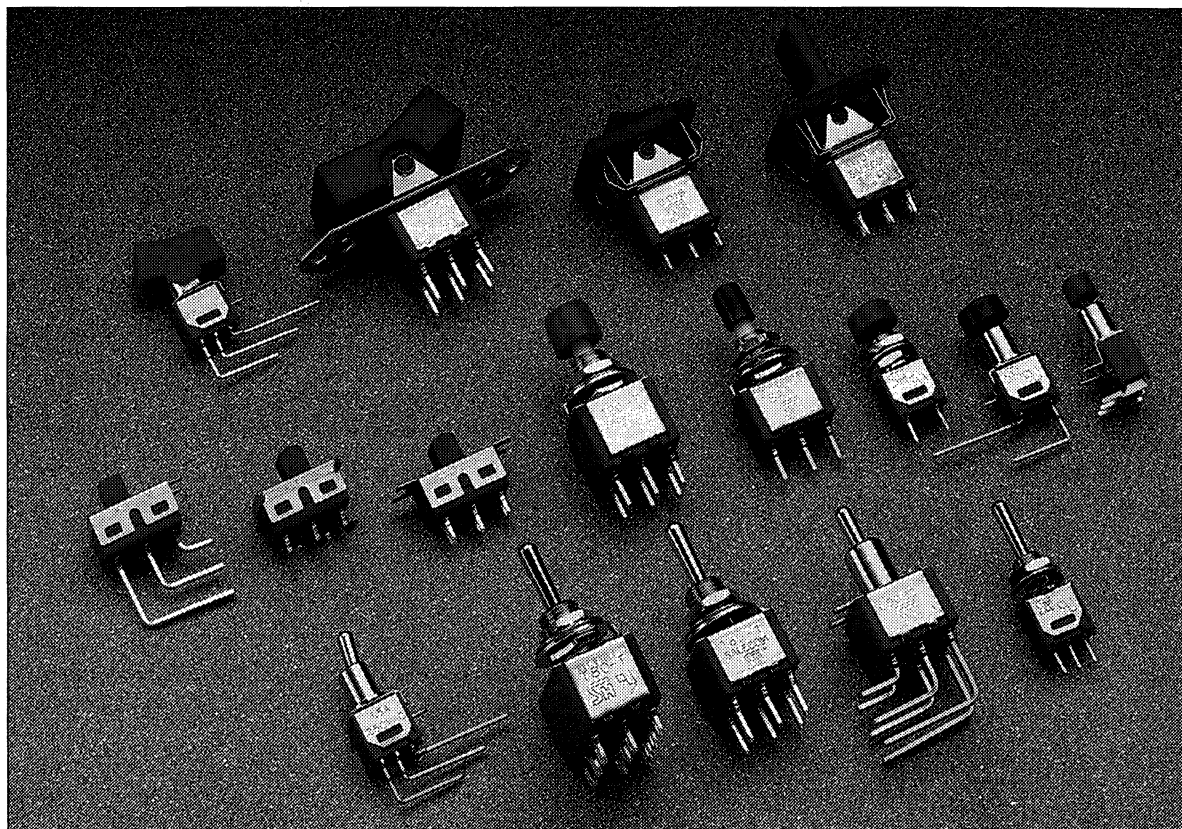
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### Pushbutton Switches

- Subminiature
- Sealed Subminiature
- Sealed Surface Mount
- Snap-Acting Momentary
- DIP
- Key

### Rocker Switches

- Power
- Subminiature
- Sealed Subminiature

## Rocker & Paddle Switches

- Miniature
- 3-Way

## Slide Switches

- Miniature

## Tact Switches

### Toggle Switches

- Miniature
- Subminiature
- Sealed Subminiature
- Sealed Surface Mount
- 3-Way

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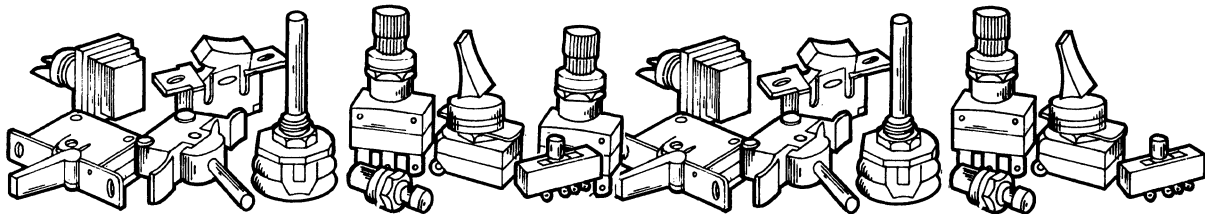
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# Switches: Pushbutton, Slide, Rocker and Toggle

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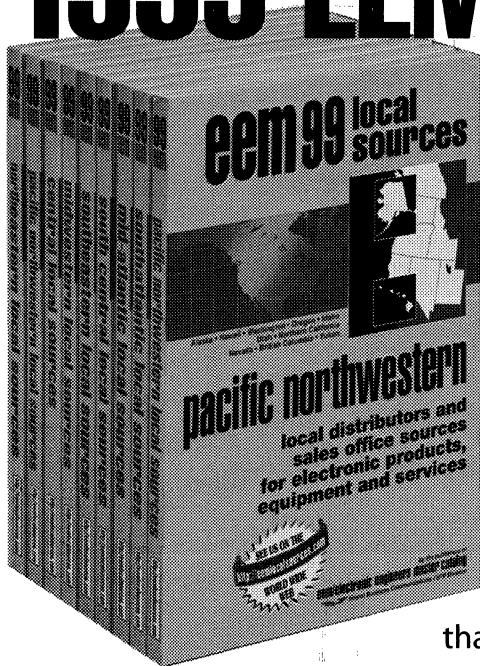


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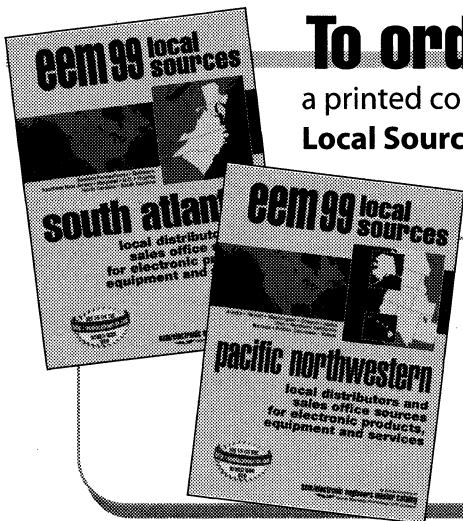
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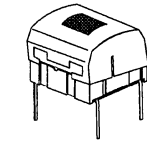
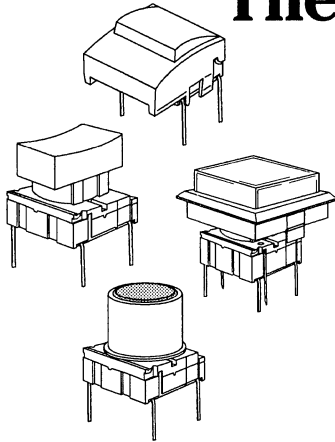


# SoLiCo/mec

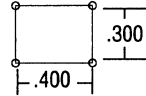
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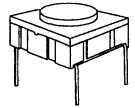
## The Sealed Multimec Switch



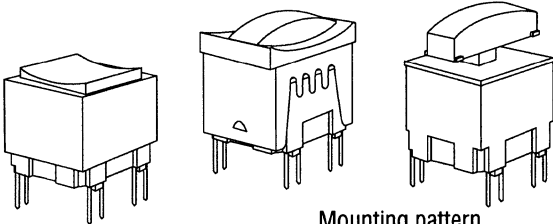
Actual size without cap  
or bezel - .400 x .400  
Mounting pattern for  
Multimec switch



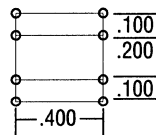
- Sealed to IP-67M
- Available with either thru-hole or surface mount terminals
- Withstands wave soldering procedures
- High temperature (+160°C)
- Low temperature versions (+65°C)
- Various cap and bezel options with ten standard colors
- Can be used with an overlay to simulate a membrane switch
- 250g key pressure actuation force, 1mm key travel
- Rated for 50mA @ 24VDC
- High reliability — 10 million cycles minimum!
- 100% inspected on the assembly line



## The Versatile Unimec Switch

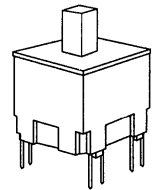


Mounting pattern  
15.000 Series Unimec

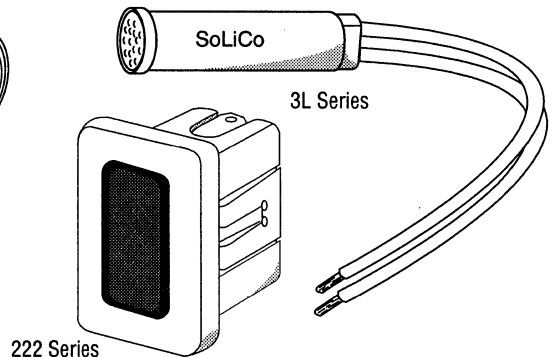
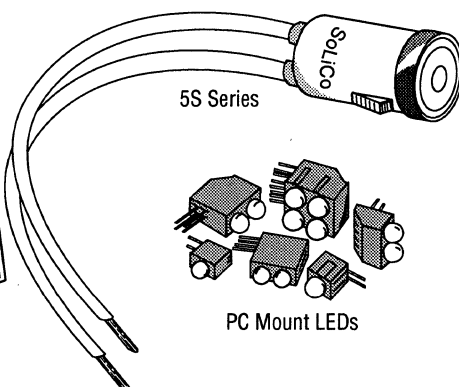
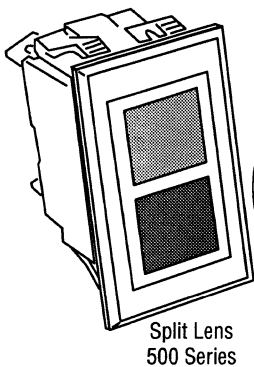


Actual size without cap  
or bezel - .470 x .470

- Momentary or Alternate action
- PC Mountable
- 8 contact functions per switch
- Hundreds of standard keycap legends
- Can be used alone or with a variety of cap, bezel, and LED options
- Vario-support mounting provides for custom keypad configurations
- Square cap available in 6 colors makes switch splashproof
- Momentary lifetime - 1,500,000 cycles
- Alternate lifetime - 500,000 cycles
- Rated for 250mA @ 120V
- Operating temperature range -25°C to +75°C
- High temperature -25°C to +160°C
- 100% inspected on the assembly line



## Indicators, PC mount LEDs, Pilot Lights



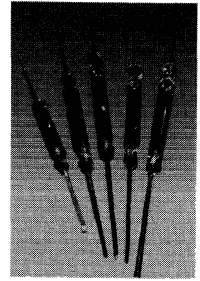
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- Highest quality, based on computerized SPC, yielding unmatched uniformity
- Custom cutting and forming of switch leads for difficult applications
- Several standard switches for a broad range of applications and loads from dry circuit to power switching



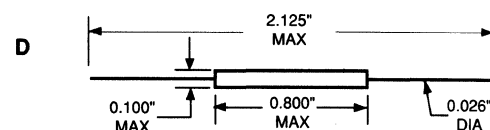
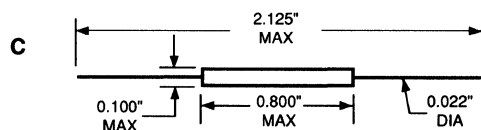
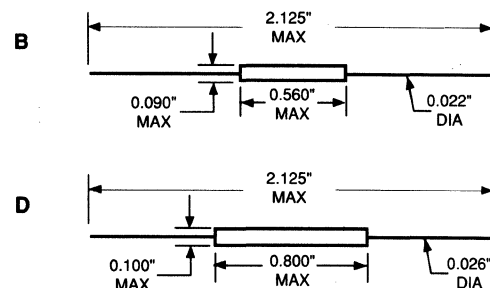
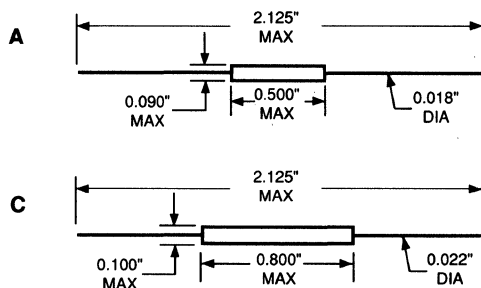
## SWITCH SPECIFICATIONS

Part Number	GR501	GR560	NR560	GR100	NL126
Contact Form	1A	1A	1A	1A	1A
Physical Characteristics	A	B	B	C	D
Contact Material	Rhodium	Rhodium	Rhodium	Rhodium	Rhodium
<b>Electrical Ratings</b>					
(1) Contact Rating, VA-Max.	10	10	10	10	50
Switching Current, Amperes-Max.	0.5	1.0	1.0	1.0	1.5
Carry Current, Amperes-Max.	1.0	1.5	1.5	1.5	2.5
DC Switching Voltage, VDC-Max.	100	100	100	200	200
AC Switching Voltage, VAC RMS-Max.	100	125	125	150	150
(2) Breakdown Voltage, VDC-Min.	200	250	250	300	300
(3) Contact Resistance, Milliohms-Max.	150	100	100	100	100
Insulation Resistance, Ohms-Min.	10 <sup>12</sup>	10 <sup>12</sup>	10 <sup>12</sup>	10 <sup>12</sup>	10 <sup>12</sup>
Contact Capacitance, Picofarads-Max.	0.3	0.2	0.2	0.2	0.3
<b>Operating Characteristics</b>					
Operate Time (Inc. Bounce), ms-Typ.	1	0.6	0.6	0.8	0.8
Release Time, ms-Typ.	0.1	0.1	0.1	0.1	0.1
Resonant Frequency, KHZ-Typ.	3.2	3.0	3.0	2.2	2.5
Vibration, 10-2000 Hz, G's-Max.	50	50	50	40	30
Shock-11ms, 1/2 Sine Wave, G's-Max.	100	100	100	100	100
Operating Temperature, °C	-40/+125	-40/+125	-40/+125	-40/+125	-40/+125
Storage Temperature, °C	-50/+155	-50/+155	-50/+155	-50/+155	-50/+155
Pull-In Sensitivity, Ampere Turns	7-30	10-50	10-50	10-60	20-60

Notes: (1) The specification for VA Rating may be exceeded for less sensitive (high AT) switches, and should be decreased for very sensitive (low AT) switches. Specific life testing for a particular load will be run by Standex Electronics upon request.

(2) Breakdown voltage is measured in the presence of a radioactive ionizing source with switch leakage current limited to 100 microamperes.

(1) Contact resistance measurements are made at 10ma from a 1 volt source with 5 AT overdrive using a 4 wire (Kelvin) measuring system with contact probes located on 1.7" centers.



Detail application assistance for custom forming and proximity applications

Call, write or fax for complete Switch and Application catalog.

## Standex Electronics

**Standex company**

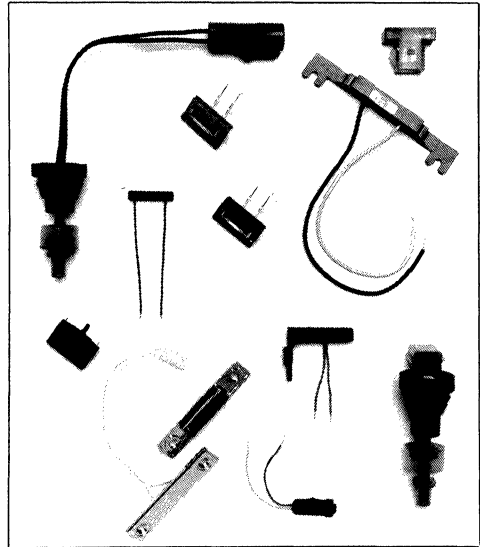
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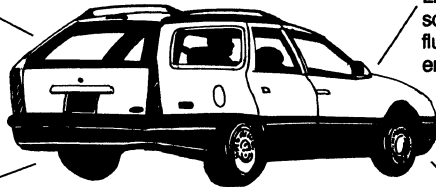
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Standex Electronics designs and builds magnetic proximity sensors for a wide range of markets and applications. The basic sensing element for most applications is the hermetically sealed reed switch. Other technologies are used as the application dictates.

- Hi-Rel Switching — hermetically sealed contacts — billions of operations switching low level loads
- No External Power Required
- Power Switching — direct switching of power loads with up to 2.5 amp DC inrush
- Wide Actuation Distance — reliable actuation at up to one inch for certain applications
- Low Cost — very competitive with other technologies



RPM Sensing — cruise control, odometer, speedometer and engine control

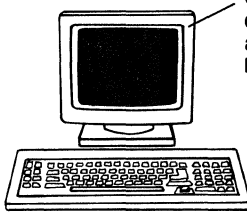


Liquid Level — washer solvent, coolant, brake fluid, transmission fluid, engine oil and fuel.

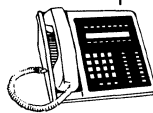
Anti-skid Braking System

Lamp Outage

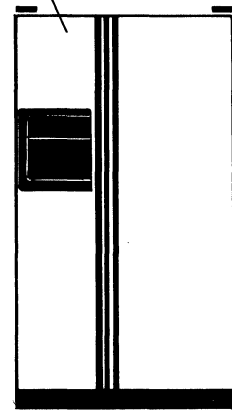
Door ajar sensing, liquid level sensing, lamp switching, dishwasher spray arm rotational sensing, and device enable applications.



Off hook sensing, device disable, interlock applications, and telephone line switching.



Rotational counting applications for gas, electric and water metering and tamper applications.



## Standex Electronics

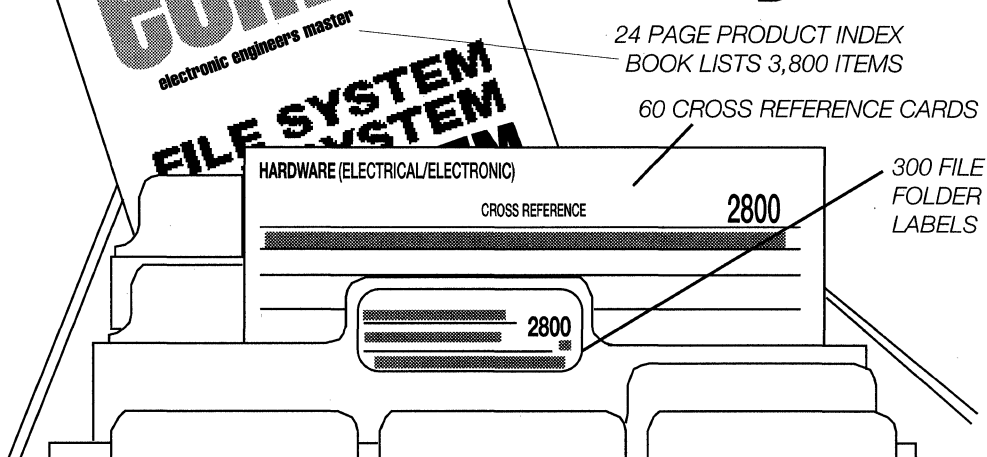
4538 Camberwell Road  
Cincinnati, OH 45209  
Phone: (513) 871-3777  
Fax: (513) 871-3779  
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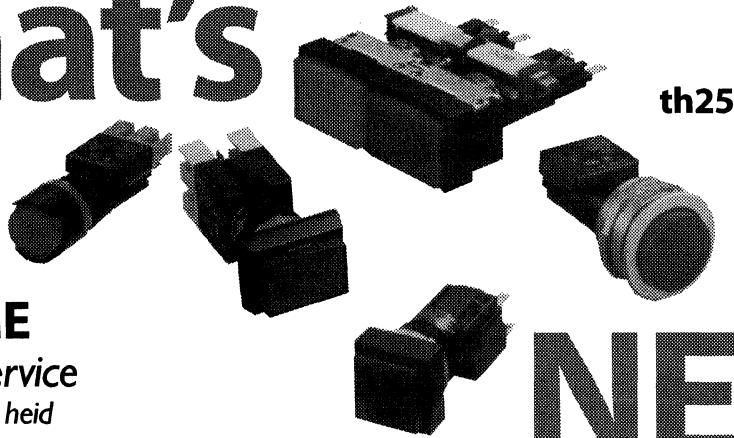
- Or, mail your purchase order and check for US \$30.00 plus local sales tax\* to:

**EEM/Hearst Business Communications, Inc.**  
645 Stewart Avenue  
Garden City, NY 11530  
Attn: Marie Botta  
(516) 227-1314 • FAX (516) 227-1453

\*Add sales tax in CA,FL,IL,MA,NJ,NY,PA,VA and GST tax in Canada.

Pre-payment in U.S. dollars required for orders shipped outside the USA. Add \$10 per set for foreign delivery.

# What's



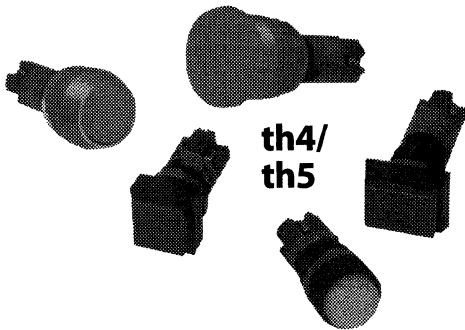
# NEW?

## NEW NAME

Same great service  
formerly tschudin & heid

## NEW PRODUCT

A whole new line of PIEZO technology



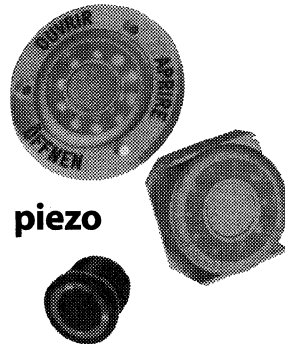
## NEW LINE

Printed Circuit Board, Thumb Wheel & CRS Rotary Switches

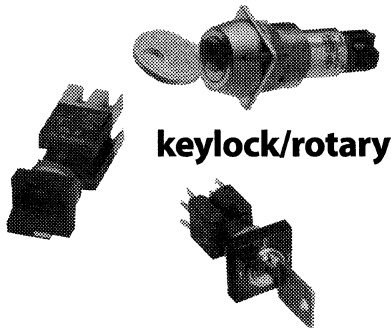
## NEW WEBSITE

[www.thusainc.com](http://www.thusainc.com)

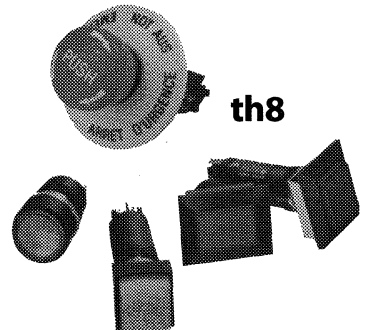
- 100 years of Swiss manufacturing
- ISO 9001
- All major international approvals



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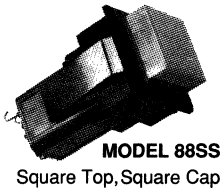
*Making a difference through service.*



# Pushbutton Switches

## REED PANEL SWITCHES

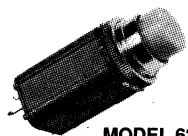
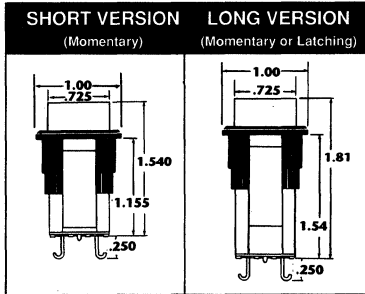
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**MODEL 88SS**

Square Top, Square Cap

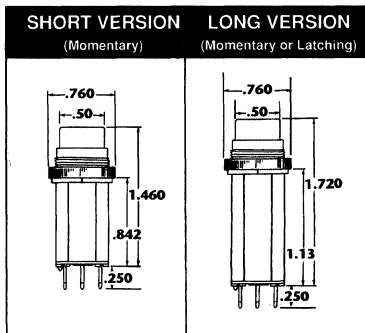
Mounting Hole: .875"  
Square Snap-in panel mounting .060 to .125" panel thickness



**MODEL 62NC**

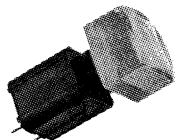
Nut & Collar  
Round Top, Round Cap

Mounting Hole: .625"  
Dia. Round Screw-in panel mounting .060 to .125" panel thickness



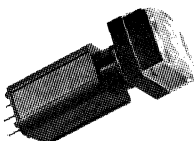
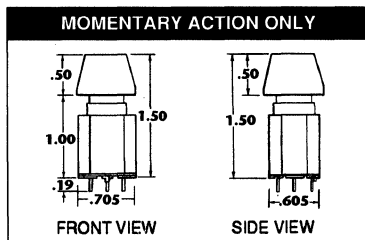
## REED KEYBOARD SWITCHES

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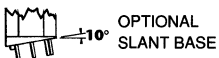
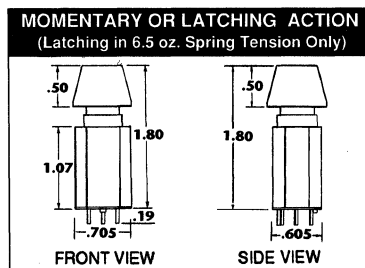


**SHORT VERSION KEYBOARD - 01**

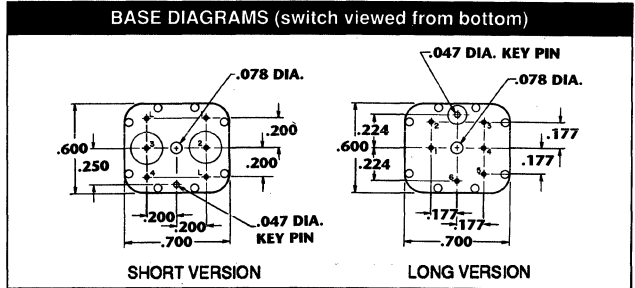
Recommended spacing: .625 or .750 centers



**LONG VERSION KEYBOARD - 02**



Consult Factory for Optional Mounting Methods.  
Beware of adjacent fields. (Speakers, Monitors, & Switches)



SWITCH ELECTRICAL DATA						01	02
SWITCH FORM	CIRCUIT DIAGRAM	MAX. CURRENT	MAX. VOLTAGE	MAX. POWER LOADING	MAX. CONTACT BOUNCE	PIN OUTS	PIN OUTS
A	SPST N.O.	500 milliamps	200 VDC	10 WATTS	0.5 milliseconds	1 & 2	1 & 6
B	SPST N.C.	250 milliamps	100 VDC	7 WATTS	0.6 milliseconds	3 & 4	3 & 4
AA	DPST N.O.	500 milliamps	200 VDC	10 WATTS	0.5 milliseconds	1 & 2	1 & 6
						3 & 4	3 & 4
BB	DPST N.C.	250 milliamps	100 VDC	7 WATTS	0.6 milliseconds	1 & 2	1 & 6
						3 & 4	3 & 4
*AB	DPST I.N.O. 1 N.C. (break before make)	250 milliamps	100 VDC	7 WATTS	0.6 milliseconds	1 & 2 3 & 4	1 & 6 3 & 4

\*Special Order Only ... Contact Factory

MAXIMUM INITIAL CONTACT RESISTANCE	100 milliohms
LONGEST PERIOD OF OPEN-CIRCUIT ELAPSED TIME DURING ANY ONE EVENT IN A CLOSURE SEQUENCE	50 microseconds
MINIMUM BREAKDOWN VOLTAGE	250 VDC
MINIMUM INSULATION	100 megohms
MINIMUM LIFE (reed)	50 million cycles

SWITCH MECHANICAL DATA	
TERMINALS	.025 Diameter Nickel
KEY TRAVEL	.187" ± .007"
PRE-TRAVEL	Minimum .050"
MINIMUM OVERTRAVEL	.020"
OPERATING FORCE (spring tension)	2.5 oz., 5 oz., 6.5 oz., 10 oz., 12 oz., or 20 oz. (±0.7 oz.)
(latching in 6.5 oz only)	

OPTIONAL  
Diodes (internal) available, switch forms A or B.  
Contact Factory for incandescent or LED data.



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FAX: 308-324-4985

THE KEY TO QUALITY

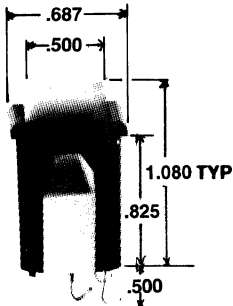
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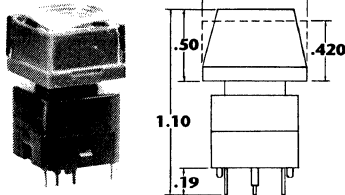
## Reed Panel Switch-04



Recommend spacing of switches: .625"  
Cap size should not exceed .725"

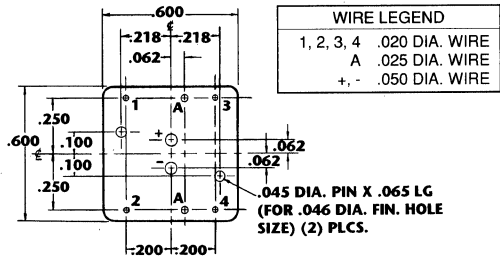
## Low Profile Keyboard Switch - 03

Momentary Action



Beware of Adjacent Magnetic Fields (Speakers, Monitors, and Switches)

### BASE DIAGRAMS (switch viewed from bottom)



WIRE LEGEND  
1, 2, 3, 4 .020 DIA. WIRE  
A .025 DIA. WIRE  
+, - .050 DIA. WIRE

04 SERIES MOUNTING HOLE: 0.625"

### SWITCH ELECTRICAL DATA

SWITCH FORM	CIRCUIT DIAGRAM	MAX. CURRENT	MAX. VOLTAGE	MAX. POWER LOADING	MAX. CONTACT BOUNCE	PIN OUTS
A	SPST N.O.	100 milliamps	50 VDC	5 WATTS	0.5 milliseconds	1 & 2
AA	DPST N.O.	100 milliamps	50 VDC	5 WATTS	0.5 milliseconds	1 & 2 3 & 4
MAXIMUM INITIAL CONTACT RESISTANCE					150 milliohms	
LONGEST PERIOD OF OPEN-CIRCUIT ELAPSED TIME DURING ANY ONE EVENT IN A CLOSURE SEQUENCE					50 microseconds	
MINIMUM BREAKDOWN VOLTAGE					150 VDC	
MINIMUM INSULATION					100 megohms	
MINIMUM LIFE (reed)					50 million cycles	

SWITCH MECHANICAL DATA	-03	-04
TERMINALS	.018" Diameter Nickel	.025 Diameter Nickel
KEY TRAVEL	.080" ± .007"	.125" ± .007"
PRE-TRAVEL	Minimum .035"	Minimum .035"
MINIMUM OVERTRAVEL	.020"	.020"
OPERATING FORCE (spring tension)	7 oz. (±0.7 oz.)	7 oz. (±0.7 oz.)

## KEYCAPS AND ADAPTERS

KEYCAP TYPES	STYLES	COLORS	SIZES (±.005")
PYRAMIDAL	2 Options: -concave -slanted can be engraved	ALL COLORS AVAILABLE (see list)	- 1 space, .725" - 1 1/2 space .725" x 1.090" - 2 space .725" X 1.465"
PYRAMIDAL SPACEBAR	Convex	Black, Opaque White, Opaque	8 space (.725" x 5.955")
SQUARE	Flat can be engraved	ALL COLORS AVAILABLE (see List)	.500" .725"
ROUND (62NC switch)	Round, flat top can be engraved	Transparent: Amber, Red Translucent: Lt. Green, White	HT. - .270" DIA. - .50"
RELEGENDABLE	3 Options: - flat cover - concave cover - pyramidal flat cover Solid available in .600 size only	Flat or Concave: ALL Base Colors Available (see List)  Pyramidal Flat: Black or White opaque bases	Square: .500" & .600" Flat, concave or solid cover .687" concave .725" concave concave 1 1/2 space: .725" x 1.090" concave only Two space .725" x 1.465" concave only Pyramidal flat: .725" only
LOW PROFILE RELEGENDABLE	Concave Cover Non-illuminated only	Black or White opaque bases	Square: .500" & .600"

NOTE: The following caps are also suitable for low profile switch: .500 square, flat or concave; .600 relegendable flat or concave; .725 pyramidal, .725 square, .725 relegendable, and .725 pyramidal flat.

### -04 PANEL SWITCH CAPS ONLY

- SQUARE .500" SIZE
- CONCAVE RELEGENDABLE .500" SIZE

## KEYCAP ADAPTERS

Three adapter styles are available. *Regular stem adapters are standard*. Extended stem adapters can be substituted for keycap to sit higher on keyboard. This will extend the height of assembly .187". Cruciform cap post is also available. Adapters need not be ordered separately.

**CUSTOM DESIGNS  
MANUFACTURED  
ON REQUEST**



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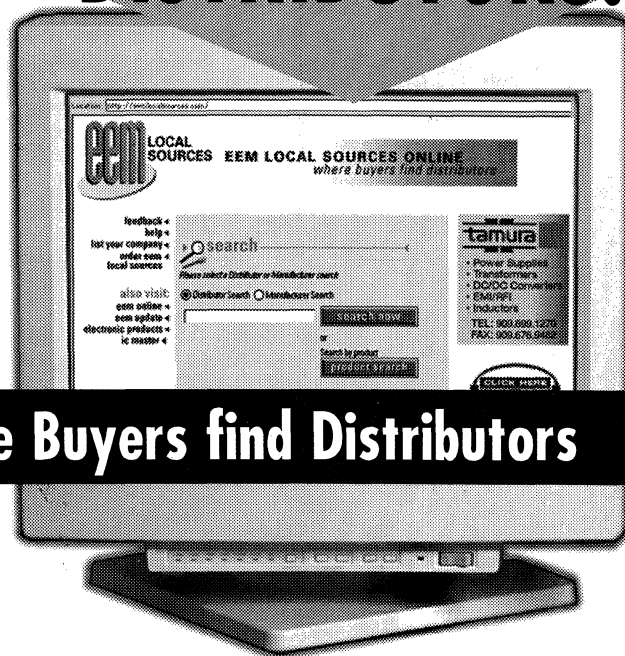
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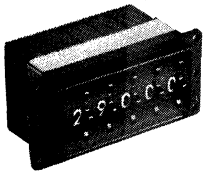
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# Presenting The Longest-Running Series In The Business

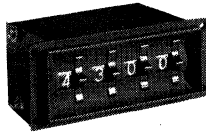
Digitran® Quality-Engineered Thumbwheel Switches  
Available Off-The-Shelf At Unbeatable Prices



## 29000 SERIES ECONOMY MINISWITCH

An economical miniswitch for high package density. Extra large in-line character readout. Width, .350" (8.9) and cutout height 1.020" (25.9)

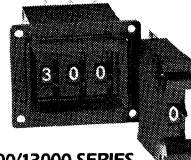
- 10, 12 or 16 Dial Positions
- Many Output Codes and Configurations
- Message Units for Longer Legends
- Optional Dial Stops to Limit Rotation
- Rear-Mounted



## 43000/44000/45000 SERIES MINISWITCH

These low cost switches feature optional LED lighting and snap-together assembly. Field installable stops to limit dial rotation. Printed circuit boards with solder or pin terminations.

- Available in Most Popular Codes
- 10 Dial Positions
- .200" High, Up-Front Dial Characters
- 43000 —
- 500" (12.7)W x .980" (24.89)H
- 44000 —
- .315" (8.0)W x 1.220" (31.0)H
- 45000 —
- .315" (8.0)W x .961" (24.4)H



## 300/13000 SERIES GENERAL PURPOSE DIGISWITCH

One of the most widely used thumbwheel switches, with more available options, output codes and special termination features than any other switch.

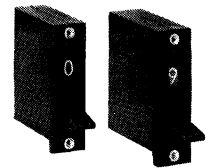
- 8, 10, 12 or 16 Dial Positions
- RFI Shielding Available
- Easy to Replace MIL-Spec Lighting
- Message Units for Longer Legends
- 13000 is Front-Mounted Version
- 300 —
- 500" (12.7)W x 1.380" (35.05)H
- 13000 —
- 500" (12.7)W x 2.00" (50.8)H



## 9000 SERIES DIGISWITCH

The 9000 offers more available options, output codes and special termination features than any other fully-sealed MIL-spec switch. Rear-mounted, qualified to MIL-S-22710/12.

- 8, 10, 12, or 16 Dial Positions
- RFI Shielding Available
- Optional Replaceable MIL-Spec Lighting
- Dial Stops to Limit Dial Rotation
- Dimensions —
- 600" (15.24)W x 1.375" (34.93)H



## 24000/28000 SERIES LEVER SWITCH

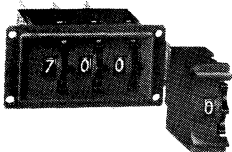
24000: Bi-directional front panel sealed switch built to perform in any hostile environment qualified to MIL-S-22710/24.

- Optional, Replaceable MIL-Spec Lighting
- Individually Mounted Switches
- 24000 —
- 480" (12.19)W x 1.175" (29.84)H

28000: Minilever commercial switch that can be actuated in either direction.

- "Upper" or "Lower" Window Location
- 90° Full Lever Travel
- 10 and 12 Dial Positions
- 28000 —
- 500" (12.7)W x .980" (24.89)H

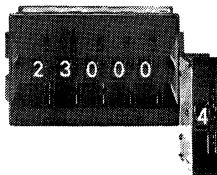
More military and commercial thumbwheels and greater code selection than anybody else. And it's all under one roof to maintain the very highest standards of product quality and delivery.



## 200/700/8000 SERIES MINISWITCH

Small switches for hostile environments, virtually impervious to sand, dust, oils, high humidity, salt spray and explosive atmospheres. Series 200 has potted wire leads, 700 — P.C.B. both qualified to MIL-S-22710/15 and /20.

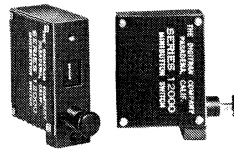
- 8, 10, 12 or 16 Dial Positions
- RFI Shielding Available
- Optional, replaceable MIL-Spec Lighting
- 8000: Commercial Version
- Dimensions:
- 500" (12.7)W x .980" (24.89)H



## 23000 SERIES "SNAP-IN" SLIMSWITCH

For applications where maximum panel density, good reliability and error-proof positive setting action are required. Switch width only .315" with cutout height of 1.221"

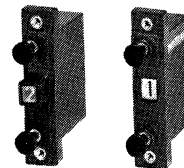
- 10 Dial Positions
- Snap-in, Front Mount — No Tools Required
- Large (.170" High) In-Line Characters



## 12000/53000 SERIES MINIBUTTON

Reliable, contamination-proof switches for applications requiring panel sealing per MIL-S-22710. No supplemental panel cover or boot is required for sealing.

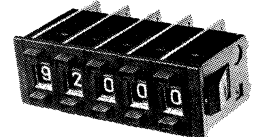
- Individually Mounted Switches
- Glass Window that Seals Switch Interior
- Metal Case —
- Facilitates R.F.I. Shielding
- Optional Replaceable MIL-Spec Lighting
- 12000 Series:
- Qualified to MIL-S-22710/17
- 12000 —
- 500" (12.7)W x .83" (21.08)H
- 53000 —
- 350" (8.89)W x 1.020" (25.91)H



## 63000/64000 SERIES BI-DIRECTIONAL MINIBUTTON

Two-button bi-directional switches designed to meet all performance requirements of MIL-S-22710. Rear-mounted, panel sealed.

- 63000 — 8, 10, 12 Dial Positions
- 64000 — 16 Dial Positions
- Metal Case —
- No RFI Shielding Required
- Optional Replaceable MIL-Spec Lighting
- Individually Mounted Switches
- 63000 —
- 410" (10.41)W x 1.230" (31.25)H
- 64000 —
- 460" (11.68)W x 1.312" (33.53)H



## 92000/93000/62000 SERIES DOUBLE PUSHBUTTON

These commercial switches are designed for applications where speed and ease of settings are important.

- Snap-together Assembly
- L.E.D. Lighting Available (92000)
- Low Cost, High Quality, High Reliability
- 10 and 16 Dial Positions Available
- Dial Stops to Limit Dial Rotation
- 92000 —
- 300" (7.62)W x .551" (14.2)H
- 93000 —
- 300" (7.62)W x .886" (22.5)H
- 62000 —
- 315" (8.00)W x .945" (24)H

OTE: Numerals in brackets indicate millimeter equivalents.

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# Bestact™ High Power Reed Switches

## Highly Reliable Contact Employing New Materials and Innovative Designs such as Wiping and Hammering Action, Bifurcated Contact and Back-stop Mechanism

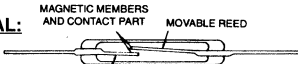
### ■ FEATURES

- 1 Sealed with an inert gas, ensuring freedom from aging and influences exerted by external environment.
- 2 The bifurcated contact and "wiping action" assures outstanding contact reliability. Failure-In-Time (FIT)  $\lambda_{60} = 9.2 \times 10^{-10}$  (5V 1mA)
- 3 Quick action permits a larger make and break capacity and longer service life.
- 4 Can switch both AC and DC, permitting direct control over a wide range from low level load to electromagnetic power load.

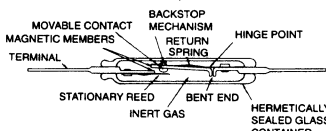
### ■ CONSTRUCTION AND OPERATING MECHANISM

Conventional reed switches are constructed simply. The contact for switching current also serves to switch the magnetic circuit. Bestact uses a separate magnetic member and contact unit (current carrying section), each using different materials and designs optimized for their functions.

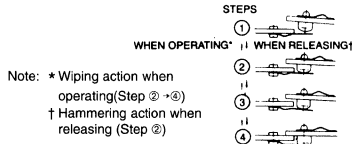
#### CONVENTIONAL:



#### BESTACT:



<Bestact (Large-capacity type)>

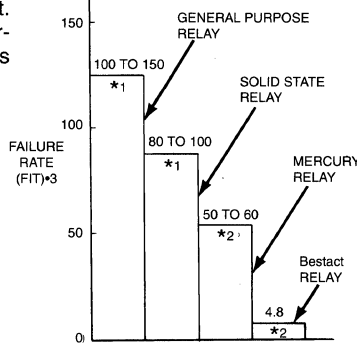


Note: \* Wiping action when operating (Step ② → ④)  
† Hammering action when releasing (Step ③)

- Medium-capacity type: 5V 1mA to 240VAC 0.5A (5A making)  
 NEMA Contact Ratings: C300 (AC) and Q150 (DC), 180VA & 69VA respectively, 1/8 HP  
 Large-capacity type: 1V 1mA to 240VAC 1A (10A making)  
 230VDC 40W (Solenoid valve)  
 NEMA Contact Ratings: C600, B300 (AC), Q300 (DC), 360VA & 69VA respectively, 1/2 HP  
 5 Near surgeless switching of inductive load.

### ■ RELIABILITY AND TYPICAL APPLICATIONS

(Field Failure Rate of Relays)



- Industrial automatic control systems
- PLC interface devices
- Transportation equipment and devices
- Water treatment plants
- Electric power equipment, nuclear power facilities, extra-high voltage electric power facilities
- Transit vehicle & railway
- Elevators
- Continuous casting machines
- Marine development application
- Various limit switches
- Thermal switches
- Cylinder position detection switches
- Low-level command and control switches
- Current relay
- Motor vehicle electrical instruments

Note: \*1. Excerpt from "Reliability Data" issued by government agency.  
 \*2. Actual results of field failure rate.

\*3. When no. of failures is zero apply following formula:

$$\lambda_{60} = \frac{\text{No. of failures} \times \text{Constant}^{**}}{\text{No. of tested contacts} \times \text{tested hour (H)}} \times 10^{-9}$$

\*\* Applying JIS (Japanese Industrial Standard) 60% reliability level, 0.917 for zero failure.

### ■ RATINGS AND SPECIFICATIONS

Application	Medium-Capacity Type		Large-Capacity Type		Remarks
	General Purpose	Heavy Duty	General Purpose	Heavy Duty	
Type	R24U	R25U	R14U	R15U	
Contact Arrangement	1N0		1N0		
Rated Continuous Current	3A		5A		
Rated Operational Current** (NEMA pilot duty)	240V 0.5A (180VA, 1/8 HP)		240V 1A (360VA, 1/2 HP)		Inductive load (NEMA pilot duty, horsepower)
Rated Operational Current** (NEMA pilot duty)	115V 0.3A (69VA)		115V 0.5A, 230V 0.2A (69VA)		Inductive load time constant 40ms for Medium-capacity 100ms for Large-capacity (NEMA pilot duty)
Maximum Making Current*	240VAC 15A		240VAC 30A		Power factor 0.7
Maximum Making Current*	240VAC 15A		240VAC 30A		Power factor 0.4
Maximum Breaking Current**	115VDC 0.5A		115VDC 0.6A 230VDC 0.4A	115VDC 0.6A 230VDC 0.4A	Time constant 40ms (Medium-capacity type) 100ms (Large-capacity type)
Minimum Operational Power Ratings	5V 1mA	24V 1mA*	1V 1mA	24V 1mA*	
Withstand Voltage across Contacts	500VAC 1minute		800VAC 1minute		
Insulation Resistance	10 <sup>9</sup> Ω or greater		10 <sup>9</sup> Ω or greater		with 500VDC megger
Initial Contact Resistance	250mΩ or less	500mΩ or less	100mΩ or less	500mΩ or less	6VDC 1A
Capacitance	0.5PF or less		0.45PF or less		
Pick-up Ampere Turn	100 to 130AT		180 to 230AT		Standard coil is 3000 turns, 33.5 mm long, 10.5mm I.D. with 0.2mm dia. wire.
Drop-out Ampere Turn	50AT or greater		60AT or greater		
Operating Time	4ms or less (Bounce not included)		4ms or less (Bounce not included)		at 150% of pick-up ampere turn
Releasing Time**	2ms or less		2ms or less		using standard coil
Maximum Bounce Time	2ms		2ms		
Mechanical Life	50,000,000 operations	Over 100,000,000 operations	50,000,000 operations	Over 100,000,000 operations	
Vibration Resistance	147.0m/s <sup>2</sup> (15G) or greater		196.0m/s <sup>2</sup> (20G) or greater		20 to 1000Hz
Impact Resistance	196.0m/s <sup>2</sup> (20G) or greater (980.0m/s <sup>2</sup> (100G) or greater)		392.0m/s <sup>2</sup> (40G) or greater (980.0m/s <sup>2</sup> (100G) or greater)		Value in parenthesis indicates breakdown G.
Terminal Drawing Force	98.0N (10kgf)		98.0N (10kgf)		
Operating Temperature	-50 to +150°C		-50 to +150°C		
Ambient Temperature Storage	-60 to 180°C		-60 to 180°C		

Note: \*1. Where 240VAC, the rated operational current is set at 10 times this value upon making (PF: 0.6 to 0.7) and 1 times the value upon breaking (PF: 0.3 to 0.4). Rated operational current 1A means 10A making and 1A breaking. Where 115V DC is indicated, the current is set at 1 times this value upon making and 1 times this value upon breaking.

\*2. The maximum making current complies with JIS C 4531, and enables 100 times making at a power factor PF: 0.7.  
 \*3. The maximum breaking current, by referring to JIS C 4531, is based on switching 25 times at PF: 0.4, time constant  $\tau = 100$  ms (DC) for either 115/230V DC cases for the large-capacity element. For the medium-capacity element, switching 25 times at PF: 0.4 (AC), time constant  $\tau = 40$  ms for 115V DC case only.  
 \*4. The breaking time indicates the value when the coil is equipped with a flywheel diode.  
 \*5. In circuit with optocoupler 5V 10mA can be used.

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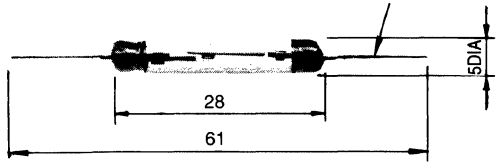
# YASKAWA Bestact™ High Power Reed Switches

Energy In Motion™

**■ DIMENSIONS in mm**

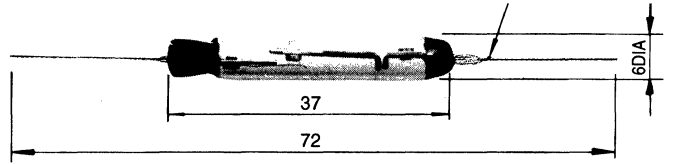
MEDIUM-CAPACITY TYPE R24U, R25U

TERMINAL: 0.5 THICK 2.4WIDE



LARGE-CAPACITY TYPE R14U, R15U

TERMINAL: 0.7 THICK 2.6 WIDE



**■ ELECTRICAL LIFE**

Voltage	Making		Breaking		Electrical Life (Thousand Operations)			
	Current (A)	Power Factor or Time Constant	Current (A)	Power Factor or Time Constant	R24U	R25U	R14U	R15U
240VAC (Inductive Load)	10	PF = 0.7	1	PF = 0.4	—	—	500	800
	5		0.5		300	1000	1000	1500
	2.5		0.25		600	2000	2000	3000
110VAC (Inductive Load)	10	PF = 0.7	1	PF = 0.4	—	—	500	800
	5		0.5		300	1000	1000	2000
	2.5		0.25		600	2000	2000	4000
110VAC (Resistive Load)	3	PF = 1.0	3	PF = 1.0	—	—	—	200
	2		2		50	200	200	1000
	1		1		300	500	1000	2000
115VDC (Inductive Load)	0.5	L/R = 100 ms <sup>-4</sup> (L/R = 40 ms)	0.5	L/R = 100 ms <sup>-4</sup> (L/R = 40 ms)	—	—	300(1000)	300(1000)
	0.3		0.3		200	300	900	900
115VAC (Inductive Load)	0.02	Relay Coil	0.012	Relay Coil	15000	30000	35000	60000
24VDC (Inductive Load)	0.037	Relay Coil	0.037	Relay Coil	10000	15000	15000	30000

Note: 1. Value of DC inductive loads tabulated above are the ones where stationary contact side is of positive polarity. However, where used at values more than rated operational current, opposite polarity can extend life. For details, contact Yaskawa.

2. Values in parenthesis are where opposite polarity is implemented.

3. Where DC light load such as relay is utilized, opposite polarity may reduce the life expectancy.

\*4. DC electrical life for R24U and R25U is based on a time constant of 40ms.

**■ PRODUCT TYPES LOAD CONTROL**



:Applicable scope

MEDIUM-CAPACITY TYPE

Type	Application	AC Power Control	DC Power Control	AC Relay Control	DC Relay Control	Electronic Circuit Control
		240VAC 120 VA 300,000 operations or greater	115VDC 30W 200,000 operations or greater	24 to 240VAC 10,000,000 operations or greater	24 to 230VDC 5,000,000 operations or greater	5V 1mA or greater
R24U	General Purpose					
R25U	Heavy Duty					24V 1mA or greater

LARGE-CAPACITY TYPE

Type	Application	AC Power Control	DC Power Control	AC Relay Control	DC Relay Control	Electronic Circuit Control
		240VAC 240 VA 500,000 operations or greater	115VDC 50W 230VDC 40W 300,000 operations or greater	24 to 240VAC 10,000,000 operations or greater	24 to 230VDC 5,000,000 operations or greater	1V 1mA or greater
R14U	General Purpose					
R15U	Heavy Duty					24V 1mA or greater

**■ SURGE VOLTAGE AT BREAKING OF INDUCTIVE LOADS**

BREAKING AC INDUCTIVE LOAD

Load: 240VAC, 60Hz		Surge Voltage (V)		
Contactor Type	NEMA Size 0	NEMA Size 2	NEMA Size 4	
Sample	Bestact	500	450	500
	Conventional Relays	1700 to 2000	1000 to 1500	800 to 1200

BREAKING DC INDUCTIVE LOAD

Load: 115 VDC		Surge Voltage (V)	
Sample	Bestact	Valve Loads	Yaskawa's Relay Type RAP-6G
	Conventional Relays	400 to 500	500 to 600
		Unstable breaking	1500 to 1700

**■ UL Recognized in Accordance with USA and Canadian standards.**

**File No. E159361**



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## KEYBOARDS/KEYPADS & MEMBRANE SWITCHES

Manufacturer	Starting EEM Page No.	Type										Features					
		Key Switch	Mechanical (Hard Contact)	Capacitive	Hall Effect	Membrane			Conductive Elastomers	Low Profile	Sealed Keyboard	Back Lighted	Illuminated Switch	Modular	Custom Legends & Symbols	Custom Capabilities	Custom Keypads
						Full Travel	Not Full Travel	Sub-Components									
Advanced Connector Technology, Inc.	B-1615	✓				✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	
Advanced Input Devices	B-1616	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Applied Group-New England Keyboard	B-1617					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Barantec Inc.	B-1618	✓	✓			✓				✓	✓	✓	✓				
Bergquist Company	B-1619						✓	✓		✓	✓	✓	✓	✓	✓	✓	
Bowmar Technology	B-1621	✓	✓			✓			✓	✓	✓	✓	✓	✓	✓	✓	
CTI Electronics Corp.	B-1622	✓	✓			✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	
Design Mark Industries	B-1624					✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	
Douglas Corp.	B-1625					✓		✓		✓	✓	✓		✓	✓	✓	
DuraSwitch Industries	B-1626		✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Dyna-graphics Corp.	B-1627					✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	
EAO Switch Corp.	B-1628	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Eastprint, Inc	B-1630		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
FEI-Flexfab Elastomerix, Inc.	B-1631	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Fujitsu Takamisawa America, Inc.	B-1632					✓	✓			✓				✓	✓	✓	
George Risk Industries, Inc.	B-1635	✓	✓							✓	✓	✓	✓	✓	✓	✓	
Grayhill Inc.	B-1636		✓							✓	✓	✓	✓	✓	✓	✓	
Hagstrom Electronics	B-1637												✓		✓	✓	
Hallmark Technologies	B-1640					✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	
Hunter Components	B-1642	✓				✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	
ICorp	B-1643						✓	✓	✓	✓	✓	✓		✓	✓	✓	
Instruments & Equipment Co.	B-1644						✓										
Jayco Interface Technology	B-1646						✓	✓	✓	✓	✓	✓		✓	✓	✓	
Laube Technology	B-1649		✓			✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	
Low Key Corp.	B-1650						✓	✓	✓	✓	✓	✓		✓	✓	✓	
Luminescent Systems, Inc.-NY	B-1652		✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	
Memtron Technologies, Inc.	B-1653						✓	✓	✓	✓	✓	✓		✓	✓	✓	
Metro Mark	B-1654					✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	
MGR Industries, Inc.	B-1656					✓	✓		✓	✓	✓	✓		✓	✓	✓	
Monopanel Technologies	B-1657						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Orbit Instrument Corp.	B-1658		✓			✓				✓	✓	✓		✓	✓		
Otto Controls	B-1659	✓	✓			✓			✓	✓							
Samsung Electro-Mechanics	B-1660	✓	✓			✓							✓				
StanKraft Inc.	B-1661					✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	
TG3 Electronics	B-1662	✓	✓			✓				✓				✓	✓	✓	
The Hall Company	B-1639						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Touchstone Technology, Inc.	B-1663	✓				✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	
Xcel Digitran	B-1664		✓	✓		✓			✓	✓			✓	✓	✓	✓	
Xymox Technologies	B-1665					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

# PRODUCT SELECTION GUIDES

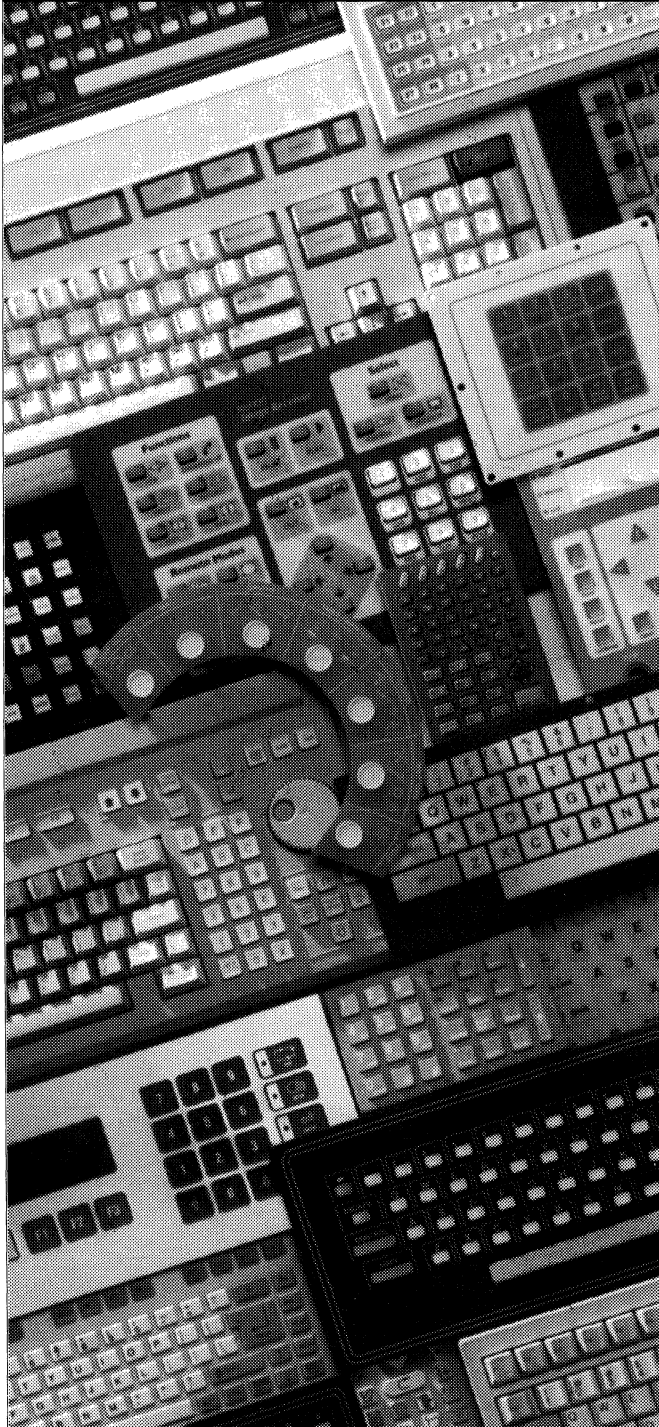
# TECHNICAL INFORMATION

## WHERE TO FIND THEM IN THE 1999 EDITION OF EEM

Batteries, Product Selection Guide	<b>D•1313</b>	Microwave Components, Product Selection Guide	<b>A•1671</b>
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide	<b>C•1003</b>	Motors, Drives, & Rotating Components, Product Selection Guide	<b>B•1169</b>
Capacitors, Product Selection Guide	<b>A•1003</b>	Oscilloscopes, Product Selection Guide	<b>D•1309</b>
Coils, Chokes, Inductors, Product Selection Guide	<b>A•1153</b>	Panel Hardware, Product Selection Guide	<b>C•1446</b>
Connectors & Sockets, Product Selection Guide	<b>C•1127</b>	Panel Meters, Analog & Digital, Product Selection Guide	<b>D•1273</b>
Cores, Magnets & Ferrites	<b>A•1349</b>	Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	<b>A•2010</b>
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	<b>A•1365</b>	Power Supplies, AC, Product Selection Guide	<b>D•2147</b>
Data Acquisition/Handling Systems & Accessories	<b>D•1139</b>	Power Supplies, DC, Product Selection Guide	<b>D•1379</b>
DC-DC Converters	<b>D•1879</b>	Protective Components (Fuses, Circuit Breakers, etc.) Product Selection Guide	<b>B•1231</b>
Delay Lines, Product Selection Guide	<b>A•1545</b>	Relays, Product Selection Guide	<b>B•1285</b>
Discrete Semiconductors, Product Selection Guide	<b>A•2049</b>	Resistors, Product Selection Guide	<b>A•1857</b>
Displays, Readouts, & CRTs, Product Selection Guide	<b>B•1006</b>	Solenoids, Product Selection Guide	<b>B•1450</b>
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	<b>C•1470</b>	Switches, Product Selection Guide	<b>B•1467</b>
Fiber Optics, Product Selection Guide	<b>B•1163</b>	Terminal Blocks	<b>C•1383</b>
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Filters, Signal, Product Selection Guide	<b>A•1615</b>	Thermal Components, Product Selection Guide	<b>B•1667</b>
Instruments, Test & Measuring, Product Selection Guide	<b>D•1178</b>	Transducers & Encoders, Product Selection Guide	<b>B•1736</b>
Keyboards, Keypads & Membrane Switches, Product Selection Guide	<b>B•1613</b>	Transformers, Product Selection Guide	<b>A•2079</b>
Lamps, Lights, & Indicators, Product Selection Guide	<b>B•1089</b>	Wire & Cable, Product Selection Guide	<b>C•1581</b>
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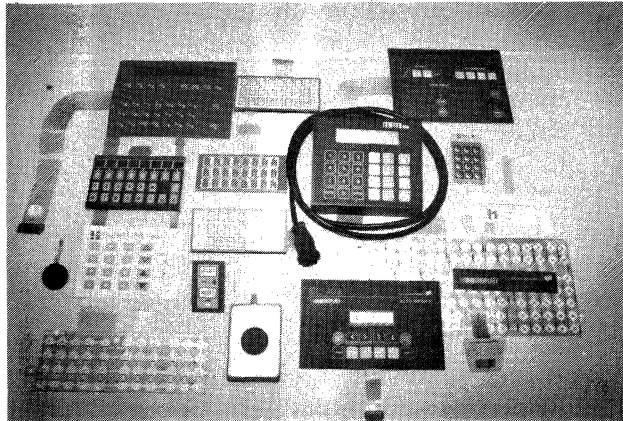
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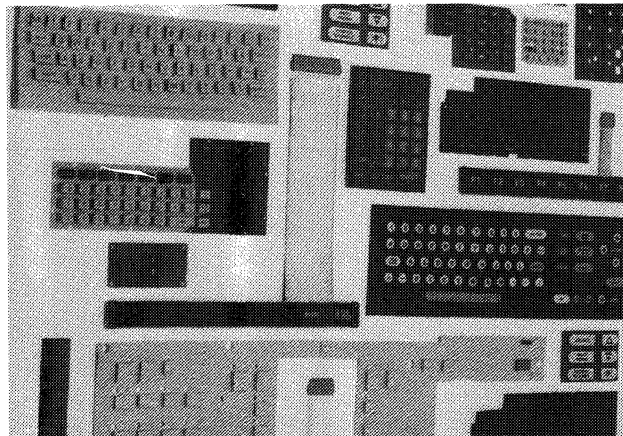
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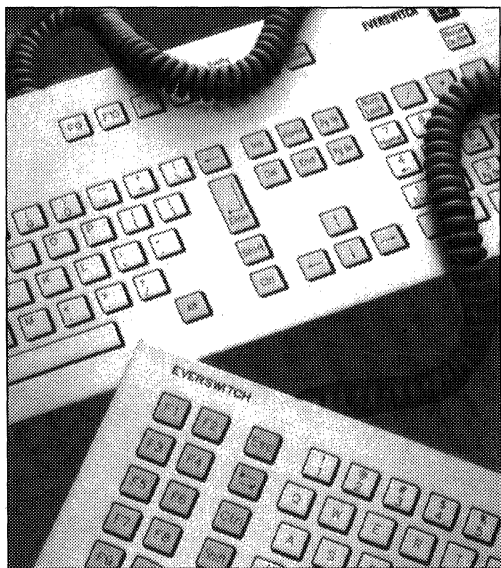
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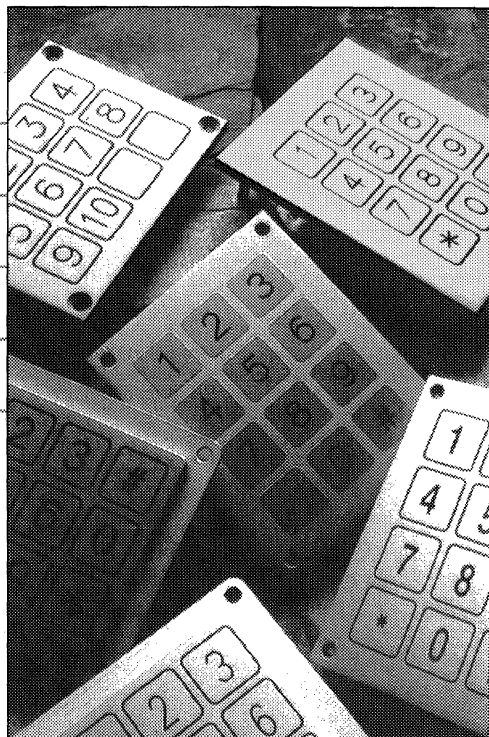


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**KEYPADS**

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RATED CURRENT: 0.2 amps

TEMPERATURE (OPER): -40C to +85C

{available to +125C}

TEMPERATURE (STORE): -40C to +125C

ACTIVATION FORCE: 3-5N (adjustable)

ACTIVATION TIME: One-shot @ 120mSec

RESISTANCE "ON": <10 Ohms

MIL STDS: 810C; 202E; 461B; 462

TOTALLY SEALED: To IP68

HOUSING MATERIAL: Aluminum, STS, Plastic

MOUNTING STYLES: Various

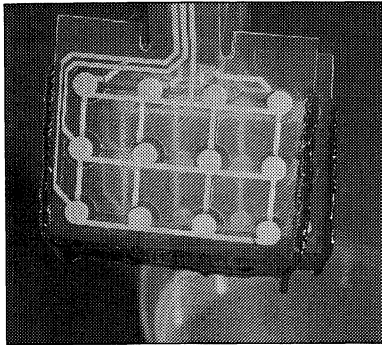
COLORS: Various

CYCLES: >50,000,000+

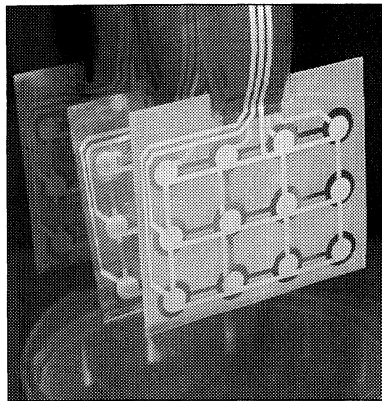
AVAILABLE: Standard & custom designs



## Why One Membrane Switch Manufacturer Stands Alone



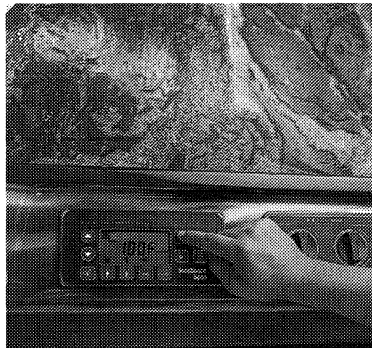
*In lab testing, pressure sensitive adhesive (PSA) switches were soaked in popular cleaning solvents mixed with red dye. Evidence of solution tracking into the switch illustrates the low resistance of PSA to chemicals.*




*In the same lab test, the HeatSeal switch exhibits no moisture ingress and no delamination of layers.*

Failure problems have plagued the membrane switch industry for years. Whether it be field failures, late deliveries or poor customer service, many membrane switch manufacturers have fallen short of customer's expectations. The Bergquist Company has been manufacturing membrane switches since 1980 and we understand our customers needs and work hard to exceed their expectations. People rely on Bergquist for:

- Superior quality and reliability
- On-time delivery
- Engineering expertise to solve problems and provide creative solutions for any application
- Personal customer service support
- A manufacturing facility designed to accommodate Volume production



*No other membrane switch manufacturer can match the durability and performance of HeatSeal®*

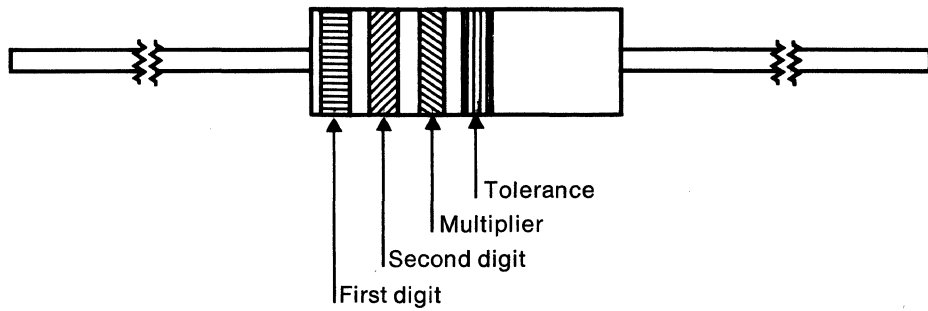


Bergquist's 30,000 square foot facility in Bigfork, MN, is dedicated to membrane switch manufacturing. The facility works off an MRPII planning system with rigid quality control specifications to assure that quality product is delivered to you, on time.

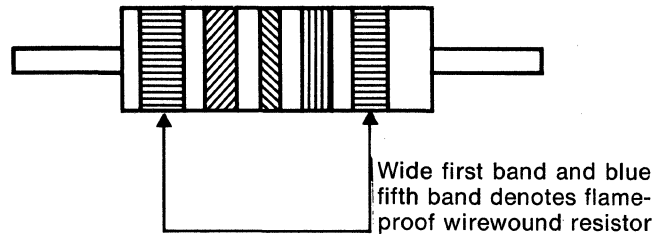
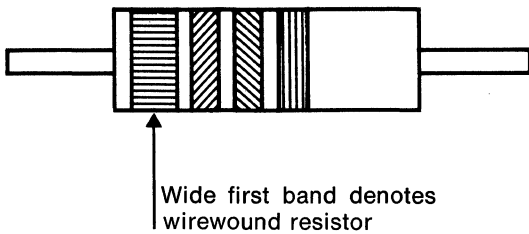
THE  
**BERGQUIST**  
COMPANY

5300 Edina Industrial Boulevard, Minneapolis, Minnesota, 55439  
Tel: (612) 835-2322 • Fax: (612) 835-0430  
Toll Free: 1 (800) 347-4572 [www.bergquistcompany.com](http://www.bergquistcompany.com)

### EIA/MIL Resistor Color Codes



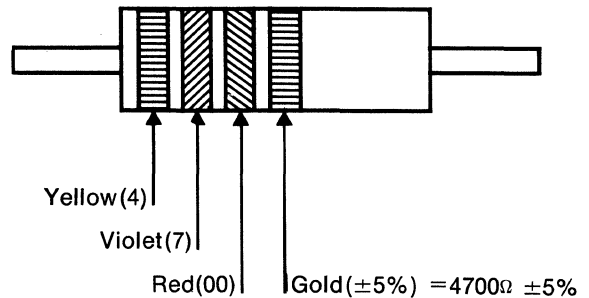
Color code for general-purpose industrial resistors



Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	± 10%
No color	—	—	± 20%

Example:



## Integrated Switch Panels & Keyboards

Bowmar keyboards and panel assemblies employ various state-of-the-art technologies in switching, lighting and information displays that offer a wide assortment of features for diverse applications.

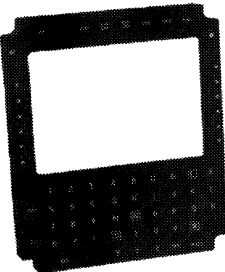
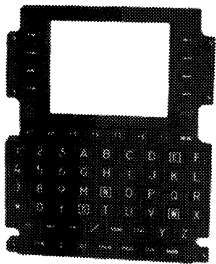
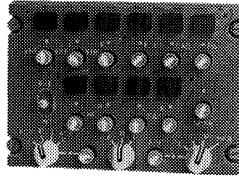
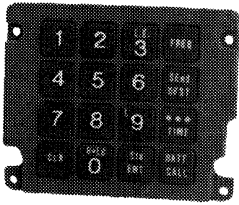
### Features

- Bowmar's patented "tri-lobe" snap-dome switches, providing superior tactile response, low contact resistance, minimal contact bounce with reliability in excess of 1,000,000 actuations
- Environmentally-sealed switch elements
- Conductive elastomeric keypads
- Graphics/EMI-shielded overlays
- Illuminated key/panel legends utilizing incandescent, electroluminescent, fiber optic or LED backlighting
- Background lighting color customized with ring filters, dyed lamps or in-house toning process.
- Efficient front or rear lamp replacement
- NVG compliance per MIL-L-85762
- Changeable keyswitch nomenclature
- Secure lighting for groundbased equipment
- Sunlight readable, dead front and customized, dual color annunciators
- Sunlight readable, dead front, custom backlit switches
- Complete conformance testing of each unit prior to delivery
- State-of-the-art photometric equipment

### Testing Capabilities

Bowmar offers a full-range of environmental testing:

EMI/RFI	Sand & Dust
Submersion	Altitude
Salt Fog	Humidity
Spills	Temperature
Shock	Rain
Vibration	



## Front Panel Assemblies

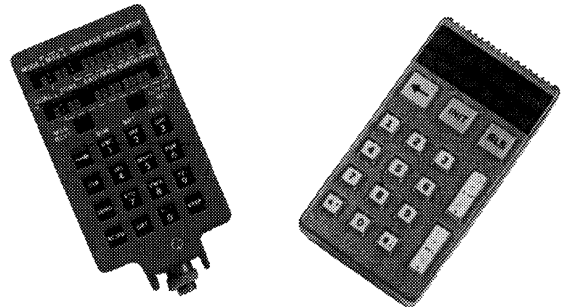
In addition to keyboards, Bowmar offers integrated interface systems that combine the keyboard with:



- Integrated LCD, LED, and CRT displays with line selectable buttons
- Customized filtering and window coatings to control glare, reflectivity and EMI
- Touch screen panels
- Switches with software controlled legend intensity

### Stand Alone I/O Devices

Stand alone I/O devices combine all the features above and are integrated in a complete package. These devices are smart turnkey subsystems, designed to interface with existing or new equipment for commercial, industrial or military applications. Features include:



- Microprocessor boards decoding and I/O management
- MUX inputs
- ARINC and MIL-STD-1553 interfaces
- Customer specified protocols

### Custom LCD Modules

To meet unique requirements, Bowmar offers custom designed LCD Modules to meet aircraft and other applications. Features include:

- Transreflective dichroic LCD with 14 segment characters
- Dot matrix LCDs
- Avionics grade AMLCD modules
- NVIS per MIL-L-85762
- All on-board drive electronics

## Your requirements are unique.

Your applications are different from other customers. That is why we are focused on custom designed solutions. As a leader in the design and manufacture of interface devices and electromechanical assemblies, Bowmar wants to be your partner for solutions and product development that offer the highest in quality and cost effectiveness. We are structured to be responsive to your needs. Our staff is organized to support the customer in all aspects of the design and development process. We serve a world wide client base and want you to think of Bowmar as part of your design and manufacturing team.

## Quality Policy

We, the employees of Bowmar Technologies, are committed to:

- 100% conformance to our customers' requirements
- Error-free work in all areas
- Exceeding our customers' expectations

Bowmar's quality system is designed to comply with ISO 9001 and military requirements. In addition, Bowmar operates to the quality requirements of our individual customers and the respective government and regulatory agencies throughout all process functions.

Quality is the priority at Bowmar. Quality is the responsibility and obligation of every employee at Bowmar, as witnessed by our quality policy. The baseline for our quality and reliability program is the Bowmar Quality Manual, which is available upon request.



ISO 9001 Company

8000 Bluffton Road • Fort Wayne, IN 46809

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# Standard & Customized Keyboards

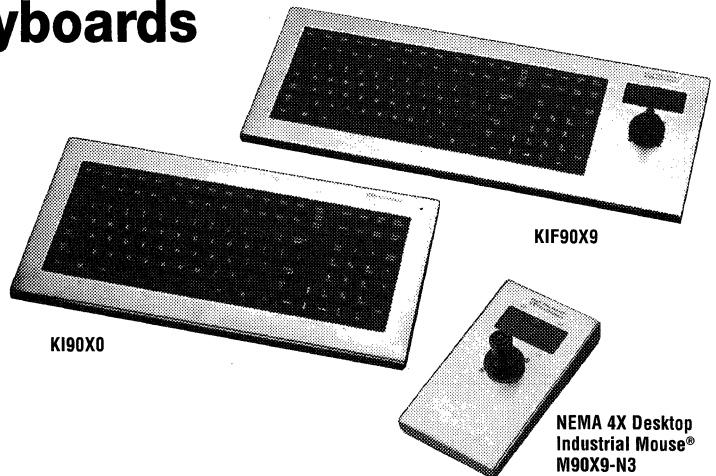
CTI builds the most complete line of NEMA 4X silicone rubber keyboards and rugged NEMA 12 full travel keyboards. CTI designs, manufactures, and stocks all components to guarantee quick delivery. Keyboards and pointing devices are compatible across all platforms.

## Rugged, NEMA 4X Keyboards

### With Optional Industrial Mouse®

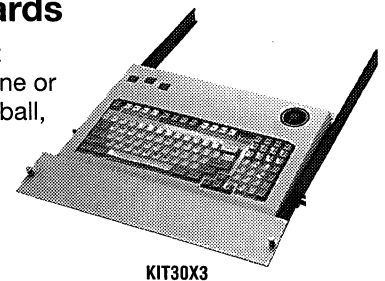
Our rugged silicone rubber keyboard with optional built-in Industrial Mouse is an unbeatable NEMA 4X team. These keyboards resist chemicals, oils, moisture, dirt, and can be hosed down.

- Desktop, panel mount, or OEM configurations
- Perfect balance between ruggedness and ease of use
- Special environmental sealing
- Solid tactile response
- Gold key switch contacts for long life
- Inductive joystick features full travel to  $\pm 20^\circ$  for the finest control, even while wearing gloves
- Optional point and click pushbutton handle



## Rack Mount Keyboards

Wide range of ready-to-mount keyboards, available stand alone or with a built-in joystick or trackball, feature a 3 1/2" fold-down front panel.



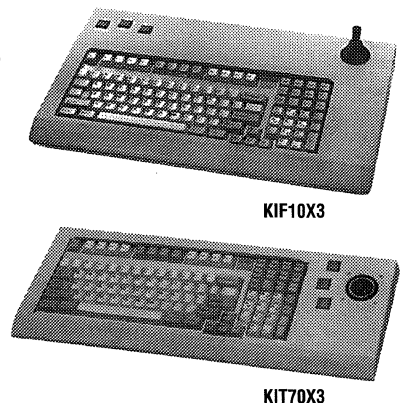
Choose from our wide selection of solid state joysticks and trackballs. Available stand alone, panel mount, or integrated into keyboards.

See our Joysticks and Trackballs ad in EEM Book D, Control Systems & Components, section 2200.

## NEMA 12 Sealed Keyboards

Rugged NEMA 12 keyboards are available stand alone or ready for rack mounting in factory floor environments. Plug and play compatibility with all computers and workstations.

- Sealed keyboard in an attractively styled metal enclosure
- Patented inductive joystick contains no moving parts
- Water resistant trackball (not NEMA rated)
- Rack mount keyboard fits standard 17 3/4" opening
- Keyboard slides on steel rails, rated for 80 lb loads



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Interfacing people and machines

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E-mail: sales@ctielectronics.com • <http://www.ctielectronics.com>

# ..... to meet every need.

## Keyboard Sub-assemblies SILICONE RUBBER OR MECHANICAL

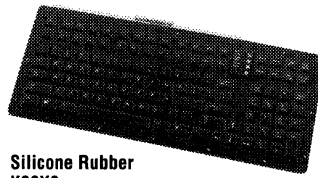
CTI's complete line of sub-assemblies offer an unmatched reputation for reliability and product support. All sub-assemblies feature tactile response and gold contacts.

### CTI encourages customization!

We can meet your requirements for:

- Joystick or trackball pointers
- Environmental sealing
- Custom enclosures
- Drive circuitry, interface electronics
- Programmable macro keys
- Custom legends

We manufacture all components, assuring fast delivery to your schedule.

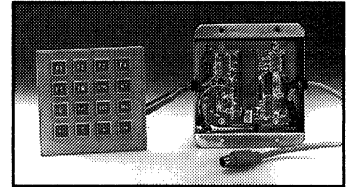


Silicone Rubber  
K88X0



Mechanical  
K48X0

## NEMA 4 Sealed Keypads



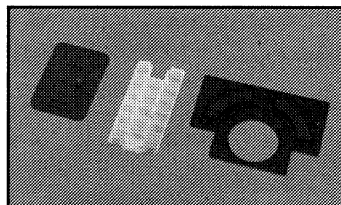
Sealed keypad can be configured up to a 3 keypad array, in 16 key increments interfaced to one electronic control. Customize keys to your requirements. Update key functions in firmware.

## Custom Applications

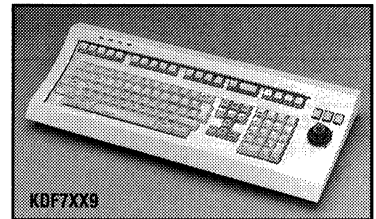
CTI wants to be your standard or custom keyboard supplier. Our aggressively priced, full travel or silicone rubber, sealed keyboards feature "plug and play" compatibility with all computers and workstations.

Keyboard solutions include:

- NEMA 4X, 12 keyboards with or without pointing devices
- Rack or shelf mount keyboards, ready to install
- User specified custom enclosures
- Special key caps and colors
- Desktop, hand held, or panel mount pointers
- Custom interfaces and protocols
- Contact us for your custom keypad systems



Custom keypads



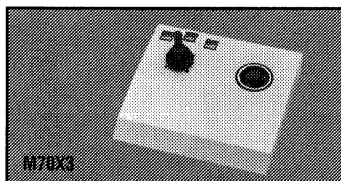
K8F7X9

Digital Equipment keyboard enclosure  
NEMA 12 rated.



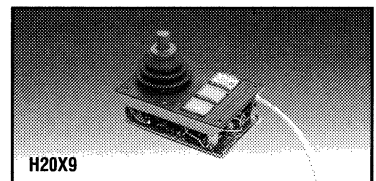
KCT32S3

Sun Microsystems® rack mount  
keyboard.



M78X3

Trackball and joystick combination  
for two hand control



H20X9

NEMA 4X panel mount  
Industrial Mouse®

Industrial Mouse is a registered trademark of CTI Electronics.  
Digital Equipment is a trademark of Digital Equipment Corp.  
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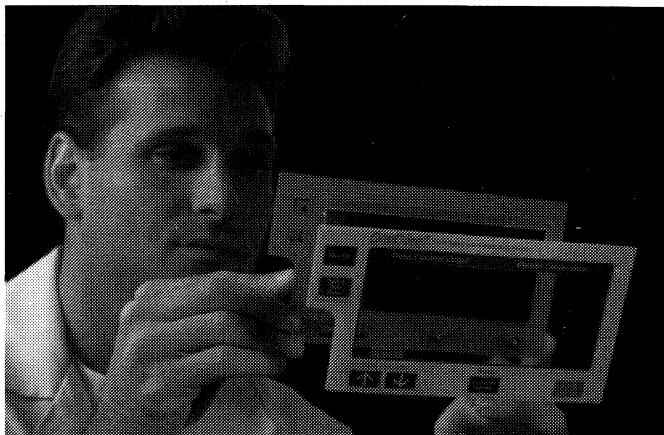
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FAX: 508-295-6752

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## Custom Membrane Keyboards

Working with your technical staff Design Mark's engineers will help you meet the most demanding specifications for both standard and custom membrane switch applications.



### Switch Products

- Flat Membrane
- Elastomer Keypads
- Tactile Feel Membrane
- (Stainless steel and polyester domes)
- Plastic Keys and Frames
- Copper/Kapton® Etched Membrane
- PC Board Membrane
- Fiber Optic, LED, EL Backlit Panels
- Full Range of ESD, EMI/RFI Shielding

### Graphic Enhancements

A wide variety of design options, including...

- Precise Color-Matching
- Hardcoats, Embossing, Deadfronts
- Selective Texturing
- Clear/Coated Lenses and Windows

### Services

- Assembly
- CAD Design
- Full-Service Art and Engineering
- Rapid Prototyping
- EDI (Electronic Data Interchange)
- Laser Cut Prototypes

### Quality Control

- Clean Room Manufacturing
- Statistical Process Control
- XY Coordinate Measuring
- Computer Color Matching
- 100% Visual and Electrical Testing
- Dock to Stock Certification
- Laser Die Tooling

### Materials

- Polycarbonate
- Polyester
- Acrylic
- FlexTek™
- Adhesive etc...

### Specifications & Typical Operating Characteristics

E-mail us: support@design-mark.com with your specifications

Operating Voltage	30 Volts DC Typical
Operating Current	20 Milliamps Typical
Contact Resistance	Layout Dependent
Power Rating	1.5 Watt Maximum
Insulation Resistance	1 Meg Ohms Minimum
Contact Bounce	20 Milliseconds Max.
Life Expectancy	1 x 10 <sup>6</sup>
Operating and Storage Temp.	-20°C to +65°C
Actuation Force	5 to 15 oz. Typical



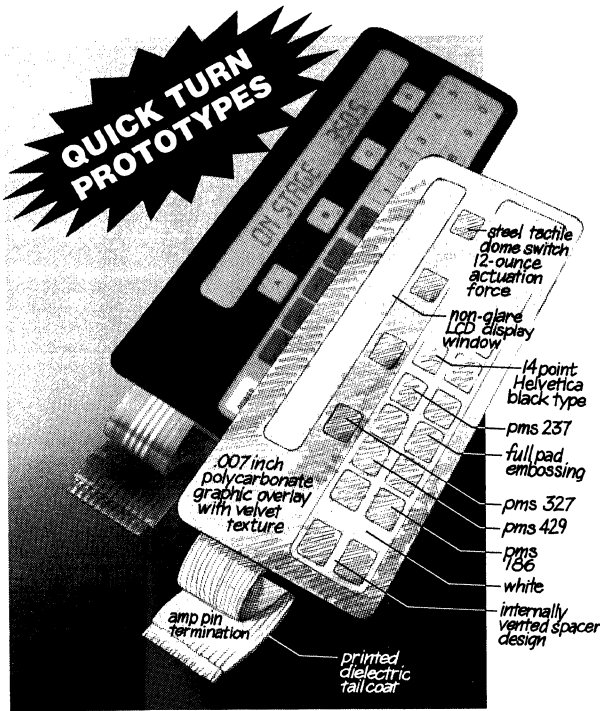
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for Professional Graphic Impact**

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# Membrane Switches Made Right!

When you need membrane switches that work right and get delivered on time, Douglas makes it happen.

Specifications can include:

- Contact ratings to 100 milliamps at up to 24 Volts DC with less than 100 Ohms closed contact resistance
- Steel or polyester tactile domes
- Printed silver or graphite inks on polyester films
- ESD and RFI shielding

## Ask Us For A Proposal

Our extensive in-house services make Douglas extremely competitive on all parts of your switch program. These include:

- Graphic Overlays
- Complete Switch Assemblies
- Water Resistant designs
- Metal or plastic Bezels and Back-Plates
- And Much More!

## Specifications

### Electrical

**Operating Voltage:** 0-24 VDC

**Operating Current:** 100 MA Max.

**Operating Contact Resistance:**

Less than 100 OHMS typical (as measured connector).

**Contact Bounce:** Less than 10 Milliseconds typical.

**Conductors:** Printed silver conductive inks or carbon blend.

(PC board assemblies available).

**RFI and Static Shielding:** Available in most configurations.

### Mechanical

**Life Expectancy:** DOUGLAS guarantees one million actuations per switch position or 12 months.

**Actuation Force:** 4 - 16 oz. range available—depending on customer specification. (4- 8 oz. is considered medium actuation force for non-tactile configuration).

**Switch Travel:** .005" to .030" typical.

**Overall Thickness:** .020" to .050" typical.

### Environmental

**Storage Temperature:** -40°C(-40°F) to +70°C(158°F)

**Storage Altitude:** Sea level to 40,000 feet.

**Operating Temperature & Altitude:**

Variable depending on customer requirements. (can be designed to operate in most environments).

**Humidity:** No delamination after 24 hours at 65°C and 95% RH. With designed construction.

*The specifications above are general. For information on more specific applications, contact one of DOUGLAS CORPORATION'S design engineers.*

## Design Considerations

**MATERIALS:** Depending on the application and environmental requirements, Polyester and Polycarbonates are commonly used. Thickness ranges are .007" to .010". Blended materials and UV hardcoat surfaces are additional options.

**SELECTIVE TEXTURING:** For hardcoats as well as aesthetic enhancement of graphic overlay.

**EMBOSSING:** Embossing of the key pads for key location can be achieved by full key pad embossment or rim embossment.

**WINDOWS:** Transparent and deadfront display windows for viewing LCD and LED displays.

**TERMINATION:** Tail termination is accomplished by snap fit connectors, solder tabs, or exposed silver tabs. .100" centers standard.

**TACTILE FEEDBACK:** Stainless steel domes, formed polyester domes and tactile overlays.

**SHIELDING:** Shielding for ESD/RFI can be accomplished by a layer of metallized polyester or screening a layer of graphite.

**BACKLIGHTING:** Douglas offers several options from Electroluminescent, fiber optics, or translucent copy to allow light penetration of customer supplied light source.

**PANEL CUTOUTS:** Die cut holes and access from mechanical switches incorporated into membrane switches.

**BACK-PLATES AND PRINTED CIRCUIT BOARDS:** Available as finished assembly with Douglas membrane switches.

**ENVIRONMENTAL DESIGN:** Applications subject to various degrees of moisture or high humidity are engineered and constructed accordingly.

### GRAPHIC DESIGN AND ENGINEERING ASSISTANCE:

Full service art and engineering departments are ready to provide complete or partial assistance in the aesthetic design of graphic overlays and engineering the correct switch construction for your application.

## Quotation Request

- Switch application.
- Quantities required for prototypes and production.
- Graphic overlay material, polycarbonate or polyester.
- Finish required, velvet or glossy.
- Number of colors to be printed on graphic overlay.
- Overall dimensions or prints.
- Embossing full keypad, raised key outline.
- Type of termination required and tail length.
- Dome type, if tactile feel is needed.
- Other special requirements.

**Ask about our JIT delivery programs!**

**Ask about UL approved switch construction!**

**DOUGLAS CORPORATION**

7180 WASHINGTON AVENUE SOUTH  
EDEN PRAIRIE, MN 55344-3512

TEL: (612) 941-2944

FAX: (612) 942-3125

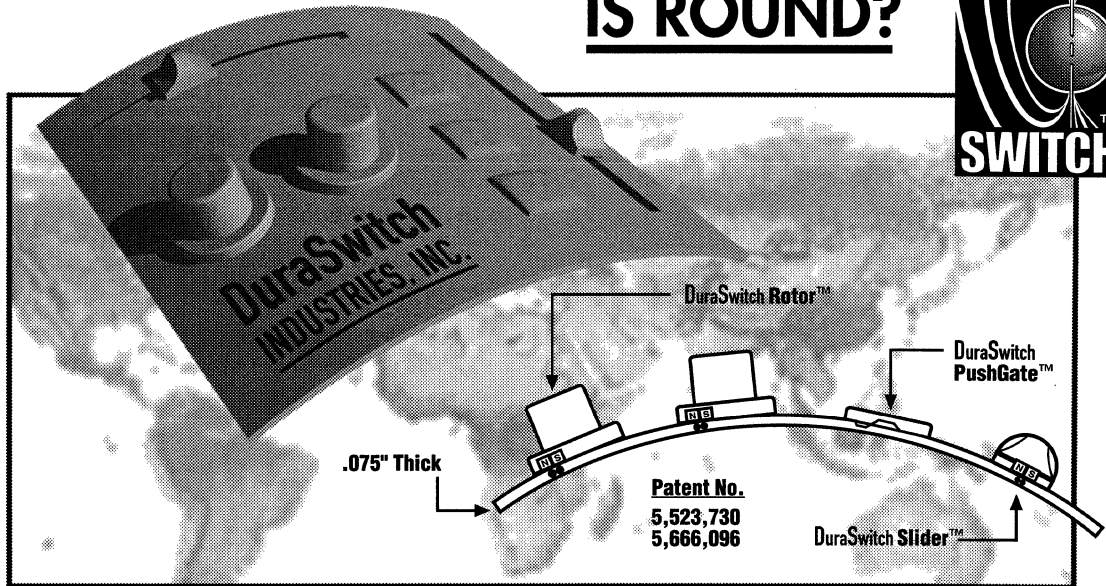
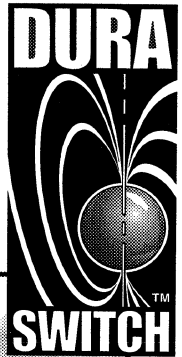
*Call for your FREE copy of our 16-page Capabilities Guide.*

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**For 25 Years, Membrane Switch Manufacturers  
Have Been Telling You That THE WORLD IS FLAT!**

# WHAT IF THE WORLD IS ROUND?



## Design Your Switch Panel for the 21st Century...

- Exercise Machines
- ATMs
- Appliances
- Control Panels
- Automobile Dash Panels
- Test Equipment
- Medical Monitors
- Electronic Switches

**Why is our trademark...DuraSwitch™?**  
 Because we **guarantee\*** that our patented switches will out-last your product warranty!  
**TESTED BEYOND  
 20 MILLION CYCLES**

**DOMES COLLAPSING?**

**EXTREME ENVIRONMENTS?**

**TEASING PROBLEMS?**

**EARLY FAILURES?**

**INCONSISTENT ACTUATION FORCE?**

# DuraSwitch™ IS YOUR ONLY SOLUTION!

DuraSwitch™ new patented technology incorporates the *feel and durability* of your favorite mechanical switches with the *low profile and low cost* you associate with membranes.

**ENGINEERING CAPABILITIES:**

- ✓ Mechanical Design
- ✓ Electronic Design
- ✓ Pro-E®
- ✓ AutoCad® 12, 13, 14
- ✓ PC & Mac

DuraSwitch™ engineers on call to assist in custom design:

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 web www.duraswitch.com  
 e-mail erics@duraswitch.com  
 FAX 602-844-9625

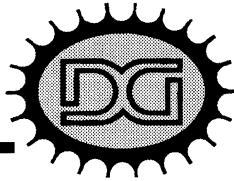
FREE DuraSwitch™ sample on request.

**DuraSwitch™  
INDUSTRIES, INC.**

## INTEGRATED ELECTRONIC SWITCH PANELS

\*specific warranty details available with each custom design

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**Dyna-Graphics  
CORPORATION**

4080 Norax Drive, Chaska, Minnesota 55318  
Phone (612)368-3344 FAX (612)368-3388

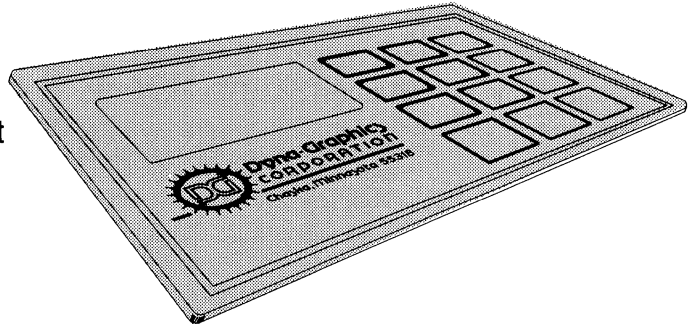
www.dyna-graphics.com • Email available through our Web Page

## CELEBRATING 25 YEARS OF GROWTH AND INNOVATION

Our *Excellent Customer Service* and *Quick Responsiveness* have helped Dyna-Graphics earn a GREAT Reputation in the industry. That's why our Customers tell us:

***"It's EASY to do business with Dyna-Graphics!"***

- Committed to Performance Excellence
- Full in House Design & Cad Engineering
- SPC and Continuous Quality Improvement
- Excellence in Customer Service
- Modern Facility and Equipment
- Creative People Working for You



### OUR PRODUCTS INCLUDE:

Membrane switches  
PCB Membrane Switches  
Transparent Membrane Switches  
Labels and Overlays  
Products on Metal Panels  
Turnkey Component Purchasing

### WE SPECIALIZE IN:

K-Motion Switches  
Keyboards Sealed From Moisture  
Rugged Line Keyboards  
Metal or Plastic Domes  
Excellent Design Capabilities  
Custom Testing and Packaging

### TYPICAL SPECIFICATIONS

<b>Environmental</b>	Operating Temperature:	-20° to 65°C (-4° to 149°F)
	Storage Temperature:	-40°C to 85°C (-40° to 185°F)
	Seals:	3M permanent acrylic adhesive resists against dust, water, oil and moisture conditions
	Special sealing options are available for wet environments	

<b>Mechanical</b>	Travel:	.001 inches to .070 inches
	Operating Force:	2 oz. to 16 oz.

<b>Electrical</b>	Operating Voltage:	30 volts maximum
	Operating Current:	10 microamps to 100 milliamps, resistive
	Closed Circuit Resistance:	100 ohms typical, dependent on size and layout
	Open Circuit Resistance:	10 megohms
	Operating Power:	1 watt maximum
	Circuitry:	X-Y matrix or one side common



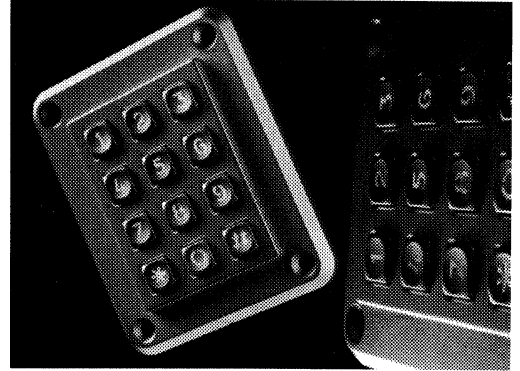
**Dyna-Graphics  
CORPORATION**

**3M Preferred  
Converter**

# e a o ■

## New! S-Series Keypads—Solid Like A Rock

A new all-metal, vandal-proof keypad is designed for high-use public applications and heavy duty commercial or industrial duty. The rugged S-Series features optional individual key LED illumination, anti-pull-off keys with tactile feel for positive operation, and front sealing to IP-67 for protection against weather and hostile environments. Available in 12-key standard or telephone styles and 16-key hexadecimal. Users can choose matrix or common point wiring; color of illumination and custom key markings are available on special request. Contact EAO for a technical data sheet containing specifications and dimensions.



S-Series telephone style illuminated keypad

### Keypads

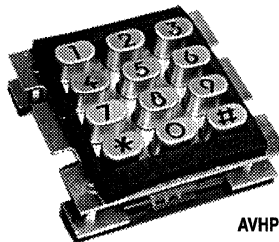
EAO Switch Corp. offers a wide selection of quality keypads ranging from rugged all-metal models designed to resist vandalism to economy units priced for low-cost applications.

Most models are available in 12-key telephone style and 16-key hexadecimal layouts. Many offer matrix or common point circuitry, sealed construction for outdoor or industrial environments, and gold contacts for reliable low level operation.

Keypads are available with individual key LED illumination, flush mounting, snap-in legends and keycaps, and special sizes from 4 to 36 keys. In all, there are 13 different keypad models available for your specific application.

Descriptions of all the keypads including features, specifications, photographs,

dimensions, and mounting information is included in the Keypad Catalog, in the Special Keypad Selection Guide, and on the internet. Request more information today. A few models of particular interest include:



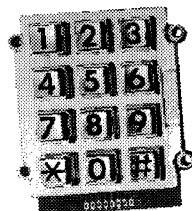
AVHP

#### AVHP

An extremely rugged all metal anti-vandal keypad with o-ring sealed anti-pull off keys for tough applications.

#### ECO METAL

An economical bright metal front keypad with anti-vandal construction.



ECO METAL

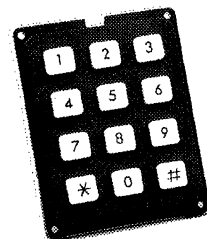
#### AVL

A sealed keypad available with individually-illuminated or non-illuminated, vandal-resistant, engraved keys.



AVL

Telephone style model features gold contacts for more than 1-million operations.



ECO

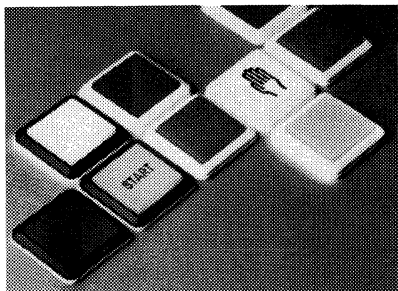
#### ECO

Our lowest priced keypad for non-critical applications features 12 or 16 keys, flush mount, and 1-million operations. An ideal selection for high volume applications.

# Real-World Switching Solutions

## Custom Panels and Assemblies

As leaders in the design of front panels, control panels, keyboards, and membrane assemblies, EAO Switch Corp. works closely with you to create the custom assembly that's right for your system. We'll analyze your drawings and specifications to deliver fast, accurate quotations, quick-turnaround evaluation prototypes, and outstanding production assemblies.

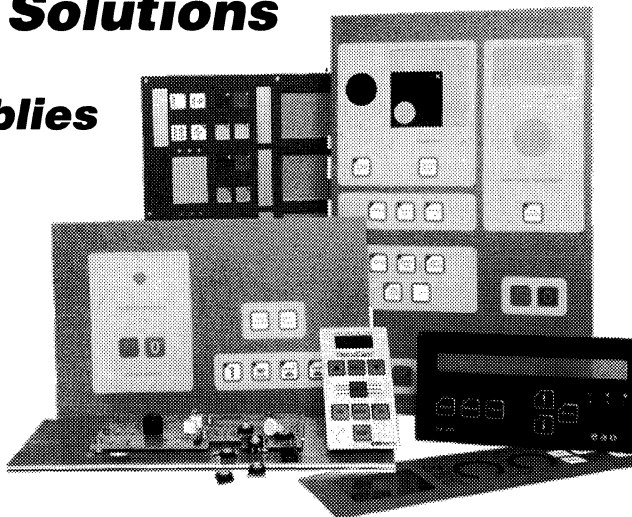


## OEM & Value Added Services

When you need those special services only an experienced 50-year-old switch company can provide, turn to EAO.

We will modify or redesign one of our outstanding switches to meet your requirements. Or, if necessary, develop a complete new switch—designed just for your special application.

When you need help customizing off-the-shelf switches for a particular installation turn to EAO's value added operation. Special lens and key cap markings including engraving, stamping, and film inserts are available as are other services such as wiring, connectors, assembly, and more. EAO doesn't just sell switches, we sell solutions.

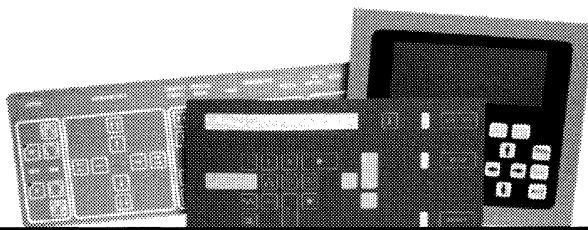


EAO will guide you through the design process, produce or utilize your CAD documents, and develop equipment to meet the most demanding real-world switching specifications.

Quality switches are the backbone of our business. By assembling work-proven components into convenient drop-in panels we save you production time and cost. Fully tested, ready-to-run front panel and control panel assemblies can include readout devices plus custom electronics and enclosures.

EAO also is ready to turn your front panel requirements into a modern trouble-free membrane switch system using high quality switch elements for smooth tactile feel operation. These advanced systems offer full key illumination, repair and replacement of individual switching functions, and the ability to operate even when the overlay is damaged.

Contact EAO today for more information about custom panels and services.



## Contact EAO

### EAO Switch Corporation

198 Pepe's Farm Road, Milford CT 06460, 203 877-4577, Fax: 203 877-3694

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**e a o** ■



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## FLEXIBLE SOLUTIONS

### CUSTOM MOLDED ELASTOMER Seals, Gaskets, Keypads, Keyboards...

FEI is a technology leader in compression and liquid injection molding of high performance silicone rubber products. We provide both components and assemblies utilizing conductive, non-conductive and self-lubricating silicones. FEI has pioneered numerous innovations in bonding, insert and overmolding of metals and plastics. We've also developed many proprietary finishing techniques including wear-resistant printing, laser etching, legend protection coatings and hardcaps as well as press-fit and bonded plastic keys.

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Silicone rubber's unique ability to be molded into complex, attractively finished, flexible parts that perform over a wide temperature range has resulted in its extensive use in many applications including:

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- Business Equipment
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- Factory Floor
- Home Appliance
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- Telecommunication

# FEI

*From Design Concept through Production,  
FEI Provides Flexible Solutions*

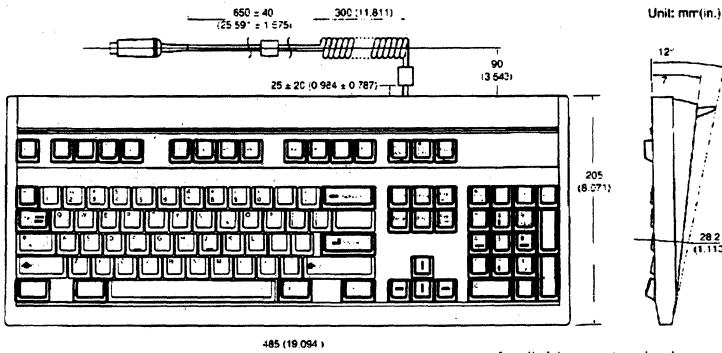
**FLEXFAB ELASTOMERIX, INC.**

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Tel 310-604-7600 • Fax 310-604-7602

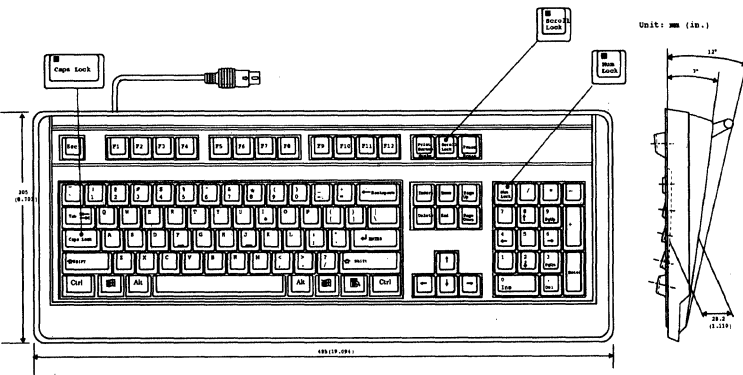
[www.fei-elastomerix.com](http://www.fei-elastomerix.com)

**On-shore Design, Prototyping and Production**

**FUJITSU KEYBOARD FKB 4720/4725 SERIES**

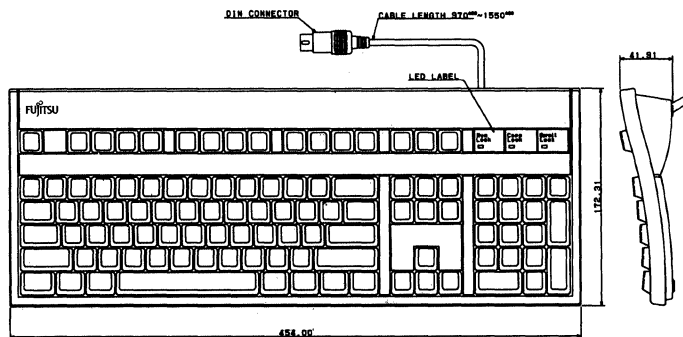


Available as standard, semi-custom, or full custom product.



Mechanical		
Item	Specification	
Operating force	55g ± 25g	
Stroke	3.8 ± 0.5mm (.150 ± .020in.)	
Tactile	20g typ, SHARP	
Operating life	30M ops. min.	
Number of keys	US: 101/104 Other: 102/105	
Keypop	Shape	Rectangular cylindrical
	Form	Sculpted (curved)
Tilt	2 levels	
Environmental		
Operating temp.	0 to 50°C	
Storage temp.	-20 to 60°C	
Humidity	90% RH at 40°C max inverse proportional change to 50% RH at 60°C	
Electrical		
Contact resistance	500Ω max. (5V DC, 1mA)	
Power supply	5 ± 0.25V DC, 250mA max.	
Interlock	F-key roll over	
Repeat	All keys (AT* mode: repeating rate specified by command)	
Interface		
Data transmission	Serial transmission (synchronous system)	
Data Format	AT* mode 11 bit (1 start + 8 data + 1 parity + 1 stop)	
Connector	5-pole DIN connector (6-pole Mini DIN connector available)	

**FUJITSU KEYBOARD FKB 8725/8735 SERIES**



Mechanical		
Item	Specification	
Operating force	55g ± 25g	
Stroke	3.8 ± 0.5mm (.150 ± .020in.)	
Tactile	20g typ, SOFT	
Operating life	10M ops. min.	
Number of keys	US: 104 Other: 105	
Keypop	Shape	Rectangular cylindrical
	Form	Sculptured (step)
Tilt	2 levels (5°/10°)	
Environmental		
Operating temp.	10 to 50°C	
Storage temp.	-20 to 60°C	
Humidity	90% RH at 40°C max inverse proportional change to 50% RH at 60°C	
Electrical		
Contact resistance	1K max. (5V DC, 1mA)	
Power supply	5 ± 0.25V DC, 100mA max.	
Interlock	F-key roll over	
Repeat	All keys (AT* mode: repeating rate specified by command)	
Interface		
Data transmission	Serial transmission (synchronous system)	
Data Format	AT* mode 11 bit (1 start + 8 data + 1 parity + 1 stop)	
Connector	5-pole DIN/6-pole Mini DIN	

\* AT and XT are trademarks of International Business Machines Corporation.



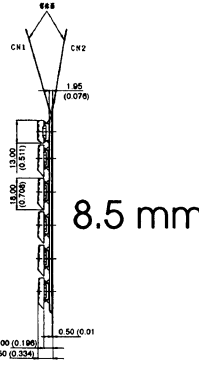
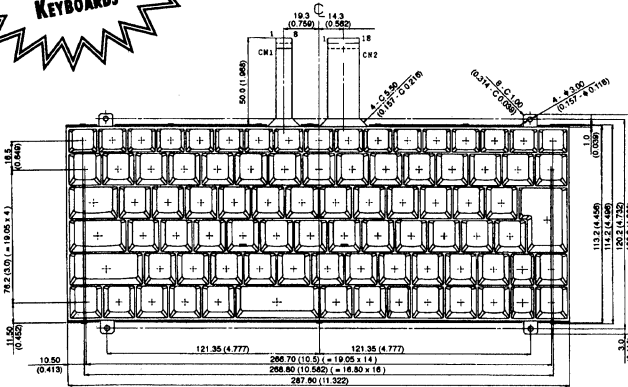


F U J I T S U K E Y B O A R D F K B 7 4 0 0 S E R I E S

**PLEASE VISIT THE FTA WEBSITE FOR LATEST KEYBOARDS**

FKB7401

**NEW**

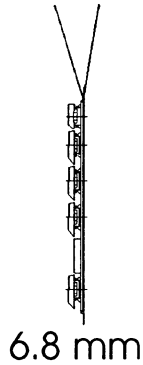
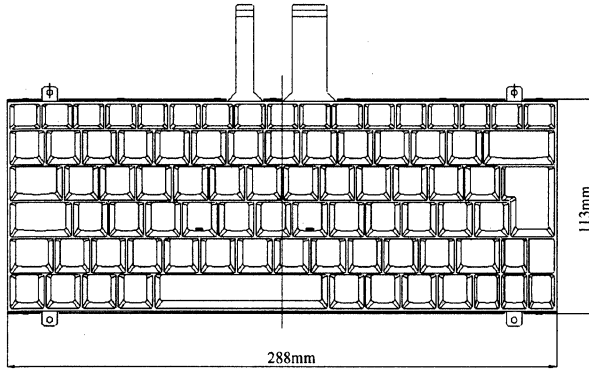


Mechanical	
Item	Specification
Operating force	55g typical
Stroke	3.0mm
Tactile response	20g typ
Matrix Size / Connector	8 x 16 / 1.25mm pitch
Weight	130 grams
Environmental	
Operating temp.	0 to 50°C
Storage temp.	-20 to 60°C
Humidity	20 to 90% RH max., at 40°C inverse proportional change to 50% RH from 40 to 60°C
Vibration	10-55-10 Hz/min., 0.15mm
Shock	10G, 11ms
Operating Life	10M Operations minimum
Electrical	
Contact resistance	1KΩ max @ 5 VDC
Insulation Resistance	50MΩ max.
Dielectric Strength	250 VDC, 1 minute
Contact Bounce	10 ms max.

F U J I T S U K E Y B O A R D F K B 7 6 0 0 S E R I E S

**NEW**

FKB7603

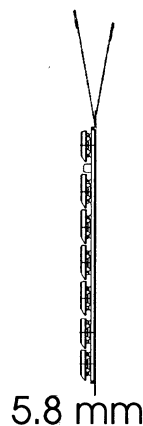
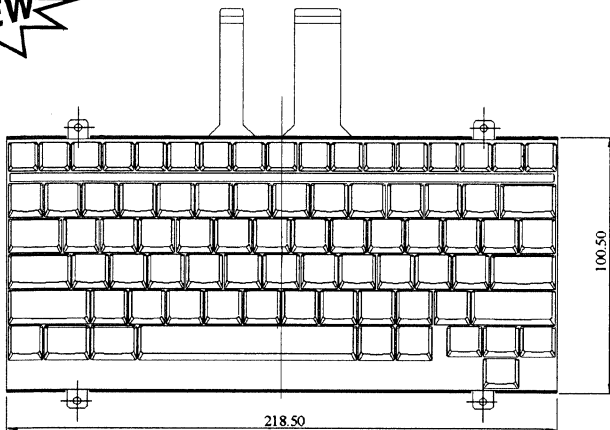


Mechanical	
Item	Specification
Operating force	55g typical
Stroke	3.0mm
Tactile response	20g typ
Matrix Size / Connector	8 x 16 / 1.25mm pitch
Weight	120 grams
Environmental	
Operating temp.	0 to 50°C
Storage temp.	-20 to 60°C
Humidity	20 to 90% RH max., at 40°C inverse proportional change to 50% RH from 40 to 60°C
Vibration	10-55-10 Hz/min., 0.15mm
Shock	10G, 11ms
Operating Life	10M Operations minimum
Electrical	
Contact resistance	1KΩ max @ 5 VDC
Insulation Resistance	50MΩ max.
Dielectric Strength	250 VDC, 1 minute
Contact Bounce	10 ms max.

F U J I T S U K E Y B O A R D F K B 7 6 5 0 S E R I E S

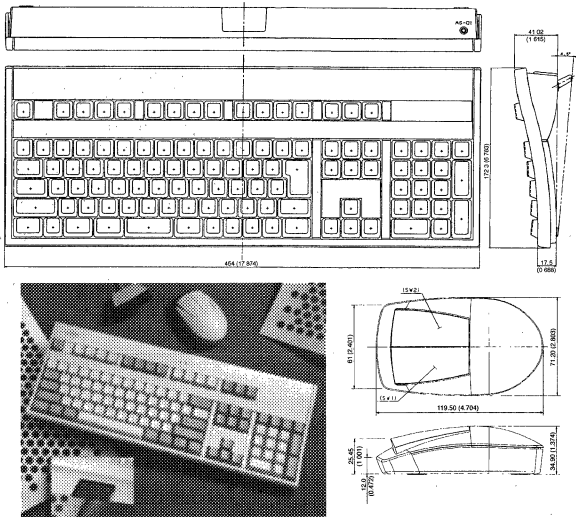
**NEW**

FKB7654



Mechanical	
Item	Specification
Operating force	55g typical
Stroke	2.0mm
Tactile response	20g typ
Matrix Size / Connector	7 x 14 / 1.25mm pitch
Weight	90 grams
Environmental	
Operating temp.	0 to 50°C
Storage temp.	-20 to 60°C
Humidity	20 to 90% RH max., at 40°C inverse proportional change to 50% RH from 40 to 60°C
Vibration	10-55-10 Hz/min., 0.15mm
Shock	10G, 11ms
Operating Life	5M Operations minimum
Electrical	
Contact resistance	1KΩ max @ 5 VDC
Insulation Resistance	50MΩ max.
Dielectric Strength	250 VDC, 1 minute
Contact Bounce	10 ms max.

# FUJITSU WIRELESS KEYBOARD AND MOUSE COMBO FKB 8775 SERIES

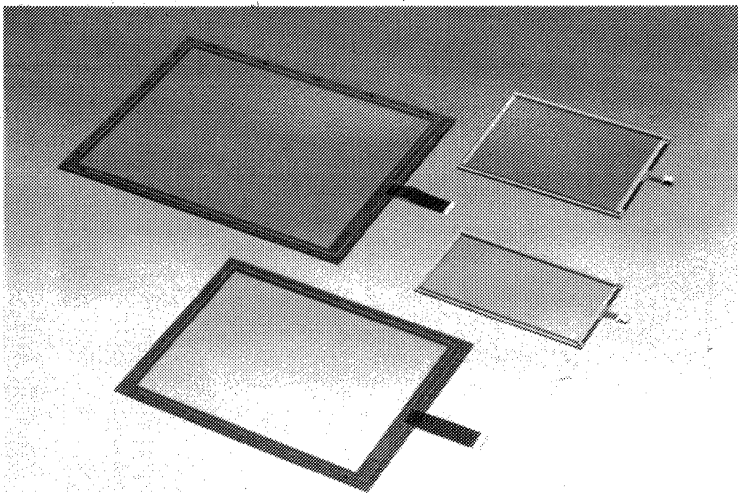


Mechanical	
Item	Specification
No. of Keys	(1) U.S.: 104 keys (2) Europe: 105 keys
Key switch type	Membrane switch
Operating force	55 gf ±25gf
Stroke	3.8mm ±0.5mm
Tactile	20gf typ. soft
Operating life	10M operations min.
Tilt	2 levels
Electrical	
Power supply/life	2 AAA / 6 months
Interface	IR 10kbps
Interlock	F-key rollover
Environment	
Operating Temp	+10° to 50° C
Storage Temp	-10° to 60° C
Humidity	90% RH max at +40° C max

Mechanical	
Item	Specification
Detection method	Optical sensor
No. of switches	2 buttons
Resolution	0.25 mm/pulse
Tracking speed	200 m/s max.
Tracking life	300 km min.
Switch life	3M operations min.
Weight	100g typ.
Electrical	
Power supply/life	2 AAA / 6 months
Interface	IR 10kbps
Environment	
Operating Temp	0 to 40° C
Storage Temp	-15° to 60° C
Humidity	90% RH max at +40° C max

Electrical	
Item	Specification
Power supply	+5V ±0.25V DC, 100mA max
Interface - KB/mouse	IR 10kbps
Interface - Host	Dual PS/2, keyboard & mouse
Interlock	F-key rollover
Connectors	Mini-DIN 6 pin
Environment	
Operating Temp	-10 to 50° C
Storage Temp	-10° to 60° C
Humidity	90% RH max at +40° C max

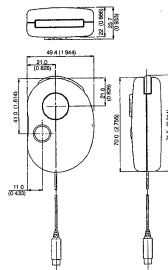
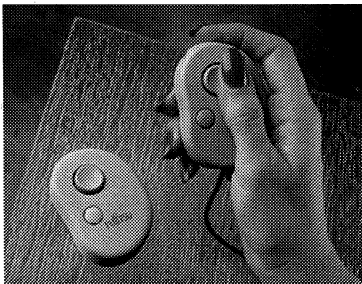
# FUJITSU PEN INPUT/TOUCH PANEL FID-550/FID-554 SERIES



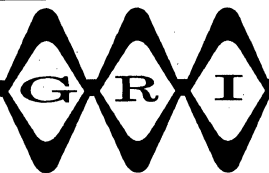
Item	Mechanical				Note	
	FID-550 Series		FID-554 Series			
	Pen	Pen/Finger	Pen	Pen/Finger		
Operation force	Pen	100g max	80g max	100g max	80g max	*1
	Finger	500g max	80g max	500g min	80g max	*2
Transparency	80% typ. (83.5% typ. OPTION)					
Haze	5% typ. (3% typ. OPTION)					
Hardness	2H min.				*3	
Linearity	1.5% max				*4	
Writing life	1M words min.		100k words min.		*5	
Knocking life	10M operations min.		1M operations min.		*6	
Electrical						
Power supply	+5V or +3.3V DC					
Resolution	0.1mm					
Sampling Rate	192 pps max.				*7	
Transmission Rate	9,600 tps					
Consumption	20 mA max.				*8	
	Op. mode	15 mA typ.				
	Sleep mode	0.4 mA typ.				
Insulation Resistance	10 M ohm min.					
Environment						
Operating Temp.	-5 to 80° C		-5 to 60° C			
Storage Temp	-50 to 85° C		-30 to 70° C			
Operating Humidity	20 to 90% RH					
Storage Humidity	10 to 90% RH				*9	

Notes) Above specification are based on our standard conditions  
 \*1: Push by plastic (R0.8)  
 \*2: Push by silicon rubber (R8, H=60°)  
 \*3: by pencil  
 \*4: Based on location accuracy spec.  
 \*5: Force by plastic (F0.8) (S0g)  
 \*6: Force by silicon rubber (H=60°), 200g, 5Hz  
 \*7: Variable by command  
 \*8: at V<sub>cc</sub> = +5V  
 \*9: Noncondensing

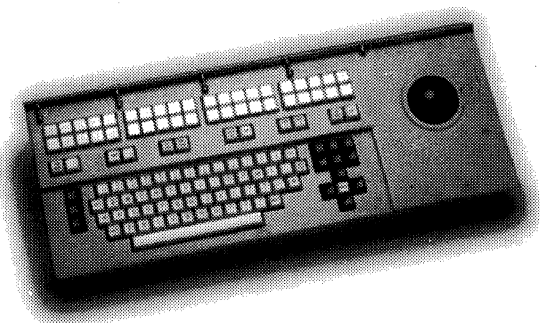
# FUJITSU PALM MOUSE FID-824 SERIES



Mechanical	
Item	Specification
Detection method	Unique magnetic field detection technology
No. of switches	1M strokes min.
Operating life	300 km min.
Switch life	1M operations min.
Weight	30g typ.
Electrical	
Power supply/l	+5V±0.25VDC, 20mA max
Interface	Clock synchronous serial transmission (PS/2)
Environment	
Operating Temp	0 to 40° C
Storage Temp	-15° to 60° C
Humidity	90% RH max at +40° C max



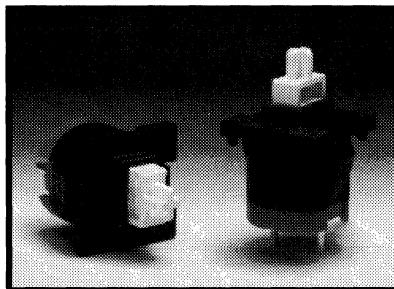
**CUSTOM KEYBOARDS,  
PANELS & KEYPADS**



**CUSTOM ENGRAVED KEYCAPS  
HUNDREDS OF STYLES TO CHOOSE FROM**



**PUSHBUTTON SWITCHES**



George Risk Industries has served the O.E.M. market for over 30 years in standard and custom designed data entry peripherals. Our team of engineers will take your original concept through to delivery of production units with the highest quality and reliability. Whatever your requirements - Keyboards or Keypads; let G.R.I. assist in resolving your design problems. G.R.I. is a company that specializes in engineering and manufacturing.

- INTERFACES
- MILITARY
- DRY REED OR MECHANICAL
- ILLUMINATED
- PROTOTYPES
- COMMERCIAL
- ENGRAVING TO SPEC
- FAST TURN AROUND
- SOFTWARE
- AEROSPACE
- LOW TO MEDIUM QUANTITIES
- INDUSTRIAL
- CUSTOM WIRE HARNESSSES

**PROXIMITY SENSORS**

**SPV-40**  
Dimensions: 1.13", 12.95mm, 0.35", 0.25", 0.14", 0.11"

**P-20**  
Dimensions: 1.13", 28.70mm, 0.25", 0.35", 0.15", 0.37", 0.40", 0.37"

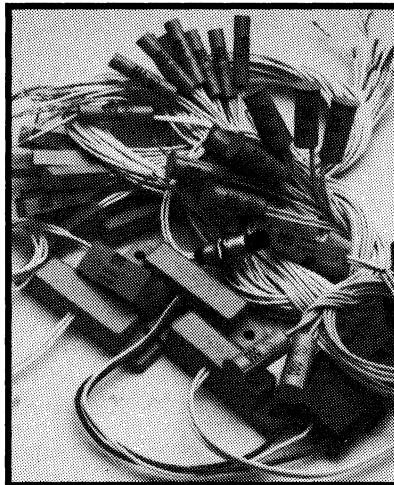
**PS-50**  
Dimensions: 1.125", 28.58mm, 0.230", 6.35mm

**P-10A**  
Dimensions: 1.13", 28.70mm, 0.75", 0.05mm

**P-30**  
Dimensions: 1.13", 28.70mm, 0.25", 6.35mm

**PS-2020**  
Dimensions: 1.200", 30.51mm, 0.315", 8.0mm

G.R.I. offers a wide selection of keyswitches: illuminated or non-illuminated, incandescent lamp or LED, dry reed or mechanical for commercial, aerospace, industrial or medical applications. Custom orders welcome.

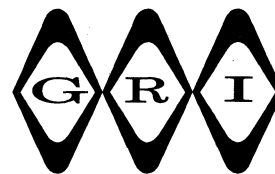


**G.R.I. PROXIMITY SENSORS** are encapsulated reed switches actuated by a magnetic field. These sensors are excellent when used on interlocks. G.R.I. Application Engineers are available to answer questions on our standard product line or to assist with your custom design requirements.

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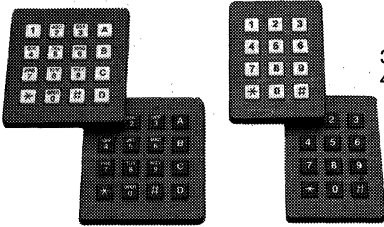


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# Keyboards and Keypads

This page describes GRAYHILL's popular 3x4, 4x4 and 5x4 keypads. Contact GRAYHILL, if you require a different configuration. Any button arrangement can be configured with our modular keyboard systems.

## CONDUCTIVE RUBBER KEYPADS



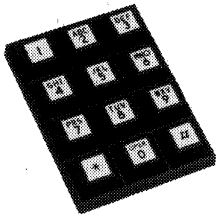
3 x 4-2.7" (68,58) x 2.0" (50,8)  
4 x 4-3.0" (76,2) x 2.2" (55,88)

### SERIES 96

Quality, economical 3x4 and 4x4 conductive rubber keypads. Available options are E.L. panel backlighting (EL=backlit) and EMI/RFI shielding (S=shielded), contact Grayhill for specifications and rear mounting versions. Operations per button: 3,000,000 for standard versions, 1,000,000 for backlit and shielded. Compatible with high resistance logic circuitry and excellent operator feedback. Matrix circuitry. Rated for 5mA @ 12Vdc for 0.5 sec. -30°C to +80°C operating temperature. Front (top) panel (F=front mount) or rear (flush) panel mounting. Type numbers with -102 and -006 feature black-on-white legends. Type numbers with -152 and -056 feature white-on-black legends. 4x4 legends are alphanumeric telephone plus A thru D; 3x4 are numeric telephone.

3 x 4 Configuration Part Number		4 x 4 Configuration Part Number	
96AB2-102-F	96AB2-152-F	96BB2-006-F	96BB2-056-F
96AB2-102-FS	96AB2-152-FS	96BB2-006-FS	96BB2-056-FS
96AB2-102-F-EL	96AB2-152-F-EL	96BB2-006-F-EL	96BB2-056-F-EL
96AB2-102-FS-EL	96AB2-152-FS-EL	96BB2-006-FS-EL	96BB2-056-FS-EL

## ENVIRONMENTALLY SEALED KEYPADS



3 x 4-3.1" (78,74) x 2.35" (59,69)  
4 x 4-3.1" (78,74) Square

### SERIES 84S

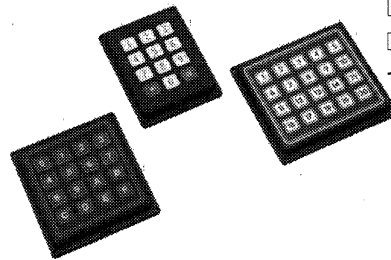
12 or 16 button keypads have a one-piece black silicone rubber boot which completely seals the switch contacts and the panel cutout. Audible snap-dome contact is gold-plated; resistance is MOS, TTL, and DTL compatible. Life is million operations per button. RFI/EMI shielding is standard. White buttons, on 0.75" (19.05) centers, are removable and interchangeable. Keypads are mounted by four studs #6-32; nuts are included. C in type number indicates single pole/common bus circuitry; others have matrix (XY) circuitry. Part number suffix indicates legend.

3 x 4 Configuration Circuitry		4 x 4 Configuration Circuitry	
Part Number	Part Number	Part Number	Part Number
<b>EMI Shielded</b>			
Matrix	84S-AB2-112-N	Matrix	84S-BB2-014-N
Matrix	84S-AB2-113-N	Matrix	84S-BB2-016-N
SP/Common	84S-AC2-112-N	SP/Common	84S-BC2-014-N
SP/Common	84S-AC2-113-N	SP/Common	84S-BC2-016-N
<b>Non-Shielded</b>			
Matrix	84SN-AB2-112-N	Matrix	84SN-BB2-014-N
Matrix	84SN-AB2-113-N	Matrix	84SN-BB2-016-N
SP/Common	84SN-AC2-112-N	SP/Common	84SN-BC2-014-N
SP/Common	84SN-AC2-113-N	SP/Common	84SN-BC2-016-N

1 2 3	1 2 3 C
4 5 6	4 5 6 D
7 8 9	7 8 9 E
* 0 #	A 0 B F
-112	-014
1 2 3	1 2 3 A
4 5 6	4 5 6 B
7 8 9	7 8 9 C
* 0 #	* 0 # D
-113	-016

## 3 X 4, 4 X 4 AND 5 X 4 SEALED KEYPADS

3 x 4-3.0" (76,40) x 2.2" (55,80)  
4 x 4-3.0" (76,40) x 2.7" (65,58)  
5 x 4-3.0" (76,40) x 3.2" (81,28)



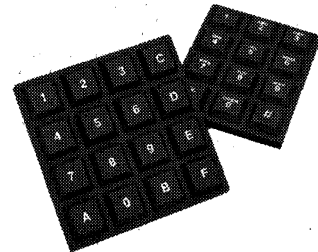
1 2 3	0 1 2 3
4 5 6	4 5 6 7
7 8 9	8 9 A B
* 0 #	C D E F
-172, -182	-072, -082
1 2 3 4 5	
6 7 8 9 10	
11 12 13 14 15	
16 17 18 19 20	
-292	

### SERIES 88

Keypads have the contact system sealed by a graphic overlay. The polyester overlay is printed on the back side eliminating legend wear. The keypad is flange mounted and can be sealed to the panel by a gasket. Gaskets are available for mounting the keypad to the top of the panel or from the back side of the panel. Standard legends are available as shown above. The -172 and -072 versions have white legends with blue accents. The -292 has black legends with silver accents. Keypads are 0.36" (9,14) overall height. Rated for 3 million operations at 10mA 24Vdc. Logic compatible with 4mS bounce at make and 10mS at break. Operating temperature -40°C to +80°C.

Description	Part Numbers		
	3 x 4	4 x 4	5 x 4
Matrix	88AB2-172	88BB2-072	—
SP/Common	88AC2-172	88BC2-072	—
Matrix	—	—	88JB2-292
SP/Common	—	—	88JC2-292
Back Panel Gasket	88M2001-2	88M2009-2	88M2019-1
Top Mount Gasket	88M2012-1	88M2015-1	88M2018-1

## LOW PROFILE ENVIRONMENTALLY SEALED KEYPADS

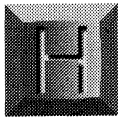


### SERIES 84LS

Series 84LS, 12 and 16 button keypads have a matrix circuitry output and are completely sealed by a silicon rubber boot. Legends are epoxy ink printed on the top surface of the boot. 3x4 legend is numeric telephone and 4x4 is hexadecimal notation as shown in the figure. 3x4 is 2.35" x 3.1"; 4x4 is 3.1" x 3.1". Termination accommodate standard connector. Integral studs mount to panel. Rated for 3,000,000 operations per button; 10 mA at 24 Vdc.

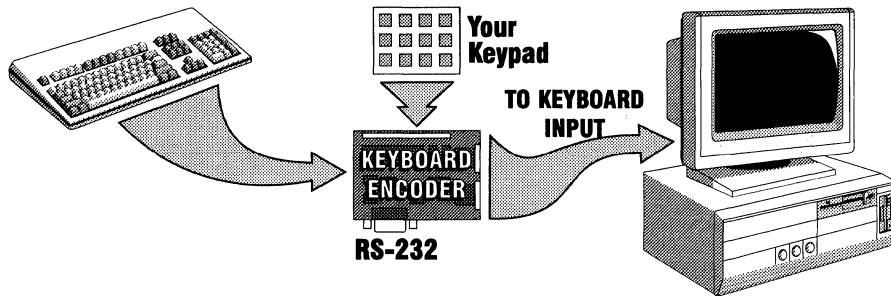
Description	Part No.
3x4 Keypad, Matrix	84LS-AB2-112
4x4 Keypad, Matrix	84LS-BB2-014

For prices, contact a Sales Office, an authorized Distributor or Grayhill.  
**Available From Your Local GRAYHILL Distributor**



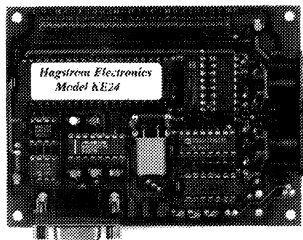
# HAGSTROM ELECTRONICS

Interface to Your PC Keyboard Input



Use with PC/XT, AT, PS/2, X86, and Compatibles • Keyboard Port for your PC Keyboard • Powered from your PC PC DIN type connectors for quick and easy use • Scan keypads, switches or other contact closures

## MODEL KE24



### The Ultimate in Flexibility!

The KE 24 can handle your encoder application. Featuring an RS-232 port and PC Keyboard connections, the KE24 controls not only keypad interfacing, but protocol conversions as well.

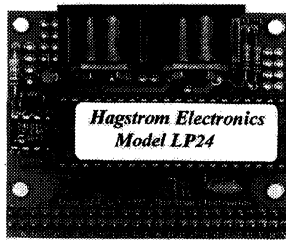
- Programmable, up to 12x12 matrix
- Each input may be configured to emulate any standard key, or a macro sequence.
- Optional Audio Transducer
- LED indicators for Caps, NUM, Scroll Lock

### KE 24 Protocol Conversion

INPUT FROM	OUTPUT TO
Keypads/Switches	PC Keyboard Input
RS-232 Port	PC Keyboard Input
Keypads/Switches	RS-232 Port
PC Keyboard	RS-232 Port

Mix and match any of the above KE24 modes to fit your requirements.

## MODEL LP24

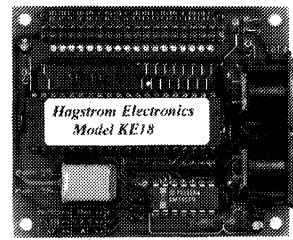


### Small Size, Big Performance!

Don't be fooled by it's size! This encoder offers features commonly found on much larger, and more expensive units. Available in several different configurations.

- Programmable, up to 12x12 matrix
- Each input may be configured to emulate any standard key, or a macro.
- Very low power consumption
- 5 pin DIN standard connectors with option for 6 pin Mini DIN

## MODEL KE18



### Simple, yet Versatile!

The KE18 is a solid performer. Easy to use, but still powerful enough to get the job done. Features are jumper selectable.

- Select Repeat, scan size, and computer type
- Scans up to 9 x 9 matrix
- Custom configurations available
- Boot your PC without a Keyboard

KE Encoder IC



### Single Chip Encoders Need to incorporate the encoder function in your own circuit?

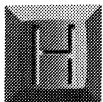
RE Encoder IC



We offer both a 40 pin DIP and 20 pin DIP encoder IC. These devices require minimal support circuitry and include schematics and all information needed to integrate them into your own design.

### Custom Designs

When you require something special, we can help! Let us quote a custom design. We provide rapid development for your specific needs.



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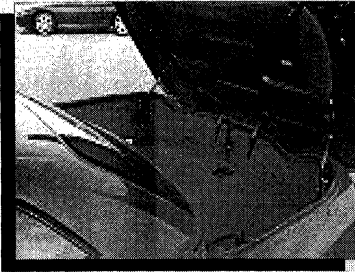
2 Green Lantern Blvd., Endicott, NY 13760  
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**Toll Free (888) 690-9080**

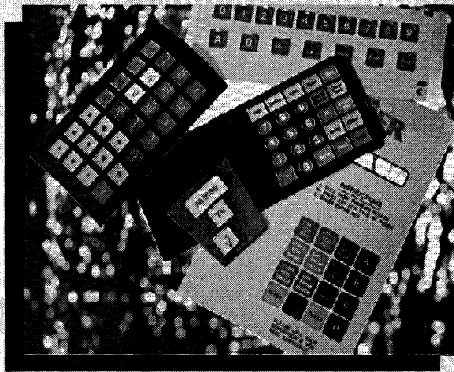


# WIRE GAUGES— DIAMETER, AREA AND COPPER WEIGHT

Size, AWG	Diameter at 20°C (68°F)		Area at 20°C (68°F)			Weight at 20°C (68°F), bare copper wire		
	mils	mm	mils	c mils	mm	lb/1,000 ft.	lb/mile	kg/km
4/0	460.0	11.68	166,200	211,600	107.2	640.5	3,382	953.2
3/0	409.6	10.40	131,800	167,800	85.01	507.8	2,681	755.7
2/0	364.8	9.266	104,500	133,100	67.43	402.8	2,127	599.5
1/0	324.9	8.252	82,891	105,600	53.49	319.5	1,687	477.6
1	289.3	7.348	85,730	83,690	42.41	253.3	1,338	337.0
2	257.6	6.543	52,120	66,360	33.62	200.9	1,061	298.9
3	229.4	5.827	41,330	52,620	26.67	159.3	841.1	237.1
4	204.3	5.189	32,780	41,740	21.15	126.3	667.1	188.0
5	181.9	4.620	25,990	33,090	16.77	100.2	528.8	149.0
6	162.0	4.115	20,610	26,240	13.30	79.44	419.4	118.2
7	144.3	3.665	16,350	20,820	10.55	63.03	332.8	93.80
8	128.5	3.264	12,970	16,510	8.367	49.98	263.9	74.38
9	114.4	2.906	10,280	13,090	6.631	39.61	209.2	58.95
10	101.9	2.588	8,155	10,380	5.261	31.43	166.0	46.77
11	90.7	2.304	6,460	8,230	4.17	24.90	131	37.1
12	80	2.05	5,130	6,530	3.310	19.8	104	29.4
13	72.0	1.83	4,070	5,180	2.63	15.7	82.9	23.4
14	64.1	1.63	3,230	4,110	2.08	12.4	65.7	18.5
15	57.1	1.45	2,560	3,260	1.650	9.87	52.1	14.7
16	50.8	1.29	2,030	2,580	1.31	7.81	41.2	11.6
17	45.3	1.150	1,610	2,050	1.040	6.21	32.8	9.24
18	40.3	1.02	1,280	1,620	0.823	4.92	26.0	7.32
19	35.9	0.912	1,010	1,290	0.653	3.90	20.6	5.81
20	32.0	0.813	804.0	1,020	0.519	3.10	16.4	4.61
21	28.5	0.724	638.0	812.0	0.412	2.46	13.0	3.66
22	25.3	0.643	503.0	640.0	0.324	1.94	10.2	2.88
23	22.6	0.574	401.0	511.0	0.259	1.55	8.16	2.30
24	20.1	0.511	317.0	404.0	0.205	1.22	6.46	1.82
25	17.9	0.455	252.0	320.0	0.162	0.970	5.12	1.44
26	15.9	0.404	199.0	253.0	0.128	0.765	4.04	1.14
27	14.2	0.361	158.0	202.0	0.102	0.610	3.22	0.908
28	12.6	0.320	125	159.0	0.0804	0.481	2.54	0.715
29	11.3	0.287	100.0	128.0	0.0647	0.387	2.04	0.575
30	10.0	0.254	78.50	100.0	0.0507	0.303	1.60	0.450
31	8.9	0.226	62.20	79.2	0.0401	0.240	1.27	0.357
32	8.0	0.203	50.30	64.0	0.0324	0.194	1.02	0.288
33	7.1	0.180	39.60	50.40	0.0255	0.153	0.806	0.227
34	6.3	0.160	31.20	39.7	0.0201	0.120	0.634	0.179
35	5.6	0.142	24.60	31.4	0.0159	0.0940	0.501	0.141
36	5.0	0.127	19.60	25.00	0.0127	0.0757	0.400	0.113
37	4.50	0.114	15.90	20.20	0.0103	0.0613	0.324	0.0912
38	4.0	0.102	12.60	16.0	0.00811	0.0484	0.256	0.0721
39	3.5	0.0889	9.62	12.2	0.00621	0.0371	0.196	0.0552
40	3.1	0.0787	7.55	9.61	0.00487	0.0291	0.154	0.0433
41	2.8	0.0711	6.16	7.84	0.00397	0.0237	0.125	0.0353
42	2.5	0.0635	4.91	6.25	0.00317	0.0189	0.0999	0.0282
43	2.2	0.0559	3.80	4.84	0.00245	0.0147	0.0774	0.0218
44	2.0	0.0508	3.14	4.00	0.00203	0.0121	0.0639	0.0180
45	1.8	0.0457	2.54	3.24	0.00164	0.00981	0.0519	0.0146
46	1.6	0.0406	2.01	2.56	0.00130	0.00775	0.0409	0.0115
47	1.4	0.0356	1.54	1.96	0.000993	0.00593	0.0313	0.00883
48	1.2	0.0305	1.13	1.44	0.000730	0.00436	0.0230	0.00649
49	1.1	0.0279	0.950	1.21	0.000613	0.00366	0.0193	0.00545
50	1.0	0.0254	0.785	1.00	0.000507	0.00303	0.0160	0.00450



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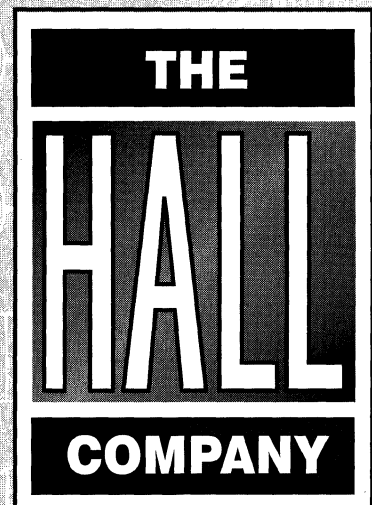
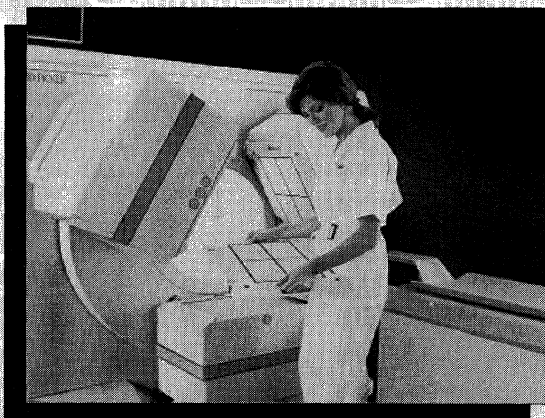
FAX: 937-653-7447

E-MAIL: [hallco@hallco.com](mailto:hallco@hallco.com)

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Urbana, Ohio 43078



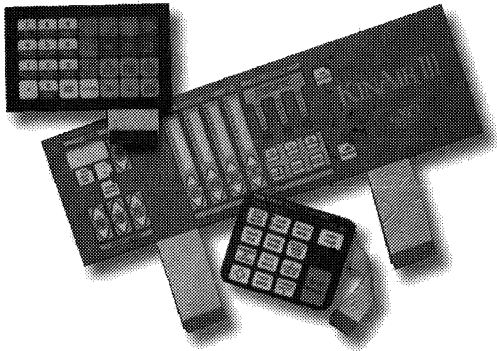
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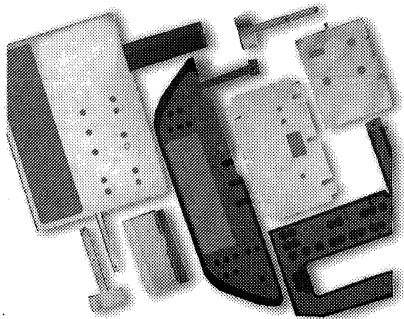
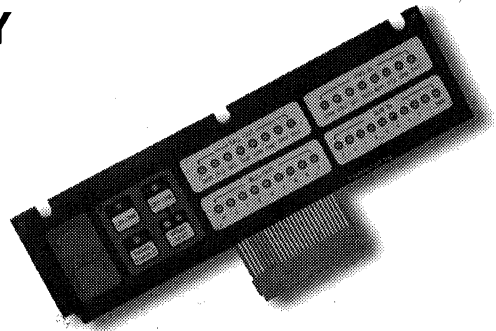


## MEMBRANE SWITCHES

- custom designed
- environmentally sealed
- polycarbonate/polyester construction
- tactile/non-tactile response
- embedded LED's available
- EMI/RFI shielding also available

## SURFACE MOUNT TECHNOLOGY

- low profile package
- enhanced viewing angle
- eliminate need for PCB
- tactile/non-tactile
- environmentally sealed
- standard LED colors available

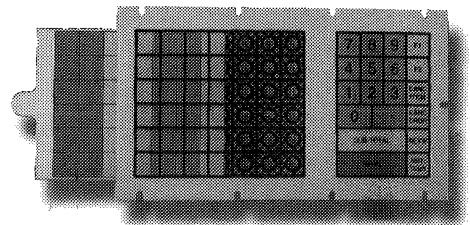


## ESD/EMI/RFI SHIELDING

- custom designed
- screen printed
- die cut shielding
- with or without adhesive
- 48 hour delivery

## VARIABLE DATA PANELS

- custom designed
- interchangeable key designations
- interchangeable switch identification
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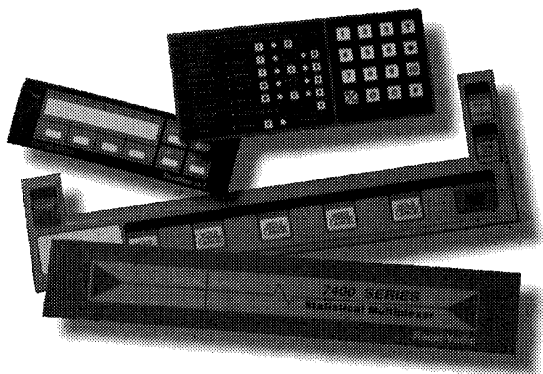
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## GRAPHIC PANEL OVERLAYS

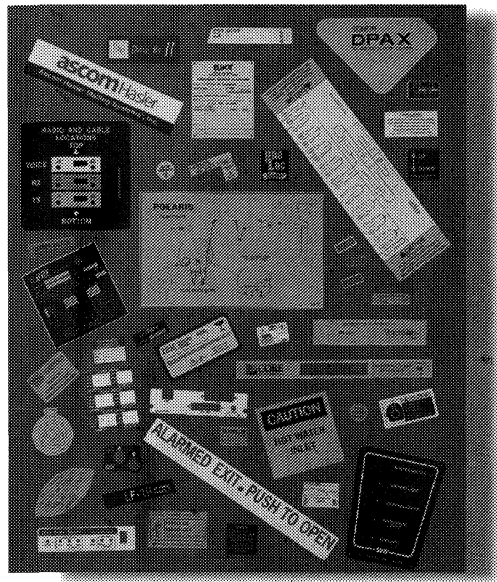
- custom designed
- pre-hardcoated materials
- polycarbonate/polyester construction
- high durability
- ultraviolet and solvent resistant
- in-process inspection

## CONTROL PANEL ASSEMBLIES

- face and sub panel material
- custom designed
- fully tested turnkey package
- reduced assembly cards
- EMI/RFI available



## 10 reasons to specify hallmark nameplates for identification



- 24 hour service available
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- UL/CSA recognized materials
- ACS computer color matching
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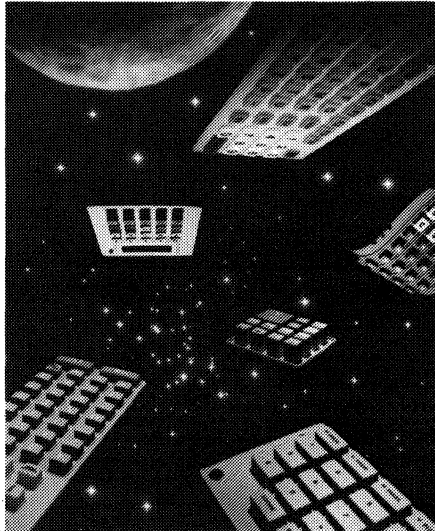
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# HUNTER COMPONENTS

A DIVISION OF E.C. HUNTER, INC.

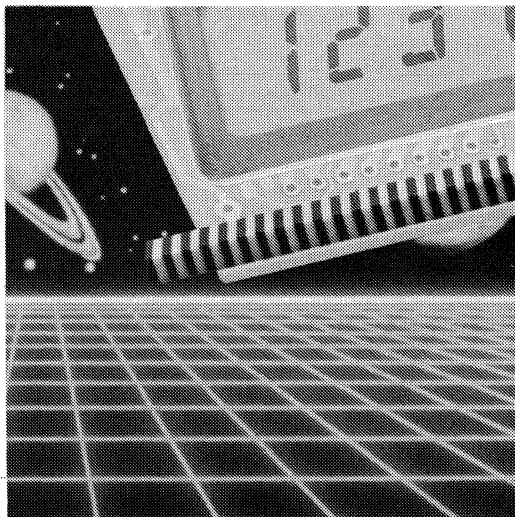
## HUNTER Silicone Rubber Keypads

- integral light pipes
- illuminated keytops
- custom colors, sizes, shapes
- dual durometer
- hybrid keyboards
- complete front panel assemblies



## HUNTER Silicone Rubber & Heat-Seal Connectors

- custom & standard products
- all contact spacings & widths
- custom-sized to any length & height
- non-abrasive, non-corrosive
- lowest cost method of connection
- design assistance at no cost

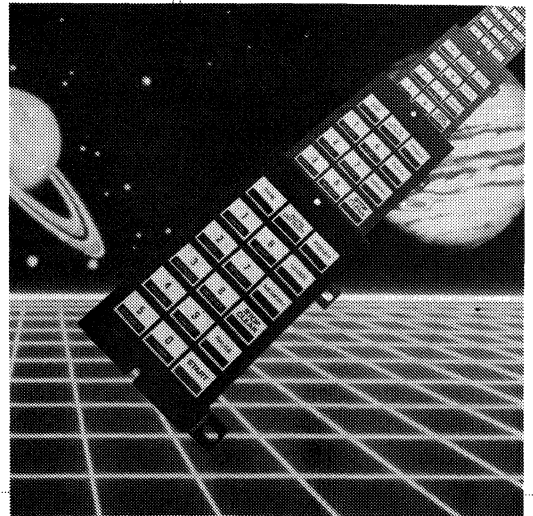


## Keypads ■ Connectors LCDs ■ Modules

## ■ Fast turn-around on tooling & prototypes

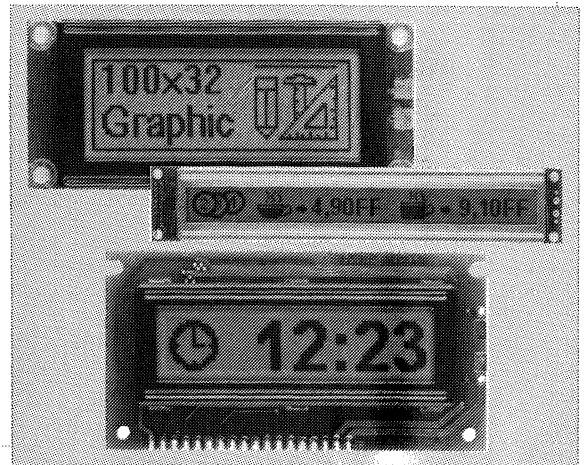
## HUNTER Membrane Keypads

- custom-designed to your specifications
- keyboard only
- complete front panel with display
- colors • embossing
- integral LED indicators
- tactile feel with polyester or stainless steel domes



## HUNTER LCDs and Modules

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- twisted nematic & supertwist
- display only
- complete modules
- with or without backlight



## ■ Complete Design Assistance

## ■ Over 20 Years Experience in Design and Manufacture

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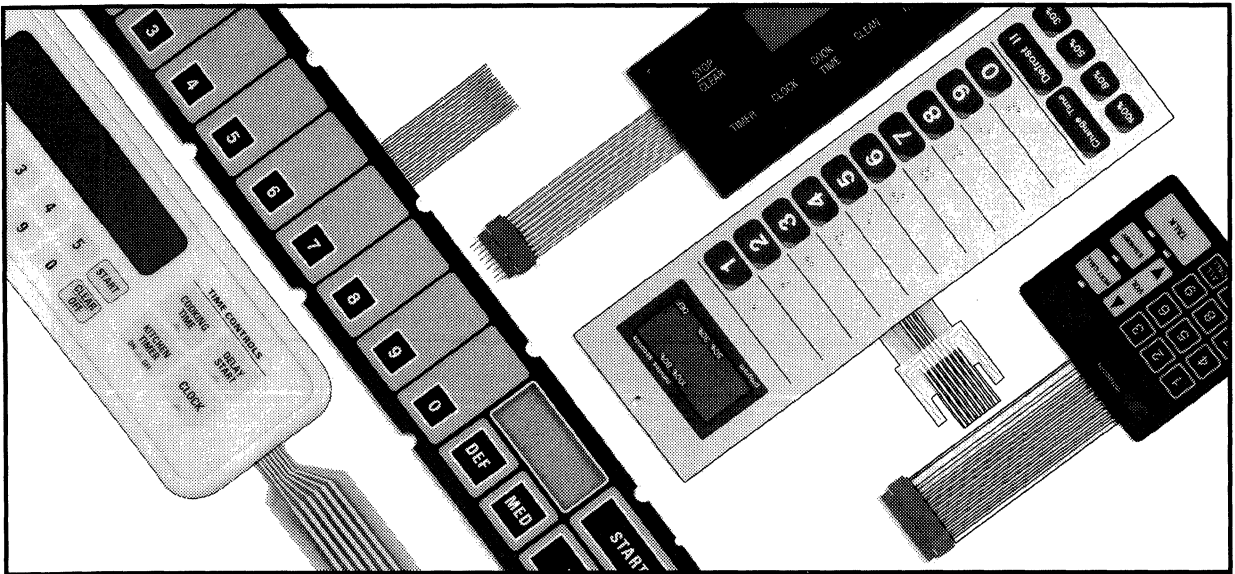
For manufacturers' sales offices, see yellow pages

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- ☞ Touch panel membrane switches
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- ☞ Membrane switch assemblies utilizing injection molded, compression molded, metal stamped, powder painted and screen printed metal formed parts
- ☞ Value added membrane switch component applications including connectors, LED's, rubber keypads, resistive circuits, and backers
- ☞ Screen printed plastic decorative overlays and faceplates
- ☞ Screen printed plastic decorative trim and labels
- ☞ Custom in house materials fabrication and adhesive coating

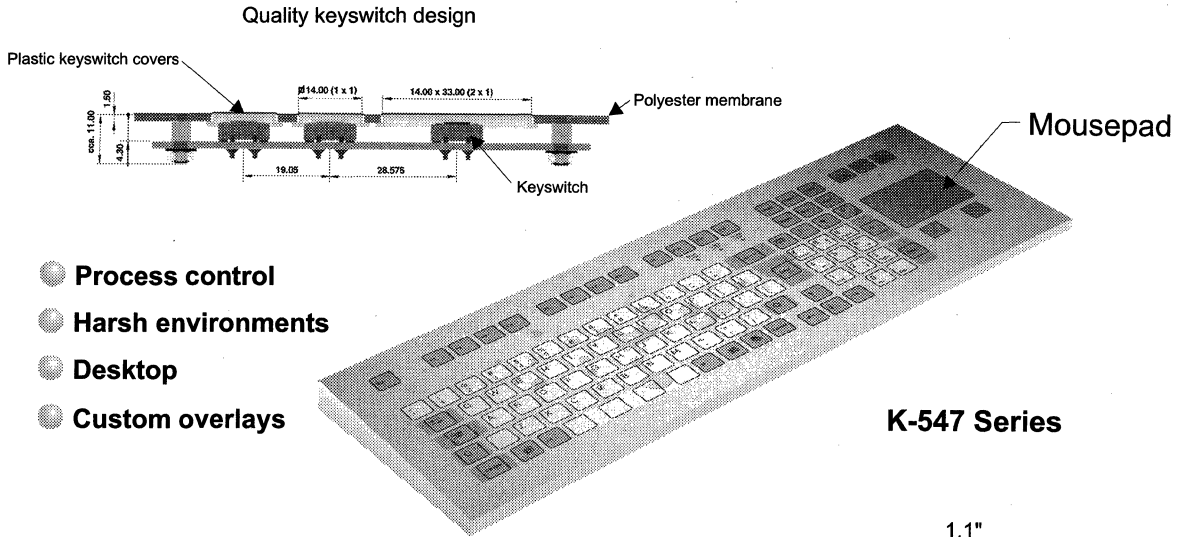
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# INSTRUMENTS & EQUIPMENT CO.

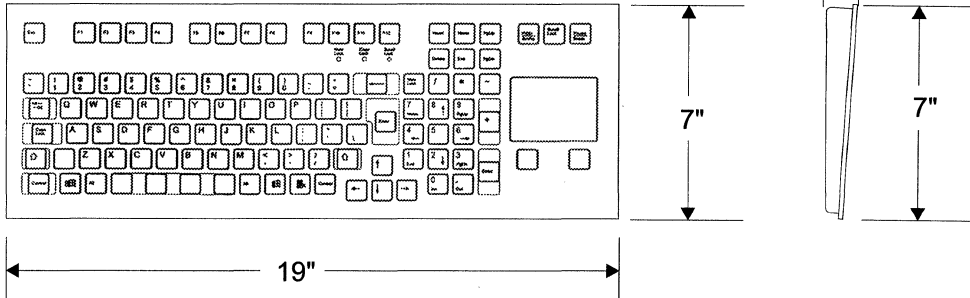
## IP65 Membrane-Protected Desktop Keyboard

Tipro *membrane-protected* keyboards feature high quality mechanical keyswitches protected from water and dust by a polyester membrane. The .3mm travel keyswitches are "click effect", supplying the user with a familiar tactile feedback right through the protective cover. This feature improves productivity by increasing the speed of data entry (no going back and hitting the same key over) and by reducing error.



- Process control
- Harsh environments
- Desktop
- Custom overlays

**K-547 Series**



<b>Model</b>	<b>K-547</b>	
<b>Number of keyswitches</b>	105	
<b>Watchdog timer</b>	Included	
<b>Keyboard interface</b>	PC AT with RS232 (DB9)	PS/2 with PS/2
<b>Mousepad interface</b>		
<b>Protection class</b>	IP65 for top surface	
<b>Keyswitch reliability</b>	300,000 Switchings	
<b>Dimensions (WxDxH)</b>	19.00" x 7.00" x 1.10"	
<b>List Price</b>	\$292	

Instruments & Equipment Company  
**800-432-1255**

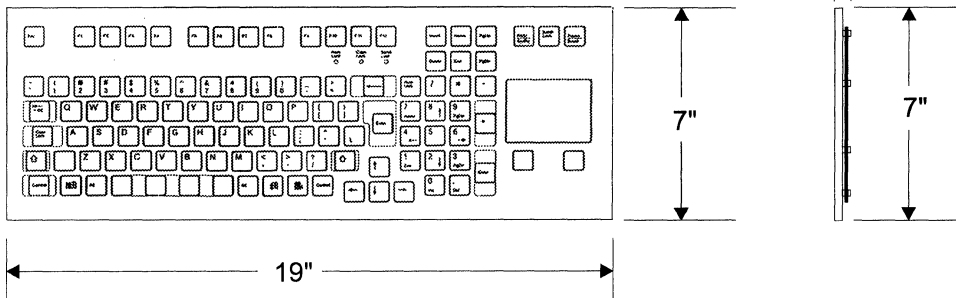
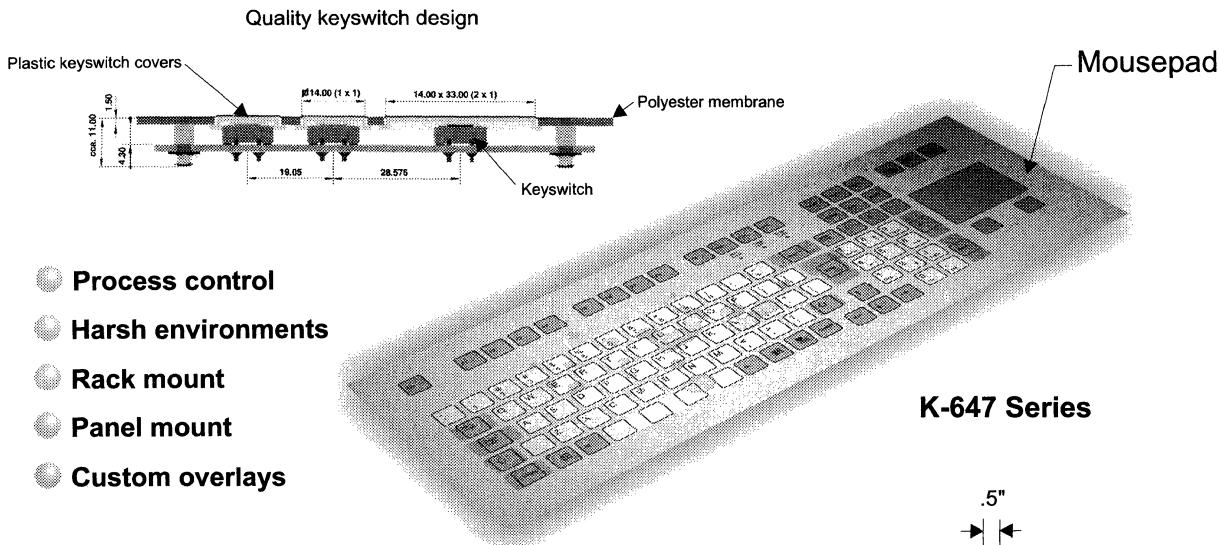


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## IP65 Membrane-Protected Rack & Panel Mount Keyboards

Tipro *membrane-protected* keyboards feature high quality mechanical keyswitches protected from water and dust by a polyester membrane. The .3mm travel keyswitches are "click effect", supplying the user with a familiar tactile feedback right through the protective cover. This feature improves productivity by increasing the speed of data entry (no going back and hitting the same key over)and by reducing error.



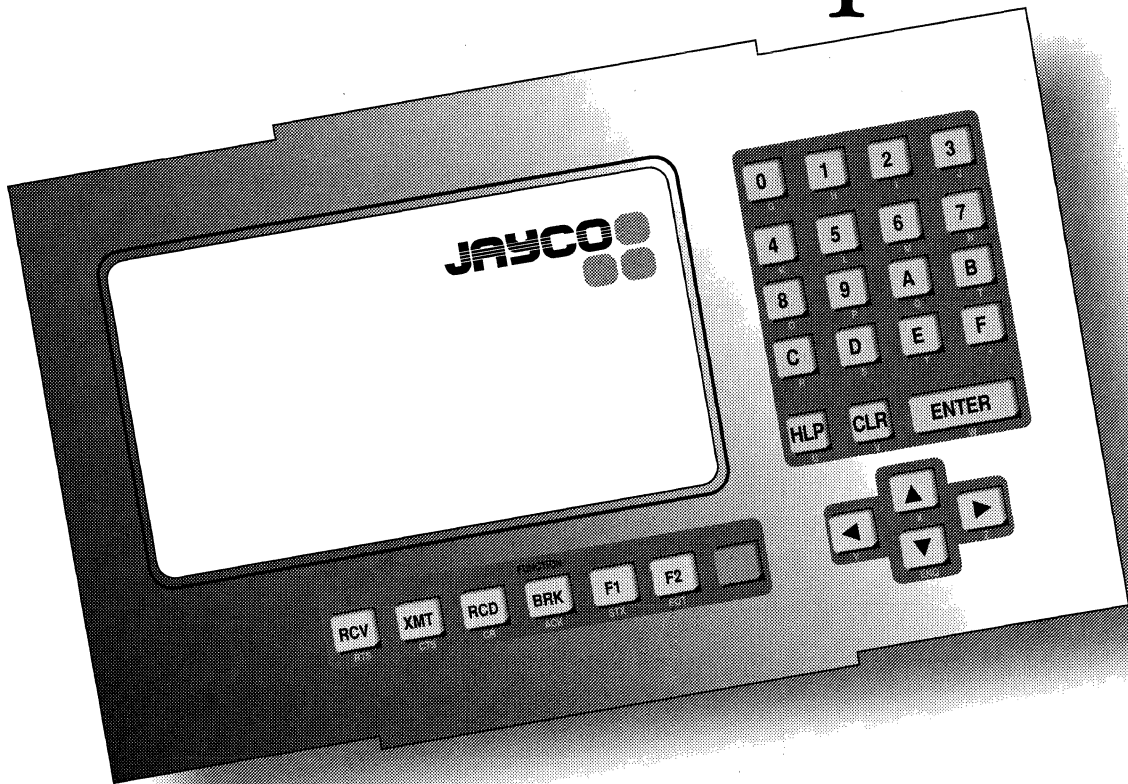
<b>Model</b>	<b>K-647</b>	
<b>Number of keyswitches</b>	105	
<b>Watchdog timer</b>	Included	
<b>Keyboard interface</b>	PC AT with RS232 (DB9)	PS/2 with PS/2
<b>Mousepad interface</b>		
<b>Protection class</b>	IP65 for top surface	
<b>Keyswitch reliability</b>	300,000 Switchings	
<b>Dimensions (WxDxH)</b>	19.00" x 7.00" x 0.50"	
<b>List Price</b>	\$292	

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# Front panels to use with pride



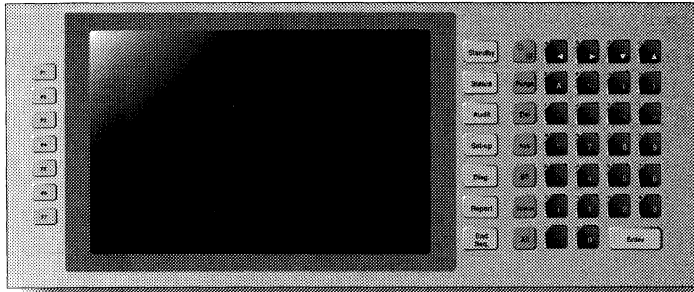
## Jayco: Meeting Your Needs

Customer "delight" is our primary goal. At Jayco, quality starts with a philosophy that places the customer at the center of everything we do. You give us purpose. We give you the best we can. Period. Everything we do is designed for customer delight. From technical assistance, fast quotes and customer design reviews, to short lead times and on-time deliveries. You tell us what you need, and we adapt to meet your needs.

Through open and honest communications, we form close ties with customers who want long-term customer-supplier partnerships. To you we offer ethics, integrity, commitment, quality, technology and value for money. And the best control panels money can buy.

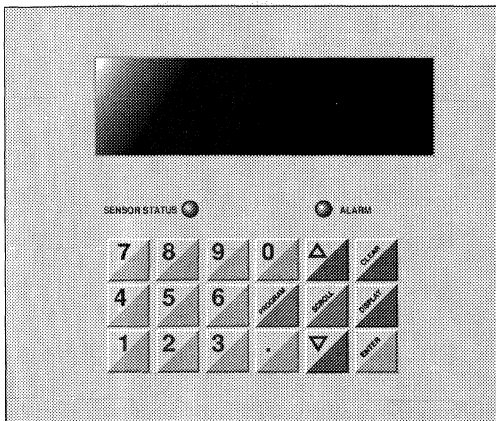
## Control Panel Assemblies

For the ultimate in convenience, a complete panel assembly is the right choice. We integrate all switch types, from membranes to mechanicals, all displays, drive circuitry, interface electronics, knobs, handles and other hardware. You place one order, for one part number, from one vendor. We design the package, source all components and assemble and test for you. A complete turnkey solution to a complex problem. All designed, engineered, documented and delivered in less time than you think.



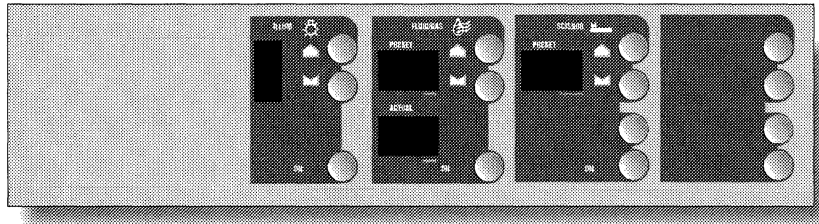
### Membrane Switches

Simply the most dependable membrane switches you can buy. This is neither luck nor magic. Only the best materials; engineered for your specific application using design for manufacturing principles; and tight process controls, with no short cuts. Everything, designed to anticipate and prevent problems. The result? A membrane switch with the best possible price-performance ratio. With all the design options you could want. You will find ours doing justice to high-end professional equipment, not on toys or games.



### Silicone Rubber Keypads

An attractive alternative to membrane switches when a light tactile feedback is required. With integral or separate keytops, SRKs give an individual mechanical switch appearance without mechanical switch drawbacks. They offer the benefits of high reliability, low cost, design flexibility, thermal stability, chemical resistance, light weight and easy assembly. Low tooling costs enable custom keypads to be practical even for short runs.



### Design Options

*Embossing*  
*Tactile Feedback*  
*ESD/EMI Shielding*  
*Selective Textures*  
*Embedded LEDs*  
*Rigid Backplates*  
*Chemical Resistance*  
*Backlighting*  
*Replaceable Legends*  
*Display Windows*  
*LCD/LED/VFD*  
*Displays*  
*Deadfront Effects*  
*Water & Dust Resistance*  
*Interface Electronics*  
 Call for details

### Technical Specifications

#### Typical Values

Current Rating	50mA at 30VDC
Circuit Resistance	Less than 100 Ohms
Contact Bounce	Less than 5 Milliseconds (non-tactile) Less than 20 Milliseconds (tactile)
Insulation Resistance	1 Gohm Min at 100VDC
Dielectric Strength	250VRMS Min
Capacitance	27 pf Max Between Any Two Traces
Actuation Force	Variable from 3oz and up
Operating Temperature	-40°C to +80°C
Operational Life	Greater than 5 Million Operations (non-tactile) Greater than 1 Million Operations (tactile)
Termination	Dupont "Cincher" Offered as Standard
Tolerances	+/- 0.010" as Standard
Emboss Height	0.010—0.015"



**Jayco Interface Technology, Inc.**

507 W. Blueridge Avenue ■ Orange, California 92865, USA

Telephone [714] 974-1701 ■ Fax [714] 998-4954

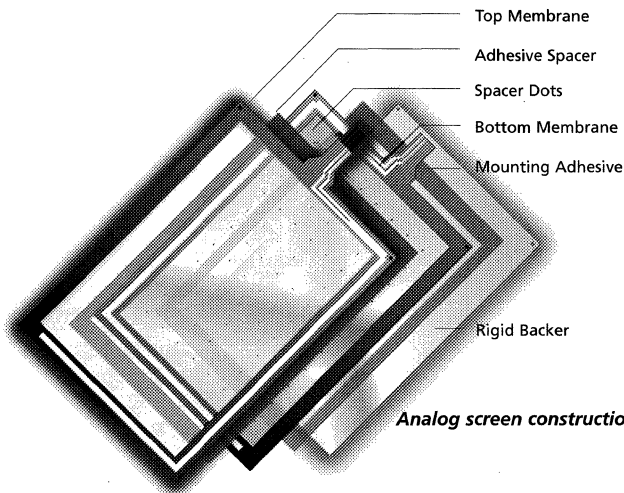
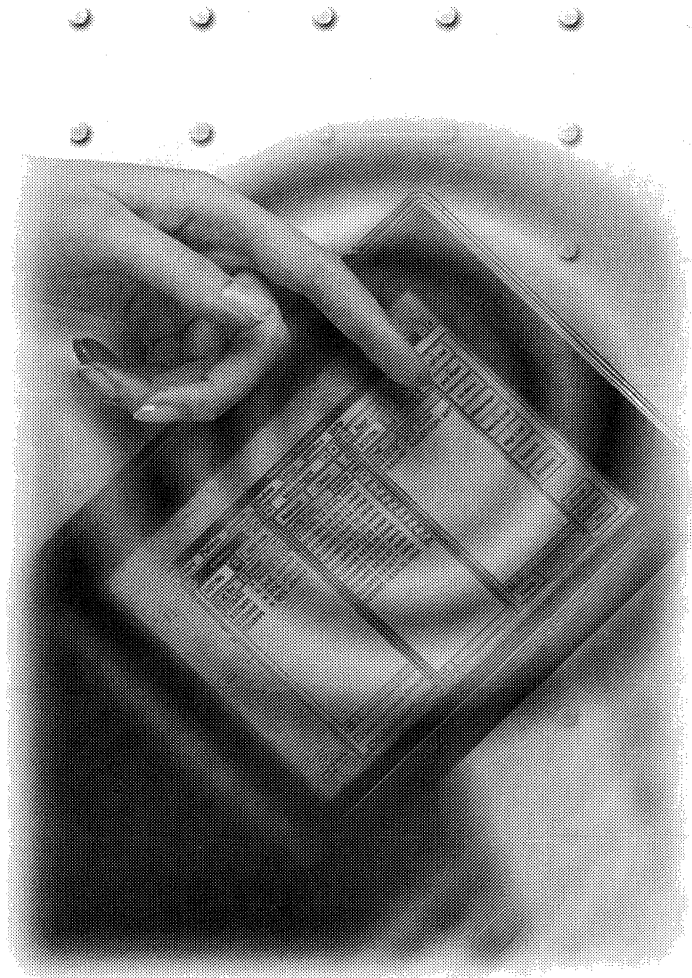
See us on the web at: [www.jaycopanels.com](http://www.jaycopanels.com)

# Advanced Touch Screen Technology Membrane Switches, Rubber Keypads.

Jayco mmi offers advanced resistive touch screen technology in both **digital** and **analog** formats. Touch screens with high resolution, superior clarity, fast response and extremely low power consumption. They feature *unbreakable* polycarbonate, or acrylic backers, as well as conventional glass backers. And with options like scratch resistant hard-coating, heat seal tails, and microdot spacers, we can design touch screens for almost any application and any budget.

Jayco mmi, through the strength and technology of the Jayco-Midori group, also offers superior membrane switches, elastomeric keypads and other operator interface technologies. With multiple facilities in USA, Japan, China, Singapore, Korea, and Taiwan, we can handle any size project.

Call us for all your touch screen or other operator interface needs.



*Analog screen construction*

## Jayco mmi

507 W. Blueridge Ave.  
Orange, CA  
92865 U.S.A.  
tel: 714.974.1701  
fax: 714.998.4954

**JAYCO** m m i

See us on the web at: [www.jaycommi.com](http://www.jaycommi.com)



# LAUBE

LAUBE TECHNOLOGY

## CUSTOM CONTROL PANELS KEY PADS CUSTOM KEYBOARD ASSEMBLIES

LAUBE TECHNOLOGY maintains a world wide reputation as a leader in the design and supply of Custom Control Panel and Keyboard Assemblies. Laube engineers will work closely with you to create the custom assembly that suits your system requirements.

It's easy to get started; just send your idea, sketch or specifications to us. Beginning with a no charge design consultation, our Engineering Department can, at your request, begin presenting you with design alternatives.

You'll be especially pleased with the quick, efficient responses and quotations you receive from us, not to mention the prompt delivery of prototypes as well as production parts. We can supply your Custom Control Panel and Keyboard Assemblies at various levels of value added capability.

### CAPABILITIES

- Engineering and design
- Electronic data transfer of drawings and engineering files
- Pro-E, AutoCad, CAD design, Adobe Illustrator, Corel Draw
- Quick Turn Prototype services
- Local inventory of ready to ship parts.

### PRODUCT

- Injection molded, stamped or die cast bezels and frames.
- Durable graphic enhancements on rubber or Polyester Keytops.
- Displays: (LCD's, CRT's, LED's or VFD)
- Conductive rubber, polyester membrane & mechanical switching elements.
- Single or multi-layered P.C. Boards.
- Flexible Circuits
- All necessary components mounted to the PCB or flex circuit.
- Cables, connectors, misc hardware.
- EMI/RFI, ESD shielding.

### QUALITY CONTROL

- ISO 9002 Certified
- Documented process controls
- Graphics wear testing
- Switch life testing
- 100% final testing

### PRODUCT CAPABILITY

- Touch screens
- Back lighting
- TPE materials

# Laube Technology

550 Via Alondra • Camarillo, CA 93012-8732

PH: 805 / 388-1050 • FAX: 805 / 388-3433

E-Mail: [info@laube.com](mailto:info@laube.com) • Visit Our Website at: [www.laube.com](http://www.laube.com)

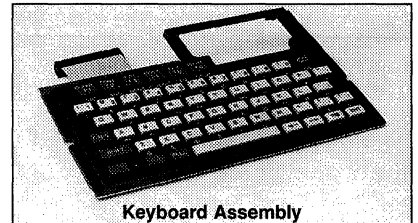
EEM 1999

For manufacturers' sales offices, see yellow pages

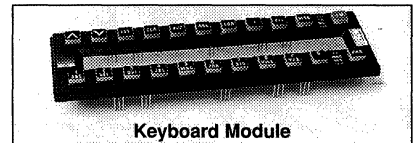
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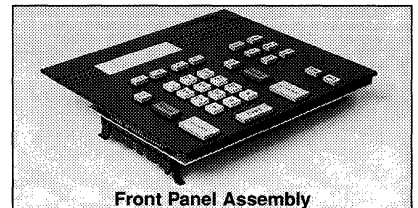
Control Panel Assembly  
with Active Electronics



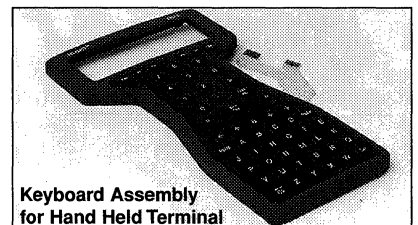
Keyboard Assembly



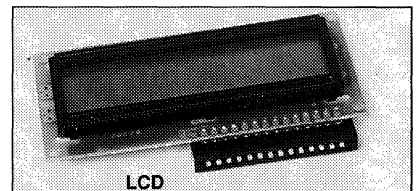
Keyboard Module



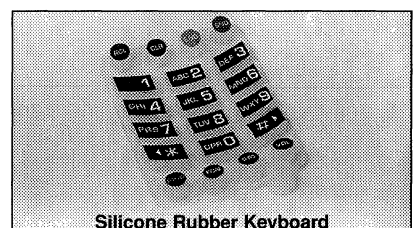
Front Panel Assembly



Keyboard Assembly  
for Hand Held Terminal



LCD



Silicone Rubber Keyboard

# low key

**THERE IS NO GREATER PRIORITY AT LOW KEY  
THAN THE COMMITMENT TO QUALITY & DESIGN EXCELLENCE**

**A FULL SERVICE MEMBRANE SWITCH MANUFACTURER  
FEATURING COMPLETE DESIGN, PROTOTYPING AND PRODUCTION  
OF CUSTOM SWITCHES/KEYBOARDS, PC ENCODERS AND ASSEMBLY SERVICES**

## INTRODUCING 1st KEY SERVICE FROM "LOW KEY CORP."

A comprehensive package that translates your prototype design into production ready system in less than 10 days.

1st KEY SERVICE is more than just the proven reliability of membrane "switch/keyboard" technology. 1st KEY SERVICE is the state-of-the-art in producing prototype, brass board, or pre-production keyboards, in as little as 2 weeks! With over 25 years of combined hands-on design knowledge and CAD/CAE support, your prototype is an investment in quality.

Think what the advantage of 1st KEY SERVICE can do to eliminate the work/time loss and bottlenecks created through confusion and the world of parading would-be keyboards suppliers flooding your lobbies today.

## THE LOW KEY DIFFERENCE

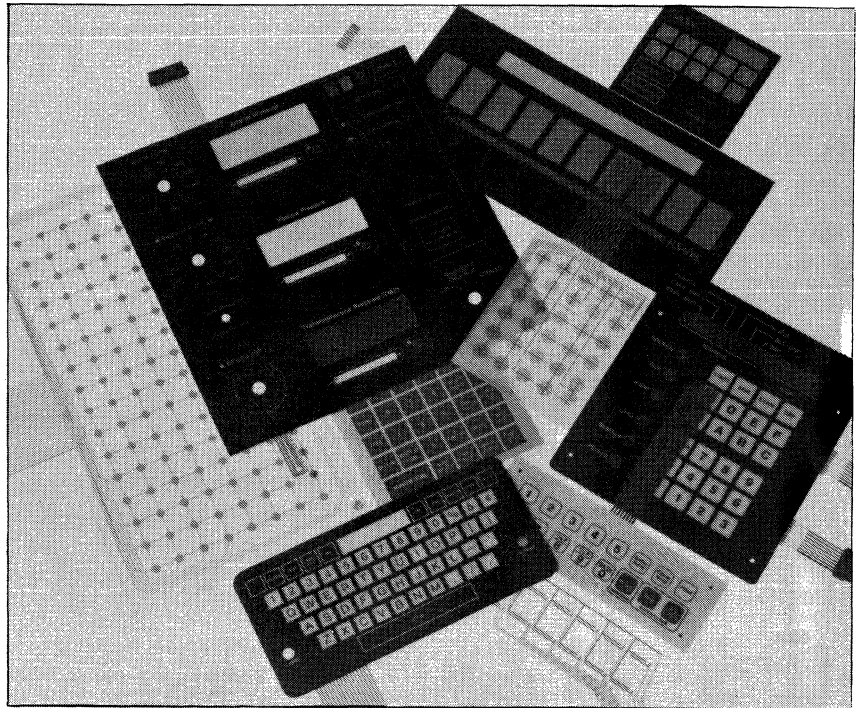
"Fax us a sketch of your idea. We'll help you design it and get it to prototype in five days."

That's the Low Key difference; a way of demonstrating our commitment to you. Welcome to Low Key, your full service membrane switch manufacturer featuring complete design, prototyping and production of custom membrane switches, keyboards, elastomeric keypads, PC encoders and turnkey assemblies. We're committed to bringing you the customized product that best suits the needs of your application.

Whether you're designing a switch for medical, industrial, or military use, we'll work with you to create the most reliable, aesthetically pleasing and cost effective product possible.

## BACKLIGHTING

Low Key offers a variety of lighting solutions. Whether industrial or military, utilizing either electroluminescent panels, plastic fiberoptic or surface mount LED's. One of these will provide the answer.



## CUSTOM SWITCHES/ KEYPADS/KEYBOARDS

Low Key membrane products offer state-of-the-art materials, unlimited design options and operational stability over a wide range of user environments. Low Key design options, include polyester film, printed circuit board and touch films, offering a wide range of current, temperature and operating conditions.

## GRAPHICALLY APPEALING

Low Key graphics are more than, just so much decorative "window dressing." Utilizing its years of experience, Low Keys graphic arts department has met the most enduring standards of excellence developed over the widest possible range of photographic imaging requirements; And end User environments. The graphic standards today, are what sells "your products" tomorrow. "Low Key" is UL recognized and CSA certified.

## UNIVERSAL MEMBRANE SWITCH/KEYBOARD ENCODERS

Low Key offers RS232/PC programmable encoders. The LK-145 & LK-150 series are software configurable, bi-directional and configurable with any contact type switch, keyboard, keypad with a switching matrix up to 12x12=144 keys.

## TURNKEY ASSEMBLY SERVICES

Low Key provides comprehensive turnkey design solutions for specific membrane switch and keyboard/keypad related applications. One stop shopping greatly lessens costly delays and multiple source confusion.



# low key

**THERE IS NO GREATER PRIORITY AT LOW KEY  
THAN THE COMMITMENT TO QUALITY & DESIGN EXCELLENCE**

## MEMBRANE SWITCHES

A Low Key membrane switch consists of a decorative, silk screened graphic overlay combined with conductive inks on a polyester carrier which, when assembled, forms a low voltage switching device.

Low Key membrane keyboards are sealed from the environment. This protects them from gross chemical and atmospheric contamination. Having no moving mechanical parts to fail, the membrane keyboard is highly reliable, cost effective, and environmentally efficient.

## OPERATING CHARACTERISTICS

- Operating Voltage 30Vdc
- Operating Current 20ma Typical
- Contact Resistance 2-50 Milliohms
- Circuit Resistance 20-30 Ohms\*
- Life Cycles (MTBF) 5,000,000
- Activation Forces Ounces 3-12 oz
- Travel Inches 0.006 Typical
- Bounce, Milliseconds 20 Typical
- Operating Temperature 0 to 150°F\*\*  
-18 to 65°C\*\*

Normal range forces can be varied to meet your specifications.

\* Depending on size and configuration of circuit.

\*\* Selected lamination materials are available for high temperature applications.

## DESIGN OPTIONS TO CONSIDER

- A. Transparent lens for LCD display (UV-hardcoated—clear glossy)
- B. Frosted windows for LEDs
- C. Membrane switch contact with embossed locating ring
- D. Die-cut keyways for pushbuttons
- E. Electroluminescent lighting
- F. Printed gas discharge display window (UV-hardcoated—transparent green)
- G. UV-textured velvet finish
- H. Membrane switch contact flat keypad surface
- I. Printed deadfront legend for seven segment display, visible only when illuminated. A variety of colors available
- J. Membrane switch contact with embossed keypad and stainless steel domes
- K. Aluminum molded on machined subplates
- L. Threaded studs and fasteners
- M. Polycarbonate Face with UV-printed hardcoat finish
- N. Embossed surface for decorative effect

Note: See Design Data Sheets for specific details on A through N.

## CONSTRUCTION & FINISHING

### DIE CUTTING

Low Key utilizes laser cut steel rule dies. Steel rule die cutting is carried out on all components of the keyboard. Typical tolerance levels of a steel rule die is generally  $\pm 0.010$  for overall dimensions, and less for die cut holes, key ways, cut outs, and rounded corners.

### EMBOSSING

Embossing of the keypad areas on membrane switch overlays is offered by Low Key, to accent key switch areas and to enhance tactile response. Embossed areas can raise circular, square, or rectangular keys more than 0.030 inches above the overlay surface.

### TERMINATIONS

Low Key membrane keyboards are most commonly terminated with Dupont/Berg insulation displacement connectors. Common to all flat and flexible circuit connectors, the clincher assembly mates to 0.025 inch pins or headers on a 0.100 center to form a complete interconnection system. Low Key offers other

types of interconnect systems in varying configurations and geometry.

### SNAPDOMES

Low Key metal snap action domes provide positive feedback over a wide spectrum of operational conditions. Dome sizes range from 0.50 inches in diameter and smaller. Domes are fabricated from a passivated stainless steel spring material. Electrical contact is made when a snap dome is given sufficient finger pressure, causing the dome to snap over into a flattened shape. This forces the dimple to bring the top and bottom circuits into contact with each other. Snap domes are not in intimate contact with the circuit.

Typical specifications on Low Key tactile domes are:

Operational M.T.B.F.	1.0 million
Total Travel	0.015 max.
Pretravel	0.008
Overtravel Nominal	0.007
Trip Travel at Make Point gm	250 gm $\pm 4$
Tactile Range	medium

### SURFACE MOUNT L.E.D.

Provide ideal solutions to shrinking board space. Combine size efficient surface mounted LED's within your switch/keyboard design. Low Key construction techniques provide large S.M.D. arrays to no increase assembly, thickness. Typically, .035" to .040".

### ELECTROLUMINESCENT PANELS

Durable, offer long life and uniform lighting. They are extremely stable over a wide range of environmental extremes and as little as .017" to the switch assembly. Also "NVIS" capable.

### FIBEROPTIC

Plastic optical devices are economical and feature long life, "low power", a thin profile and are heat and EMI free.

### UNIVERSAL MEMBRANE SWITCH/KEYBOARD ENCODER

Low Key offers a selection of programmable, software configurable encoders. These interfaces allow communications between matrix switches, keypads and keyboards. Up to 144 contacts in a maximum matrix of 12x12. Output data provides either PC or RS232 formats. LCD and LED displays are easily multiplex adding greater efficiency to packaging and operation.

### SHIELDING

Low Key designs your membrane product to assure conformance across a broad spectrum of certification regimes an directives. Shields are integrated into the membrane assembly, addressing known ESD/RFI or EMI phenomenon. Protecting sensitive display and electronic components, requires a thorough product evaluation to determine actual cost effective solutions and not short term overkill remedies.

## KEYBOARDS • KEYPADS HANDHELD TERMINALS • INTEGRATED DISPLAYS

### SPECIALISTS IN RUGGEDIZED KEYBOARD SYSTEMS

For over 20 years, Luminescent Systems Inc. (LSI) has been a leader in the design and manufacture of ruggedized keyboards, keypads and hand-held terminals for use in a variety of industrial, aerospace and military applications. LSI offers both standard and custom products.

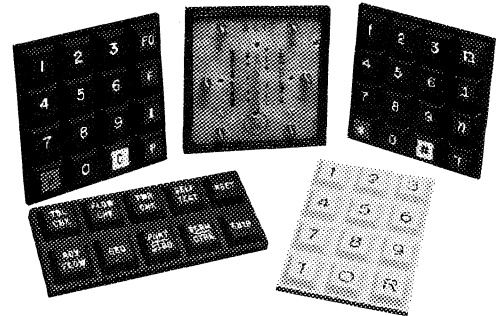
#### FULL TRAVEL KEYBOARDS

- Rugged Construction for Harsh Environments
- Industry Standard Interfaces
  - PS/2, AT/XT, SUN Type 5, DEC LK201/401
- Withstand temperature extremes
- Rain/drip-proof
- Shock/Vibration Protection
- EMI/RFI Compatibility
- Integral Trackball Option
- Custom cabling
- Backlighting
- Many versions available from stock



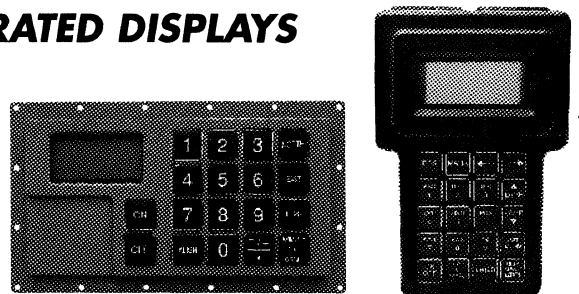
#### KEYPADS

- Rugged Construction for Harsh Environments
- Standard Versions
  - 12, 16, 20 and 25 button X-Y matrix
- Waterproof
- Long-life construction.
- EMI Shielding
- Backlighting (LED or electroluminescent)
- Protective Coating for Harsh Chemicals



#### HANDHELD TERMINALS AND INTEGRATED DISPLAYS

- Rugged Construction for Harsh Environments
- Integral display (LED or LCD)
  - Heated for cold temperature operation
- Waterproof
- EMI/RFI Compatibility
- Backlighting (Night Vision Compatible)
- Standard versions available



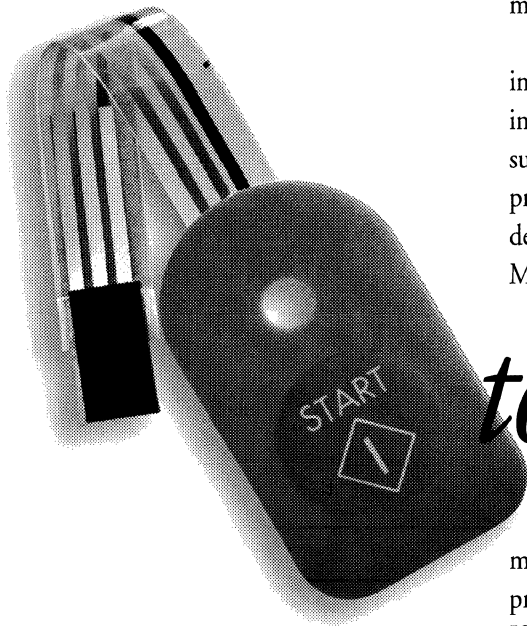
Contact LSI to learn how our dedication to ruggedized keyboard systems can help you develop your product. If one of our standard products doesn't fit your application, we will be happy to develop a custom keyboard to meet your specific requirements.

**LSI** Luminescent  
Systems Inc.

An Astronics Company

77 Olean Road, East Aurora, NY 14052-2593 USA • 716-655-0800 • Fax 716-655-0309 • E-Mail sales@lumsys.com  
Europe: Van Kerckhovenstraat 110, Bus 204, 2880 Bornem, Belgium • +32-3-890-4740 • Fax +32-3-890-4744  
Web Site: <http://www.lumsys.com>

GRAPHIC OVERLAYS, MEMBRANE SWITCHES... AND BEYOND



In today's business climate, you need far more than just a membrane switch. . .

You need a supplier who begins with innovative technologies, rapid prototyping and responsive customer and field support— and continues with strict process controls, flexible just-in-time delivery programs and solid reliability. Memtron is that supplier.

*to finish.*

So we challenge you to find another membrane switch manufacturer who provides our breadth of product. . .and ISO 9001 capability.

From start to finish, we are designing and building the best switches you can find in this directory, or anywhere in North America.

**MEMTRON**  
TECHNOLOGIES INC.

Call us: 1-888-MEMTRON  
Visit our Web site: <http://www.memtron.com>  
E-mail us: [sales@memtron.com](mailto:sales@memtron.com)

Write us: 530 North Franklin St.  
P.O. Box 207  
Frankenmuth, MI 48734-0207

ISO 9001  
CERTIFIED



<http://www.memtron.com>



# MEMBRANE SWITCHES AND GRAPHIC OVERLAYS THAT PERFORM AS WELL AS THEY LOOK

*INTEGRATED ELITE™  
 LIGHTING IN A WIDE RANGE  
 OF COLORS AND SHAPES*

*RIGOROUS TESTING TO MEET  
 THE MOST DEMANDING  
 SPECIFICATIONS*

*EMBOSSING:  
 PADS  
 RIMS  
 GRAPHICS*

*CLOSE TOLERANCE  
 MANUFACTURING FOR  
 PRECISION SWITCHES AND  
 DETAILED GRAPHICS*

*A BROAD SELECTION OF  
 TACTILE FEEDBACK  
 OPTIONS, COLORS AND  
 TEXTURES*



WWW.METROMARK.COM

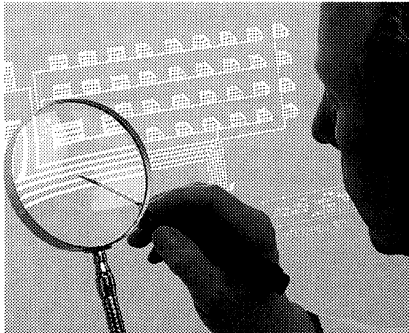
## YOUR SINGLE SOURCE SUPPLIER FOR CONSUMER AND OEM APPLICATIONS



For well over a decade MetroMark has supplied high quality membrane switches and graphic overlays to OEM and consumer product manufacturers worldwide. Our years of engineering experience plus the latest in materials and technologies have earned us a reputation for quality keypads, face plates and overlays that meet the highest standards for appearance and reliability.

### TECHNOLOGY AND CRAFTSMANSHIP

We apply the latest technologies to our design and manufacturing processes with Computer Aided Design (CAD), close tolerance screen printing and advanced engineering and switch technologies. Our Auto-CAD™ based system generates materials with tolerances



*CRAFTSMANSHIP IS STILL THE  
BASIC INGREDIENT OF DESIGN  
AND MANUFACTURING*

of .002". An ACS digital color system guarantees totally accurate color matching. And CAM enables us to produce high quality soft tool prototypes in under 72 hours, without the use of costly dies.

### WE ASK THE RIGHT QUESTIONS

We carefully analyze your needs, to insure that the materials and process chosen will meet your requirements. We'll explore textures, materials, tactile feedback choices, and suggest design options to reduce cost, speed manufacture and improve quality.

### YOUR SINGLE SOURCE

MetroMark is a single source that can combine membrane switches, embossed or debossed keypads, graphics and electroluminescent lighting into a single product. It's another way we meet our customers' needs with better component integration plus simplified purchase and delivery.



*METROMARK MEMBRANE SWITCHES  
UNDERGO RIGOROUS IN-HOUSE  
TESTING TO MEET OR EXCEED THE  
MOST DEMANDING SPECIFICATIONS.*

TACTILE FEEDBACK  
OPTIONS

INTEGRATED  
ELECTROLUMINESCENT  
LIGHTING

RAPID LOW-COST  
PROTOTYPING

COMPUTERIZED  
COLOR MATCHING

TEXTURE OPTIONS  
AND COATING

DIE CUTTING,  
THERMAL CUTTING  
AND EMBOSsing

COMPUTER AIDED  
DESIGN

"ISO BASED"  
QUALITY STANDARDS

ALL PRODUCTS  
MADE IN THE USA

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11574 ENCORE CIRCLE • MINNETONKA, MN 55343-8862  
WWW.METROMARK.COM

# MGR INDUSTRIES INC.

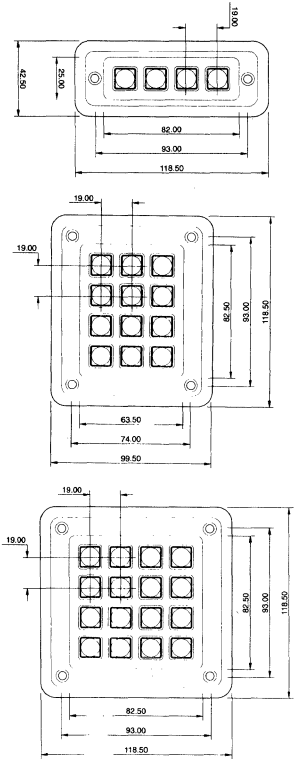
450-B INDUSTRIAL DRIVE, FORT COLLINS, CO 80524  
 TEL: 970-221 2201 ■ FAX: 970-484 4078  
 E-Mail: mgrind@webaccess.net ■ Website: www.mgrind.com

## Three Keypads, each available in four price and performance specifications!

- Four different keypad series, offering price/performance levels for all applications.
- 4, 12 and 16 key formats in each keypad series.
- Fully interchangeable. - each keypad series is dimensionally and electrically compatible with the others.
- Compatible with STORM Keypad Encoders.
- 4 Key 1 Pin Common 12/16 Key Matrix Pin Out

## Storm K Range

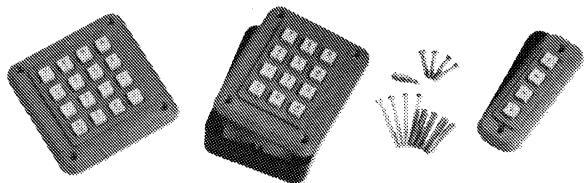
### DIMENSION DRAWINGS



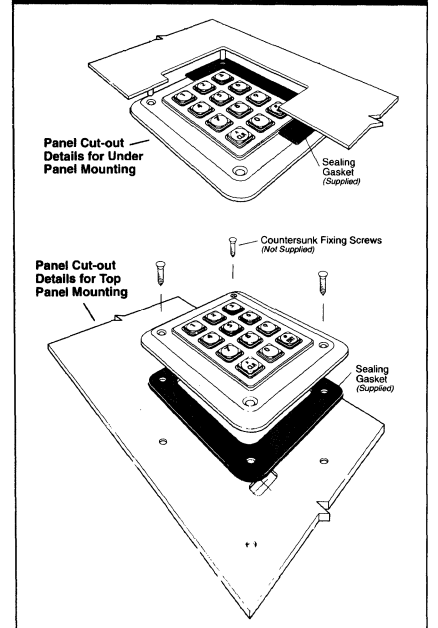
Dimensions apply to STORM 1000, 2000, 3000 & 4000 Series. All Dimensions in Millimetres (mm). Mounting Dimensions Supplied With Product

### PRODUCT SELECTION GUIDE

	1000 SERIES Public / Outdoor Environments	2000 SERIES Industrial / Outdoor Environments	3000 SERIES General Service Sheltered Outdoor Use	4000 SERIES Light / Indoor Applications
<b>FORMATS AVAILABLE</b>	<b>FORMAT PART NUMBER</b>	<b>FORMAT PART NUMBER</b>	<b>FORMAT PART NUMBER</b>	<b>FORMAT PART NUMBER</b>
4 KEY	1K041103 F1-F4:	2K041103 F1-F4:	3K041103 F1-F4:	4K041103 F1-F4:
12 KEY	Calculator: 1K120103 Telephone: 1K12T103	Calculator: 2K120103 Telephone: 2K12T103	Calculator: 3K120103 Telephone: 3K12T103	Calculator: 4K120103 Telephone: 4K12T103
16 KEY	Calculator: 1K160103 Telephone: 1K16T103	Calculator: 2K160103 Telephone: 2K16T103	Calculator: 3K160103 Telephone: 3K16T103	Calculator: 4K160103 Telephone: 4K16T103
<b>SERVICE CONDITIONS</b>				
Vandal Resistant	✓	✗	✗	✗
Impact Resistant	✓	✓	✗	✗
NEMA 4 (+) IP67	✓	✗	✗	✗
NEMA 4 IP65	✓	✓	✗	✗
NEMA 12 IP54	✓	✓	✓	✗
<b>PRICE RATIO (APPROX.)</b>	1	0.65	0.45	0.35
<b>PRODUCT FEATURES</b>				
Responsive Key Action	✓	✓	✓	✓
Replaceable Keypads	✓	✓	✓	✗
Key Life (Cycles)	4 Million	4 Million	2 Million	1 Million
Service Temp (Dry)	-40°C to +100°C	-25°C to +85°C	-10°C to +85°C	0°C to +70°C
Case Material	Chromed Zinc	Super Impact Polymer	Gen. Serv. Polymer	Gen. Serv. Polymer
Case Colour	Silver	Mid Grey	Mid Grey	Mid Grey
Keypad Material	Chromed Zinc	Super Impact Polymer	Gen. Serv. Polymer	Silicone Rubber
Keypad Colour	Silver	Light Grey	Light Grey	Light Grey
Keypad Legends	Engraved	Laser Marked	Printed	Printed



### MOUNTING AND CONNECTION DETAILS



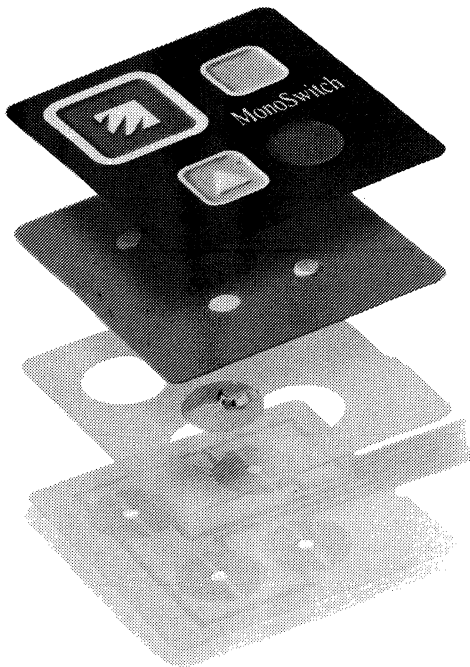
Available from Newark Electronics 1-800-281-4320, ext. 80  
 and Digi-Key Corporation 1-800-344-4539



# WHEN RELIABILITY COUNTS MEMBRANE SWITCHES

## MONOPANEL OFFERS MORE !

- IN HOUSE PRINTED CIRCUIT BOARD MFG
- SWITCH ASSEMBLIES
- STANDARD OR CUSTOM PRODUCTS
- VARIETY OF TACTILE FEEL
- HIGH TEMP PRODUCTS (105° C)
- BACK LIGHTING - LED'S, EL, FIBER OPTIC
- EMI/RFI, ESD PROTECTION
- TAMPER RESISTANT PRODUCTS
- 12 & 16 POSITION KEYPADS, PROTOTYPE PANELS
- ELECTRONIC CONTROL PANELS, CIRCUIT DESIGN OR REFINEMENT OF AN EXISTING DESIGN
- CONDUCTIVE RUBBER PADS AND ASSEMBLIES



### MONOSWITCH™ RELIABLE TACTILE FEEL

The unique patented (5,523,730) design of the MonoSwitch eliminates the uncertainty of collapsing metal domes and the temperature limitation of polydomes. It gives you crisp, reliable tactile feel!

Visit us at our Web Site:  
[www.monopanel.com](http://www.monopanel.com)



**MONOPANEL™**  
**TECHNOLOGIES, INC.**

Our e-mail is:  
[sales@monopanel.com](mailto:sales@monopanel.com)

**PHONE: (414) 256-5200 FAX: (414) 256-5252**  
**1535 SOUTH 101st ST. • WEST ALLIS, WI 53214 - 4008**

## THE MONOPANEL DIFFERENCE

### QUALITY

We are known for quality parts that are designed for long-term reliability. Our adherence to ISO 9000 quality standards assures our customers of Monopanel's commitment to quality.

### PARTNERSHIP

Monopanel Technologies, Inc., is a pioneer in membrane switch technology, producing quality switches for over 20 years. During that time, we have developed strong business partnerships. Just ask our current customers.

### INNOVATION

From flex to added-value, printed circuit-board-based products, we are a complete membrane switch business. Innovative designs and materials are used to meet your most stringent needs. Our in-house printed circuit board capability, and the attachment of electronic components and hardware, allow us to respond to all your needs. LED's, EL, fiber optics for backlighting, embossing, metallic dome, polydomes or patented MonoSwitch for tactile feel, sealed construction, high temperature materials and our patented (5,747,757) tamper resistant product - all are within our capabilities. Send us your requirements.

### COMMITMENT

We are totally committed to continuous improvement, and to being your complete membrane switch supplier. For more information about Monopanel Technologies and the services we offer, please call or fax your request to us.



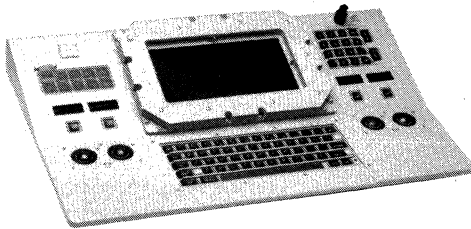
# RUGGEDIZED SWITCH PANEL & CUSTOM KEYBOARD DESIGNS

CORPORATE FACILITIES:

80 CABOT COURT, HAUPPAUGE, L.I. NY 11788, (516) 435-8300 • FAX: (516) 435-8458

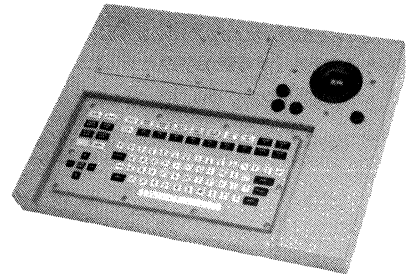
**ORBIT INSTRUMENT CORP.**

## RUGGEDIZED KEYBOARD / BALL TRACKER ASSEMBLIES



OPERATE CONTROL TRAY  
KEYBOARD TRACKBALL

INSTALLED IN  
CONSOLES AS  
REMOVABLE  
ASSEMBLIES FOR  
EASY ACCESS



OPERATE CONTROL TRAY  
KEYBOARD TRACKBALL

MIL - E - 16400 / MIL - E - 5400

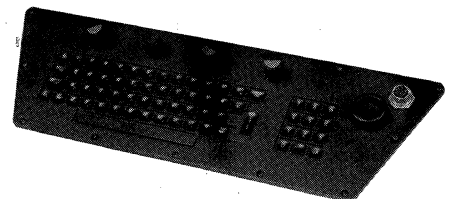


FULL TRAVEL  
BACKLIGHTED  
KEYBOARD

## BACK LIGHTED KEYBOARDS & CUSTOM PANEL DESIGNS

FEATURING:

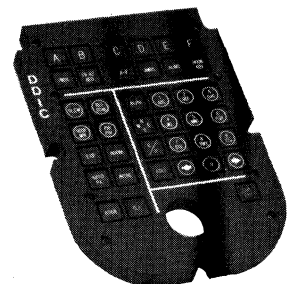
- ORBIT LOW PROFILE SNAP ACTION SWITCH TECHNOLOGY
- SWITCHES CAN BE SPLIT LEGEND OR TRI SPLIT
- RUGGED DESIGN CONSTRUCTION
- RELENDABLE KEYCAPS
- FULL TRAVEL
- CUSTOM ENCODING
- BACKLIGHTED



SNAP ACTION  
BACKLIGHTED  
KEYBOARD OPTICAL  
ENCODERS, FORCESTICK



RUGGEDIZED  
KEYBOARD/TRACKBALL  
AT, IBM/PS2 COMPATIBLE



AIRBORNE  
BACKLIGHTED  
INTERGRATED SWITCHPANEL

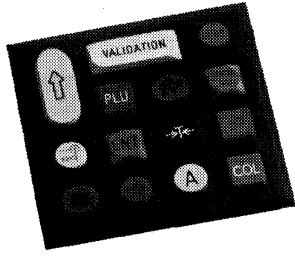


# Keypads for Demanding Applications

ISO 9001 Certified

## Features

- Front panel environmental sealed up to IP67
- Custom appearance
- Choice of operating forces
- Crisp tactile feedback
- Wide variety of styles and configurations
- Vibration and Shock resistant
- Low profile design
- 1 x 4 through 5 x 9 arrays
- Front Panel Mount & Rear Panel Mount styles



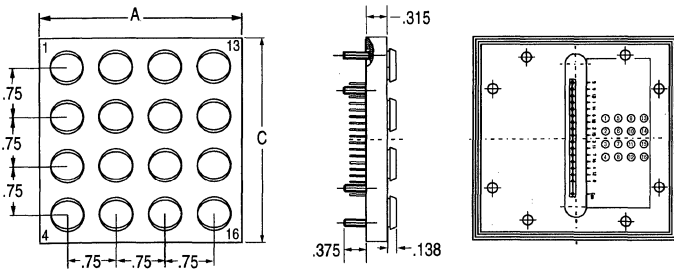
In today's equipment, keypads are one of the most important components because they are the physical interface between machine and operator. Therefore, it is essential that the product be both aesthetically appealing and reliable in operation. Z Series keypads feature a positive but easy to operate tactile action that creates maximum operator confidence. Reliability in hostile environments is also a major advantage. Z Series keypads are sealed to resist ingress from dust, humidity and rain. Sturdily constructed, these keypads are also able to withstand high levels of shock and vibration.

Appearance is not only attractive but also the keypad assemblies appear as if they are custom tooled and molded. A wide range of standard colors and legends are available or we will customize to your specification. For very tough, vandal-resistant applications we can supply keypads with metal keycaps.

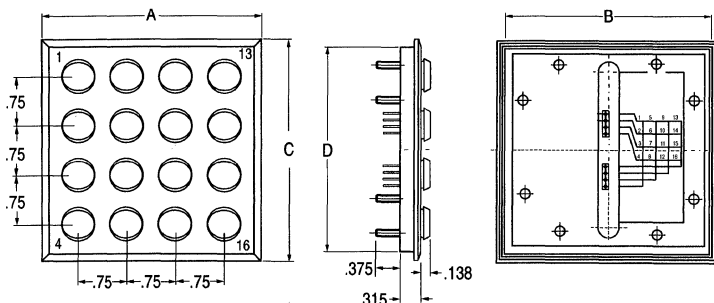
## Available Products

Number of Key's	Keypad Orientation	Electrical Circuit	
		Common Bus	Matrix
4	1x4	Yes	No
8	2x4	Yes	Yes
12	3x4	Yes	Yes
16	4x4	Yes	Yes
20	5x4	Yes	Yes
24	6x4	Contact Factory	Contact Factory
28	7x4	No	Yes
45	9x5	Contact Factory	Contact Factory

## Rear Panel Mount: Series Z1



## Front Panel Mount: Series Z2



## Mechanical:

- Total Travel .04 inches nominal
- Pretravel .027 inches
- Operating Force 11oz.
- Life >1,000,000 Cycles

## Electrical:

- Operating Voltage 30mV to 100V
- Dielectric Strength 1,000V rms
- Switching current 70 mA max.
- Insulation Resistance > 10MW

## Contact Resistance

- Carbon plated PCB 200 W max.
- Optional Gold plated PCB 1 W max.

## Bounce:

1 msec. typical

## Environmental Sealing:

IP 65 (IP 67 with proper installation)

## Operating Temperature:

-25°C to 75°C

## Storage Temperature:

-45°C to 85°C

## Materials:

- Contact Surfaces Gold/Carbon Standard (Gold/Gold on request)
- Rubber Cover EPDM (Silicon available)
- PCB FR3/FR4
- Base Support Plate Zinc Plated Steel
- Operating Button ABS or Metal

## Mounting Hardware:

Mounting Hardware: 1 Mounting bracket, 2 screws, 2 nuts, 2 washers and 2 spacers.

## Mounting Dimensions:

See the drawings. **Note:** The number on the keycaps correspond to the numbers on the connection diagram.

## Connector:

AMP Type MODU II X-828214-X with Interlock. Recommended female connector: AMP Type MODU IV with Interlock

## Electrical Circuit:

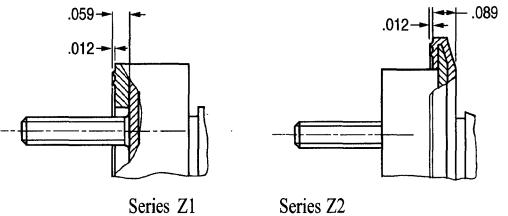
Matrix or Common Bus

## EMI-Protection:

Keypads can be supplied with internal shielding.

## ESD-Protection:

Keypad can be used as ESD-protected component with proper installation.



	Series Z1			Series Z2		
	A (In.)	C (In.)	A (In.)	B (In.)	C (In.)	D (In.)
1 x 4	.869	3.118	1.139	.869	3.388	3.118
2 x 4	1.620	3.118	1.889	1.620	3.388	3.118
3 x 4	2.370	3.118	2.640	2.370	3.388	3.118
4 x 4	3.120	3.118	3.388	3.120	3.388	3.118
5 x 4	3.871	3.118	4.140	3.870	3.388	3.118
6 x 4	4.620	3.118	4.885	4.621	3.388	3.118
7 x 4	5.372	3.118	5.642	5.372	3.388	3.118
9 x 5	6.872	3.790	7.143	6.867	4.130	3.870

A Partner You Can Trust



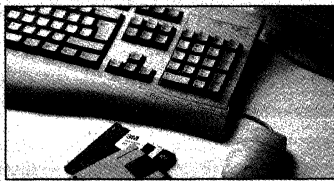
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 95134 U.S.A.  
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 FAX: (1-408)544-4967-8

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# K EYBOARDS



Tel : 82-331-210-5804  
 E-mail : parkij@samsung.co.kr

## Desktop Keyboard

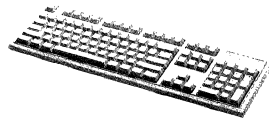
### Specifications

- IBM PC, Window95 Compatible
- Multi-Language Available
- Comfortable Touch and Feel
- Highly Reliable Membrane Key Switch
- Optional Plastic Palm-Rest
- Straight Enter Key Available
- Operating Life : Over 20 MIL.
- Key Travel : 3.8mm ±0.5mm
- Operating Force : 55g ±10g
- Agency Approved : FCC, UL, CSA, CE, TÜV

SEM-DC8H  
(High/Middle)



SEM-DC8L  
(Low-Cost)



## Wireless IR Compact Keyboard

### Specifications

- Built-in Trackball
- Carrier Frequency : 38.4kHz & 56kHz (DIP Switch)
- Working Distance & Angle : 7 m, ±45°
- Channel : 16 Ch
- Battery Life : Over 3 Months (AA × 2, Alkaline)
- Key Number : 87 Keys + 11 Hot Keys

SEM-CIR

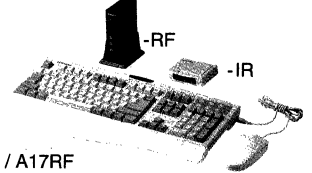


## Wireless Keyboard

### Specifications

- Wire / Wire-Less Changeable
- Carrier Frequency : 38.4kHz (RF: 49MHz)
- Working Distance & Angle : 7 m, ±45° (RF: No Limit)
- Channel : 16 Ch (RF: 7 Ch)
- Battery Life : Over 3 Months

SEM-A17IR / A17RF



## USB Keyboard

### Specifications

- 4 Downstream Ports for USB Device Support(HUB)
- Speed : 12Mbps (HUB), 1.5Mbps (HUB-Less)
- PS-2 Mice Supportable (HUB-Less)

SEM-A17UH(HUB)  
A17UL(HUB-Less)

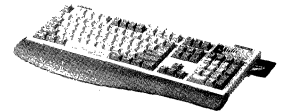


## Smart Card Reader Keyboard

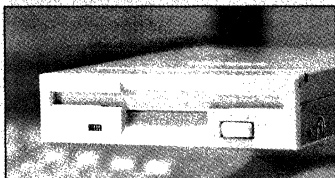
### Specifications

- Smart Card Reader Keyboard for E-Commerce
- Card Protocol : ISO 7816-3
- Powerful Password Security Logic
- Card Real / Write Life : 100K Times
- Pin : 8 Pins

SEM-A17SC



# F LOPPY DISK DRIVES



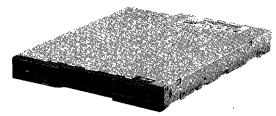
Tel : 82-331-210-6301  
 E-mail : sb-yang@samsung.co.kr



## SFD-321B

### FEATURES

- Compact 1 inch height size
- 3 Mode storage capacity (unformatted)  
 2.0/1.0MB(Factory standard)  
 1.6/1.0MB  
 2.0/1.6/1.0MB
- 250/500KB/sec transfer rate
- 3msec track to track access time
- Brushless dual-speed DC direct drive motor
- 20,000 hours MTBF(25% of duty cycle)
- Dual read channels
- Low power consumption
- Industry standard interface compatibility
- Low acoustic noise



## SFD-321S

### FEATURES

- Double sided, Dual Density
- 1/2 inch height ultra slim
- Low power consumption
- Industry standard interface compatibility
- Low acoustic noise
- Dimensions(W × D × H)(mm) : 96 × 126 × 12.7

### SIGNAL INTERFACE ASSIGNMENTS

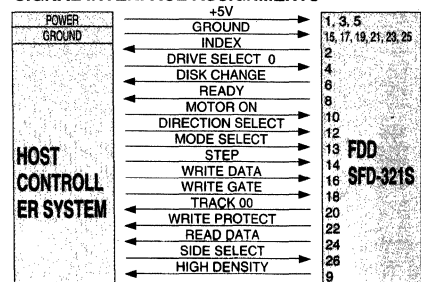


Figure. Signal Interface Assignments  
 (1) Signal Interface Connector : SUMIKO P/N LVIA026R000Z or equivalents  
 (2) Interface cable : 26pin, 1mm pitch, 0.35t  
 (3) Safety Approvals : UL, CSA, TUR CE

SINCE  
1984

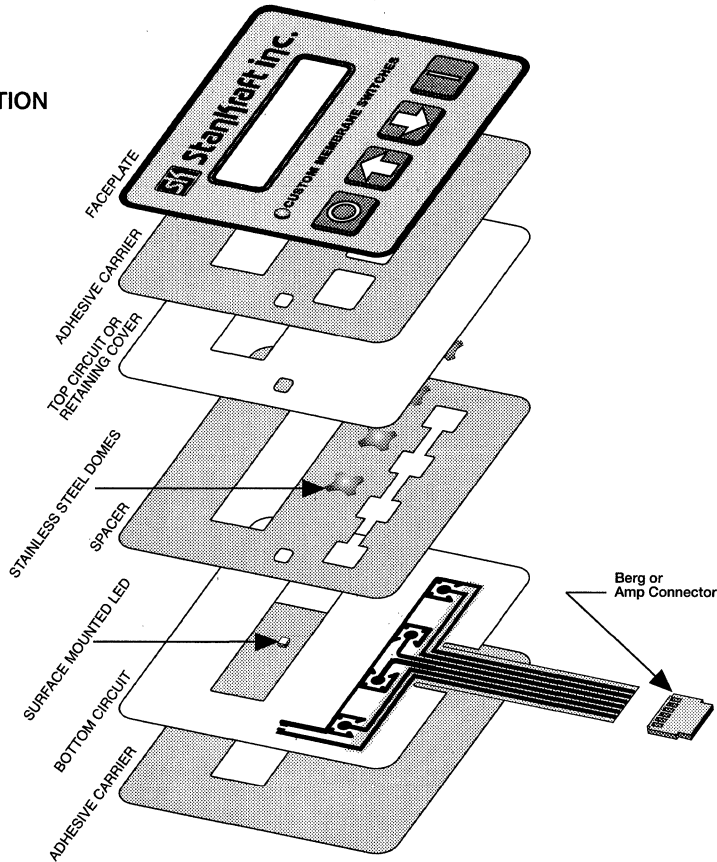


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**IDEAS HAPPEN**

## TG3 EXPERIENCE...

At TG3 Electronics, we combine decades of engineering experience in electrical and mechanical design with fresh, innovative ideas that make custom keyboards perform the way they should... to your requirements.



### TG3 Keyboard Technologies Include:

- Full-Travel Mechanical Action
- Full-Travel Membrane (FTM®)

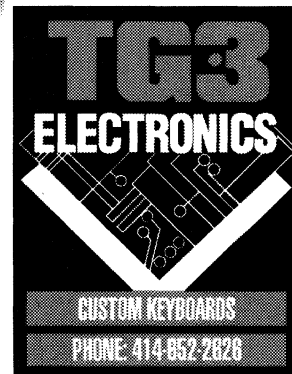
#### Features and options:

- Cherry family of keyswitches including the highly dependable MX and ML series keyswitches
- TG3 family of keyswitches (formerly Oak FTM®)
- Tactile feedback switches available
- Qwerty, POS, non-encoded matrix or fully encoded configurations (reconfigurable layouts are also available)
- Custom enclosures (structural foam, injection molded, metal)
- Sealable, dust-resistant
- DIN Compatible
- UL/CSA/FCC/EC certification as requested
- EMI/ESD shielding and testing available
- CMOS electrical designs
- Custom software for encoded applications
- PC/XT/AT, PS/2, Macintosh and other industry protocols
- TTL, RS232, RS422 and other electrical interfaces
- Custom serial or parallel communication protocols and electrical interfaces
- Auto repeat on encoded keyboards
- N key rollover
- Multiple keycode strings
- Reprogrammable keys (All encoded keyboards are designed with the Intel-based family of microprocessors 8031, 8051, 8751, 8748, 8749.)

#### Keycaps:

- Full spectrum of standard colors
- Custom-color matching
- Many standard and custom shapes and sizes to choose from

- 2-Shot, sublimated, engraved, pad printed and front skirt legends available
- Relegendable styles
- Lens-lighted



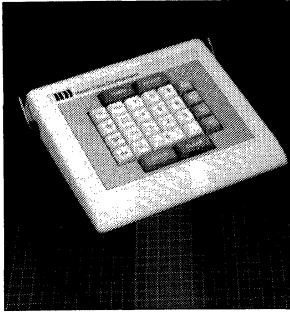
- Any Configuration (POS, QWERTY, Etc.)
- Non-Encoded or Encoded (PC/XT/AT/PS2, ASCII, MAC, SUN & Custom)
- Custom Enclosures (Plastic and Metal)
- Wide Variety of Keycaps and Profiles (DIN compatible), Custom Legends

- UL/CSA/FCC/CE Compliance
- Experienced in Pointing Device, Encoder and Display Applications
- Fast Turn On Prototypes
- Any Quantity
- Splash Resistant

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# Special-Purpose Keyboards and Terminals

Sometimes the computer keyboard is more of a barrier than a carrier of input data. Often it intimidates its users; sometimes it offers more access to your system than you want it to; but, other times, even with 102 keys, it doesn't provide the characters or macro strings that are required to run your application efficiently; and sometimes it is just too big, too heavy, too clumsy. We can help...with custom-configured, modular keyboards that are economical, adaptable, and readily available.



## Touchstone 2 Keypads

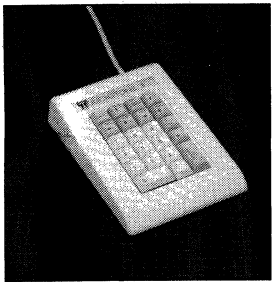
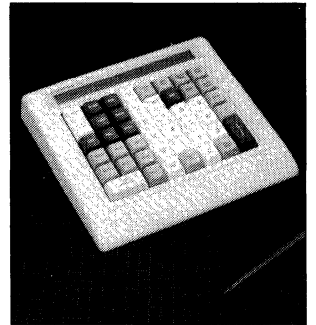
**Model 248, 8 x 8" footprint, 48 keys max.**

Up to 48 full-travel keys with membrane switches and keyboard port or serial port encoder. These keypads are fully configurable within the 6-row x 8-column matrix, and readily adaptable to your exact requirements. Two auxiliary ports.

## The Mini-terminal

**Model 210, 8 x 8" footprint, 48 keys max.**

A full-featured RS-232 terminal with 2-line x 40 character LCD. With optional RAM installed, the Model 210 can perform calculations and other intelligent functions. Other features include multi-frequency annunciator and menu-driven selection of communications options.



## Touchstone 3 Keypads

**Model 324, 5 x 7½" footprint, 24 keys max.**

This compact, lightweight keypad is available in either a PC-compatible keyboard port with integrated wedge, or RS-232 version with Windows-compatible drivers. ROM-based custom character set can have macros. Custom-printed keycaps or re-legendable keys. Conductive rubber switches.

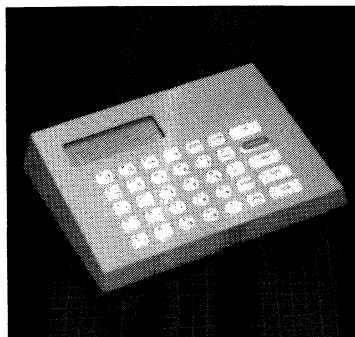
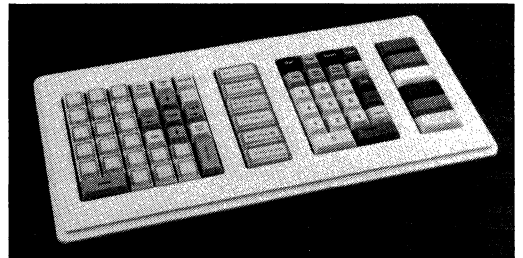
**Model 516, 5 x 6½" footprint, 16 keys max.**

**Model 720, 4 x 6" footprint, 20 keys max.**

Similar to Model 324 above, but smaller.

**6 Rows x 17 Columns in square format**  
**Model 617, 7½ x 14½" footprint, 102 keys max.**

Ideal for many point-of-sale applications, this keyboard is fully-configurable up to a maximum of 102 single-space keys. Choose re-legendable, custom-printed or blank keycaps in any color.



## Custom Keyboards are our Specialty.

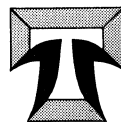
Even in very small quantities, we can supply completely custom keyboards in painted steel enclosures at very reasonable prices. We can also furnish mag-stripe & bar code readers, backlighting, RS-485, flat membrane keyboards and more. Just tell us what you need.

## You can count on Touchstone Technology.

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## Free Custom Keypad Designer's Kit.

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TECHNOLOGY INC.  
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ROCHESTER, NEW YORK 14624

# Custom Keyboards For Unique or Demanding Applications

For the past 15 years, XCEL has successfully offered custom Digitran® keyboards for the most demanding applications. Our keyboard customers buy from us because our keyboards are reliable, rugged and can withstand the solvents, solutions, liquids, dust and temperature ranges to which their equipment is exposed. We specialize in rigorous applications such as:

- Point of Sale Terminals
- Industrial Controllers
- Medical Instrumentation
- Telecommunications Systems
- Military Systems
- Intelligent Terminals
- Graphics CAD/CAM Terminals
- Test Instrumentation

Our microprocessor based, intelligent keyboard and application specific firmware allows us to integrate a multitude of Electrical Interface Protocols and Data Input Peripherals, including:

#### Input Peripherals:

- Mouse, Trackball
- Bar Code Magnetic Stripe Readers
- LCD Displays

#### Protocols:

- PS-2, PC-AT & PC-XT
- ASCII & TTL
- RS-232
- RS-422
- RS-423



#### Reliable, Extended Life:

Our full-travel keyboards use our patented capacitance key switches which have a rated life of 100 million cycles. We use double-shot legended keycaps and rigid FR4 printed circuit boards to provide the component reliability required to remain compatible with our 100 million lifecycle capacitance switches.

#### Environmentally Qualified:

We provide keyboards for the widest of temperature ranges. All of our full

travel, capacitance keyboards include our PF-SHIELD: a thermo-plastic film that provides environmental protection against dust, liquid spills, water spray, industrial solvents and most laboratory solutions. To maintain the professional image of your equipment, PF-SHIELD is "hidden" underneath your enclosure or front panel, eliminating unsightly plastic, rubber or membrane keyboard overlays.

#### Custom Layouts:

Call us for your custom requirements.

## Subsystem Engineering & Manufacturing

XCEL Corporation combines 35 years experience designing and developing data input and display devices with our extensive, vertically integrated manufacturing capability to offer a complete solution:

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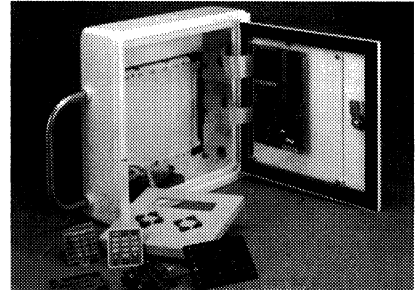
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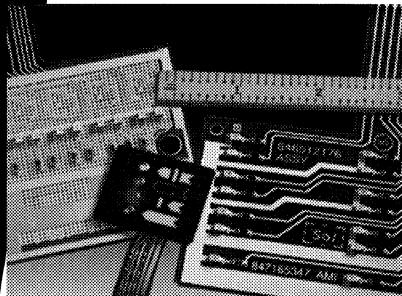


**Membrane Switches** – With a wide variety of product features and an experienced design team, Xymox can manufacture the custom switch you need.

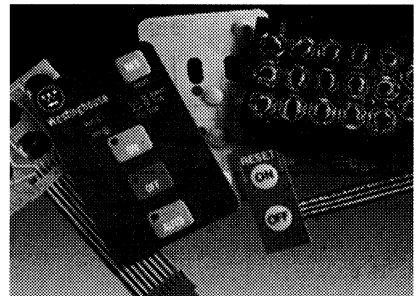


**Value-added Assemblies** – Xymox Integrated Membrane Switch Modules (IMSM) include displays, custom electronics, elastomers, membrane switches, printed circuit boards and enclosures.

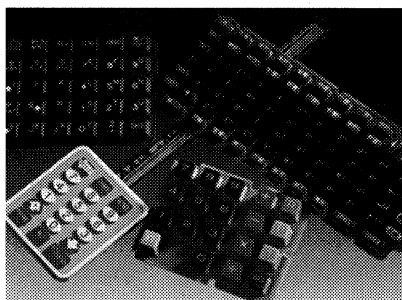
**Consistently  
meeting or  
exceeding  
customer  
requirements,  
every hour  
of every  
day.**



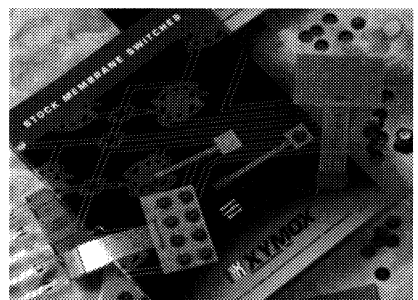
**Polyester Flex Circuits** – Screen printed silver circuits on polyester with surface mount components provide a cost effective alternative to circuit boards and standard flex circuits. LED layers can also be integrated into a switch package.



**Tactile Feedback Domes** – Stainless steel or thermoformed polyester domes provide a switch user with tactile feedback. Each dome type is rated to 2 million plus cycles and each can withstand high temperature environments.



**Elastomeric Keypads** – If you need the look and feel of rubber, Xymox can meet your needs with a conductive or non-conductive elastomer. Shorting to a printed circuit board or assembled to a polyester dome switch for highest reliability.



**Stock Switches** – With over 100 different configurations readily available through a worldwide network of distributors, you can have the switch you need within a matter of days. And with Xymox stock switches, you have no tooling or artwork costs.

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ISO 9001  
Certified

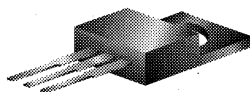
Other NTC & PTC  
Thermistors of  
Superior Quality:

Series	Description
QT0805	Surface Mount
QTMC	Epoxy Beads
QTLC	Interchangeables
QTG(N)	D07 Glass Seals
RTH	MIL-R-23648/1/9/19/20
QTC11	Wire Bond Chips
QTO220	EIA TO220 Packages
QTA	316 SS Gas/Air Sensor
QTP	316 SS NPT Hex Sensor
QTR	316 SS Immersion Sensor
QTRL	Surface Sensors

## NEW PRODUCT RELEASES

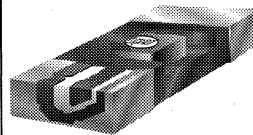
[www.thermistor.com](http://www.thermistor.com)

**TO220 Power**



NTC / PTC

**Linear 0805**



PTC

**High Temp.**



NTC

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## THERMISTORS, THERMOCOUPLES, & SENSORS

Manufacturer	Starting EEM Page No.	NTC	PTC	Leaded Chip	Disc	Hybrid Chip	Inter-changeable	Inrush Current Suppressors	Sensors, Temperature	Switches, Temperature Sensing	Thermocouple	Other Features
Advanced Sensor Div.	B•1668	√§	√§	√	√	√§	√	√	√	√		Glass encapsulated thermistors, precision interchangeable thermistors, surface mount thermistors, custom probes and assemblies, resistor networks, resistance values to 5M Ohm, tolerances to ±0.05° C, expert design engineering assistance available.
Advanced Thermal Products, Inc.	B•1674	√	√	√	√			√	√	√		
Alpha Thermistor	B•1677	√	√	√	√		√	√	√			Glass, RTD's
Ametherm, Inc.	B•1678	√	√		√			√	√			36 AMP inrush current limiter 8-32mm diameter
Best Technology Inc.	B•1680										√	Thermal Converters
Betatherm Corp.	B•1681	√		√			√		√			Customized Probe Assemblies
DCC Corp.	B•1686											Thermocouple welder, Data logger
Elmwood Sensors, Inc.	B•1687	√	√	√	√		√	√	√	√		
Fenwal Electronics	B•1689	√		√	√				√			Probe assemblies, Thermistor software program
Keystone Thermometrics	B•1690	√	√	√	√	√§		√	√	√		
Omega Engineering	B•1695	√	√						√	√	√	Dual construction, Emersion styles, Surface styles, Full line of accessories and instruments
Quality Thermistor, Inc.	B•1698	√	√	√		√§	√		√	√		SMD 0402-1206, TO226, MIL, QPL, DESC Approved, ISO9001 Space qualified
Raychem Corporation	B•1701		√	√	√							Resettable overcurrent, Circuit Protection
RTI Electronics Inc.	B•1702	√	√	√	√	√	√	√	√	√		
SELCO Products Company	B•1710				√				√			
Semitec USA Corp.	B•1714	√§						√	√			
Sensor Scientific, Inc.	B•1719	√		√			√		√			RTD elements
Texas Instruments	B•1725											Pressure Transducers
Therm - O - Disc / Emerson Electric Co.	B•1726								√§	√§		
Therm - O - Disc / Midwest Components Products Group	B•1727	√§	√§	√	√	√§	√	√	√§	√§		
Thermolyte Corp.	B•1731											Thermoelectric coolers
Vishay Dale Electronics	B•1732	√	√	√	√	√	√	√	√			
Warren G-V	B•1733								√	√		
YSI Incorporated	B•1734	√§					√§		√§			

## THERMOSTATS

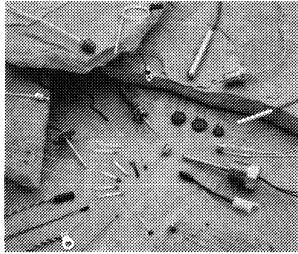
Manufacturer	Starting EEM Page No.	Low Profile	Grounded	Sealed (Immersion)	Isolated Contact	Isolated Case	Hermetic Seal	Disc
Elmwood Sensors, Inc.	B•1687	√	√	√	√	√	√	√
Omega Engineering	B•1695	√	√	√		√	√	
Philips Technologies	B•1697	√	√	√	√	√	√	√
Raychem Corporation	B•1701	√						√
SELCO Products Company	B•1710	√					√	√
Therm-O-Disc / Emerson Electric Co.	B•1726		√	√		√		√
Warren G-V	B•1733			√	√	√	√	

§ Surface Mount

# ADVANCED SENSOR

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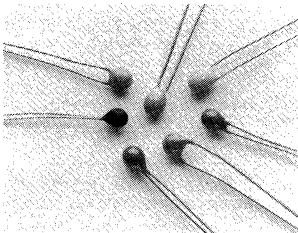
## U.S. Sensor Corp.



U.S. Sensor is a world class manufacturer of an extensive variety of the highest quality thermistors as well as thermistor probes and assemblies. The company's products include NTC and PTC thermistors which are produced using proprietary state of the art processing techniques. Customers worldwide use U.S. Sensor thermistors in their most demanding applications.

To assure that U.S. Sensor maintains its competitive position in the market place and continues to provide products which exceed its customers specified requirements, the company continues to make substantial investments in the most advanced component manufacturing equipment as well as in research and development of innovative products and manufacturing processes.

## Precision Interchangeable Thermistors



U.S. Sensor's precision interchangeable thermistors are low cost, highly accurate, stable devices designed specifically for temperature sensing, control and compensation applications. They are particularly suited for uses where their precision interchangeability eliminates the necessity for costly individual circuit calibration.

### Features

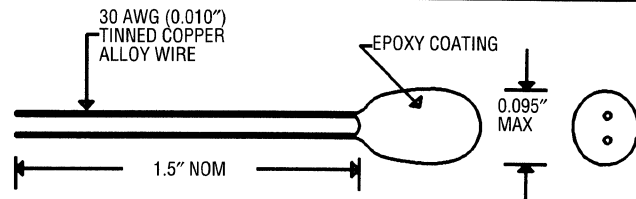
- Highly accuracy • Epoxy Encapsulated
- Fast thermal response • High stability
- Low cost • Long life
- Small size • R/T Curve-matched

### Options

- Special lead materials and lengths
- Special encapsulants or probe housings
- Non-standard resistance values and tolerances

### Specifications

- Thermal time constant: 1 second max in a well stirred oil bath, 10 seconds max in still air
- Dissipation constant: 1 mW/°C
- Maximum power rating: 30 mW at 25°C derated to 1 mW at 125°C

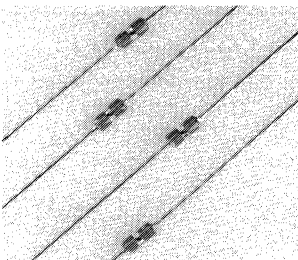


PART NUMBER (±0.1°C 0-70°C)	PART NUMBER (±0.2°C 0-70°C)	RESISTANCE Ω @ 25°C	R-T CURVE	BETA (°K) 0-50°C	RESIS-RATIO 25-125°C
PS102J2	PT102J2	1000*	J	3890	29.3
PS222J2	PT222J2	2252	J	3890	29.3
PS302J2	PT302J2	3000	J	3890	29.3
PS502J2	PT502J2	5000	J	3890	29.3
PS602J2	PT602J2	6000	J	3890	29.3
PS103G2	PT103G2	10000	G	3575	23.5
PS103J2	PT103J2	10000	J	3890	29.3
PS203J2	PT203J2	20000	J	3890	29.3
PS303J2	PT303J2	30000	J	3890	29.3
PS503J2	PT503J2	50000	J	3890	29.3
PS503R2	PT503R2	50000	R	4140	38.1
PS104R2	PT104R2	100000	R	4140	38.1

\*0.125" maximum diameter over epoxy coating.

- Interchangeability tolerance of ±0.1°C or ±0.2°C from 0-70°C
- Operating temperature: -80°C to +150°C
- Storage and operation temperature for best long term stability: PT series = -80° to +120°C, PS series = -80° to +75°C

## Glass Encapsulated Thermistors



U.S. Sensor's low cost glass encapsulated thermistors are manufactured using super stable NTC chips which are hermetically sealed in a glass (D0-35 diode style) package. The result is a device which exhibits excellent long term reliability and stability even when subjected to severe environmental or thermal conditions. Their uniform dimensions and axial lead configuration makes them

especially suitable for use with automatic insertion equipment.

### Features

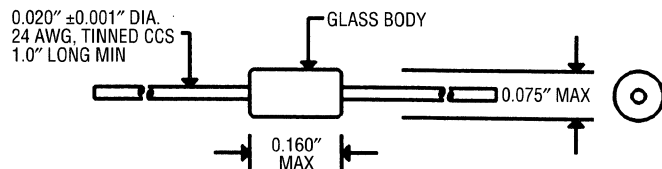
- High temperature capability to 300°C
- Hermetically sealed glass package • Low cost
- High stability • High voltage insulation
- Tinned CCS lead wires are solderable or weldable

### Options

- Non-standard resistance values and tolerances
- Point matched at specified temperatures
- Tape and Reel packaging

### Specifications

- Thermal time constant: 5 seconds (still air)
- Thermal time constant: 0.5 seconds (stirred liquid)
- Dissipation constant: 2 mW/°C (still air)



PART NUMBER	RESISTANCE Ω @ 25°C	*RESISTANCE TOL ±%	R-T CURVE	BETA (°K) 0-50 °C
252FG1K	2500	10	F	3420
502FG1K	5000	10	F	3420
822JG1K	8200	10	J	3890
103JG1K	10000	10	J	3890
123JG1K	12000	10	J	3890
203JG1K	20000	10	J	3890
253JG1K	25000	10	J	3890
303JG1K	30000	10	J	3890
503JG1K	50000	10	J	3890
753JG1K	75000	10	J	3890
104JG1K	100000	10	J	3890
254JG1K	250000	10	J	3890
504RG1K	500000	10	R	4140
105RG1K	1000000	10	R	4140

\*Resistance Tolerances of ±1%, 2%, and 5% are available upon request.

## Epoxy Encapsulated Chip Thermistors

U.S. Sensor's epoxy encapsulated thermistors are manufactured using the same state of the art manufacturing techniques as those used to produce precision interchangeable devices. This results in devices with superior long term reliability characteristics especially suitable for temperature measurement, temperature control and temperature compensation applications.

### Features

- Low Cost • High Stability • Epoxy encapsulated • Small size • Fast thermal response

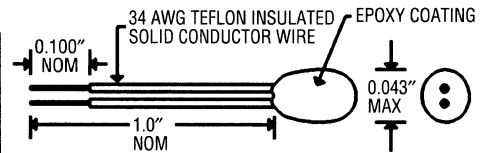
### Options

- Special lead materials and lengths • Special encapsulants or probe housings
- Non-standard resistance values and tolerances • Point matched at specified temperatures

### Specifications

- Thermal time constant: 0.1 second in water, 1.0 second in still air
- Dissipation constant: 1mW/°C

PART NUMBER	RESISTANCE Ω @ 25°C	*RESISTANCE TOL ±%	R-T CURVE	BETA (K) 0-50°C	MAX OPERATING TEMP °C
MB103J2K	10000	10	J	3890	150
MB153J2K	15000	10	J	3890	150
MB203J2K	20000	10	J	3890	150
MB303J2K	30000	10	J	3890	150
MB503J2K	50000	10	J	3890	150
MB104R2K	100000	10	R	4140	150

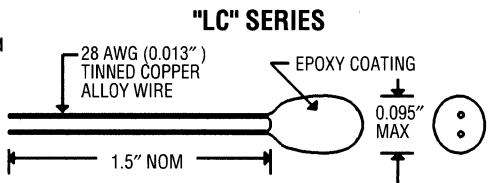


\*Resistance Tolerances of ±1%, 2%, 5% and 20% Are Available Upon Request

### Specifications

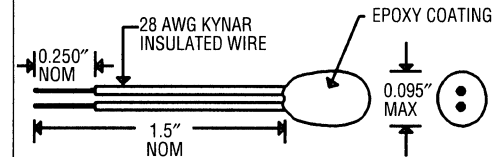
- Thermal time constant: 1 second max. in a well stirred oil bath, 10 seconds max in still air.
- Dissipation constant: 1 mW/°C
- Max. operating temperature: LC series 150°C, KC series 125°C. (R-T Curve "B" devices limited to 100°C Max.)

PART NUMBER (INSULATED LEADS)	PART NUMBER (BARE LEADS)	RESISTANCE Ω @ 25°C	*RESISTANCE TOL ±%	R-T CURVE	BETA (K) 0-50°C
KC101B2K	LC101B2K	100	10	B	2930
KC102F2K	LC102F2K	1000	10	F	3420
KC222J2K	LC222J2K	2252	10	J	3890
KC302J2K	LC302J2K	3000	10	J	3890
KC502J2K	LC502J2K	5000	10	J	3890
KC103G2K	LC103G2K	10000	10	G	3575
KC103J2K	LC103J2K	10000	10	J	3890
KC203J2K	LC203J2K	20000	10	J	3890
KC303J2K	LC303J2K	30000	10	J	3890
KC503J2K	LC503J2K	50000	10	J	3890
KC104R2K	LC104R2K	100000	10	R	4140



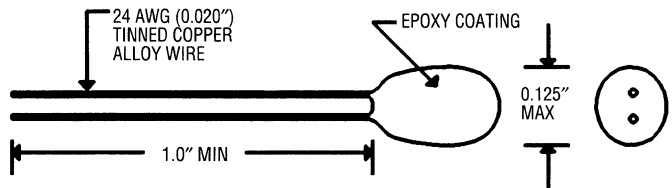
\*Resistance Tolerances of ±1%, 2%, 5% and 20% Are Available Upon Request

### "KC" SERIES



### Specifications

- Thermal time constant: 2 seconds max in a well stirred oil bath, 15 seconds max in still air.
- Dissipation constant : 3 mW/°C



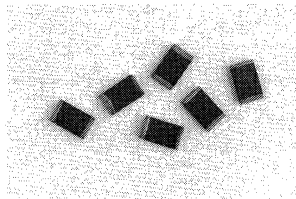
PART NUMBER	RESISTANCE Ω @ 25°C	*RESISTANCE TOL ±%	R-T CURVE	BETA (K) 0-50°C	MAX OPERATING TEMP °C
DC101B2K	100	10	B	2930	100
DC102F2K	1000	10	F	3420	150
DC222J2K	2252	10	J	3890	150
DC302J2K	3000	10	J	3890	150
DC502J2K	5000	10	J	3890	150
DC103G2K	10000	10	G	3575	150
DC103J2K	10000	10	J	3890	150
DC203J2K	20000	10	J	3890	150
DC303H2K	30000	10	H	3810	150
DC303J2K	30000	10	J	3890	150
DC503J2K	50000	10	J	3890	150
DC104R2K	100000	10	R	4140	150

\*Resistance Tolerances of ±1%, 2%, 5% and 20% Are Available Upon Request

# ADVANCED SENSOR

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## Surface Mount End-Banded Chip Thermistors



U.S. Sensor's surface mount end-banded thermistor elements are designed for use on hybrid substrates, integrated circuits or printed circuit boards. They have tinned nickel barrier metallization which is suitable for soldering. Since they are manufactured using the most advanced equipment

and technology available, their dimensional parameters are extremely uniform making the devices especially suitable for use with automatic handling and placement equipment.

### Features

- Surface mountable • Small size
- Low cost • Rated to 150°C operating temperature

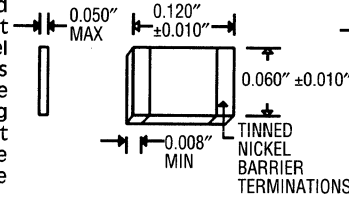
### Options

- Non-standard resistance values and tolerances
- Special electrode materials • Special dimensions
- Tape and reel packaging

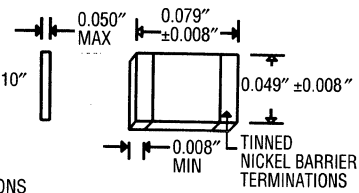
### Specifications

- Thermal time constant: 10 seconds max.
- Dissipation constant: 1 mW/°C

### "NW" SERIES 1206 PACKAGE



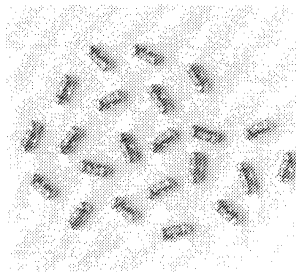
### "NR" SERIES 0805 PACKAGE



PART NUMBER "NW SERIES"	PART NUMBER "NR SERIES"	RESISTANCE Ω @ 25°C	*RESISTANCE TOL ±%	R-T CURVE	BETA (K) 0-50°C
NW102B1K	NR102B1K	1000	10	B	2930
NW502F1K	NR502F1K	5000	10	F	3420
NW103F1K	NR103F1K	10000	10	F	3420
NW203F1K	NR203F1K	20000	10	F	3420
NW253J1K	NR253J1K	25000	10	J	3890
NW303J1K	NR303J1K	30000	10	J	3890
NW503J1K	NR503J1K	50000	10	J	3890
NW753J1K	NR753J1K	75000	10	J	3890
NW104J1K	NR104J1K	100000	10	J	3890

\*Resistance Tolerances of 5% and 20% Are Available Upon Request.

## Surface Mount "Melf" Style Thermistors



U.S. Sensor's NTC "MELF" glass encapsulated surface mount thermistors are manufactured using super stable NTC chips which are hermetically sealed in a glass package. The result is an extremely reliable surface mount package which is capable of withstanding the most severe environmental conditions. Tape and reeling for use with automatic insertion equipment is available.

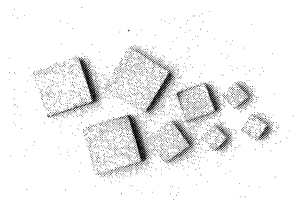
### Features

- Surface mountable • Hermetically sealed glass package • Low cost
- High stability • Rated to 220°C operating temperature

### Options

- Non-standard resistance values and tolerances
- Point matched at specified temperatures • Tape and reel packaging

## Leadless Chip Thermistors



U.S. Sensor's leadless chip thermistor elements are designed for use on hybrid substrates, integrated circuits or printed circuit boards. They have silver metallization on their top and bottom which is suitable for various contact techniques including wire bond, epoxy or solder. Since they are manufactured using the most advanced equipment and technology available, their dimensional parameters are extremely uniform, making the devices especially suitable for use with automatic handling and placement equipment.

and technology available, their dimensional parameters are extremely uniform, making the devices especially suitable for use with automatic handling and placement equipment.

### Features

- Surface mountable • Small size
- Very low profile • Low cost
- Rapid response time • Rated to 150°C

### Options

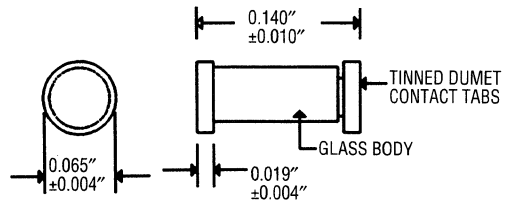
- Non-standard resistance values and tolerances
- Special electrode materials (silver or gold)
- Special dimensions
- Tape and reel packaging

### Specifications

- Thermal time constant: 8 seconds max.
- Dissipation constant: 2 mW/°C

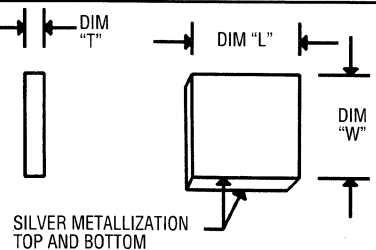
PART NUMBER	RESISTANCE Ω @ 25°C	*RESISTANCE TOL ±%	R-T CURVE	BETA (°K) 0-50°C	MAX OPERATING TEMP °C
SM103J1K	10000	10	J	3890	220
SM153J1K	15000	10	J	3890	220
SM203J1K	20000	10	J	3890	220
SM253J1K	25000	10	J	3890	220
SM303J1K	30000	10	J	3890	220
SM403J1K	40000	10	J	3890	220
SM503J1K	50000	10	J	3890	220

\*Other Resistance Tolerances Available Upon Request.



### Specifications

- Thermal time constant: 2 seconds max
- Dissipation constant: 1 mW/°C



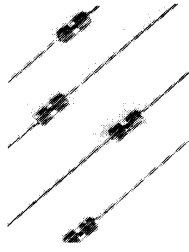
PART NUMBER	RESISTANCE Ω @ 25°C	*RESISTANCE TOL ±%	R-T CURVE	BETA (K) 0-50°C	NOMINAL DIMENSIONS "INCHES"		
					DIM "L"	DIM "W"	DIM "T"
BC101B1K	100	10	B	2930	0.060	0.060	0.015
BC501F1K	500	10	F	3420	0.075	0.075	0.015
BC102F1K	1000	10	F	3420	0.045	0.045	0.015
BC222J1K	2252	10	J	3890	0.070	0.070	0.010
BC302J1K	3000	10	J	3890	0.065	0.065	0.010
BC502J1K	5000	10	J	3890	0.055	0.055	0.015
BC103J1K	10000	10	J	3890	0.040	0.040	0.015
BC203J1K	20000	10	J	3890	0.030	0.030	0.015
BC303J1K	30000	10	J	3890	0.025	0.025	0.020
BC503J1K	50000	10	J	3890	0.020	0.020	0.020

\*Resistance Tolerances of 5% and 20% Are Available Upon Request.

# ADVANCED SENSOR

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## Silicon PTC Thermistors



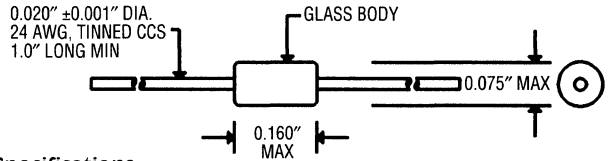
U.S. Sensor's Silicon positive temperature coefficient (PTC) thermistors are hermetically sealed in the same exceptionally reliable D0-35 glass package as U.S. Sensor's line of glass encapsulated NTC thermistors. Due to their low cost and nearly linear resistance-temperature relationship, these devices are especially useful for temperature compensation, measurement and control. They are available in various resistance values and tolerances and are supplied either bulk packaged or taped and reeled.

### Features

- Nearly Linear R/T Characteristics
- Low Cost
- High Stability
- Fast Thermal Response
- Hermetically Sealed Package

### Options

- Non-Standard Resistance Values
- Non-Standard Tolerances
- Point Matched at Specific Temperatures
- Tape and Reel Packaging
- Probe Mounted Versions



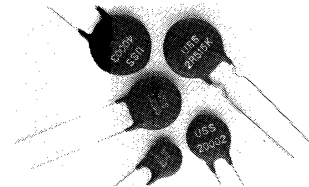
### Specifications

- +0.7%/°C positive temperature coefficient
- Thermal Time Constant: 8 Seconds Max. (Still Air)
- Thermal Time Constant: 0.4 Seconds Max. (Flowing Fluid)
- Dissipation Constant: 2 mW/°C Nom
- Maximum operating temperature 150°C

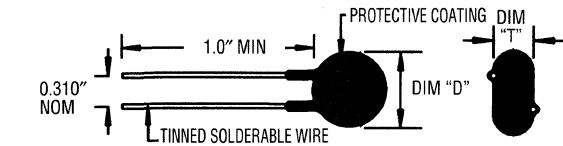
PART NUMBER	*RESISTANCE @25°C (Ω)	*RESISTANCE TOL ± %	R - T CURVE
501GS3K	500	10	SIL
821GS3K	820	10	SIL
102GS3K	1000	10	SIL
202GS3K	2000	10	SIL
302GS3K	3000	10	SIL

\*Other Resistance Values Available Upon Request

## Inrush Current Limiting Power Thermistors



U.S. Sensor's inrush current limiting power thermistors are specially formulated and processed NTC thermistors suitable for suppressing high inrush currents in switching power supplies and other applications where the high initial starting currents are undesirable. Their unique design enables them to handle extremely high current and voltage levels. In a typical power supply application, the device is used in series with the filter capacitors. Upon application of the initial voltage, the device, due to its relatively high resistance, limits the current flow to an acceptable level until the capacitors are charged. Thereafter, the device decreases in resistance substantially to a level where the voltage drop across it is negligible.



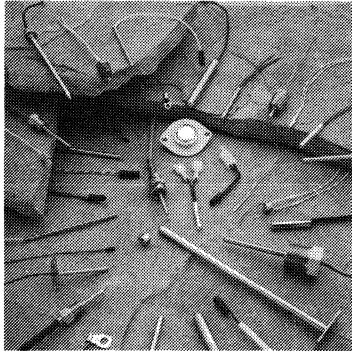
### Specification Table

PART NUMBER	R <sub>0</sub> RESISTANCE @25°C ±20% (OHMS)	I <sub>MAX</sub> MAX STEADY STATE CURRENT (AMPS)	R <sub>1MAX</sub> RESIS @ MAX CURRENT Ω	DIM "D" MAX OVER COATING	DIM "T" MAX OVER COATING	LEAD DIA (NOM)
ST2R018B	2.0	18	0.030	0.900"	0.350"	0.040"
ST2R503B	2.5	3	0.150	0.600"	0.250"	0.032"
ST2R507B	2.5	7	0.050	0.600"	0.250"	0.032"
ST2R509B	2.5	9	0.040	0.700"	0.250"	0.032"
ST2R510B	2.5	10	0.040	0.900"	0.300"	0.040"
ST2R515B	2.5	15	0.030	0.900"	0.300"	0.040"
ST5R002B	5.0	2	0.400	0.600"	0.250"	0.032"
ST5R005B	5.0	5	0.100	0.600"	0.250"	0.032"
ST5R007B	5.0	7	0.070	0.600"	0.250"	0.032"
ST7R004B	7.0	4	0.200	0.600"	0.300"	0.040"
ST10003B	10.0	3	0.200	0.450"	0.300"	0.032"
ST10005B	10.0	5	0.200	0.600"	0.350"	0.040"
ST10006B	10.0	6	0.150	0.600"	0.350"	0.040"
ST20002B	20.0	2	0.600	0.500"	0.300"	0.032"
ST40002B	40.0	2	0.600	0.625"	0.250"	0.032"

## Resistance Temperature Chart

CURVE TYPE	"B"	"F"	"G"	"J"	"R"	"SIL"
BETA 0-50°C	2930	3420	3575	3890	4140	---
R RATIO R <sub>0</sub> /R <sub>50</sub>	5.28	6.94	7.58	9.065	10.44	---
TEMP °C	R <sub>T</sub> /R <sub>25</sub>	R <sub>T</sub> /R <sub>25</sub>	R <sub>T</sub> /R <sub>25</sub>	R <sub>T</sub> /R <sub>25</sub>	R <sub>T</sub> /R <sub>25</sub>	R <sub>T</sub> /R <sub>25</sub>
-50	24.3	39.49	44.13	67.01	82.31	0.525
-40	14.4	21.68	23.98	33.65	40.34	0.577
-30	8.93	12.38	13.52	17.70	20.67	0.632
-20	5.69	7.329	7.891	9.707	11.03	0.691
-10	3.68	4.482	4.754	5.533	6.114	0.754
0	2.45	2.825	2.949	3.265	3.508	0.820
10	1.68	1.830	1.879	1.990	2.078	0.889
20	1.18	1.216	1.226	1.249	1.268	0.962
25	1.00	1.000	1.000	1.000	1.000	1.000
30	0.854	0.8270	0.8194	0.8057	0.7946	1.039
40	0.628	0.5747	0.5592	0.5326	0.5108	1.118
50	0.464	0.4073	0.3893	0.3602	0.3361	1.202
60	0.350	0.2941	0.2760	0.2488	0.2260	1.288
70	0.267	0.2160	0.1990	0.1752	0.1550	1.379
80	0.208	0.1612	0.1458	0.1255	0.1083	1.472
90	0.163	0.1221	0.1084	0.09154	0.07700	1.569
100	0.130	0.09370	0.08168	0.06786	0.05563	1.670
110	0.105	0.07282	0.06235	0.05106	0.04079	1.774
120	0.0852	0.05730	0.04818	0.03896	0.03032	1.882
130	0.0700	0.04560	0.03764	0.03010	0.02284	1.993
140	0.0579	0.03668	0.02972	0.02354	0.01742	2.107
150	0.0483	0.02980	0.02370	0.01861	0.01344	2.225

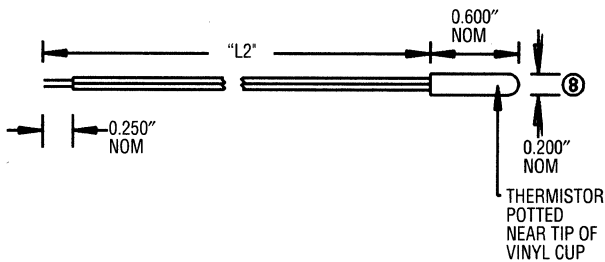
## Thermistor Probe Assemblies



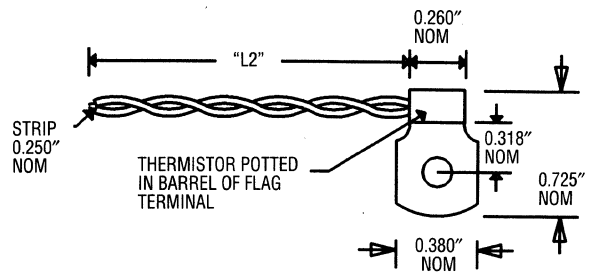
U.S. Sensor Corp. manufactures an extensive line of thermistor probe assemblies to meet the most demanding environmental applications. The styles illustrated here represent only a portion of what we have available. U.S. Sensor's expert application engineering department can assist in designing a probe assembly to best suit your needs.

Dimensions "L1", "L2" and "D" are user selectable. In most cases, the probe housings are available with various probe materials and lengths as well as with a wide selection of lead wire materials and terminations. The electrical characteristics of the thermistor element and the accuracy is dependent upon the requirements of the application.

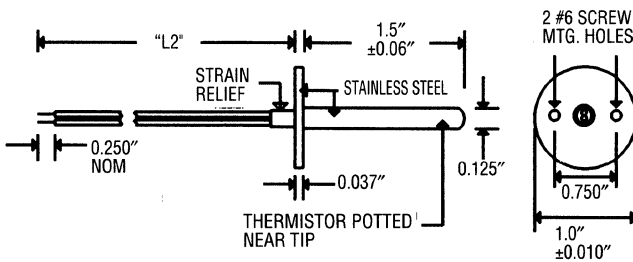
**H0927** Low Cost Vinyl Probe



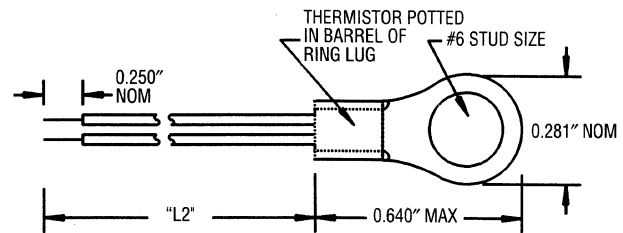
**H0968** Flag Terminal Probe



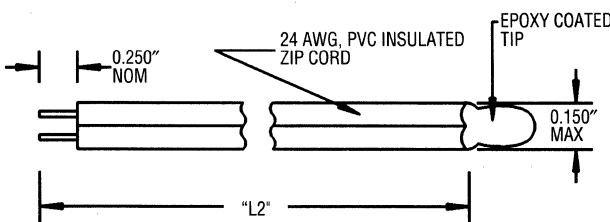
**H1060** Flange Mountable Stainless Steel Probe



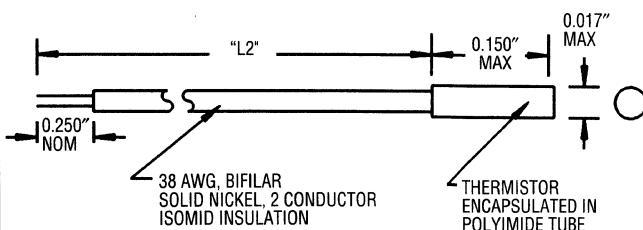
**H1327** Ring Lug Housing



**H1492** Epoxy Dipped Zip Cord Probe



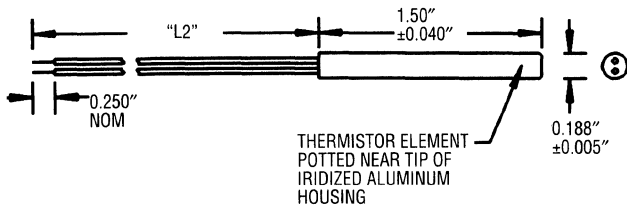
**H1744** Polyimide Tube Housing



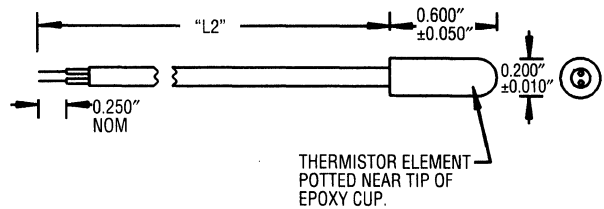


## Thermistor Probe Assemblies

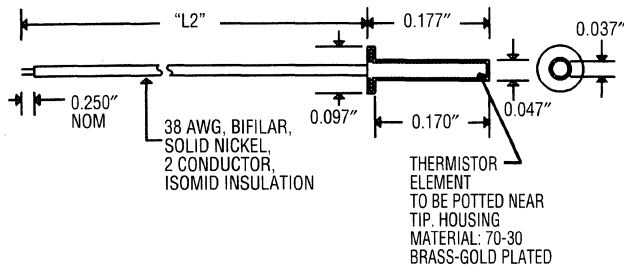
**H1801** Aluminum Housing Probe



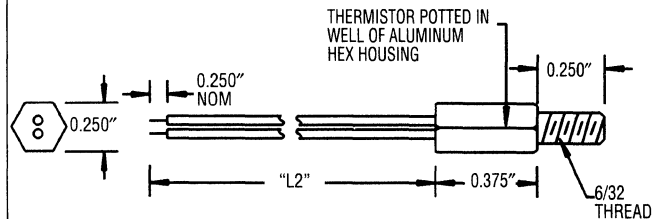
**H1817** Epoxy Housing Probe



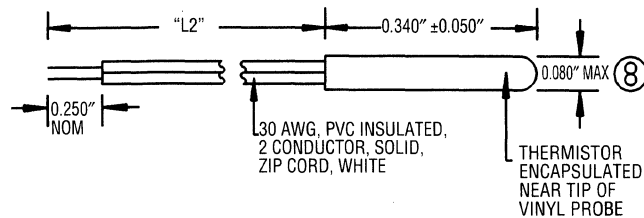
**H1826** Fast Response Micro-Probe



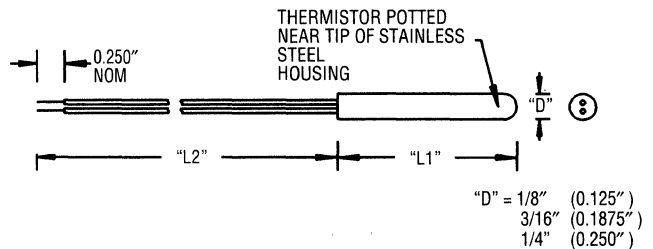
**H1887** Aluminum Hex Housing



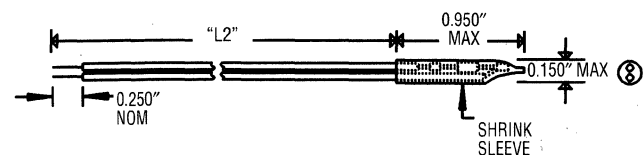
**H2010** Small Vinyl Medical Probe



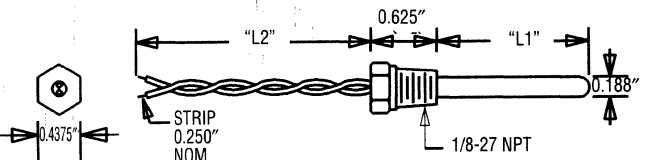
**H2022** Stainless Steel Immersion Probe



**H2049** Shrink sleeve probe



**H2097** Threaded Stainless Steel Immersion Probe



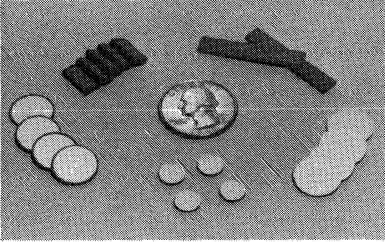
NOTE: OTHER THREAD SIZES AS WELL AS OTHER PROBE DIAMETERS ARE AVAILABLE. PLEASE CONTACT U.S. SENSOR'S APPLICATION ENGINEERING DEPARTMENT.

# THERMISTORS

ADVANCED THERMAL PRODUCTS, INC.



## PTC THERMISTORS FOR SELF-REGULATING HEATERS



### Features:

- No thermostat needed
- Virtually unlimited life
- No moving parts to wear
- Very low cost
- No electrical noise
- Efficient

### Typical Applications:

- Curling iron
- Hair dryer
- Hot melt glue gun
- Food warmer
- Liquid Crystal display
- Automotive chokes
- Plug-in aroma heater
- Plug-in insecticide
- Wax motor
- TCXO heater
- Heat tracing tape
- Diesel fuel heater

Positive Temperature Coefficient thermistors are truly remarkable for their ability to function as self-regulating heating elements. They can operate at a nearly constant temperature over a broad range of voltage and dissipation conditions. PTC heaters can be manu-

factured in many different configurations. These include discs, rectangles, squares, cylinders, and various shapes with holes to increase surface area. Multiple PTCs can be used in parallel to provide constant heating over a larger area.

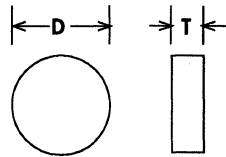
### Standard Disc PTC Heaters

Switch Temp. (°C)	V <sub>max</sub> (Volts)	D (in.)	T (in.)	R <sub>25</sub> (Ohms)	ATP Type#
50	30	.500	.051	9	P5005B050Z900H
90	30	.500	.051	9	P5005B090Z900H
135	30	.500	.051	9	P5005B135Z900H
170	30	.500	.051	9	P5005B170Z900H
70	265	.500	.083	170	P5008E070Z172H
120	265	.500	.083	170	P5008E120Z172H
150	265	.500	.083	170	P5008E150Z172H
190	265	.500	.083	170	P5008E190Z172H

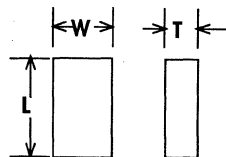
### Standard Rectangular PTC Heaters

Switch Temp. (°C)	V <sub>max</sub> (Volts)	L (in.)	W (in.)	T (in.)	R <sub>25</sub> (Ohms)	ATP Type#
50	30	.472	.236	.051	16	PR425B050Z161H
90	30	.472	.236	.051	16	PR425B090Z161H
135	30	.472	.236	.051	16	PR425B135Z161H
170	30	.472	.236	.051	16	PR425B170Z161H
70	265	.472	.236	.083	300	PR428E070Z302H
120	265	.472	.236	.083	300	PR428E120Z302H
150	265	.472	.236	.083	300	PR428E150Z302H
190	265	.472	.236	.083	300	PR428E190Z302H

### Disc Heater



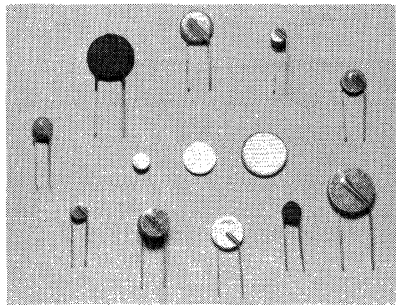
### Rectangular Heater



—Other Disc and Rectangular sizes available upon request

- UL RECOGNIZED PTC HEATERS AND OVER-CURRENT PROTECTORS
- UL CATEGORY XGPU2 —THERMISTOR TYPE DEVICES
- FILE # E 157106 (M) • CONTACT FACTORY FOR UL MODEL MEMBERS

## PTC THERMISTORS FOR OVER-CURRENT PROTECTION



### Features:

- Fast Switching
- No Electrical Noise
- Virtually Unlimited Life
- Self Resetting
- No Contacts
- Automatic Operation
- Efficient

### Typical Applications:

- Telephone Line Fault Protection
- Transformer Protection
- FHP Motor Protection
- Transistor Protection
- Speaker Protection

### ATP Standard Over-Current Protectors

V <sub>max</sub>	R <sub>25</sub>	I <sub>ns</sub>	I <sub>ms</sub>	H	δ	D <sub>max</sub>	Wire Diameter		ATP TYPE #
Maximum Voltage (volts)	Resistance at 25°C (±20%) (Ω)	Maximum No Switch Current (Amps)	Minimum Must Switch Current (Amps)	Heat Capacity (Watt-sec. °C)	Dissipation Constant (Watt. °C)	Maximum Diameter (in.)	(in.)	(ga.)	
15	0.8	0.89	1.58	0.57	.015	.650	.032	20	P6004A120X080F
	1.0	0.77	1.37	0.48	.014	.600	.032	20	P5504A120X100F
	1.5	0.56	0.99	0.32	.011	.500	.020	24	P4504A120X150F
	2.0	0.46	0.82	0.25	.010	.450	.020	24	P4004A120X200F
50	5	0.36	0.63	0.85	.015	.650	.032	20	P6006C120X500F
	10	0.21	0.37	0.38	.010	.450	.020	24	P4006C120X101F
	20	0.13	0.23	0.21	.008	.350	.020	24	P3006C120X201F
	7	0.31	0.55	1.41	0.16	.016	.650	.032	20
132	10	0.25	0.45	1.19	.015	.600	.032	20	P5510D120X101F
	25	0.13	0.23	0.48	.010	.400	.025	22	P3510D120X251F
	50	0.08	0.15	0.25	.008	.300	.020	24	P2510D120X501F
	100	0.05	0.10	0.16	.007	.250	.020	24	P2010D120X102F
265	25	0.14	0.25	0.94	.012	.450	.025	22	P4015E120X251F
	50	0.09	0.16	0.53	.009	.350	.020	24	P3015E120X501F
	100	0.06	0.10	0.24	.008	.250	.020	24	P2015E120X102F
400	50	0.10	0.18	0.96	.012	.400	.025	22	P3520F120X501F
	100	0.06	0.11	0.49	.009	.300	.020	24	P2520F120X102F

**Notes:** 1. Maximum Voltage listed as DC or 60 Hz. AC. 2. Maximum No Switch Current (I<sub>ns</sub>) is the maximum current that the PTC can pass without switching into its high resistance state. 3. Minimum Must Switch Current (I<sub>ms</sub>) is the minimum current that is necessary to switch the PTC into its high resistance state. 4. I<sub>ns</sub> is calculated at the maximum ambient temperature, while I<sub>ms</sub> is determined at the minimum ambient temperature. For ATP standard products, T<sub>min</sub> is 0°C and T<sub>max</sub> is 50°C.

# THERMISTORS

ADVANCED THERMAL PRODUCTS, INC.



## Temperature Sensing Probes and Assemblies Using:

- Glass Encapsulated NTC Thermistors
- Epoxy Coated Chip NTC Thermistors
- Disc NTC Thermistors
- National Semiconductor LM34/LM35 Temp. Sensors
- Analog Devices AD590/AD592 Temperature Sensors
- Silicon PTC Thermistors and Ceramic PTC Thermistors

### GENERAL PURPOSE PROBES

**Type: AB**  
Square Aluminum Block

**Type: BT**  
Closed End Nickel-Plated Brass Tube

TYPE	A	B
BT1	.231"	1.25"
BT2	.250"	1.75"

**Type: CT**  
Closed End Copper Tube

**Type: HS**  
Heat Shrink Sleeve

**Type: PT**  
Molded Plastic Shell

**Type: SA**  
Gas/Air Flow Sensor

### SURFACE TEMPERATURE PROBES

**Type: AY**  
Hex Aluminum Surface Sensor

TYPE	A	B
AY1	.250"	10-32 UNC
AY2	.312"	1/4"-28 UNC

**Type: CX**  
Clamp-On Copper Tube

**Type: RC**  
Closed End Ring Terminal

**Type: RT**  
Open End Ring Terminal

### IMMERSION PROBES

**Type: BX**  
Brass Housing with Integral Connector

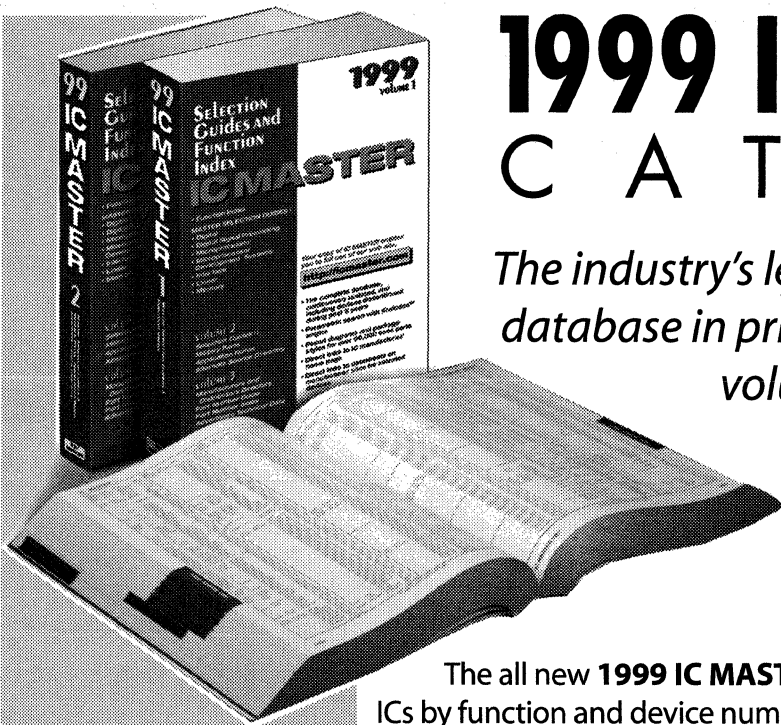
**Type: SG**  
Flange Mount Stainless Steel Tube

**Type: ST**  
Closed End Stainless Steel Tube - Straight

TYPE	A	B
ST1	.125"	0.5" to 6.0"
ST2	.156"	0.5" to 9.0"
ST3	.187"	0.5" to 12.0"
ST4	.250"	0.5" to 12.0"

**Type: SX**  
Stainless Steel Hex Head Pipe Plug with Closed End Tube

TYPE	A	B	C	D
SX1	.125"	0.5" to 6.0"	1/8" - 27NPT	7/16"
SX2	.156"	0.5" to 9.0"	1/8" - 27NPT	7/16"
SX3	.187"	0.5" to 12.0"	1/8" - 27NPT	7/16"
SX4	.156"	0.5" to 9.0"	1/4" - 18NPT	9/16"
SX5	.187"	0.5" to 12.0"	1/4" - 18NPT	9/16"
SX6	.250"	0.5" to 15.0"	1/4" - 18NPT	9/16"



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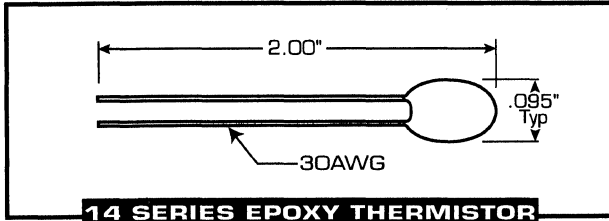
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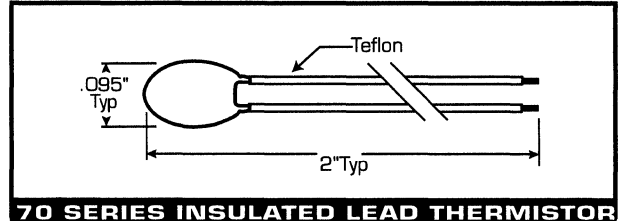
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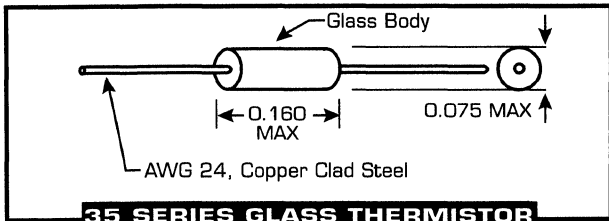
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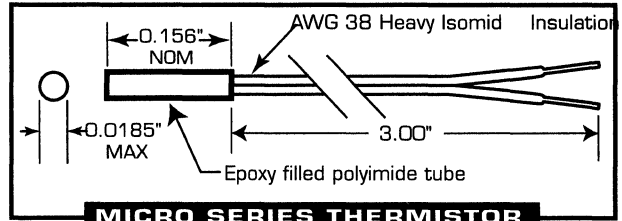
**14 SERIES EPOXY THERMISTOR**



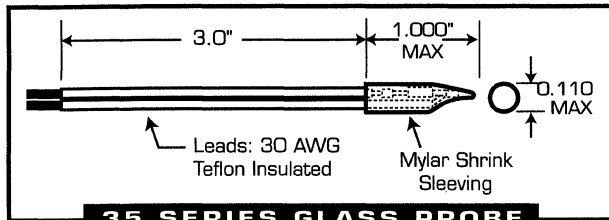
**70 SERIES INSULATED LEAD THERMISTOR**



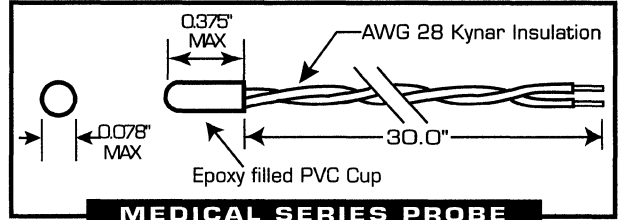
**35 SERIES GLASS THERMISTOR**



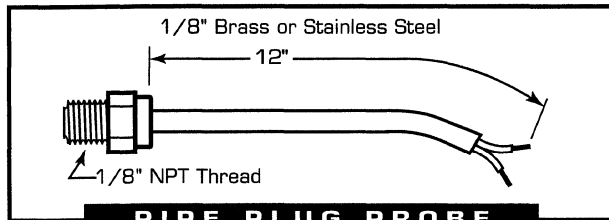
**MICRO SERIES THERMISTOR**



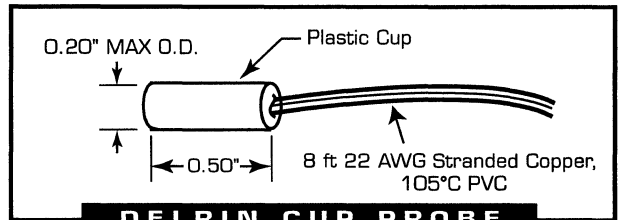
**35 SERIES GLASS PROBE**



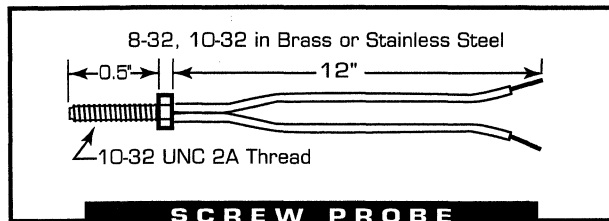
**MEDICAL SERIES PROBE**



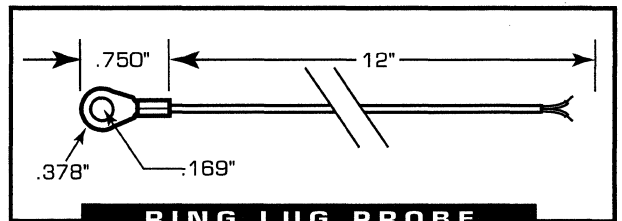
**PIPE PLUG PROBE**



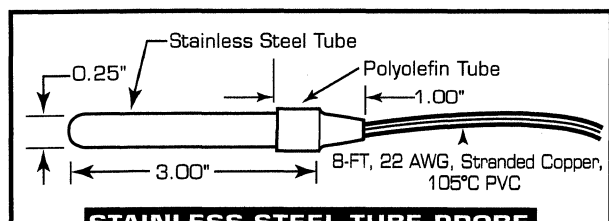
**DELRIN CUP PROBE**



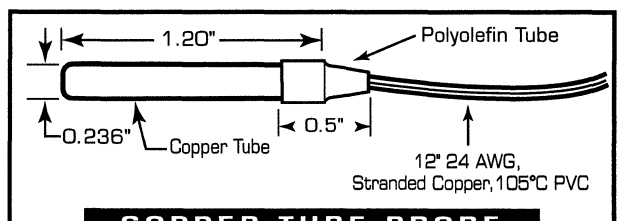
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**RING LUG PROBE**



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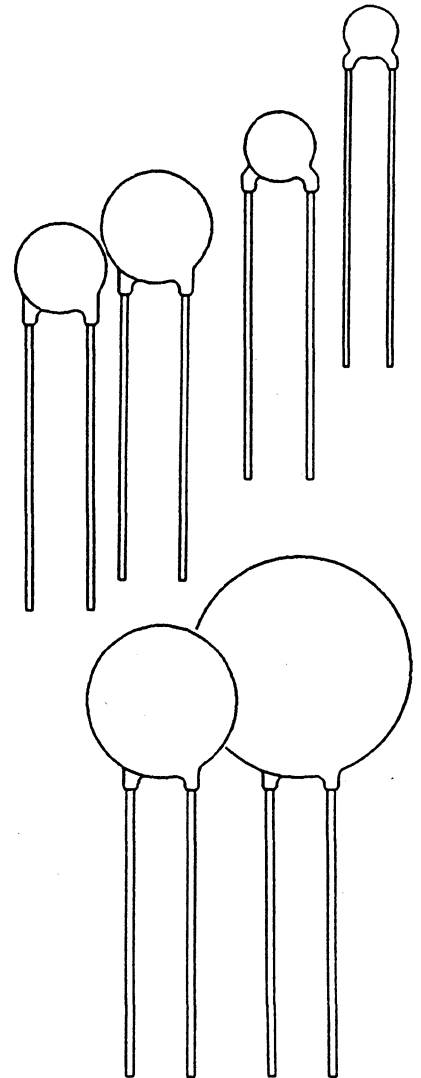
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electrical current and quickly heat up to a negligible resistance after current flows through the Thermistor. Surge Limiters are available in standard configurations, with a wide range of resistance and current carrying capabilities to fit your needs. They can also be custom designed to meet a variety of resistance, tolerance, size, lead configuration, and custom package specifications.

## SURGE LIMITERS

Part Number	R <sub>25</sub> °C	SSI (Amps)	Rmax (Ohms)	Dmax (mm)	Tmax (mm)	Leads (mm)
	(Ohms)					
SL08 5R003	5.0	3.0	0.210	8.0	4	0.032
SL08 7R002	7.0	2.5	0.295	8.0	4	0.032
SL08 10002	10.0	2.5	0.330	8.0	4	0.032
SL10 1R506	1.5	6.0	0.070	10.3	5	0.032
SL10 2R005	2.0	5.5	0.090	10.3	5	0.032
SL10 2R505	2.5	5.0	0.103	10.3	5	0.032
SL10 4R004	4.0	4.0	0.170	10.3	5	0.032
SL10 10003	10.0	3.0	0.200	9.50	5	0.032
SL10 10004	10.0	3.2	0.180	9.50	5	0.032
SL12 1R008	1.0	8.0	0.040	11.5	5	0.032
SL12 10005	10.0	5.0	0.130	11.5	5	0.032
SL12 12101	120.0	1.0	2.340	11.5	5	0.032
SL15 2R508	2.5	8.0	0.070	15.0	6	0.032
SL15 2R509	2.5	9.0	0.040	15.0	6	0.032
SL15 5R007	5.0	7.0	0.070	15.0	6	0.032
SL15 10006	10.0	6.0	0.150	15.0	6	0.032
SL15 16004	16.0	4.0	0.270	15.0	6	0.032
SL15 25003	25.0	3.0	0.400	15.0	6	0.032
SL15 22102	220.0	2.0	0.800	15.0	5	0.032
SL22 0R516	.50	16.0	0.019	22.0	6	0.040
SL22 1R020	1.0	20.0	0.020	22.0	6	0.040
SL22 2R018	2.0	18.0	0.022	22.0	6	0.040
SL22 2R510	2.5	10.0	0.040	22.0	6	0.040
SL22 2R515	2.5	15.0	0.030	22.0	6	0.040
SL22 5R012	5.0	12.0	0.051	22.0	6	0.040
SL22 10008	10.0	8.0	0.100	22.0	6	0.040
SL32 0R530	.50	30.0	0.013	32.0	6	0.040
SL32 0R536	.50	36.0	0.010	32.0	6	0.040
SL32 1R030	1.0	30.0	0.014	32.0	6	0.040
SL32 1R036	1.0	36.0	0.010	32.0	6	0.040
SL32 2R023	2.0	23.0	0.022	32.0	6	0.040
SL32 2R025	2.0	25.0	0.018	32.0	6	0.040
SL32 5R020	5.0	20.0	0.034	32.0	6	0.040
SL32 10015	10.0	15.0	0.090	32.0	6	0.040



### Reliable Service and On-Time Delivery

When we talk about reliability, we mean more than a rugged, dependable product. We're also talking about our performance as a supplier.

Ametherm is committed to being flexible and responsive to your needs. We offer short lead-times and on-time delivery. We also have the ability to provide Just-in-Time deliveries.

We are high-volume producers, which enables us to offer you competitive pricing for our full line of products.

### Custom Design

Ametherm is able to design and manufacture products for your unique applications. We can also offer kinked and custom lead configurations.

### The Highest Quality Standards

Rigorous testing and production control ensure that our products perform to specifications. Critical manufacturing processes are monitored via statistical process control. Raw materials are purchased only from qualified suppliers. Each product design is also tested to verify that it can perform to maximum specifications.

## Reliability Delivered On Time

3111 N. Deer Run Road, Suite 4, Carson City, NV USA 89701  
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(800) 808-2434

www.ametherm.com

Negative Temperature Coefficient (NTC) Thermistors

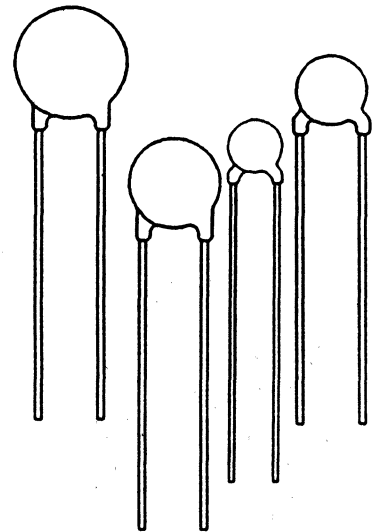
	NT02	NT05	NT08
Resistance at 25°C (±10%)	100Ω - 200KΩ	25Ω - 100KΩ	10Ω - 1KΩ
Tolerance		1% - 25%	
R Ratio 0° / 50°		5.60 - 13.80	
Beta 0° / 50°		3033 - 4641	
Size	02mm ref	05mm ref	08mm ref
Lead AWG	26	24 - 26	24 - 26
NTC's are a double-terminal semiconductor made from sintered mixtures of metal oxides such as manganese, cobalt, and nickel. The NTC decreases in resistance as a result of an increase in external, internal, or combination effect in body temperature. Because most conductors have a positive temperature coefficient of resistance, the NTC Thermistor is used to compensate such items as copper coils using a shunt resistor to bring the temperature coefficient of the NTC Thermistor down to a usable range.			
<b>OPTIONAL PACKAGING:</b>	<ul style="list-style-type: none"> <li>✓ Bare Discs</li> <li>✓ Kinked Leads</li> <li>✓ High-temperature Construction</li> <li>✓ Silicon Coating</li> <li>✓ Custom Lead Configurations</li> </ul>		

PTC THERMISTORS for Over-Current Protection

PTC Thermistors are thermally-sensitive resistors made of polycrystalline ceramic materials. The base compounds of Barium and Strontium Titanate are high-resistivity materials made semicon-

ductive by the addition of dopants. PTCs are normally used in over-current protection applications, such as motor starters and liquid-level sensing.

Part Number	R <sub>25</sub>		Ins	I <sub>ms</sub>	H	δ	D max	Leads
	Ω	Volts	Amps	Amps	Watt - sec °C	Watt °C	mm	in. / Ga.
CL17 0R8120	0.8	15	0.89	1.58	0.57	.015	.650	.032/20
CL15 1R0120	1.0	15	0.77	1.37	0.48	.014	.600	.032/20
CL13 1R5120	1.5	15	0.56	0.99	0.32	.011	.500	.020/24
CL12 2R0120	2.0	15	0.46	0.82	0.25	.010	.450	.020/24
CL17 5R0120	5.0	50	0.36	0.63	0.85	.015	.650	.032/20
CL12 100120	10.0	50	0.21	0.37	0.38	.010	.450	.020/24
CL09 200120	20.0	50	0.13	0.23	0.21	.008	.350	.020/24
CL17 7R0120	7.0	132	0.31	0.55	1.41	.016	.650	.032/20
CL15 100120	10.0	132	0.25	0.45	1.19	.015	.600	.032/20
CL10 250120	25.0	132	0.13	0.23	0.48	.010	.400	.025/22
CL08 500120	50.0	132	0.08	0.15	0.25	.008	.300	.020/24
CL06 101120	100.0	132	0.05	0.10	0.16	.007	.250	.020/24
CL12 250120	25.0	265	0.14	0.25	0.94	.012	.450	.025/22
CL09 500120	50.0	265	0.09	0.16	0.53	.009	.350	.020/24
CL06 101120	100.0	265	0.06	0.10	0.24	.008	.250	.020/24
CL10 500120	50.0	400	0.10	0.18	0.96	.012	.400	.025/22
CL08 101120	100.0	400	0.06	0.11	0.49	.009	.300	.020/24



R<sub>25</sub> = Resistance at 25°C (±20%)  
 Ins = Maximum No-Switch Current  
 H = Heat Capacity

I<sub>ms</sub> = Minimum Must-Switch Current  
 δ = Dissipation Constant  
 D<sub>max</sub> = Maximum Diameter

Reliability Delivered On Time

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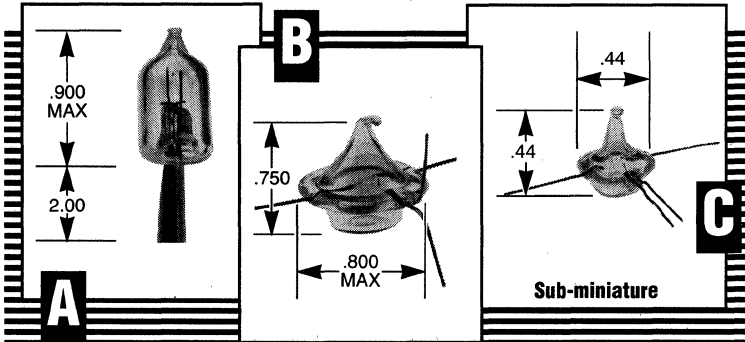
# BEST TECHNOLOGY INC.

400 Boren Ave. N., Seattle, WA 98109 206/623-6135 FAX 206/382-0186

## NEW from BEST TECHNOLOGY LOW MASS THERMOCOUPLES

For Temperature measurements on very low mass objects try our Low Mass Thermocouples. Techniques developed in manufacturing Vacuum Thermocouples enable Best Technology to provide thermocouples using wires from 0.001 inches dia. to as small as 0.00035 inches dia.

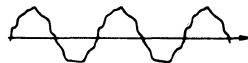
### VACUUM THERMAL CONVERTERS



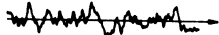
Vacuum Thermal Converters (VTC) are true RMS current measuring devices. A VTC consists of a thermocouple mounted on an electrically heated wire and encased in an evacuated glass bulb. The measured temperature of the heater wire is independent of wave shape or frequency over very wide ranges. The VTC is calibrated at D.C. and used to measure A.C. to as high as 1 GHz. Extremely high crest factors can be accommodated. Operating range is from 0-65 MHz for the standard pattern models, up to 300 MHz for UHF pattern and up to 1 GHz for sub-miniature UHF pattern models.

BEST VTC's are used throughout the world as basic AC-DC transfer standards as well as for true RMS Voltmeters and Power Meters. They can be made as Vacuum gages by exposing the heater and thermocouple to the Vacuum to be measured instead of being mounted inside an evacuated bulb. BEST supplies Vacuum gages to custom order.

#### TRUE RMS MEASUREMENT



- where the signal is periodic with distorted wave shapes



- or where random wave shapes are present, even with high crest factors

### APPLICATIONS CHART

VTCs are used as basic AC-DC transfer standards as well as other instrumentation applications including vacuum measurement.

VTC Type	Current mA **	Freq MHz	R/E %*	Applications
UHF	2.5-1000	0-300	.04	General purpose
UHF Matched Pairs	2.5-1000	0-300	.005	Voltmeters
Sub-Min. UHF	2.5-1000	0-1GHz	.08	Artificial squibs
Std. Pattern	1-1000	0-65	.005	Low current models available
Std. Pattern Matched Pairs	1-1000	0-65	.005	Voltmeters
Low AC-DC Transfer error	5 10	1.0 1.0	NA NA	SS288} AC-DC Transfer error 1 ppm to 100KHz, SS283} 10ppm to 1MHz
Vacuum Gages	1-1000	NA	NA	Vacuum measurement
Open Heaters	1k-50k	0-300	.20	High current RF

\*\* Range of full scale current values.

\* Best reversal error, standard is 0.2%

### POPULAR MODELS

Model No.	Range mA	Heater Resis. Ohms±10%	Couple Resis. Ohms±10%	O/C EMF ±12% mV	Max. Over-load %	See Fig.
S1	1.0	1750	13	7	250	A
S7	5.0	90	8	7	250	A
SS288	5.0	90	8	7	200	A
SS283	10.0	25	8	7	200	A
U1	5.0	90	8	7	250	B
SUB MIN U1	5.0	90	8	7	250	C
U2	10.0	25	8	7	250	B
U27	2.5	200	8	7	250	B

Hundreds of other models available. Thermocouple vacuum gauges to custom order. Write or call for application assistance.





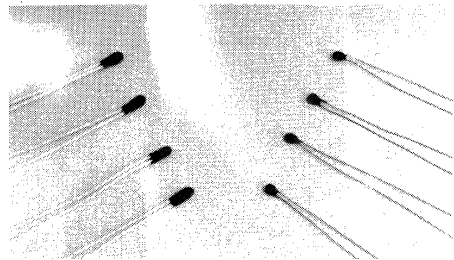
# BetaTHERM

## NTC Thermistor Devices

### INTERCHANGEABLE BetaCURVE THERMISTOR DEVICES

#### FEATURES

- Available in all Chip & Probe styles, insulated & non-insulated leads
- Superior Temp. Accuracy & Interchangeability
- Rugged—Reliable—Cost Efficient
- Proven Stability and Life Capability
- Rapid Time Response
- Rated from -55 to 150°C.
- 1.0 mW/°C Dissipation Constant
- 10 sec. Maximum Time Constant



#### BetaCURVETHERMISTOR DEVICES (±0.2°C. 0° to 70°C.)

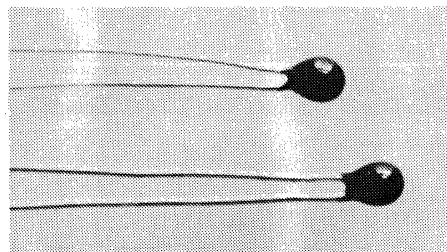
Nominal R @ 25°C. (ohms)	Part Number	R-T Curve #	0-50°C Beta Value (K.)	α @ 25°C. (%/°C)
2,252	2.2K3A1	3	3892	-4.4
5,000	5K3A1	3	3892	-4.4
10,000	10K3A1	3	3892	-4.4
10,000	10K4A1	4	3749	-4.0
30,000	30K5A1	5	3811	-4.3
50,000	50K6A1	6	4143	-4.7
100,000	100K6A1	6	4143	-4.7

+ BetaCURVE devices have ±0.2% C, curve track tolerance capability over the recommended use temperature span. Products with tighter deviation or extended temperature range can be factory ordered.

+ + Interchangeable BetaCURVE products with ±0.2 to 1.0 deg. C curve-track tolerance capability over 0-70°C are available. Products with tighter dT deviation or extended temperature can be factory ordered.

### 2 AND 3 mW/°C INTERCHANGEABLE BetaCURVE DEVICES

(Standard Tolerance ±.2°C. from 0°C to 70°C.)

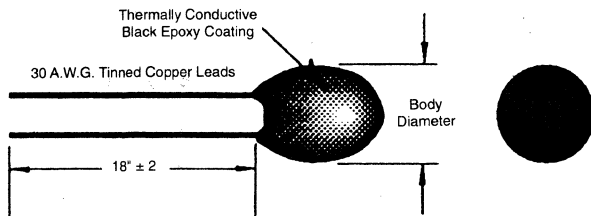
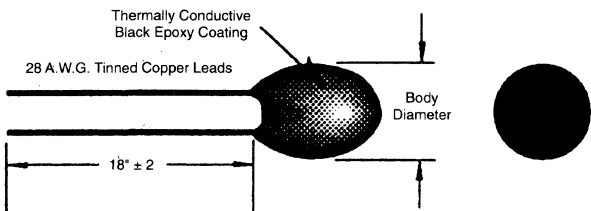


#### FEATURES

BetaTHERM introduces two new series to the existing product family. Both series are made from the same high quality materials found in all BetaTHERM products. The addition of these products will allow design engineers greater flexibility on sensor design projects. By using slightly larger chip thermistor elements and 30 A.W.G. and 28 A.W.G. tinned copper leads, the dissipation constant is raised to 2 mW/°C and 3mW/°C respectively. This also effects the Thermal Time Constant which is lengthened to 12 and 14 seconds in air, typical.

#### STANDARD 2mW/°C BetaCURVETHERMISTORS (±0.2°C. 0° to 70°C.)

Nominal R @ 25°C. (ohms)	Part Number	R-T Curve #	0-50°C Beta Value (K.)	α @ 25°C. (%/°C)
* 2,252	2.2K3A1W2	3	3892	-4.4
* 3,000	3K3A1W2	3	3892	-4.4
5,000	5K3A1W2	3	3892	-4.4
10,000	10K3A1W2	3	3892	-4.4
10,000	10K1A1W2	4	3575	-4.0
30,000	30K5A1W2	5	3811	-4.3
50,000	50K6A1W2	5	4143	-4.7
100,000	100K6A1W2	5	4143	-4.7
1,000,000	1M9A1W2	9	4582	-5.2



#### STANDARD 3mW/°C BetaCURVETHERMISTORS (±0.2°C. 0° to 70°C.)

Nominal R @ 25°C. (ohms)	Part Number	R-T Curve #	0-50°C Beta Value (K.)	α @ 25°C. (%/°C)
* 2,252	2.2K3A1W3	3	3892	-4.4
* 3,000	3K3A1W3	3	3892	-4.4
5,000	5K3A1W3	3	3892	-4.4
10,000	10K3A1W3	3	3892	-4.4
10,000	10K1A1W3	4	3575	-4.0
30,000	30K5A1W3	5	3811	-4.3
50,000	50K0A1W3	6	4143	-4.7
100,000	100K6A1W3	6	4143	-4.7
1,000,000	1M9A1W3	9	4582	-5.2

\* Note: Body dia. for all units is .095" max., except for 2.2K3 and 3K3 which is .110" max.

BetaTHERM Corporation • 910 Turnpike Road, Shrewsbury, MA 01545 • 508-842-0516 Fax: 508-842-0748 • www.betatherm.com  
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# BetaTHERM

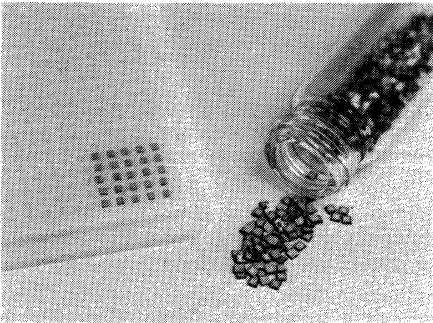
## NTC Thermistor Devices

### GOLD TERMINATION BetaCHIP THERMISTOR

#### FEATURES

- Top and Bottom Metallization
- Rapid Time Response
- Rated from -55 to 150°C.
- Surface Mount Capability

- Uniformly Sized for Pick & Place Assembly
- 1.0 mW/°C. Dissipation Constant
- 10 sec. Maximum Time Constant



#### LEADLESS BetaCURVETHERMISTOR (±10% Tolerance @ 25°C.)

Nominal R @ 25°C. (ohms)	"Chip" Part Number	R-T Curve #	0-50°C Beta Value (K.)	$\alpha$ @ 25°C. (%/°C)
2,252	2.2K3CG2	3	3892	-4.4
3,000	3K3CG2	3	3892	-4.4
5,000	5K3CG2	3	3892	-4.4
10,000	10K3CG2	3	3892	-4.4
10,000	10K4CG2	4	3749	-4.0
30,000	30K5CG2	5	3811	-4.3
30,000	30K6CG2	6	4143	-4.7
50,000	50K6CG2	6	4143	-4.7
100,000	100K6CG2	6	4143	-4.7

Standard BetaCHIP Leadless Thermistor Elements available in other R<sub>25</sub> tolerance limits.

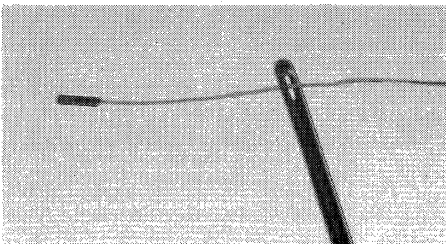
BetaCHIP Products with tighter R<sub>25</sub> tolerance or sorted at T other than 25°C can be factory ordered.

### microCHIP THERMISTOR PROBES

#### FEATURES

- High Stability Probe  
(Industrial & Medical Applications Typically)
- Temperature Accuracy +0.1 C.

- Rapid Time Response Design
- Time Constant — < 1.0 sec.
- Extremely small profile diameter



#### microCHIP THERMISTOR PROBE CHARACTERISTICS DEVICE AVAILABILITY

Part No.	Material No.	Ro @ 25V (ohms)	Temp. Tol. (°C)	Max. Exposure Temp. (°C)	Typical Application Use
10K3MCD1	3	10,000	0.1	150	Medical Probe
100K6MCD1	6	100,000	0.2	150	Fast Response

#### GLASS COATED microCHIP THERMISTOR PROBE

Part No.	Material No.	Ro @ 37°C (ohms)	Temp. Tol. @ 37°C	Max. Exposure Temp. (°C)	Typical Application Use
G22K7MCD8	7	14,004	±15% @ 37°C	150	Thermidilution Catheters, and other medical applications.

Other Styles, Resistance Values and Tolerances Available. Contact BetaTHERM Application Engineering for details.

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# BetaTHERM

## NTC Thermistor Devices

TEMP °F °C	(Curve) #3				(Curve) #4				(Curve) #5				(Curve) #6			
	Resistance Multiplier	$\alpha$ (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP CURVE	Beta-CHIP CURVE	Resistance Multiplier	$\alpha$ (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP CURVE	Beta-CHIP CURVE	Resistance Multiplier	$\alpha$ (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP CURVE	Beta-CHIP CURVE	Resistance Multiplier	$\alpha$ (%)	Max. Deviation (%) from Curve Nom. Beta-CHIP CURVE	Beta-CHIP CURVE
-112 -80	729.68	-8.90	13.0	1.46												
-103 -75	471.37															
-94 -70	309.56	-8.29	9.5	1.15												
-85 -65	206.49															
-76 -60	139.79	-7.69	7.5	0.98												
-67 -55	95.978				60.86				79.36				121.63			
-58 -50	66.782	-7.14	5.5	0.87	44.17	-6.30	4.3	0.68	56.43	-6.67	4.70	0.70	83.38	-7.40	7.0	0.95
-49 -45	47.061				32.39				40.57				57.89			
-40 -40	33.5668	-6.61	4.3	0.79	23.983	-5.92	3.6	0.61	29.47	-6.26	3.61	0.58	40.672	-6.83	5.1	0.74
-31 -35	24.2193				17.928				21.63				28.909			
-22 -30	17.6682	-6.21	3.5	0.68	13.523	-5.56	2.9	0.53	16.02	-5.91	2.92	0.49	20.774	-6.45	4.1	0.64
-13 -25	13.0242				10.289				11.98				15.085			
-4 -20	9.6973	-5.81	2.7	0.56	7.893	-5.23	2.3	0.44	9.032	-5.57	2.29	0.41	11.065	-6.08	3.2	0.53
5 -15	7.2894				6.1030				6.869				8.1938			
14 -10	5.5297	-5.51	2.0	0.45	4.7549	-4.94	1.7	0.35	5.266	-5.25	1.71	0.53	6.1237	5.74	2.4	0.42
23 -5	4.2314				3.7316				4.068				4.6169			
32 0	3.2651	-5.20	1.4	0.33	2.9490	-4.65	1.2	0.25	3.166	-4.94	1.17	0.24	3.5102	-5.40	1.6	0.30
41 5	2.5395				2.3462				2.481				2.6904			
50 10	1.9903	-4.80	0.8	0.20	1.8787	-4.40	0.7	0.15	1.958	-4.67	0.68	0.15	2.0781	-5.10	1.0	0.19
59 15	1.5714				1.5136				1.556				1.6170			
68 20	1.2494	-4.52	0.3	0.07	1.2268	-4.16	0.2	0.05	1.243	-4.41	0.22	0.05	1.2673	-4.81	0.3	0.06
77 25	1.0000	-4.39	0.0	0.00	1.00000	-4.04	0.0	0.00	1.0000	-4.30	0.00	0.00	1.00000	-4.68	0.0	0.00
86 30	0.80560	-4.26	0.3	0.07	0.81966	-3.92	0.2	0.05	0.8089	-4.18	0.21	0.05	0.79428	-4.55	0.3	0.06
95 35	0.65301				0.67539				0.6580				0.63489			
104 40	0.53249	-4.03	0.7	0.21	0.55937	-3.73	0.6	0.16	0.5382	-3.96	0.16	0.15	0.51058	-4.30	0.9	0.20
113 45	0.43669				0.46557				0.4425				0.41301			
122 50	0.36010	-3.80	1.2	0.36	0.38933	-3.53	1.0	0.28	0.3656	-3.77	0.98	0.26	0.33598	-4.08	1.4	0.33
131 55	0.29851				0.32707				0.3036				0.27480			
140 60	0.24871	-3.61	1.6	0.52	0.27599	-3.36	1.3	0.40	0.2332	-3.58	1.33	0.37	0.22593	-3.87	1.9	0.48
149 65	0.20823				0.23387				0.2122				0.18669			
158 70	0.17516	-3.42	2.0	0.68	0.19900	-3.19	1.7	0.52	0.1786	-3.42	1.66	0.49	0.15502	-3.68	2.3	0.63
167 75	0.14801				0.17000				0.1509				0.12932			
176 80	0.12562	-3.25	2.3	0.85	0.14579	-3.05	2.0	0.65	0.1281	-3.25	1.97	0.60	0.10837	-3.49	2.7	0.78
185 85	0.10706				0.125483				0.1091				0.091215			
194 90	0.091610	-3.07	2.7	1.03	0.108395	-2.91	2.3	0.78	0.09333	-3.10	2.26	0.73	0.077097	-3.33	3.1	0.94
203 95	0.078698				0.093960				0.08011				0.065428			
212 100	0.067863	-2.92	3.0	1.20	0.081719	-2.78	2.5	0.91	0.06900	-2.95	2.53	0.86	0.055744	-3.17	3.5	1.11
221 105	0.058730				0.071303				0.05964				0.047674			
230 110	0.051006	-2.77	3.3	1.37	0.062409	-2.65	2.8	1.05	0.05173	-2.81	2.79	0.99	0.040921	-3.04	3.9	1.27
239 115	0.044448				0.054792				0.04500				0.035251			
248 120	0.038859	-2.64	3.6	1.59	0.048246	-2.52	3.0	1.20	0.03928	-2.68	3.03	1.13	0.030469	-2.91	4.2	1.45
257 125	0.034082				0.042603				0.03438				0.026424			
266 130	0.029982	-2.51	3.9	1.73	0.037723	-2.42	3.3	1.33	0.03019	-2.59	3.26	1.26	0.022990	-2.87	4.5	1.67
275 135	0.026454				0.033492				0.02658				0.020064			
284 140	0.023408	-2.41	4.1	1.91	0.029812	-2.32	3.5	1.50	0.02346	-2.49	3.48	1.40	0.017563	-2.74	4.8	1.96
293 145	0.020770				0.026604				0.02077				0.015419			
302 150	0.018478	-2.31	4.4	2.17	0.023798	-2.23	3.7	1.66	0.01843	-2.39	3.69	1.55	0.013575	-2.6	5.1	2.16

Typical "Chip" Element Resistance Range (Ohms @ 25°C.)	(Curve) #3			(Curve) #4			(Curve) #5			(Curve) #6		
	2252 to 20,000			5,000 to 30,000			10,000 to 50,000			50,000 to 100K		
BETA Value & Max. Beta Deviation for 0/50°C. Ro Ratio	BETA Value	BetaCHIP	Max % Dev. BetaCURVE	BETA Value	BetaCHIP	Max % Dev. BetaCURVE	BETA Value	BetaCHIP	Max % Dev. BetaCURVE	BETA Value	BetaCHIP	Max % Dev. BetaCURVE
	3892	1.4	0.32	3575	1.0	0.30	3811	0.94	0.30	4143	1.3	0.30
Nominal R Ratio & 0/50 Max. Deviations for 0/70 Temperature Span (°C.) 25/125	R Ratio Value			R Ratio Value			R Ratio Value			R Ratio Value		
	9.06	2.5	0.7	7.58	2.2	0.9	8.65	2.2	0.9	10.45	3.1	0.9
	18.65	3.4	1.0	14.82	2.9	1.1	17.73	2.9	1.1	22.65	4.1	1.1
	29.27	3.9	1.4	23.51	3.3	1.3	29.15	3.3	1.3	38.07	4.6	1.3

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# BetaTHERM

## NTC Thermistor Devices

### Interchangeable BetaCURVE Thermistor Devices

Resistance @25°C	Curve No.	Temperature Tolerance 0 to 70°C	Color Code	Resistance Tolerance	Part Number And Class 25°C	Alpha 25°C	0/50°C Beta Value
2,252	3	±0.1°C	Brown	±0.25%	2.2K3A1A	-4.39%	3892
*2,252	3	±0.2°C	Brown	±0.5%	2.2K3A1B	-4.39%	3892
2,252	3	±0.5°C	Brown	±1.0%	2.2K3A1C	-4.39%	3892
2,252	3	±1.0°C	Brown	±2.0%	2.2K3A1D	-4.39%	3892
3,000	3	±0.1°C	Red	±0.25%	3K3A1A	-4.39%	3892
*3,000	3	±0.2°C	Red	±0.5%	3K3A1B	-4.39%	3892
3,000	3	±0.5°C	Red	±1.0%	3K3A1C	-4.39%	3892
3,000	3	±1.0°C	Red	±2.0%	3K3A1D	-4.39%	3892
5,000	3	±0.1°C	Orange	±0.25%	5K3A1A	-4.39%	3892
*5,000	3	±0.2°C	Orange	±0.5%	5K3A1B	-4.39%	3892
5,000	3	±0.5°C	Orange	±1.0%	5K3A1C	-4.39%	3892
5,000	3	±1.0°C	Orange	±2.0%	5K3A1D	-4.39%	3892
10,000	3	±0.1°C	Yellow	±0.25%	10K3A1A	-4.39%	3892
*10,000	3	±0.2°C	Yellow	±0.5%	10K3A1B	-4.39%	3892
10,000	3	±0.5°C	Yellow	±1.0%	10K3A1C	-4.39%	3892
10,000	3	±1.0°C	Yellow	±2.0%	10K3A1D	-4.39%	3892
10,000	4	±0.1°C	Black	±0.25%	10K4A1A	-4.04%	3575
*10,000	4	±0.2°C	Black	±0.5%	10K4A1B	-4.04%	3575
10,000	4	±0.5°C	Black	±1.0%	10K4A1C	-4.04%	3575
10,000	4	±1.0°C	Black	±2.0%	10K4A1D	-4.04%	3575
30,000	5	±0.1°C	White	±0.25%	30K5A1A	-4.30%	3811
*30,000	5	±0.2°C	White	±0.5%	30K5A1B	-4.30%	3811
30,000	5	±0.5°C	White	±1.0%	30K5A1C	-4.30%	3811
30,000	5	±1.0°C	White	±2.0%	30K5A1D	-4.30%	3811
30,000	6	±0.1°C	Green	±0.25%	30K6A1A	-4.68%	4143
*30,000	6	±0.2°C	Green	±0.5%	30K6A1B	-4.68%	4143
30,000	6	±0.5°C	Green	±1.0%	30K6A1C	-4.68%	4143
30,000	6	±1.0°C	Green	±2.0%	30K6A1D	-4.68%	4143
50,000	6	±0.1°C	Blue	±0.25%	50K6A1A	-4.68%	4143
*50,000	6	±0.2°C	Blue	±0.5%	50K6A1B	-4.68%	4143
50,000	6	±0.5°C	Blue	±1.0%	50K6A1C	-4.68%	4143
50,000	6	±1.0°C	Blue	±2.0%	50K6A1D	-4.68%	4143
100,000	6	±0.1°C	Violet	±0.25%	100K6A1A	-4.68%	4143
*100,000	6	±0.2°C	Violet	±0.5%	100K6A1B	-4.68%	4143
100,000	6	±0.5°C	Violet	±1.0%	100K6A1C	-4.68%	4143
100,000	6	±1.0°C	Violet	±2.0%	100K6A1D	-4.68%	4143

\* Industry standard ±.2°C tolerance from 0°C to 70°C

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**BetaTHERM**

**NTC Thermistor Devices**

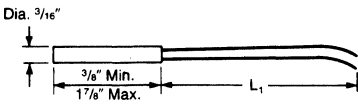
**CUSTOMIZED PROBE ASSEMBLY CONSTRUCTIONS**

**FEATURES**

- Customized for Each Application
- Cost-Effective Designs to Performance Specs
- Prompt Betatherm Design/Build Execution
- Rugged – Reliable – Stable – Constructions
- Surface, Immersion and Gas Sensing Designs
- Available with epoxy or glass coated thermistors

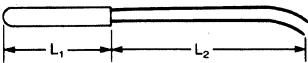
**CONFIGURATIONS**

**PH005 Round Aluminum Probe (Flat End)**



Available with Individual (Teflon or PVC) Insulated Wire or (Teflon or PVC) Insulated Cables

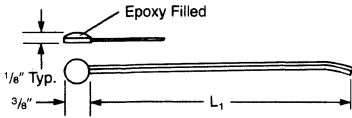
**PH008 Round T304 T316 Stainless Steel Probe (Spherical End)**



Available with Individual Lead Wires or Cable. Teflon or PVC Insulation

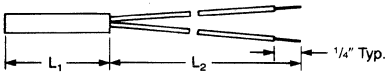
(Probe Diameters Available in Hypodermic Gage Sizes 6.5 to 22.5 and Fractional Sizes 1/16" to 3/8".)

**PH010 Flat Stainless Steel Cup (Surface Sensing)**



Available with Dual Cond Zip Cable, Individual Leads and or Cable. Teflon or PVC Insulation.

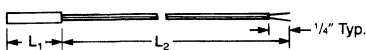
**PH019 Plastic (Nonshrink Mylar) Tube Epoxy Filled**



Standard Outside Dia.  
.070" O.D.  
.078" O.D.  
.095" O.D.

Standard with 28 AWG to 34 AWG Individual Leads. Teflon PVC or Uninsulated Leads.

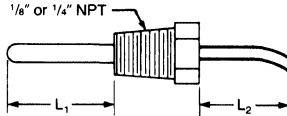
**PH020 Plastic (Polyimide) Microtube Epoxy Filled**



Standard Outside Dia.  
.017" Max. O.D.  
.018" Max. O.D.  
.040" ± .002" O.D.

Standard with 40 AWG Bifilar Nickel Leads with Isomid Insulation.

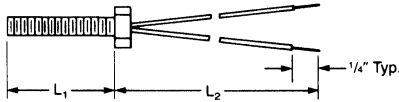
**PH025 Stainless Steel or Brass Pipe Thread Immersion Probe**



Standard Probe Dia.  
1/8" S.S.  
3/16" S.S.  
1/4" S.S.

Available with Individual Leads or Jacketed Cable Teflon or PVC.

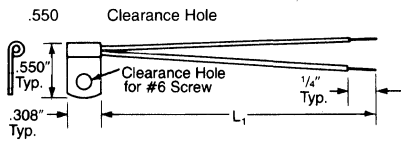
**PH032 Brass or Stainless Steel Hex Head Probe**



Standard Thread Size  
10-32  
1/4-20  
3/8-16

Standard with individual Leads, Teflon or PVC Insulation

**PH066 Tinned Copper "Flag Terminal" (Surface Mounting)**

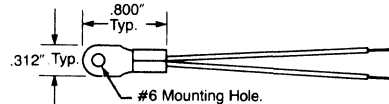


Available with Individual Leads, 24 to 30 AWG, Teflon or PVC Insulation

**PH069 Stainless Steel Air (Gas) Sensing Probe**

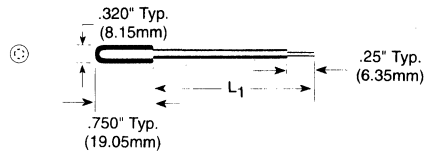


**PH080 Tinned Copper "Ring Tongue" Terminal (Surface Mounting)**

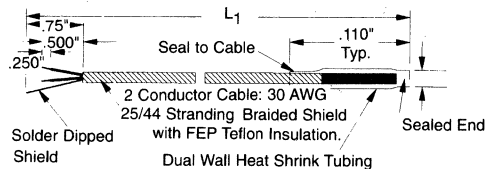


Standard with Individual Leads 22 AWG to 24 AWG, Teflon or PVC Insulation

**PH105 Round End Vinyl Economical Probe**



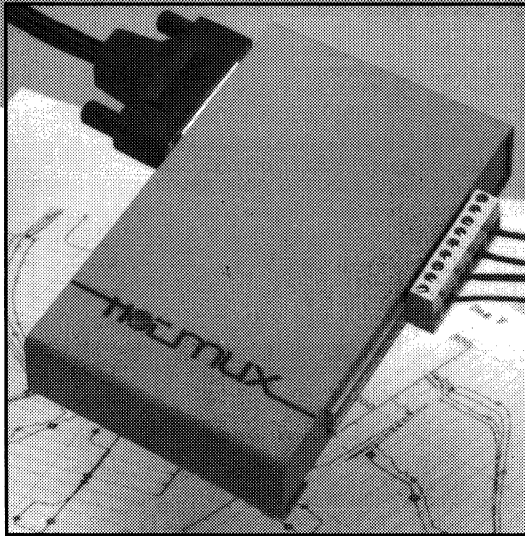
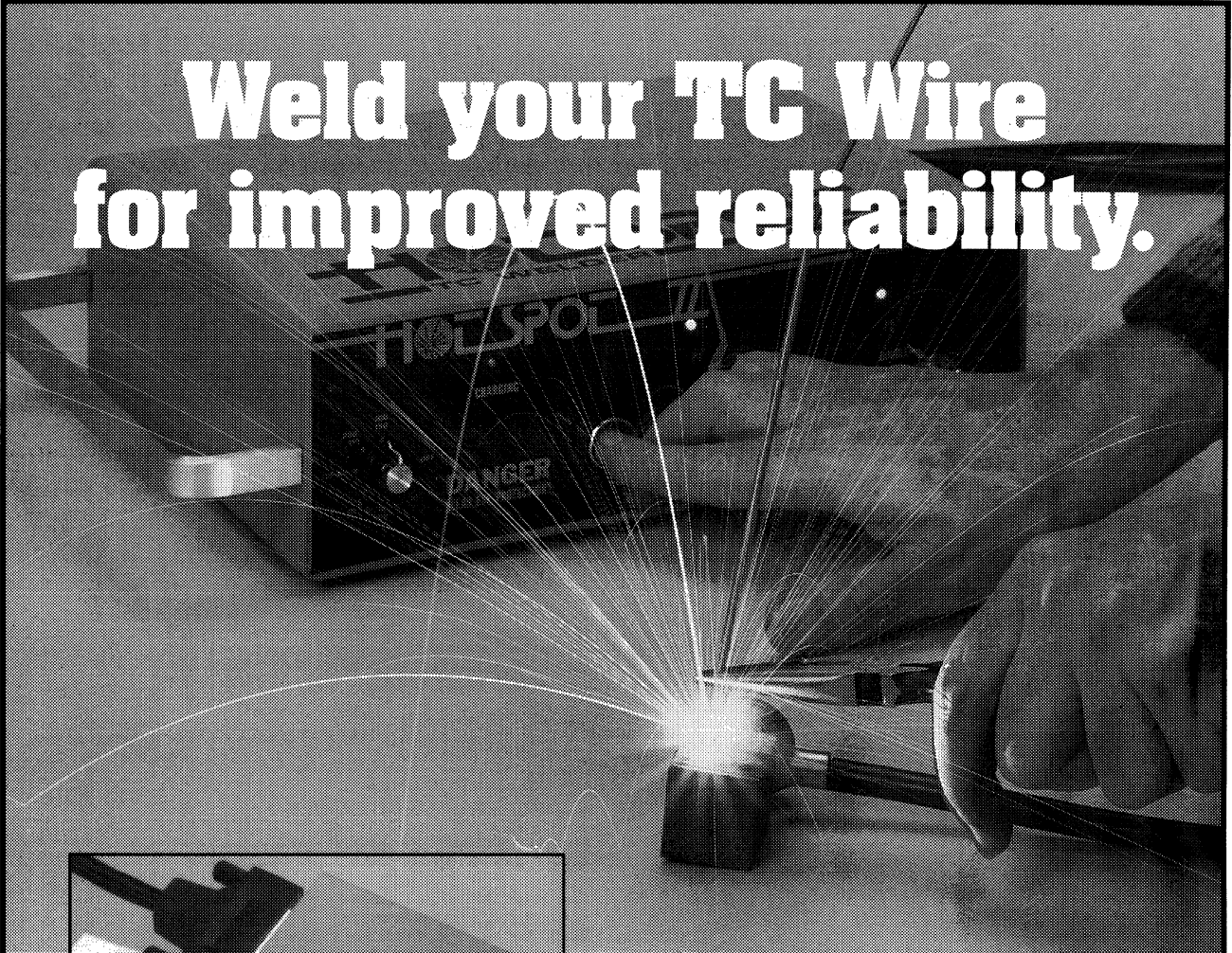
**PH150 Sealed Teflon Probe and Cable**



Interchangeable BetaCURVE and BetaCHIP devices are available in most probe assembly configurations. For more information please contact BetaTHERM Application Engineering Department

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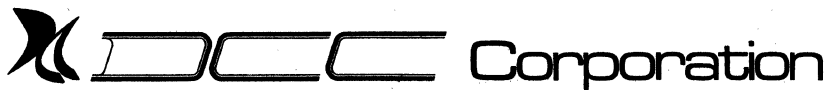
# Weld your TC Wire for improved reliability.



## Monitor and log thermocouple readings

- Cost effective thermocouple welder makes reliable sensor in seconds.
- HotMux data logger monitors signals and transmits data to PC at less than \$50 per channel.

### Call for additional information

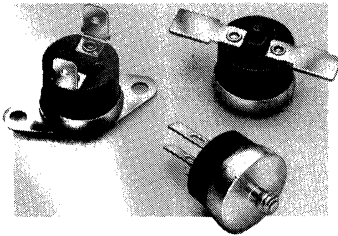


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 609-662-7272 / FAX: 609-662-7862  
[www.thomasregister.com/dcc](http://www.thomasregister.com/dcc)

# ELMWOOD SENSORS

## WHERE RELIABILITY IS BUILT IN.

### 1/2" THERMOSTATS



Designed to open or close on temperature rise, 1/2" Thermostats operate in an ambient temperature range up to 550°F (287°C). Devices are thermally and mechanically inspected at the factory. Cost-efficient for commercial applications.

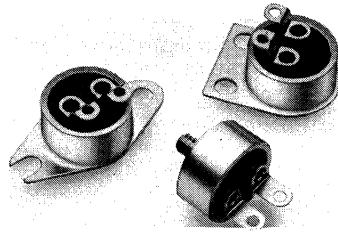
#### APPLICATIONS:

- Small Appliances
- Fire and Smoke Alarms
- Data Processing Equipment

#### FEATURES:

- Cost Efficient
- Set to Specifications
- UL Recognized, CSA Certified & European Approved

### PRECISION THERMOSTATS



When applications call for precise specifications, Elmwood has a full line of Precision Thermostats with a variety of mounting and package configurations available. For narrow or wide differentials. When accuracy and reliability is serious business, you can count on these high quality thermostats.

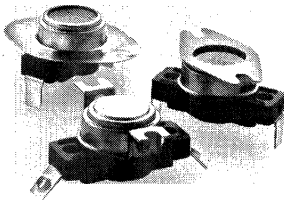
#### APPLICATIONS:

- Aerospace & Avionics
- Medical Equipment
- Power Supplies
- Data Processing Equipment

#### FEATURES:

- Tight Tolerances
- Small Size and Weight
- Variety of Mounting & Package Configurations Available

### 3/4" THERMOSTATS



Designed to open and close on temperature rise, 3/4" Thermostats are specifically designed to meet the demanding temperature control requirements of a wide range of major appliances and equipment. Thermostats are rated up to 25 Amps-240 Volts and meet UL Standard 353.

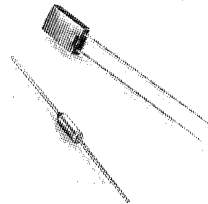
#### APPLICATIONS:

- Major Appliances
- Commercial Appliances
- Data Processing Equipment
- Spa and Hot Tub Equipment

#### FEATURES:

- 25 Amp Capacity
- Narrow Temp Differential
- Tight Temp Tolerances
- Rugged Construction
- Recognized by UL, CSA and European Approval Agencies

### THERMAL FUSES AND MOTOR & TRANSFORMER PROTECTORS



Miniature, heat-sensitive devices designed for over temperature protection of electrical appliances and equipment or transformers and fractional horsepower motors. Thermal Fuses are rated to 15 Amps and can be configured to your specifications. Motor and Transformer Protectors have a patented, non-eutectic design, feature an isolated and sealed cap and are rated to 5 Amps. Both are UL Recognized, CSA Certified and meet major international approvals. Immediate off-the-shelf availability in the widest range of standard temperatures and leads.

#### APPLICATIONS:

- Small Appliances
- HVAC
- Major Appliance
- Motor & Transformer

#### FEATURES:

- Popular Temp Range
- Insulated Case (MTP)
- Customized Assemblies Available

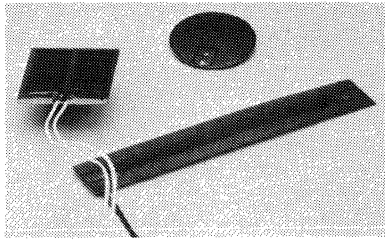
ISO 9001

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**ELMWOOD SENSORS, INC.**

500 Narragansett Park Drive/Pawtucket, RI 02861-4325/Tel: 401-727-1300/Fax: 401-728-5390/www.elmwoodsensors.com

**Elmwood  
Sensors**

## FLEXIBLE HEATERS



Elmwood's Flexible Heaters are available in flat, spiral, molded to shape and transparent configurations. These products are offered with a broad range of mounting choices providing cost effective heat for your unique design needs.

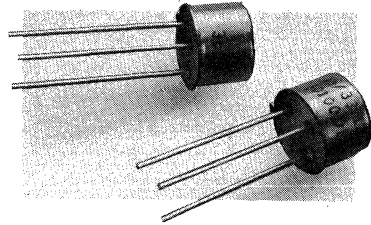
### APPLICATIONS:

- Medical Electronics
- Process Control
- Small Appliances
- Food Service Equipment
- Liquid Crystal Displays

### FEATURES:

- Etched & Wire Wound Elements
- Integrated Temperature Controls
- Multiple Watt Density
- Custom Designs
- Design Kits Available

## THE WORLD'S FIRST TO-5 THERMAL SWITCH



Elmwood's 3600 Series TO-5 Thermostat provides reliable protection against damage caused by hazardous temperatures on your printed circuit board. Customized configurations are available.

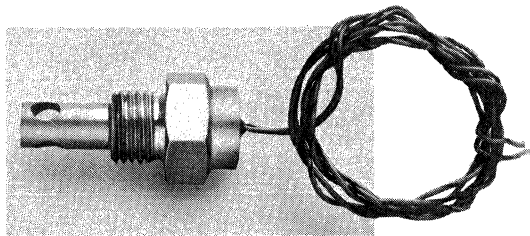
### APPLICATIONS:

- Power Supplies
- Logic Boards
- Medical Electronics
- Telecommunications
- Personal Computers

### FEATURES:

- Hermetically Sealed/Wave Solderable
- Switches Up To 1 Amp
- 100% Temperature Tested
- Heat Sink Mounting Brackets Available

## THERMISTOR ASSEMBLIES



Elmwood's Accumistor Series of thermistor assemblies are available with PTC's and NTC's to meet your needs. Thermistors can be combined for reliable multi-purpose sensing capabilities and as self-regulating heaters in electronics, process control and automotive applications.

### APPLICATIONS:

- Temperature Setting
- Level & Flow Sensing
- Precision Heating
- Over-Current Protection

### FEATURES:

- Packaged Assemblies
- Range:  $-40^{\circ}\text{C}$  to  $200^{\circ}\text{C}$
- Solid State Technology
- Customized Assemblies

## CUSTOMER SERVICE PROGRAMS



At Elmwood, our commitment to customer service goes beyond product quality. Our customer service programs are designed to fit your specific needs:

- **Redi-Temp**—An off-the-shelf program with a one week delivery schedule.
- **Elmwood Express**—A priority delivery service that puts your rush order on the fast track.
- **Design Assistance**—Pre-packaged assemblies made to fit your requirements complete with custom brackets, terminals, wiring, connectors, overmolds, etc.
- **Lead Time Programs**—Production and sample lead times that others try to beat.

And our customers service representatives are trained professionals assigned to you from order entry to order shipment.

No one puts more into thermal sensing than Elmwood. Don't accept anything less.

ISO 9001

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**Thermal Sensing Technologies...Worldwide**



# "Looking for thermistors? You're in the right place."

— Mister Thermistor™



At Fenwal Electronics, thermistors are our whole life. Our only business. No resistors! No capacitors! No transistors! Just the world's broadest line of thermistors and thermistor probe assemblies. And because they're the only thing we do, we do them very well. Very fast. Very economically. And with ISO 9001 certification. For information on the thermistor lines listed here, give us a call at (508) 478-6000 or fax us at (508) 473-6035.

## NTC THERMISTORS

### CHIP SERIES

- Surface Mounted, End-banded • Uninsulated Leads • Series I Glass Encapsulated
- Uni-Curve® Interchangeable R-T Curve-Matched
- Micro-Mini Chip • Without Leads • Insulated Leads • Series II Glass Encapsulated, Interchangeable, LTN® Linear Thermistor Networks • Other Available – Chip Thermistors

### BEAD SERIES

- Small Beads • Standard Beads
- ISO-Curve® Interchangeable Glass Probes & Beads • Micro-Mini Probes
- E-I Matched Beads • Glass Probes
- Other Available – Bead Thermistors
- Sub-Mini Probes

### DISC SERIES

- Discs 0.1 to 0.4" Diameter • Inrush Current Limiters (ICL)

### THERMISTOR PROBE ASSEMBLIES

- Surface • Immersion • Gas/Air
- Oven Probes • General Purpose and Special Medical Sensors

### THERMISTOR SOFTWARE PROGRAM

- IBM Compatible • Thermicalc User Friendly • Everything About NTC Thermistors • Includes R-T Curve Calculations

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THERMISTOR LITERATURE**



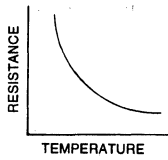
**FENWAL ELECTRONICS**

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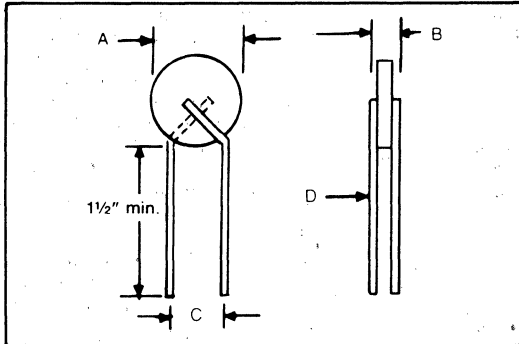
**KEYSTONE THERMOMETRICS**  
A COMMITMENT TO EXCELLENCE

**DISC TYPE THERMISTORS WITH CROSSED LEADS**



NTC (Negative Temperature Coefficient) thermistors decrease in resistance as temperature increases. Their maximum operating temperature is 150°C. Zero-power resistance values at 25°C range from 10 Ω to 250K Ω; other values upon request. Disc thermistors are available with various coatings, lead styles, and resistance tolerances. Contact Keystone Thermometrics or write for catalog.

Disc thermistors are available with various coatings, lead styles, and resistance tolerances. Contact Keystone Thermometrics or write for catalog.



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 Allied Electronics 1-800-433-5700  
 Dexter Corporation 1-800-345-4082  
 Digi-Key Corporation 1-800-344-4539  
 Mouser Electronics 1-800-346-6873  
 Newark Electronics 1-800-463-9275  
 Component Distributors 1-800-777-7334

KCC TYPE	R <sub>0</sub> @ 25°C (Ω)	Tol. %	A (in.)	B (in.)	C (in.)	D (AWG)	Dissipation Constant (mW/°C)	Resist. Ratio	Temp. Coef. @ 25°C (%/°C)
RL1004-65.6-59-D1	100	20	0.110	0.120	0.100	26	2.5	5.6	-3.42
RL1003-312-73-D1	500	10	0.110	0.110	0.100	26	2.5	6.9	-3.83
RL1007-624-73-D1	1,000	10	0.110	0.150	0.100	26	2.8	6.9	-3.83
RL1003-1157-95-D1	2,000	10	0.110	0.110	0.100	26	2.8	9.2	-4.43
RL1003-1746-97-D1	3,000	10	0.110	0.110	0.100	26	2.5	9.1	-4.40
RL1004-2910-97-D1	5,000	10	0.110	0.120	0.100	26	2.5	9.1	-4.40
RL1009-5820-97-D1	10,000	10	0.110	0.170	0.100	26	3.0	9.1	-4.40
RL1005-5744-103-D1	10,000	10	0.110	0.130	0.100	26	2.5	9.6	-4.49
RL1007-13.8K-120-D1	25,000	10	0.110	0.150	0.100	26	2.8	11.4	-4.84
RL1003-26.7K-140-D1	50,000	10	0.110	0.110	0.100	26	2.5	12.9	-5.08
RL1006-53.4K-140-D1	100,000	10	0.110	0.140	0.100	26	2.7	12.9	-5.08
RL1004-104.7K-155-D1	200,000	10	0.110	0.120	0.100	26	2.5	13.8	-5.23
RL1006-135.2K-138-D1	250,000	10	0.110	0.140	0.100	26	2.7	12.1	-4.96
RL2004-16.4-59-D1	25	20	0.220	0.130	0.156	24	6.5	5.6	-3.42
RL2007-32.8-59-D1	50	20	0.220	0.160	0.156	24	6.5	5.6	-3.42
RL2003-62.4-73-D1	100	10	0.220	0.120	0.156	24	6.5	6.9	-3.83
RL2006-125-73-D1	200	10	0.220	0.150	0.156	24	6.5	6.9	-3.83
RL2008-187-73-D1	300	10	0.220	0.170	0.156	24	6.5	6.9	-3.83
RL2003-289-95-D1	500	10	0.220	0.120	0.156	24	6.0	9.2	-4.43
RL2004-582-97-D1	1,000	10	0.220	0.130	0.156	24	6.5	9.1	-4.40
RL2007-1164-97-D1	2,000	10	0.220	0.160	0.156	24	6.5	9.1	-4.40
RL2006-1600-103-D1	2,786	10	0.220	0.150	0.156	24	6.5	9.6	-4.49
RL2005-2203-120-D1	4,000	10	0.220	0.140	0.156	24	6.5	11.4	-4.84
RL2006-2753-120-D1	5,000	10	0.220	0.150	0.156	24	6.5	11.4	-4.84
RL2012-5506-120-D1	10,000	10	0.220	0.210	0.156	24	7.2	11.4	-4.84
RL2006-13.3K-140-D1	25,000	10	0.220	0.150	0.156	24	6.5	12.9	-5.08
RL2005-27K-138-D1	50,000	10	0.220	0.140	0.156	24	6.5	12.1	-4.96
RL2008-52.3K-155-D1	100,000	10	0.220	0.170	0.156	24	6.5	13.8	-5.23
RL3004-6.56-59-D1	10	20	0.320	0.130	0.250	24	7.0	5.6	-3.42
RL3504-31.2-73-D1	50	10	0.370	0.130	0.250	24	7.5	6.9	-3.83
RL3006-59.4-85-D1	100	10	0.320	0.150	0.250	24	7.2	8.4	-4.23
RL3004-144.95-D1	250	10	0.320	0.130	0.250	24	7.0	9.2	-4.43
RL3004-291.97-D1	500	10	0.320	0.130	0.250	24	7.0	9.1	-4.40
RL3005-574-103-D1	1,000	10	0.320	0.140	0.250	24	7.0	9.6	-4.49

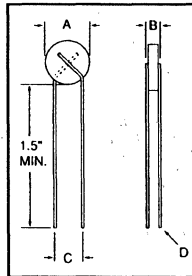
†Resistance Ratio: Ratio of zero-power resistance @ 0°C to zero-power resistance @ 50°C.

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**STANDARD THERMISTORS FOR TEMPERATURE MEASUREMENT**

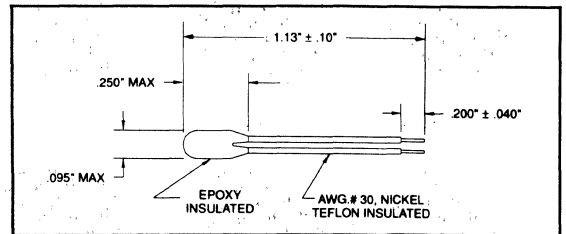
Accuracy ± 1°C (0°C - 120°C)



TYPE	R <sub>25</sub> °C	A MAX. (IN.)	B MAX. (IN.)	C REF. (IN.)	D AWG. (DIA.)	D.C. mW/°C	T.C. SEC.
RL3005-574.0-103-SA	1000	.32	.14	.25	24 (0.20)	3.5	30
RL2005-1148-103-SA	2000	.22	.14	.15	24 (0.20)	2.5	20
RL2006-1600-103-SA	2786	.22	.15	.15	24 (0.20)	2.5	20
RL2007-1723-103-SA	3000	.22	.16	.15	24 (0.20)	2.5	20
RL2008-2010-103-SA	3500	.22	.17	.15	24 (0.20)	2.5	20
RL1003-2871-103-SA	5000	.11	.11	.10	26 (0.16)	1.0	10
RL1004-4019-103-SA	7000	.11	.12	.10	26 (0.16)	1.0	10
RL1005-5744-103-SA	10000	.11	.13	.10	26 (0.16)	1.0	10

Operating Range: -50°C + 150°C  
 D.C.: Dissipation Constant (mW/°C)  
 T.C.: Time Constant (Seconds)  
 \*Optional temperature accuracies are available upon request.

**MINIATURE SENSORS**  
1°C Accuracy

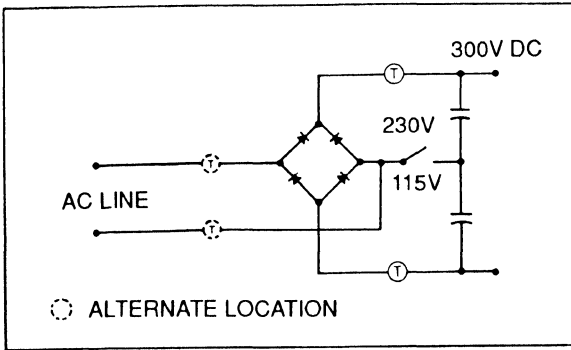


Type	R <sub>0</sub> @ 25°C	Temp. Coef. %/°C @ 25°C	Material	Resist. Ratio 0°C/50°C
RL0503-1248-73-MS	2K	-3.83	MS73	6.9
RL0503-2890-95-MS	5K	-4.43	MS95	9.2
RL0503-5820-97-MS	10K	-4.40	MS97A	9.1
RL0503-17.56K-96-MS	30K	-4.32	MS96	8.8
RL0503-27.53K-120-MS	50K	-4.84	MS120	11.4
RL0503-55.36K-122-MS	100K	-4.78	MS122	11.1

Temperature Accuracy: ± 1°C @ 25°C  
 Dissipation Constant: 1.4 mW/°C  
 Time Constant: 15 sec.  
 Operating Range: -50°C to +150°C

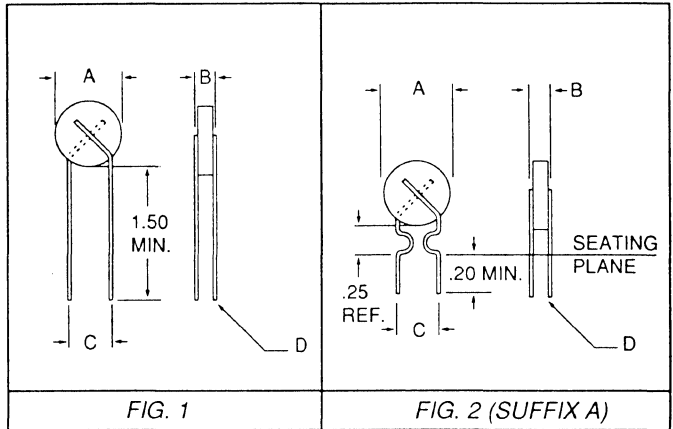
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# INRUSH CURRENT LIMITERS



The circuit diagram above displays a typical way to limit inrush current.

Protection against extremely high peak inrush current, especially in AC/DC switching power supplies, is now available with Keystone Inrush Current Limiters. These special NTC thermistors effectively control surge currents because the thermal time constant of the current limiter is longer than the electrical time constant (RC) of the thermistor and the capacitor.



All inrush current limiters are insulated with a protective coating. Optional lead designs available upon request.

Note: For Figure 2 design add "A" suffix to type. (Example: CL-10A.)

Type Fig. 1	R <sub>0</sub> @ 25°C ±25% (ohms)	Max.* Steady State Current amps (RMS)	A max. (in.)	B max. (in.)	C ref. (in.)	D (AWG)	Cx (max.)** μ farads		Eqn. Const. for Res. Under Load***			Approx. Res. Under Load at % Max. Rated Current				Diss. Const. (mW/°C)	Time Const. (sec.)
							@ 120 VAC	@ 240 VAC	X	Y	Current Range Min.I./Max. I	25%	50%	75%	100%		
CL-11	0.7	12	0.77	0.22	0.328	18	2700	600	0.50	-1.18	4.0 ≤ I ≤ 12	14	.06	.04	.02	25	100
CL-21	1.3	8	0.55	0.21	0.328	18	800	200	0.60	-1.25	3.0 ≤ I ≤ 8.0	25	.09	.06	.04	15	60
CL-30	2.5	8	0.77	0.22	0.328	18	6000	1500	0.81	-1.25	2.5 ≤ I ≤ 8.0	34	.14	.09	.06	25	100
CL-40	5	6	0.77	0.22	0.328	18	5200	1300	1.09	-1.27	1.5 ≤ I ≤ 6.0	65	.27	.16	.11	25	100
CL-50	7	5	0.77	0.26	0.328	18	5000	1250	1.28	-1.27	1.5 ≤ I ≤ 5.0	96	.40	.24	.16	25	120
CL-60	10	5	0.77	0.22	0.328	18	5000	1250	1.45	-1.30	1.2 ≤ I ≤ 5.0	1.09	.44	.26	.18	25	100
CL-70	16	4	0.77	0.22	0.328	18	5000	1250	1.55	-1.26	1.0 ≤ I ≤ 4.0	1.55	.65	.39	.27	25	100
CL-80	47	3	0.77	0.22	0.328	18	5000	1250	2.03	-1.29	0.5 ≤ I ≤ 3.0	2.94	1.20	.71	.49	25	100
CL-90	120	2	0.93	0.22	0.328	18	5000	1250	3.04	-1.36	0.5 ≤ I ≤ 2.0	7.80	3.04	1.75	1.18	30	120
CL-101	0.5	16	0.93	0.22	0.328	18	4000	1000	0.44	-1.12	4.0 ≤ I ≤ 16	.09	.04	.03	.02	30	120
CL-110	10	3.2	0.40	0.17	0.250	24	600	150	0.83	-1.29	0.7 ≤ I ≤ 3.2	1.10	.45	.27	.18	8	30
CL-120	10	1.7	0.40	0.17	0.250	24	600	150	0.61	-1.09	0.4 ≤ I ≤ 1.7	1.55	.73	.46	.34	4	90
CL-130	50	1.6	0.45	0.17	0.250	24	600	150	1.45	-1.38	0.4 ≤ I ≤ 1.6	5.13	1.97	1.13	.75	8	30
CL-140	50	1.1	0.45	0.17	0.250	24	600	150	1.01	-1.28	0.2 ≤ I ≤ 1.1	5.27	2.17	1.28	.89	4	90
CL-150	5	4.7	0.55	0.18	0.328	22	1600	400	0.81	-1.26	1.0 ≤ I ≤ 4.7	.66	.27	.16	.11	15	110
CL-160	5	2.8	0.55	0.18	0.328	22	1600	400	0.60	-1.05	0.8 ≤ I ≤ 2.8	.87	.42	.27	.20	9	130
CL-170	16	2.7	0.55	0.18	0.328	22	1600	400	1.18	-1.28	0.5 ≤ I ≤ 2.7	1.95	.80	.48	.33	15	110
CL-180	16	1.7	0.55	0.18	0.328	22	1600	400	0.92	-1.18	0.4 ≤ I ≤ 1.7	2.52	1.11	.69	.49	9	130
CL-190	25	2.4	0.55	0.18	0.328	22	800	170	1.33	-1.34	0.5 ≤ I ≤ 2.4	2.63	1.04	.60	.41	15	110
CL-200	25	1.7	0.55	0.18	0.328	22	800	170	0.95	-1.24	0.4 ≤ I ≤ 1.7	2.74	1.18	.70	.49	9	130
CL-210	30	1.5	0.40	0.20	0.250	24	600	150	1.02	-1.35	0.3 ≤ I ≤ 1.5	3.83	1.50	.87	.60	8	30

\*These values are suggested maximums based on the thermistor in 25°C ambient without air flow.

Current ratings can be increased depending on the magnitude of air flow.

\*\*These ratings are suggested maximums. Contact Keystone Engineering Department for assistance in applications exceeding these ratings.

\*\*\* To determine the resistance value under load, use R = XI<sup>Y</sup> where X and Y are constants in the table above and I is the current (amps).



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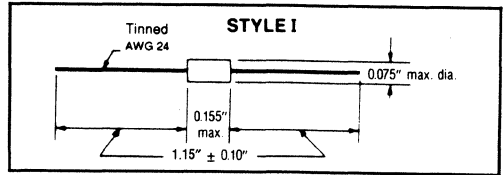
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# GLASS ENCAPSULATED THERMISTORS

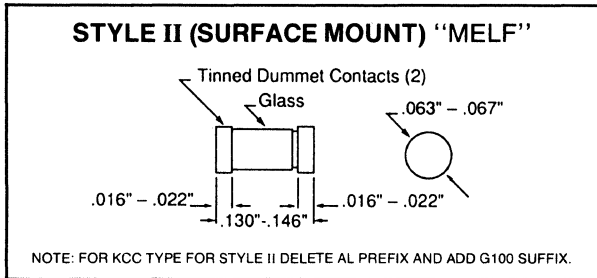
Keystone glass encapsulated NTC thermistors are tiny pellets of thermistor material hermetically sealed in glass bodies with a controlled amount of selected atmosphere. The hermetic seal makes these parts extremely stable in applications up to 204°C (400°F).

Temperature Range: -50°C to 204°C  
Dissipation Constant: 2.0 mW/°C  
Time Constant: 3 seconds

**Packaging Options Available Upon Request:**  
Style I — Axial reel tape to EIA RS-296  
Style II — Pocket tape to EIA RS-481



Type	R <sub>0</sub> @ 25°C ± 10%	Temp. Coef. @ 25°C (%/°C)	Material
AL03006-165.9-55-G1	250	-3.34	GE55*
AL03006-331.8-55-G1	500	-3.34	GE55*
AL03006-624-73-G1	1K	-3.83	GE73
AL03006-1248-73-G1	2K	-3.83	GE73
AL03006-1576-101-G1	2786	-4.68	GE101
AL03006-1847-76-G1	3K	-3.85	GE76
AL03006-2463-76-G1	4K	-3.85	GE76
AL03006-3079-76-G1	5K	-3.85	GE76
AL03006-5818-97-G1	10K	-4.41	GE97A
AL03006-11.7K-98-G1	20K	-4.34	GE98
AL03006-17.53K-98-G1	30K	-4.34	GE98
AL03006-29.1K-97-G1	50K	-4.32	GE97B
AL03006-58.2K-97-G1	100K	-4.32	GE97B
AL03006-111.3K-123-G1	200K	-4.71	GE123
AL03006-269.8K-138-G1	500K	-4.99	GE138
AL03006-535K-145-G1	1M	-5.07	GE145

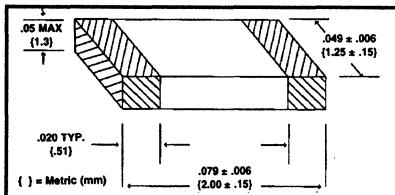


\*Maximum operating temperature: 150°C

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## SURFACE-MOUNT NTC THERMISTORS (EIA 0805 SIZE)

PCB MOUNT:  
Dissipation Constant: 5mW/°C  
Time Constant: 10 sec.

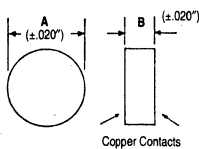


Type Number	R @ 25°C	Temp. Coef. %/°C @ 25°C	Material
NC0805R502TX	5000	-3.83	C73
NC0805R103TX	10000	-4.12	C96
NC0805R223TX	22000	-4.43	C95
NC0805R303TX	30000	-4.4	C96
NC0805R503TX	50000	-4.49	C97
NC0805R104TX	100000	-4.84	C103
NC0805R204TX	200000	-4.78	C122

Note: For resistance tolerance replace "X" with 10, 5, 3 or 2 for the corresponding resistance tolerance.

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## PTC HEATERS

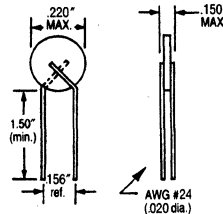


Typical applications for PTC heaters:  
• Contact lens cleaner kits  
• Medical equipment  
• In-line diesel fuel heaters  
• Temperature stabilization or electronic components  
• LCD heaters

Operating Voltage V <sub>OP</sub>	Type	A (in.)	B (in.)	Resistance @25°C ±40%	Transition Temperature (°C)	Wattage at Max. Power Dissipation
24	5506-5-65-24-PTH	.55	.06	5	65	20
	5506-5-110-24-PTH	.55	.06	5	110	35
	5506-20-140-24-PTH	.55	.06	20	140	40
120	5510-25-65-120-PTH	.55	.10	25	65	20
	5510-100-120-120-PTH	.55	.10	100	120	25
	5510-150-140-120-PTH	.55	.10	150	140	35
	7510-10-110-120-PTH	.75	.10	10	110	45
240	5515-50-65-240-PTH	.55	.15	50	65	20
	6315-500-110-240-PTH	.63	.15	500	110	25
	6315-250-120-240-PTH	.63	.15	250	120	30

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## PTC TEMPERATURE THERMISTORS



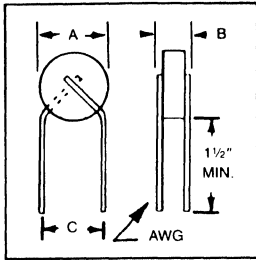
Resistance @ 25°C: 150Ω max.  
Resistance @ Accuracy Temp. (±5°C): 1000Ω

Max. Voltage: 30 volts  
Time Constant: 20 seconds  
Dissipation Constant: 2.6mW/°C

Type	Transition Temperature	Accuracy Temperature ±5°C
RL2006-100-30-30-PTD	30°C	45°
RL2006-100-40-30-PTD	40°C	55°
RL2006-100-50-30-PTD	50°C	65°
RL2006-100-60-30-PTD	60°C	75°
RL2006-100-70-30-PTD	70°C	85°
RL2006-100-80-30-PTD	80°C	95°
RL2006-100-90-30-PTD	90°C	105°
RL2006-100-100-30-PTD	100°C	115°
RL2006-100-110-30-PTD	110°C	125°
RL2006-100-120-30-PTD	120°C	135°

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## STANDARD PTC THERMISTORS



The values for Dissipation Constant and Time Constant listed in the table below are reference values. Actual values are a function of mounting, air flow and other factors which affect the PTC's ability to dissipate heat.

Standard PTCs are supplied uninsulated, but can be supplied with an insulation upon request.

Operating Voltage	Type	R @ 25°C ± 30%	Transition Temp °C T <sub>s</sub>	Dissipation Constant mW/°C	Time Constant Sec.	"H" Joules/°C	A Max.	B Max.	C Ref.	AWG No.
5	RL6505-5-110-5-PTO	.5	110	18	70	.8	.70	.16	.33	20
12	RL5305-1-120-12-PTO	1.0	120	14	50	.6	.60	.15	.33	20
	RL5305-2-120-12-PTO	2.0	120	14	50	.6	.60	.16	.33	20
	RL5305-2.5-110-12-PTO	2.5	110	14	50	.6	.60	.16	.33	20
	RL4005-5.0-110-12-PTO	5.0	110	10	40	.3	.45	.15	.25	24
	RL3005-10-110-12-PTO	10.0	110	7	35	.2	.35	.15	.25	24
	RL3005-15-110-12-PTO	15.0	110	7	35	.2	.35	.15	.25	24
	RL2006-20-80-12-PTO	20.0	80	6	30	.1	.25	.15	.15	24
	RL3005-25-110-12-PTO	25.0	110	7	35	.2	.35	.15	.25	24
25	RL7008-1.5-110-25-PTO	1.5	110	18	80	1.5	.75	.18	.33	20
	RL5008-3.0-110-25-PTO	3.0	110	14	50	.8	.55	.18	.33	22
	RL5506-5.0-110-25-PTO	5.0	110	14	50	.7	.60	.16	.33	22
	RL4006-10-110-25-PTO	10.0	110	10	40	.4	.45	.17	.25	24
	RL3006-20-120-25-PTO	20.0	120	7	35	.2	.35	.16	.25	22
	RL3006-30-110-25-PTO	30.0	110	7	35	.2	.35	.15	.25	24
	RL3006-50-30-25-PTO	50.0	30	7	35	.2	.35	.15	.25	24
	RL3006-50-40-25-PTO	50.0	40	7	35	.2	.35	.15	.25	24
	RL3006-50-50-25-PTO	50.0	50	7	35	.2	.35	.15	.25	24
	RL3006-50-60-25-PTO	50.0	60	7	35	.2	.35	.15	.25	24
	RL3006-50-70-25-PTO	50.0	70	7	35	.2	.35	.15	.25	24
	RL3006-50-80-25-PTO	50.0	80	7	35	.2	.35	.15	.25	24
	RL3006-50-90-25-PTO	50.0	90	7	35	.2	.35	.15	.25	24
	RL3006-50-100-25-PTO	50.0	100	7	35	.2	.35	.15	.25	24
	RL3006-50-110-25-PTO	50.0	110	7	35	.2	.35	.15	.25	24
RL3006-50-120-25-PTO	50.0	120	7	35	.2	.35	.15	.25	24	
50	RL5506-5-65-50-PTO	5.0	65	14	50	.7	.60	.18	.33	20
	RL5506-5-110-50-PTO	5.0	110	14	50	.7	.60	.16	.33	22
	RL4508-7-110-50-PTO	7.0	110	12	45	.6	.50	.18	.33	22
	RL4006-10-110-50-PTO	10.0	110	10	40	.4	.45	.17	.25	24
	RL4508-15-110-50-PTO	15.0	110	12	45	.6	.50	.18	.33	22
	RL4508-20-110-50-PTO	20.0	110	12	45	.6	.50	.18	.33	22
	RL4010-50-110-50-PTO	50.0	110	12	60	.6	.45	.20	.33	22
	RL2510-100-110-50-PTO	100.0	110	8	40	.2	.30	.22	.15	22
	RL3312-200-110-50-PTO	200.0	110	9	45	.5	.40	.23	.25	20
	RL2010-500-110-50-PTO	500.0	110	7	40	.2	.25	.18	.15	24
120	RL7510-10-120-120-PTO	10.0	120	20	90	2.2	.80	.23	.33	18
	RL5512-15-110-120-PTO	15.0	110	14	90	1.4	.60	.23	.33	20
	RL6010-20-120-120-PTO	20.0	120	18	90	1.4	.65	.23	.33	20
	RL5510-25-60-120-PTO	25.0	60	15	90	1.2	.60	.22	.33	20
	RL4510-50-120-120-PTO	50.0	120	12	70	.8	.50	.20	.33	22
	RL3510-100-110-120-PTO	100.0	110	11	45	.5	.40	.20	.25	22
	RL2510-200-110-120-PTO	200.0	110	8	40	.2	.30	.20	.15	22
240	RL6315-40-110-240-PTO	40.0	110	18	90	2.3	.65	.27	.33	18
	RL5515-50-65-240-PTO	50.0	65	17	80	1.8	.60	.27	.33	20
	RL6315-50-110-240-PTO	50.0	110	18	90	2.3	.65	.27	.33	18
	RL6015-100-120-240-PTO	100.0	120	18	90	2.1	.65	.27	.33	20
	RL6315-250-110-240-PTO	250.0	110	18	90	2.3	.65	.27	.33	18
	RL6315-500-110-240-PTO	500.0	110	18	90	2.3	.65	.27	.33	18
	RL3020-1000-100-240-PTO	1000.0	100	12	60	.7	.35	.31	.25	20
	RL3020-1500-100-240-PTO	1500.0	100	12	60	.7	.35	.31	.25	20
	RL3020-3000-100-240-PTO	3000.0	100	12	60	.7	.35	.31	.25	20
	RL1710-25K-65-240-PTO	25000.0	65	6	40	.1	.20	.20	.15	24
480	RL7020-1K-100-480-PTO	1000.0	100	18	90	3.8	.75	.32	.33	18
	RL5020-2K-100-480-PTO	2000.0	100	15	80	2.0	.55	.32	.33	18
	RL3020-5K-100-480-PTO	5000.0	100	12	60	.7	.35	.31	.25	20



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# STANDARD PTC RESETTABLE FUSES

KEYSTONE STANDARD PTC RESETTABLE FUSES												
Operating Voltage	R25°C ± 20%	Type	Minimum <sup>1</sup> Switch Current		Maximum <sup>2</sup> No-Switch Current		"H" Joules/°C	D.C. mW/°C	A Max.	B Max.	C Ref.	AWG No.
			0°C	20°C	30°C	55°C						
5	5	RL6505-5-110-5-PTF	2.32	2.12	1.34	1.02	.8	18	.70	.16	.33	20
12	1.0	RL5305-1.0-110-12-PTF	1.45	1.32	.84	.64	.6	14	.60	.15	.33	22
	2.5	RL5305-2.5-110-12-PTF	.92	.84	.53	.40	.6	14	.60	.16	.33	20
	5.0	RL4005-5.0-110-12-PTF	.55	.50	.32	.24	.3	10	.45	.15	.25	24
	10.0	RL3005-10-110-12-PTF	.32	.30	.19	.14	.2	7	.35	.15	.25	24
	25.0	RL3005-25-110-12-PTF	.20	.19	.12	.09	.2	7	.35	.15	.25	24
25	1.5	RL7008-1.5-110-25-PTF	1.34	1.22	.77	.59	1.5	18	.75	.18	.33	20
	3.0	RL5008-3.0-110-25-PTF	.84	.76	.48	.37	.8	14	.55	.18	.33	22
50	5.0	RL5506-5.0-110-50-PTF	.65	.59	.37	.29	.7	14	.60	.16	.33	22
	10.0	RL4006-10-110-50-PTF	.39	.35	.22	.17	.4	10	.45	.17	.25	24
	25.0	RL4508-25-110-50-PTF	.27	.24	.15	.12	.6	12	.50	.18	.33	22
	50.0	RL4010-50-110-50-PTF	.19	.17	.11	.08	.6	12	.45	.20	.33	22
	100.0	RL3810-100-110-50-PTF	.13	.12	.08	.06	.6	12	.42	.20	.25	24
	200.0	RL3312-200-110-50-PTF	.09	.08	.05	.04	.5	9	.40	.23	.25	20
120	10.0	RL7510-10-110-120-PTF	.55	.50	.32	.24	2.2	20	.80	.23	.33	20
	20.0	RL6010-20-110-120-PTF	.37	.34	.21	.16	1.4	18	.65	.23	.33	20
	50.0	RL4510-50-110-120-PTF	.19	.17	.11	.08	.8	12	.50	.20	.33	22
	100.0	RL3510-100-110-120-PTF	.13	.12	.07	.06	.5	11	.40	.20	.25	22
240	50.0	RL6315-50-110-240-PTF	.23	.21	.13	.10	2.3	18	.65	.27	.33	18
	100.0	RL6315-100-110-240-PTF	.16	.15	.09	.07	2.3	18	.65	.27	.33	18
	250.0	RL6315-250-110-240-PTF	.10	.09	.06	.05	2.3	18	.65	.27	.33	18

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# STANDARD U.L. RECOGNIZED PTC RESETTABLE FUSES

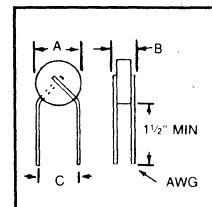
U.L. FILE E82830 — U.L. CATEGORY XGPU2 (THERMISTOR-TYPE DEVICES)													
Operating Voltage	R25°C ± 20%	Type	U.L. Style No.	Minimum <sup>1</sup> Switch Current		Maximum <sup>2</sup> No-Switch Current		"H" Joules/°C	D.C. mW/°C	A Max.	B Max.	C Ref.	AWG No.
				0°C	20°C	30°C	55°C						
5	5	RL6505-5-110-5-PTU	L/005-NC-0001/B	2.32	2.12	1.34	1.02	.8	18	.70	.16	.33	20
12	1.0	RL5506-1.0-110-12-PTU	L/012-LC-0001/B	1.45	1.32	.84	.64	.7	14	.60	.15	.33	22
	2.5	RL3506-2.5-110-12-PTU	L/012-HC-0003/B	.73	.67	.42	.32	.3	9	.40	.15	.25	24
	5.0	RL2506-5.0-110-12-PTU	L/012-FC-0005/B	.49	.45	.28	.22	.1	8	.30	.15	.15	24
	10.0	RL2006-10-110-12-PTU	L/012-EC-0010/B	.30	.27	.17	.13	.1	6	.25	.15	.15	24
25	1.5	RL7008-1.5-110-25-PTU	L/025-OD-0002/B	1.34	1.22	.77	.59	1.5	18	.75	.18	.33	20
	3.0	RL5008-3.0-110-25-PTU	L/025-KD-0003/B	.84	.76	.48	.37	.8	14	.55	.18	.33	22
50	5.0	RL5508-5.0-110-50-PTU	L/050-LD-0005/B	.65	.59	.37	.29	1.0	14	.60	.17	.33	22
	10.0	RL4008-10-110-50-PTU	L/050-ID-0010/B	.39	.35	.22	.17	.5	10	.45	.17	.25	24
	20.0	RL3008-20-110-50-PTU	L/050-GD-0020/B	.24	.22	.14	.11	.3	8	.35	.16	.25	24
	50.0	RL2008-50-110-50-PTU	L/050-ED-0050/B	.14	.13	.08	.06	.1	7	.25	.16	.15	24
120	10.0	RL7512-10-110-120-PTU	L/120-PF-0010/B	.55	.50	.32	.24	2.7	20	.80	.23	.33	20
	20.0	RL5512-20-110-120-PTU	L/120-LF-0020/B	.32	.30	.19	.14	1.4	14	.60	.23	.33	20
	50.0	RL3512-50-110-120-PTU	L/120-HF-0050/B	.16	.15	.09	.07	.6	9	.40	.22	.25	22
	100.0	RL2512-100-110-120-PTU	L/120-FF-0100/B	.11	.10	.06	.05	.3	8	.30	.22	.15	22
240	50.0	RL6320-50-110-240-PTU	L/240-NH-0050/B	.23	.21	.13	.10	3.1	18	.70	.32	.33	18
	100.0	RL4520-100-110-240-PTU	L/240-JH-0100/B	.14	.13	.08	.06	1.6	13	.50	.30	.33	20
	200.0	RL3020-200-110-240-PTU	L/240-GH-0200/B	.08	.07	.04	.03	.7	8	.35	.29	.25	22

<sup>1</sup>Minimum Switch Current: The minimum current required to switch the PTC at the ambient indicated.

<sup>2</sup>Maximum No-Switch Current: The maximum current that the PTC can pass without switching at the ambient indicated.

NOTE: The current values and dissipation constant listed are for reference only. Actual values are a function of mounting, air flow, and other factors which affect the PTC's ability to dissipate heat.

All PTCs from higher voltage rating groups can be used for lower voltage applications.



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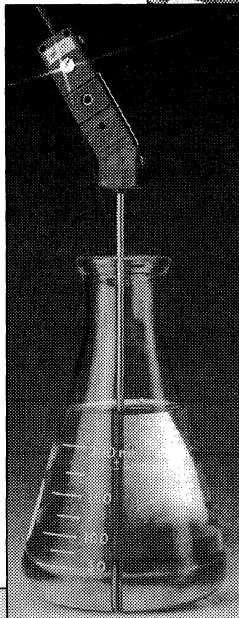
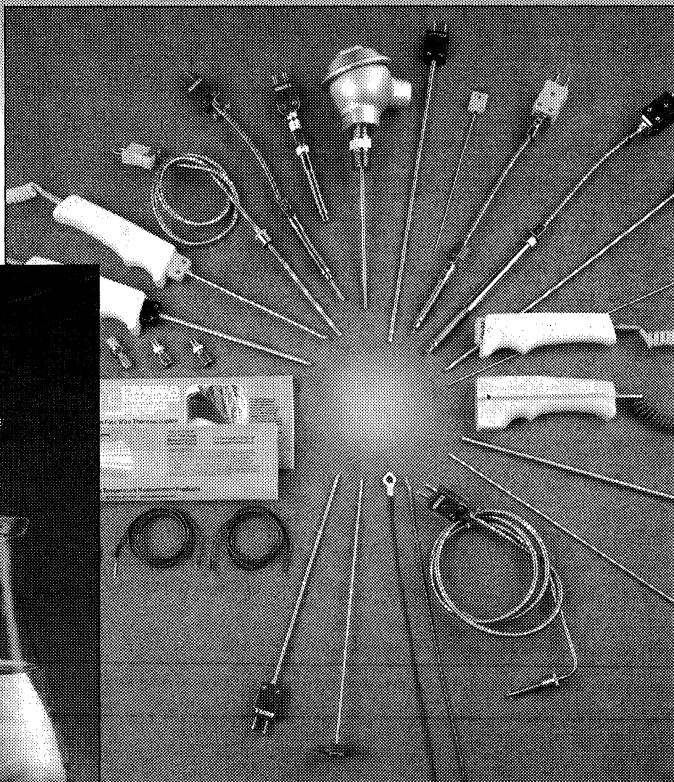


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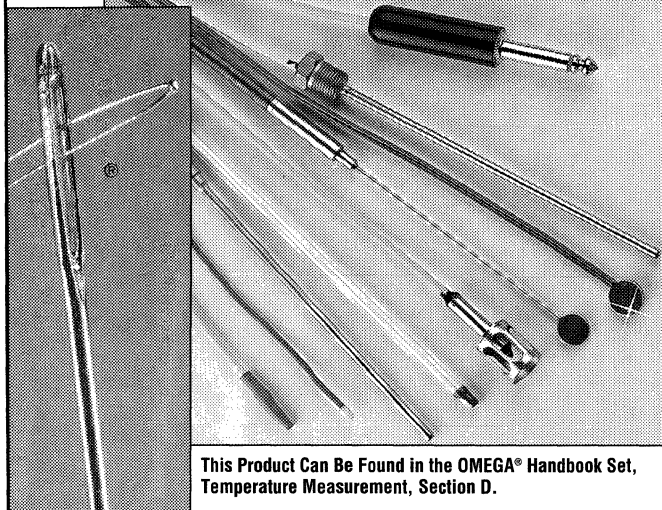
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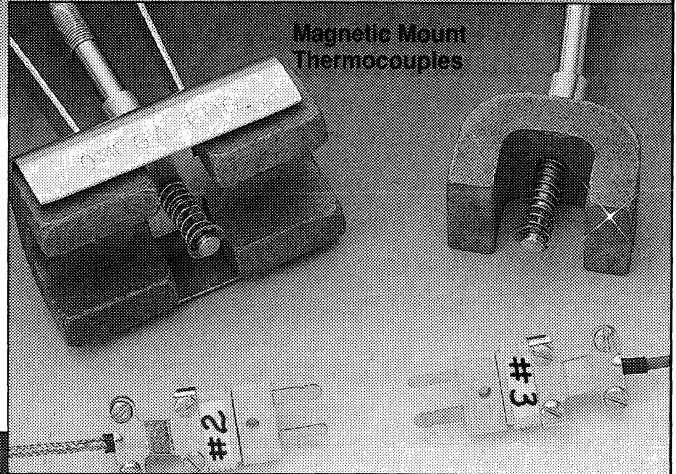
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# Where Do I Find Temperature Measurement Sensors? OMEGA... Of Course!

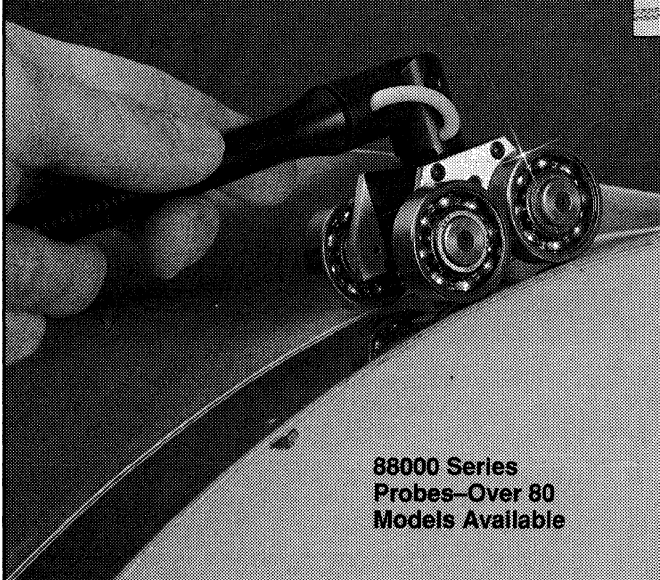


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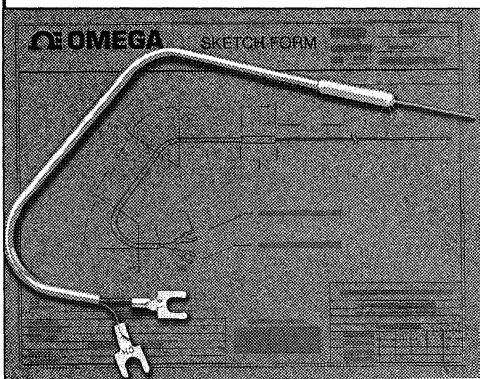
These Products Can Be Found in the OMEGA® Handbook Set, Temperature Measurement, Section A.



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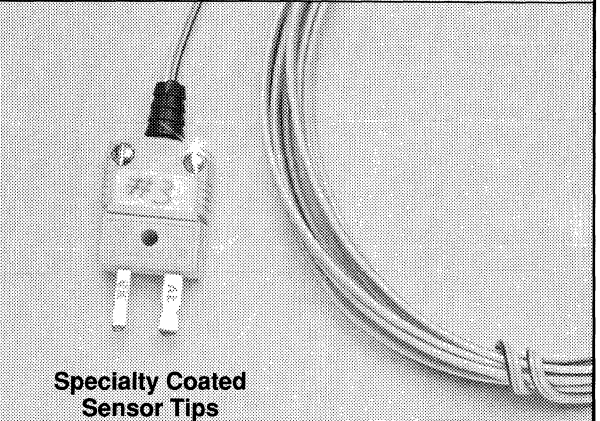
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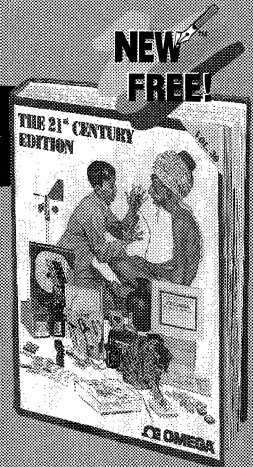


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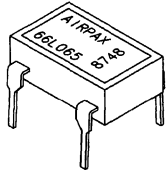
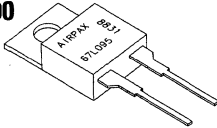
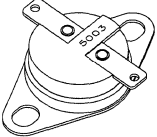
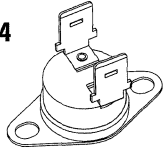
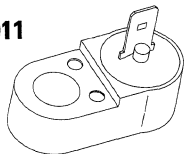
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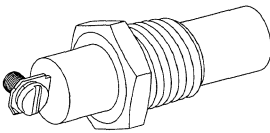
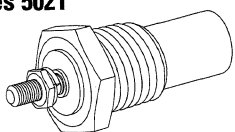
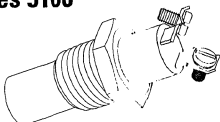
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**Airpax Thermostats** are available in an assortment of surface sensing and immersion styles, which can be specified with contacts opening or closing at temperatures from 35°F to 500°F. A large selection of mounting and terminal configurations add to the options available to meet your specific applications requirements. Contact Philips Technologies, Airpax Protector Group, 807 Woods Road, Cambridge, Maryland 21613, Tel: 410-228-1500 or Fax 410-228-3456.

## Surface Sensing Thermostats

	General Description	Features
<b>Series 6600</b> 	<p>The Airpax Series 6600 is a miniature bimetallic snap acting thermostat which provides accurate and reliable sensing and switching in a single device. It provides fast, positive response and excellent repeatability with 1 amp switching capability at 48 Vdc over its operating temperature range of 40°C to 120°C (104°F to 230°F). The temperature is preset at the factory and non-adjustable in the field.</p>	<ul style="list-style-type: none"> <li>• Operating temperature range from 40°C to 120°C</li> <li>• Short term exposure limit: 260°C, 10 sec.</li> <li>• Long term exposure limit: -55°C to 160°C</li> <li>• Standard dual in-line package (DIP)</li> <li>• Epoxy sealed for wave soldering and cleaning</li> <li>• UL recognized, CSA certified</li> <li>• VDE approved</li> </ul>
<b>Series 6700</b> 	<p>The series 6700 bimetallic thermostat provides accurate and reliable sensing and switching in a single device. Primarily developed for thermal management applications the 6700 series provides fast, accurate response thru its operating range of 40°C to 120°C.</p>	<ul style="list-style-type: none"> <li>• Operating temperature range from 40°C to 120°C</li> <li>• Dielectric strength 1480 Vac 60Hz</li> <li>• International product packaging standard Y220/T0220</li> <li>• 120Vac, 48 Vdc, 1 amp</li> <li>• Epoxy sealed for wave soldering and cleaning</li> <li>• UL recognized, CSA certified</li> <li>• VDE approved</li> </ul>
<b>Series 5003</b> 	<p>Here's an extremely thin, wafer-type thermal switch with an overall depth of only .250". It provides fast, positive response, excellent repeat reliability and good shock and vibration resistance over its operating range of 35°F to 350°F. A choice of open-on-rise (OPR) or close-on-rise (CLR) contact is available.</p>	<ul style="list-style-type: none"> <li>• Overall depth is only .250"</li> <li>• Operating temperature range from 35°F to 350°F</li> <li>• OPR or CLR contact are available</li> <li>• 120Vac 5 amp, 240Vac 3 amp</li> <li>• 2.3 grams</li> <li>• Variety of mountings and terminations available</li> <li>• UL recognized, CSA certified</li> </ul>
<b>Series 5004</b> 	<p>Designed for European requirements of 4mm clearance and 240Vac, this thermostat is designed for use in such industrial electrical equipment as business machines, radar, computer peripherals, heater blanket controls and heat sink protection.</p>	<ul style="list-style-type: none"> <li>• 4mm clearance and 120Vac 15 amp, 240Vac 10 amp</li> <li>• Operating temperature range from 35°F to 350°F</li> <li>• Environmental sealing available</li> <li>• UL recognized, CSA certified</li> <li>• VDE Approved</li> <li>• Variety of styles available</li> </ul>
<b>Series 5011</b> 	<p>A very low-cost thermostat that will meet a number of exacting requirements. It is hermetically sealed and offers fast response. The grounded case design is unique compared to the surface sensing thermostats offered today by other manufacturers. Plug, wire-lead, and isolated-base mountings are available. The 5011 is available with a 1/4-20 stud mounting.</p>	<ul style="list-style-type: none"> <li>• Low cost, grounded unit</li> <li>• Operating temperature range from 35°F to 500°F</li> <li>• Many mounting packages available</li> <li>• 120Vac, 32Vdc, 3amp</li> <li>• Stud-mounted version available</li> <li>• High vibration resistance</li> </ul>

## Immersion Thermostats

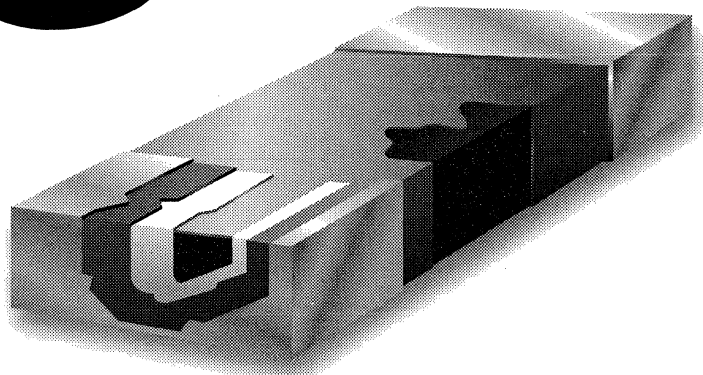
	General Description	Features
<b>Series 5020</b> 	<p>This snap action hermetically sealed temperature control is designed for use whenever a hermetic seal and high-vibration resistance are required. Protects engines from damage from overheating by sensing high water or oil temperatures. The snap action disc is located in the very tip of the probe, assuring rapid and true response to liquid temperature. The tube will withstand a Pressure Exposure Limit of 1500 PSI. Insulation Resistance of 50 megohms minimum at 500 Vdc is an important feature of the advanced design control.</p>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• Grounded case</li> <li>• Operating temperature range from 35°F to 480°F</li> <li>• 32Vdc, 3amp</li> <li>• 5020 - 13QPL Listed: Mil-S-12285/1</li> <li>• All stainless T.I.G. construction</li> </ul>
<b>Series 5021</b> 	<p>A single throw, snap action, sealed temperature control, excellent for applications requiring high vibration resistance. Specifically designed with snap action disc located in the very tip of the brass probe, this thermostat is ideally suited to protect engines from over heating damage by accurately sensing high water and oil temperatures.</p>	<ul style="list-style-type: none"> <li>• Solid one-piece brass body construction</li> <li>• Operating temperature range from 35°F to 325°F</li> <li>• High vibration resistance</li> <li>• Waterproof</li> <li>• QPL listed: Mil-S-12285/2</li> <li>• Grounded case</li> <li>• 28Vdc, .25amp</li> </ul>
<b>Series 5100</b> 	<p>This two-terminal, immersion-type hermetically sealed thermostat can be used on water-cooled engines, hydraulics systems, degreasers, industrial air compressors and tanks include stationary and portable air compressors, steam-cleaning equipment and for many types of diesel and gas engine protection. It offers rapid response to liquid or air temperature.</p>	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• All stainless T.I.G. construction</li> <li>• Operating temperature range from 35°F to 480°F</li> <li>• 120Vac 3 amp and 240Vac 1.5 amp model available</li> <li>• Isolated case</li> <li>• UL recognized</li> <li>• CSA certified</li> </ul>

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## Negative Temperature Coefficient Surface Mount Thermistors

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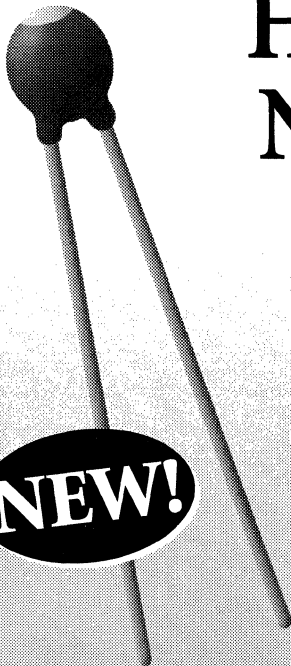


- QTI Patented Technology, #5,257,003
- EIA-575 Standard Configurations
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- EIA 481 Tape & Reel Standard Packaging
- Temperature Tolerance Point Matching
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- Eliminates Tin/Silver Whisker Growth
- Optimized For High Frequency Design
- Resistances From 50 OHM To 10.0 Meg OHM @ 25°C

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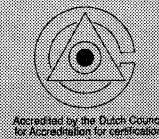
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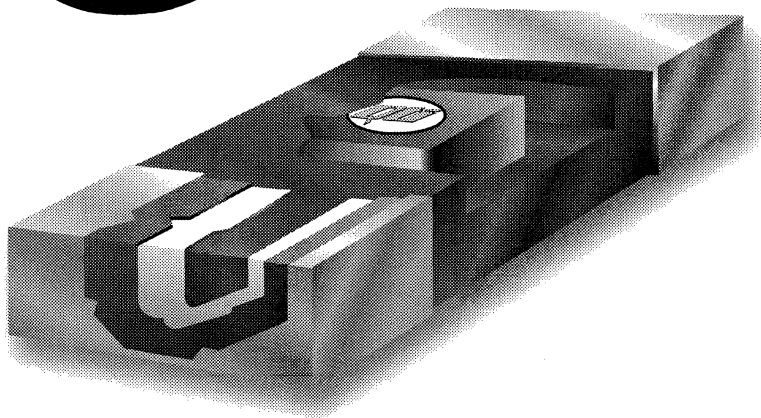
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**QUALITY THERMISTOR, INC.**

# Positive Temperature Coefficient Surface Mount Thermistor

(QT0805 Series)

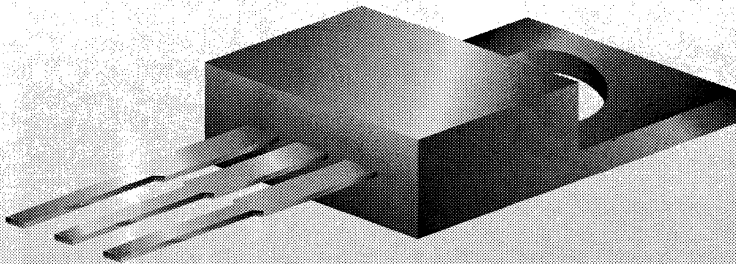
**NEW!**



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- Linear 7000 ppm / °C Tempco
- EIA-575 Standard 0805 Configuration
- DESC (HI-REL) Drawing #98018
- EIA 481 Tape & Reel Packaging
- Temperature Tolerance Point Matching
- Rugged Fracture Stabilized Construction
- Eliminates Tin/Silver Whisker Growth
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- Commercial Values Available From 22 OHM to 30K OHM
- Replaces RTH42ES & RTH22ES Series

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- Standard Metal Tab & Fully Molded Designs
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- Ruggedly Designed For Automated Insertion
- Specialized Current Limiting Applications
- Heat Sink Over-Temperature Protection
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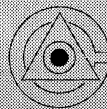
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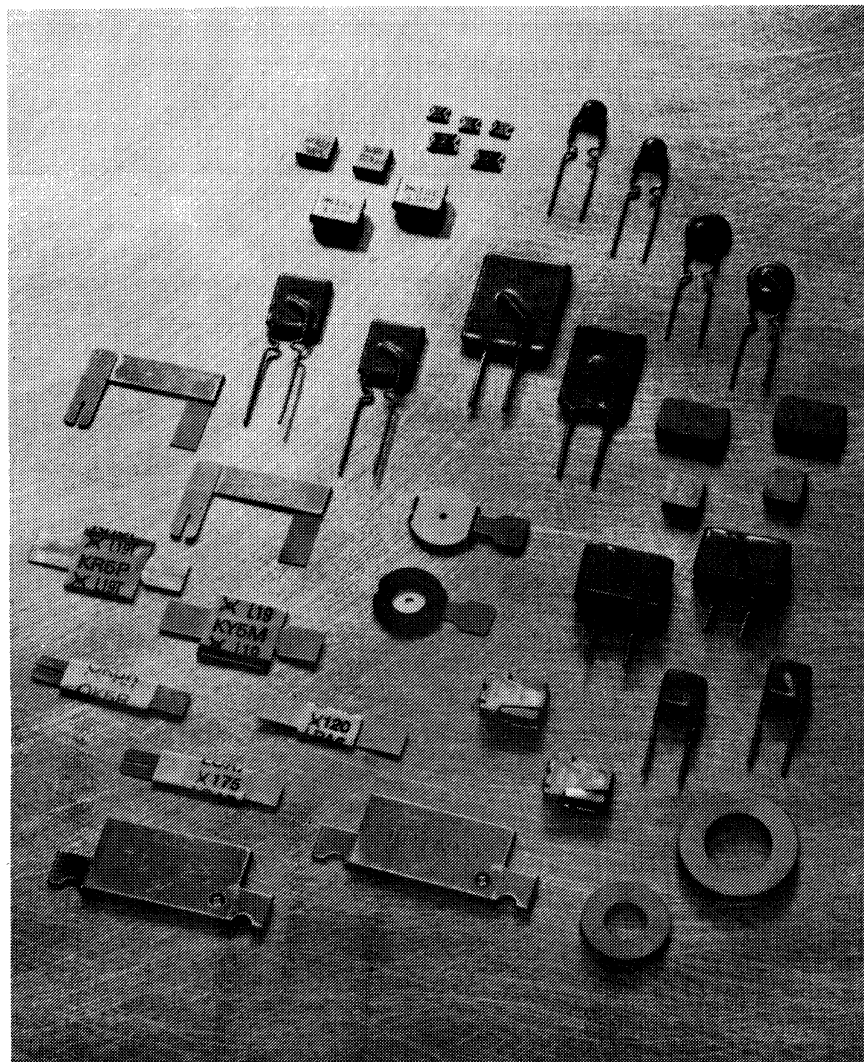
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## PolySwitch Resettable Fuses



*PolySwitch resettable fuses protect electrical and electronic circuits against excessive current.*

PolySwitch circuit protection devices protect electrical and electronic circuits against excessive current. Like traditional fuses and circuit breakers, PolySwitch devices interrupt the flow of dangerously high current during fault conditions. But unlike traditional fuses and circuit breakers, PolySwitch devices automatically reset after the fault is cleared and power to the circuit is removed.

PolySwitch resettable fuses are polymer positive temperature coefficient (PPTC) devices that rapidly increase resistance in response to excessive currents. When the current flowing through a PolySwitch device is

within its maximum rating, its "base" resistance is very low. If the current rises above its maximum rating, the PolySwitch device's resistance abruptly rises.

Depending upon the PolySwitch resettable fuse and the amount of current, the trip time required to reduce the current can be as short as one millisecond. Once power to the protected circuit is removed, the PolySwitch device's resistance begins to drop, resetting the device after the fault is corrected so that normal operation can resume when the power is reapplied.

**Caution:** Operation beyond maximum ratings may result in device damage and possible electrical arcing and flame.

**Note:** These devices are intended for protection against occasional overcurrent or overtemperature fault conditions, and should not be used when repeated fault conditions are anticipated.

*See Our Additional Data Pages In Section - B•4300*

**PolySwitch devices are used in a variety of applications including:**

- Audio Visual Equipment
- Batteries
- Computers
- Electronic Games and Toys
- Loudspeakers
- Medical Electronics
- MOSFET Devices
- Motors, Fans, and Blowers
- POS Equipment
- Process and Industrial Controls
- Satellite Video Receivers
- Security and Fire Alarm Systems
- Telecommunications Networks
- Test and Measurement Equipment
- Transformers

**PolySwitch devices have distinct advantages over other methods of circuit protection:**

- As solid-state devices, PolySwitch resettable fuses better withstand mechanical shock and vibration.
- Remotely resettable, they can reset thousands of times, thus eliminating unnecessary product downtime, service, and warranty repairs.
- Low resistance means low voltage drops in power circuits.
- Many PolySwitch devices are UL, TÜV, and CSA recognized components.

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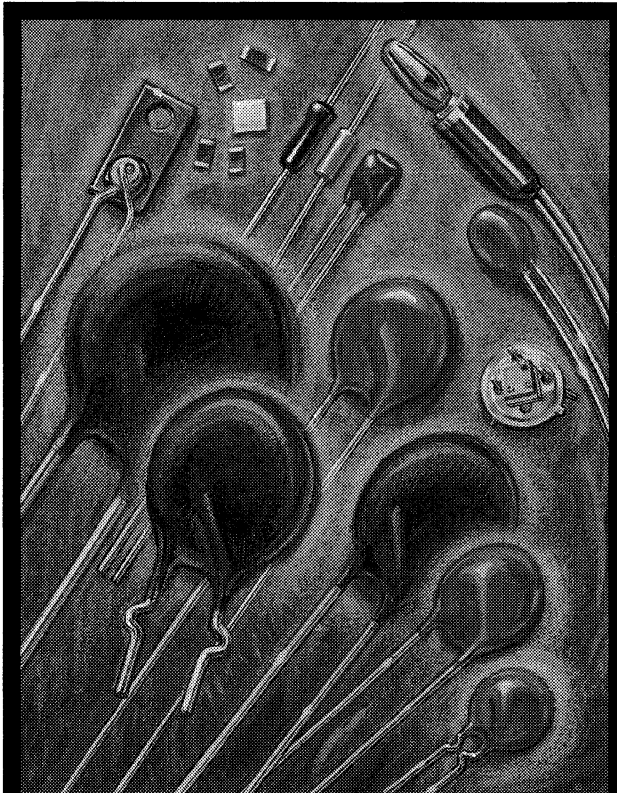


## RTI Electronics, Inc.

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# THERMISTORS



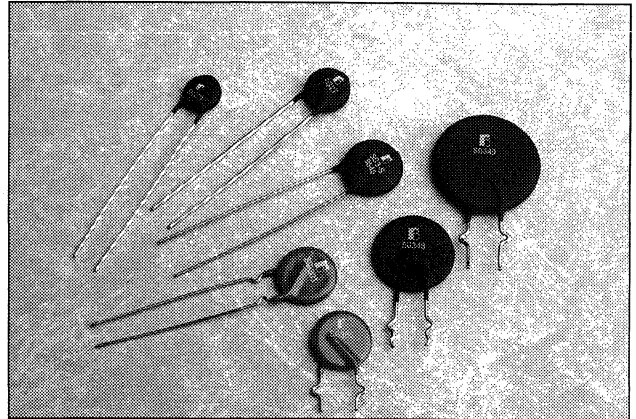
## THE COMPANY

RTI Electronics, Inc. designs, manufactures and sells quality thermistor products to a diverse international marketplace of military, industrial and commercial customers. The company has developed lasting customer relationships by providing reliable industry standard products, timely service and competitive prices.

RTI Electronics, Inc. offers its customers state of the art manufacturing facilities dedicated to advanced thermistor production. The company is staffed by experienced innovative engineering and production professionals uniquely qualified to assist in the design and production of the most demanding thermistor applications. As the recognized leader in the supply of inrush current limiting devices used in switching power supplies, RTI's Surge-Gard™ product line enjoys a unique position in the world marketplace, and the company has earned a reputation for meeting the most exacting specifications as well as delivery schedules on a global level.

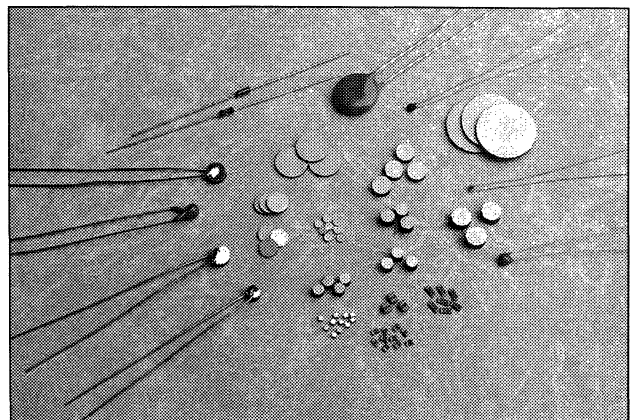
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## SURGE-GARD™ Inrush Current Limiters



RTI's Surge-Gard™ devices are manufactured of a specially formulated metal oxide ceramic material which is capable of suppressing high inrush current surges. They are especially useful in power supplies where, because of the extremely low impedance of the capacitor being charged, the bridge is subjected to an exceedingly high current surge at turn-on. The Surge-Gard™, being of relatively high resistance, limits the current for 1 to 2 seconds during which time the device decreases in resistance substantially to a point where its voltage drop is negligible.

## NTC Thermistors



**Disc • Leaded • Surface Mount Devices  
Chip • Molded • Hermetically Glass Sealed**

RTI's NTC Disc Thermistors are available in resistances from 1.0 to 200,000 ohms. They are suitable over a range of resistance values and temperature coefficients from relatively low resistances and temperature coefficients to very high values. Resistance tolerance of  $\pm 1\%$  through  $\pm 20\%$  are available. Tolerances are specified at 25°C, or at any temperature within the operating range.



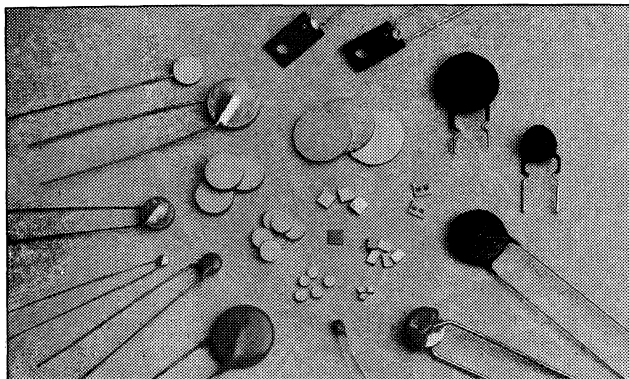
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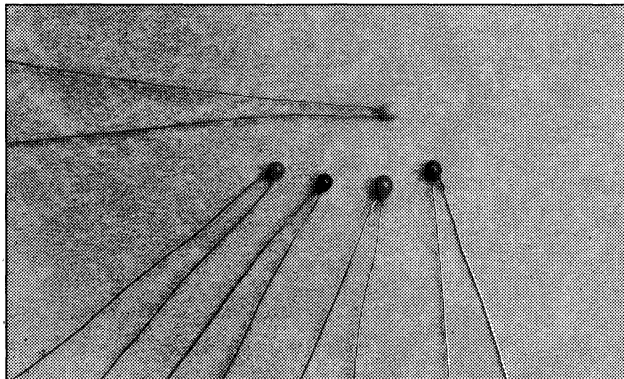
## Standard PTC Thermistors



### DISC • LEADED SURFACE MOUNT DEVICES • CHIP

- Over-Temperature Protection
- Temperature Compensation
- Arc Suppression
- Time Delay
- Liquid Level Sensing
- Air Flow Sensing
- Automatic Color TV Degaussing
- Non-Destructive Fusing
- Self-Regulating Heaters
- Single Phase Motor Starting

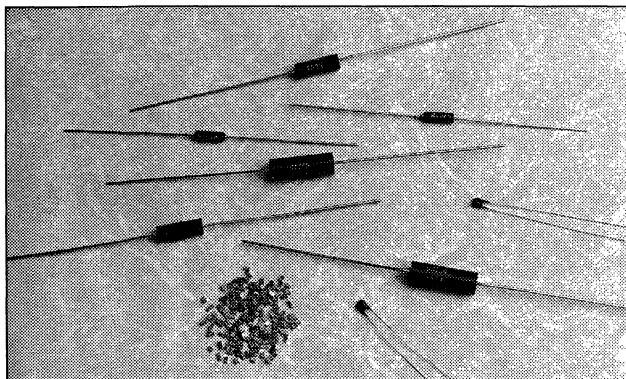
## ACCU-CURVE™ Interchangeable NTC Thermistor



RTI's Accu-Curve™ thermistors are small, high quality, low cost, epoxy encapsulated, precision, curve matched devices which are available in a variety of electrical parameters. They offer true interchangeability over wide temperature ranges and eliminate the need for individual circuit adjustments or padding. These thermistors provide highly accurate and stable temperature sensing capability for applications such as temperature measurement or compensation.

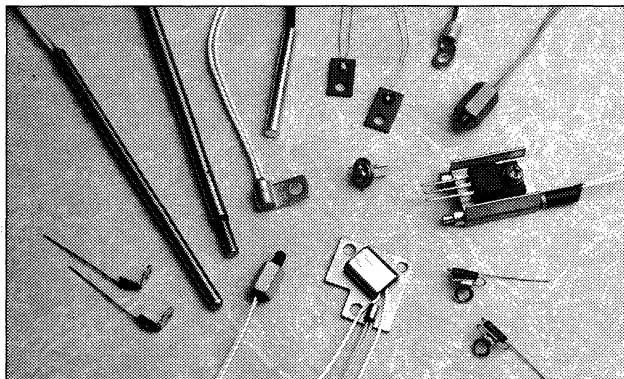
- Dissipation Constant 1 mW/°C Minimum
- Time Constant 10 Seconds

## Silicon PTC Thermistors



The positive temperature coefficient of resistance is very large: approximately 0.7% /°C, making these units ideal for use in temperature compensating and sensing applications. Applications include amplifiers, power supplies, transducers, telemetry, computers, magnetic amplifiers, thermometry, meteorology, temperature regulation, and overtemperature protection. RTI's PTC thermistors are designed and built to withstand all environmental conditions required by the most stringent Mil specs. They meet or exceed all requirements of MIL-T-23648 for positive temperature coefficient thermistors.

## Probes & Assemblies



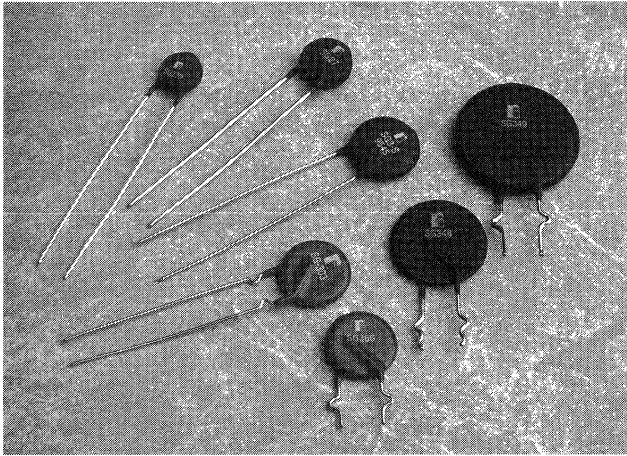
RTI Electronics, Inc. has extensive experience in designing thermistors to suit the specific needs of users for a wide range of applications. RTI Electronics, Inc. has produced components from simple consumer sensors to hybrid substrates for critical satellite applications.

RTI's application engineers are available to work with the proper resistance properties, response times, sizes and other application specific requirements.



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## **SURGE-GARD™** **Circuit Protection Devices** **NTC Thermistors**

### **NTC Thermistors**

#### **SURGE-GARD™** **Features**

- **Lowers rectifier cost by reducing required peak forward surge current rating**
- **Reduces Noise**
- **Reduces Fuse Failures**
- **High Current Capability**

Negative Temperature Coefficient (NTC) thermistors are thermally sensitive semiconductor resistors which exhibit a decrease in resistance as absolute temperature increases. Change in the resistance of the NTC thermistor can be brought about either by a change in the ambient temperature or internally by self-heating resulting from current flowing through the device. Most of the practical applications of NTC thermistors are based on these material characteristics.

### **Inrush Current Limiting Devices**

RTI manufactures SURGE-GARD™ inrush current limiting devices using specially formulated metal oxide ceramic materials. These devices are capable of suppressing high inrush current surges. They are especially useful in power supplies where the low impedance of the charging capacitor exposes the diode bridge rectifier to an excessively high current surge at turn-on.

### **Thermistor Terminology for Inrush Current Limiting Devices**

- **I<sub>MAX</sub>** - The maximum steady state RMS AC or DC current.
- **I<sub>OP</sub>** - The actual operating current.
- **R<sub>I MAX</sub>** - The approximate resistance under maximum steady state current conditions.
- **MAX Operating Temperature** - RTI's recommended maximum ambient temperature is 65°C without de-rating. (Ref. Fig. C for de-rating information)
- **Recovery Time** - SURGE-GARD™ devices require time to return to their ambient resistance state in order to provide adequate inrush current limiting at each power turn-on. This time varies with each device, the mounting configuration and the ambient operating temperature. RTI recommends a minimum of 60 seconds. The selection of a capacitor bleeder resistor can reduce the required cool down time requirement.





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## Applications

RTI's **SURGE-GARDS™** are used in many applications today that require limiting inrush current when power is applied to a system. The most popular application is the inrush protection of the AC current in switching power supplies (SPS). The primary reason for having surge current suppression in a SPS is to protect the diode bridge rectifier as the input or charging capacitor is initially charged. This capacitor draws significant current during the first half AC cycle and can subject the components in line with the capacitor to excessive current. The inherent equivalent series resistance (ESR) of the capacitor provides very little protection for the diode bridge rectifier. Use of the proper **SURGE-GARD™** will provide maximum current protection when the power supply is turned on and allow the design engineer to select lower peak current rated diode bridge rectifiers for use in their SPS.

If the resistance of one **SURGE-GARD™** does not provide sufficient inrush current limiting for an existing application, two or more may be used in series or in separate legs of the power supply circuit. **SURGE-GARDS™** should not be used in parallel since one unit will tend to conduct nearly all the current available. **SURGE-GARDS™** may be used in the AC input side or in the circuit on the DC line between the charging capacitors and the diode bridge rectifier circuit. (Reference Figure A)

### **SURGE-GARD™** Selection Procedure

- Calculate **I<sub>MAX</sub>**
- **CALCULATE R@25°C**
- Select **SURGE-GARD™** specified to handle the input energy & maximum current with a **R@25°C** value capable of limiting the inrush current
- Evaluate Joules Rating
- Calculate the **SURGE-GARD™** resistance at **I<sub>OP</sub>** using the 'M' curve in Figure B
- Check Figure C if de-rating is required for high ambient operating temperature

## Selection Considerations for **SURGE-GARDS™**

- **I<sub>MAX</sub>** - The first critical consideration in the selection of a **SURGE-GARD™** is the maximum steady state current (AC or DC) of the power supply. **SURGE-GARDS™** are rated for maximum continuous current. The input power (P<sub>in</sub>) is calculated as P<sub>in</sub> = P<sub>out</sub>/efficiency. In the case of a 75 Watt SPS with 0.70 efficiency, 100% load is calculated to be 107.14 Watts. The maximum input current is at the minimum input voltage. The effective input current (I<sub>e</sub>) is equal to the maximum load divided by the minimum input voltage. In this case, a 75 Watt SPS, I<sub>e</sub> = P<sub>in</sub>/V<sub>in</sub><sup>(low)</sup> = 107.14 Watts/90 Volts = 1.2 Amps. Therefore, the **SURGE-GARD™** must have an **I<sub>MAX</sub>** rating of at least 1.2 Amps.
- **R@25°C** - The second step is to determine the minimum R value of the **SURGE-GARD™** to be selected that will limit the one cycle maximum current rating of the diode bridge rectifier to 50% of its rating to ensure adequate surge protection. Several additional calculations must be made to determine the estimated resistance value required at the point in time of the maximum current surge. RTI provides for a maximum AC voltage rating of 265V RMS on most **SURGE-GARDS™**. (Reference the **Specifications**.) If the desired maximum inrush current is less than 100 Amps (50% of the diode bridge with a peak current rating of 200 Amps), then solving for R would produce a value of 2.65 Ω. If the **MAX Operating Temperature** is other than 25°C then the zero power resistance value must be calculated using the **NTC Resistance/Temperature Conversion Tables**.



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## Selection Considerations for SURGE-GARDs™ (Cont.)

As an example, if the **MAX Operating Temp.** is 50°C, and the **SURGE-GARD™** selected has an **R-T Curve A**, the  $R_T/R_{25}$  factor is **0.464**. This indicates in order for the **SURGE-GARD™** to have the same effective current limiting characteristic at the elevated temperature, it must have a higher resistance than the **R@25°C** value previously determined. To simplify our selection of the minimum R value divide the initial **R@25°C** value by the  $R_T/R_{25}$  factor. In this case, the **Minimum R@25°C value** =  $2.65 \Omega / 0.464 = 5.71 \Omega$ .

### SURGE-GARD™ Installation Options

- **Thru-hole Leads**
  - **Insulated/Uninsulated**
  - **Standoffs**
  - **Preformed Leads**
  - **See Figure D**
- **Select a SURGE-GARD™** - The third requirement is to select a **SURGE-GARD™** from the **Specifications**. First find the column labeled **R@25°C**. The resistance values are listed in ascending order. If the exact R value calculated is not listed round up to the next highest R value. In this example that would be a 6Ω, 5 Amp part, number SG418. Notice that the current rating is higher than required. This current rating is mass dependent therefore the part would be larger in size than the circuit requires. Continue down the column until the closest current rating is located. In this case it would be a 10Ω, 3 Amp rated part, number SG220. This would be the selected **SURGE-GARD™** of choice.
  - **Evaluate Joules Rating** - The fourth step is to review the amount of energy that can be absorbed or dissipated by a **SURGE-GARD™** before a failure may occur. The **SURGE-GARD™** devices are rated in **Joules**. In order to calculate the Joules rating the input capacitor value must be specified. Assume that the input capacitor is 220μfd. The instantaneous energy is equal to one half times the capacitance of the capacitor plus its tolerance times the peak voltage squared. In this example,  $E_i = 0.5 (220 (+/-Tol))^{10^{-6}} * (265 * 1.414)^2 = 15.44 \text{ J (nominal)}$ . The Joules rating for the SG220 selected is 17J. (Please note that other criteria such as hold up time, ripple current, capacitor discharge time, and the efficiency of the power supply design may affect the **SURGE-GARD™** selection process. Consult RTI's application engineering personnel for additional information.)
  - **Calculate  $I_{OP}/I_{MAX}$  Ratio** - Next, estimate the actual operating current,  $I_{OP}$ , and calculate the  $I_{OP}/I_{MAX}$  ratio. The nominal resistance of a **SURGE-GARD™** when operated at its  $I_{MAX}$  rating is specified in the **Specifications** under the **R<sub>I MAX</sub>** heading. The device's resistance when it is operated at a current less than its  $I_{MAX}$  rating can be estimated by multiplying its **R<sub>I MAX</sub>** rating by the factor, **M**. As an example, a **SURGE-GARD™** with an  $I_{MAX}$  of 3.0 Amps and an **R<sub>I MAX</sub>** of 0.20 Ω that is operated at 1.2 Amps, the  $I_{OP}/I_{MAX}$  current ratio is 1.2 Amps/3.0 Amps = 0.40. The corresponding **M** factor can be determined from the graph shown in Figure C to be 3.2. Therefore the device's estimated resistance at 1.2 Amps can be calculated to be  $R = 3.2 * 0.20 \Omega = 0.64 \Omega$ . If two different **SURGE-GARDs™** have similar  $I_{MAX}$  ratings but different **R@25°C** values and they meet the circuit requirements, then select the one with the lowest **R<sub>I MAX</sub>** nominal value.
  - Lastly, if the **MAX Operating Temp.** range is >65°C or <0°C, refer to the **SURGE-GARD™ Recommended  $I_{MAX}$  De-rating Curve**, Figure C.



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## SURGE-GARD™ Installations

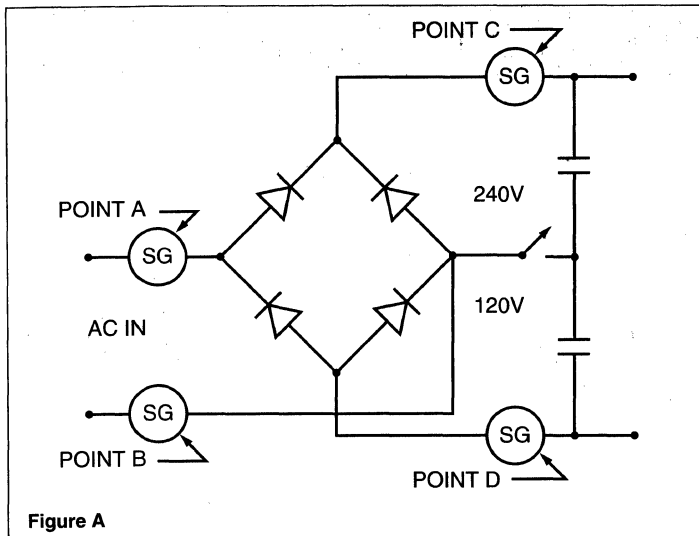


Figure A

## SURGE-GARD™ Resistance Curve

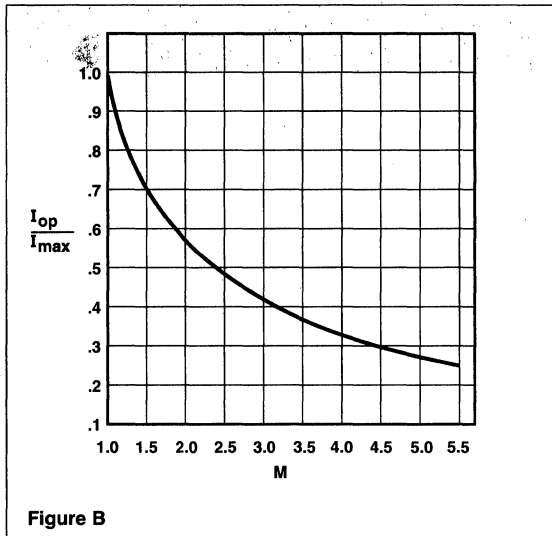


Figure B

## SURGE-GARD™ Recommended Imax Derating Curve

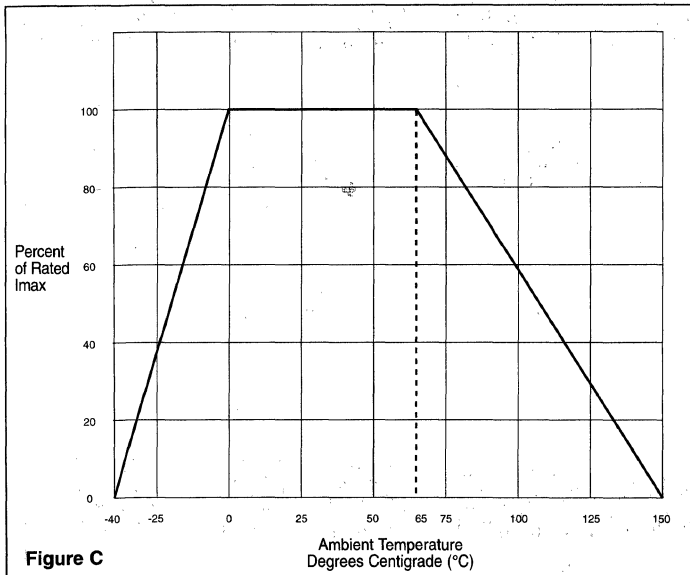


Figure C

The recommended Imax current versus the ambient temperature is shown in Figure C.

If the ambient temperature is between 0°C and 65°C, the percent of Imax is 100%.

If the ambient temperature is between 65°C and 150°C, the percent of Imax =  $100 [1 - \frac{T-65°C}{85°C}]$

T = ambient temperatures between 65°C and 150°C

If the ambient temperature is between 0°C and -40°C, the percent of Imax =  $100 [1 - \frac{T-0°C}{-40°C}]$

T = ambient temperatures between 0°C and -40°C

## Lead Style Configurations

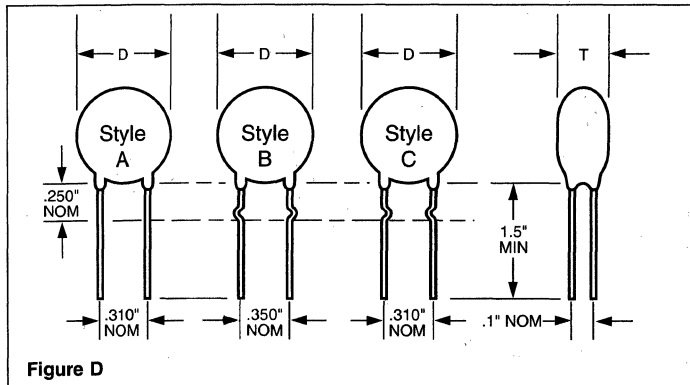


Figure D



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## SURGE-GARD™ Specifications

Part Number			R@25°C (Ohms)	R Tolerance (±%)	I <sub>max</sub> (AMPS)	R <sub>lmax</sub> (Ohms)	Max. D (Inches)	Max. T (Inches)	Lead Dia. (Inches)	NTC Curve	Surge Rating (Joules)
Style A	Style B	Style C									
SG260	SG326		.5	20	30.00	.010	1.250	.200	.040	A	31*
SG415	SG327		.7	25	12.00	.030	.740	.200	.040	A	45
SG100	SG301		1.0	15	20.00	.015	.900	.300	.040	A	48*
SG405	SG328		1.0	25	30.00	.015	1.250	.250	.040	A	157
SG416	SG329		1.3	25	8.00	.050	.525	.200	.040	A	40
SG110	SG302		2.0	15	18.00	.030	.900	.350	.040	A	80
SG420	SG355		2.0	25	23.00	.025	1.250	.300	.040	A	250
SG120		SG303	2.5	15	3.00	.150	.600	.250	.032	A	27
SG130		SG304	2.5	15	7.00	.050	.600	.250	.032	A	27
SG140		SG305	2.5	15	9.00	.040	.600	.250	.032	A	27
SG150	SG306		2.5	15	10.00	.040	.900	.300	.040	A	87
SG160	SG307		2.5	15	15.00	.030	.900	.300	.040	A	87
SG170	SG308		4.0	15	8.00	.070	.600	.250	.040	A	27
SG32	SG330		4.0	20	14.00	.050	.900	.350	.040	A	100
SG180		SG309	5.0	15	2.00	.400	.600	.250	.032	A	36
SG413			5.0	25	2.80	.250	.530	.200	.025	A	23
SG190		SG310	5.0	15	4.00	.150	.600	.250	.032	A	36
SG450		SG373	5.0	15	6.00	.100	.600	.250	.032	A	30
SG200		SG311	5.0	15	7.00	.070	.600	.250	.032	A	40
SG44	SG332		5.0	20	8.00	.050	.600	.250	.040	A	40
SG26	SG333		5.0	15	12.00	.060	.900	.275	.040	A	100
SG418		SG334	6.0	15	5.00	.150	.600	.270	.032	A	40
SG210	SG312		7.0	15	4.00	.200	.600	.300	.040	A	50
SG85	SG335		7.0	25	5.00	.150	.600	.300	.040	A	45
SG64	SG336		7.0	15	10.00	.080	.950	.275	.040	J	100
SG13		SG337	10.0	15	2.00	.300	.500	.250	.040	A	17
SG220		SG313	10.0	15	3.00	.200	.450	.300	.032	A	17
SG42	SG338		10.0	15	5.00	.200	.600	.350	.040	A	44
SG27	SG314		10.0	15	6.00	.150	.500	.350	.040	A	40
SG40	SG72		10.0	20	8.00	.100	.900	.350	.040	J	50
SG451	SG374		12.0	15	4.00	.220	.500	.350	.040	A	40
SG452		SG375	15.0	15	2.50	.330	.550	.300	.032	A	40
SG86			16.0	25	1.70	.600	.530	.300	.025	A	45
SG414			16.0	25	2.70	.400	.530	.300	.025	A	45
SG63	SG320		16.0	25	4.00	.250	.750	.250	.040	J	50
SG230		SG315	20.0	15	1.75	.600	.500	.300	.032	A	31
SG411		SG341	25.0	25	1.70	.600	.500	.300	.032	A	30
SG412		SG342	25.0	25	2.40	.400	.500	.300	.032	A	30
SG38	SG343		30.0	15	3.00	.400	.600	.250	.040	B	25
SG240		SG316	40.0	15	2.00	.600	.625	.250	.032	B	20
SG52	SG344		47.0	25	3.00	.500	.770	.240	.040	B	55
SG453		SG376	60.0	15	1.50	1.000	.600	.250	.032	B	50
SG250	SG317		120.0	15	3.00	.900	.925	.250	.040	C	36
SG31	SG346		220.0	20	1.30	1.900	.600	.300	.040	C	25

For applications requiring ratings not shown, contact RTI Electronics, Inc. applications engineering.

Maximum operating voltage is 265V RMS.

\*Maximum operating voltage is 120V RMS.



# RTI Electronics, Inc.

2900 Blue Star Street  
 Anaheim, CA 92806-2509  
 Tel.: (714) 630-0081  
 Fax: (714) 630-4131  
 www.rtie.rti-corp.com

## NTC Resistance/Temperature Conversion Tables

Temperature °C	R-T Curve A		R-T Curve B		R-T Curve C		R-T Curve J	
	R <sub>T</sub> /R <sub>25</sub>	DEV	R <sub>T</sub> /R <sub>25</sub>	DEV	R <sub>T</sub> /R <sub>25</sub>	DEV	R <sub>T</sub> /R <sub>25</sub>	DEV
-60	43.0		75.0	6.6	140.5	6.6	52.5	
-55	31.9		54.1	6.1	96.4	6.1	39.0	
-50	24.3		39.7	5.6	67.0	5.6	29.2	18.5
-45	18.6		29.2	5.2	47.2	5.2	22.1	17.0
-40	14.4	7.6	21.7	4.7	33.7	4.7	16.9	15.4
-35	11.3	6.9	16.4	4.3	24.3	4.3	13.0	14.0
-30	8.93	6.2	12.5	3.8	17.7	3.8	10.1	12.5
-25	7.10	5.6	9.58	3.4	13.0	3.4	7.90	11.2
-20	5.69	5.0	7.42	3.0	9.71	3.0	6.24	9.9
-15	4.56	4.4	5.75	2.6	7.30	2.6	4.96	8.7
-10	3.68	3.7	4.50	2.2	5.53	2.2	3.97	7.4
-5	2.99	3.1	3.55	1.9	4.23	1.9	3.20	6.2
0	2.45	2.5	2.82	1.5	3.27	1.5	2.60	5.0
5	2.02	2.0	2.26	1.2	2.54	1.2	2.12	3.9
10	1.68	1.6	1.83	0.8	1.99	0.8	1.74	2.7
15	1.42	1.1	1.48	0.5	1.57	0.5	1.44	1.6
20	1.18	0.6	1.22	0.2	1.25	0.2	1.20	0.5
25	1.00	0.0	1.00	0.0	1.00	0.0	1.00	0.0
30	.854	0.6	.828	0.4	.806	0.4	.841	1.4
35	.732	1.1	.689	0.7	.653	0.7	.710	2.3
40	.628	1.6	.576	1.0	.533	1.0	.602	3.2
45	.537	2.0	.482	1.3	.437	1.3	.513	4.3
50	.464	2.5	.406	1.5	.360	1.5	.439	5.0
55	.403	3.0	.343	1.8	.299	1.8	.377	5.9
60 <sup>+</sup>	.350	3.4	.292	2.0	.249	2.0	.326	6.7
65	.305	3.8	.247	2.3	.208	2.3	.282	7.5
70	.267	4.2	.212	2.5	.175	2.5	.245	8.2
75	.236	4.6	.182	2.8	.148	2.8	.214	9.0
80	.208	4.9	.157	3.0	.126	3.0	.188	9.8
85	.183	5.3	.137	3.2	.107	3.2	.165	10.5
90	.163	5.6	.120	3.4	.0916	3.4	.146	11.2
95	.145	6.0	.105	3.6	.0787	3.6	.129	11.9
100	.130	6.3	.0920	3.8	.0679	3.8	.114	12.6
105	.117	6.7	.0812	4.0	.0588	4.0	.102	13.3
110	.105	7.0	.0723	4.2	.0511	4.2	.0908	13.9
115	.0943	7.3	.0641	4.4	.0445	4.4	.0813	14.4
120	.0852	7.6	.0569	4.6	.0389	4.6	.0730	14.9
125	.0771	7.9	.0508	4.8	.0342	4.8	.0657	15.6
130	.0700	8.2	.0455	4.9	.0301	4.9	.0593	16.3
135	.0636	8.4	.0408	5.1	.0265	5.1	.0536	17.0
140	.0579	8.6	.0368	5.3	.0235	5.3	.0486	17.6
145	.0529	9.0	.0332	5.4	.0208	5.4	.0442	18.0
150	.0483	9.3	.0300	5.5	.0185	5.5	.0402	18.4

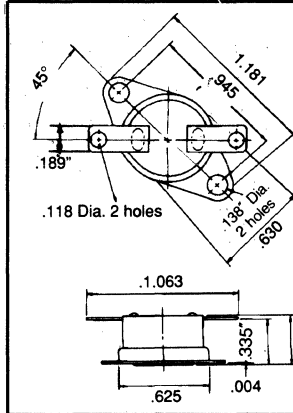
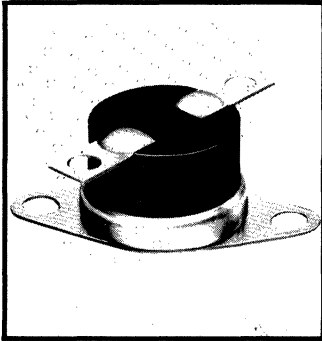
## NTC Resistance/Temperature Curve Characteristics

R-T Curve	A	B	C	J
Temperature Coefficient $\alpha$ @ 25°C	-3.3%/°C	-3.9%/°C	-4.4%/°C	-3.5%/°C
Beta, $\beta$	3000°K	3530°K	3965°K	3200°K

# SELCO 1/2" DISC

Selco model numbers SC, SO, SC-A, SO-A and SO-AM are still available. Consult Selco.

## CA AND OA (602-S) THERMOSTATS (602-K) GOLD CONTACTS



**U.L. ELECTRICAL RATINGS**  
 125VAC, 15 Amps, Resistive  
 250VAC, 10 Amps, Resistive  
 100,000 Cycles

**TEMPERATURE RANGE**  
 50 Degrees F. to  
 320 Degrees F.

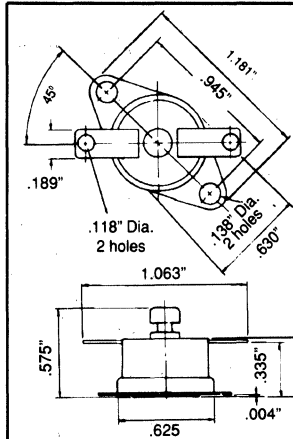
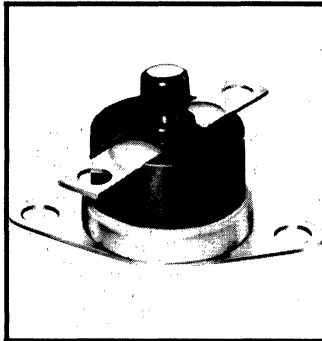
**GOLD CONTACTS RECOMMENDED**  
**250mA or less**  
 120VAC, 125VA (Pilot Duty)  
 30VDC, 1 Amp  
 100,000 Cycles

**APPROVALS**  
 U.L. File No. E145478(S)  
 Guide XAPX2  
 CSA File No. LR63201  
 VDE File No. 69046  
 DEMKO File No. DK-45

**INDUCTIVE LOAD RATINGS**  
 120VAC FLA 5.8 Amps  
 LRA 34.8 Amps  
 240VAC FLA 2.9 Amps  
 LRA 17.4 Amps  
 1/4 horsepower, 6000 cycles

**INSULATION RESISTANCE**  
 100 MΩ or more  
 (with a 500 VDC megger)  
**DIELECTRIC STRENGTH**  
 1,500 V for 1 minute  
**HEAT DURABILITY**  
 320 F.

## OAM (603-U) MANUAL RESET THERMOSTATS (603-K) GOLD CONTACTS



**U.L. ELECTRICAL RATINGS**  
 125VAC, 15 Amps, Resistive  
 250VAC, 10 Amps, Resistive  
 6,000 Cycles

**APPROVALS**  
 U.L. File No. E145478(S)  
 Guide XAPX2  
 CSA File No. LR63201  
 CSA File No. LR94425

**TEMPERATURE RANGE**  
 122 Degrees F. to  
 320 Degrees F.

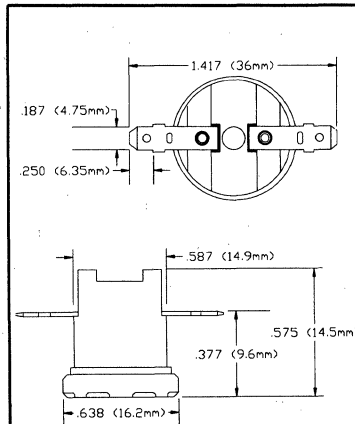
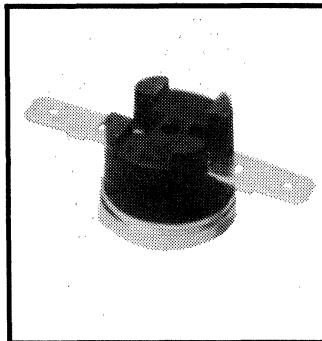
**MANUAL RESET**  
 30% below its operating  
 temperature

**CIRCUIT RESISTANCE (initial value)**  
 50 MΩ or less

**AUTOMATIC RESET**  
 -40 Degrees F.

**INSULATION RESISTANCE**  
 100 MΩ or more  
 (with a 500 VDC megger)  
**DIELECTRIC STRENGTH**  
 1,500 V for 1 minute  
**HEAT DURABILITY**  
 320 F.

## SERIES US-622P - 4-POST CASE



**U.L. ELECTRICAL RATINGS**  
 125VAC, 15 Amps, Resistive  
 250VAC, 10 Amps, Resistive  
 100,000 Cycles

**DIFFERENTIAL**  
 18F. -45F. (10-25C.)

**ENVIRONMENTAL TEMPS**  
 -4F. -392F. (-20C. -200C.)

**CIRCUIT RESISTANCE (initial value)**  
 50mΩ or more

**INSULATION RESISTANCE**  
 100 mΩ or more  
 (with a 500VDC megger)

**DIELECTRIC STRENGTH**  
 1500VAC/1 minute

**TEMPERATURE RANGE**  
 32F. -365F. (0-185C.)

**COFFEE MAKER, NORMAL & DRY OVERRIDE:**  
 455F. (235C.)

TO INSURE THAT A SAFE COMBINATION OF THERMOSTAT AND APPLICATION IS ACHIEVED, THE PURCHASER MUST DETERMINE PRODUCT SUITABILITY FOR THEIR INDIVIDUAL REQUIREMENTS.



To Order Call: (800) 336-3963 • (714) 712-6200 • Fax: (714) 712-6222  
 Selco Products Co. • 709 N. Poplar St. • Orange, CA 92868

# THERMOSTATS

**MODELS AVAILABLE FROM STOCK -**
**CA-CLOSE ON RISE (normally open)**
**OA-OPEN ON RISE (normally closed)**

CA/OA solder tab(or other)	CA/OA quick connect (QC) printed circuit board (PCB)	OA-M manual reset	CA/OA stud mount (ST)	OPEN degree F.	CLOSE degree F.
<b>OA-50</b>				50±5	32±8
<b>CA-50</b>				32±8	50±7
<b>OA-60</b>	OA-60-QCR (3) OA-60-PCB			60±5	40±8
<b>CA-60</b>				60±5	40±8
<b>OA-80</b>	OA-80-PCB			40±8	60±7
<b>OA-85</b>				80±5	50±8
<b>CA-85</b>	CA-85-PCB			85±5	70±8
	OA-95-QC (3)			70±6	55±7
<b>OA-100</b>				95±5	77±6
<b>CA-100</b>				100±5	70±8
				70±6	100±7
			CA-104-ST	87±6	104±7
<b>OA-110</b>	OA-110-QC (3)			110±5	80±8
<b>CA-110</b>	CA-110-PCB			80±6	110±7
<b>OA-120</b>	OA-120-QC (3)	OA-120MA(3)(1)		120±5	90±8
<b>CA-120</b>				90±6	120±7
<b>OA-130</b>			OA-130-ST	130±5	100±8
			CA-130-ST	100±6	130±7
	CA-130-QC (3)			110±6	130±7
<b>OA-140</b>	OA-140-QVC (3)	OA-140M(3)		140±5	110±8
<b>CA-140</b>	CA-140-QC (3)			110±6	140±7
<b>OA-150</b>	OA-150-QCC (3)	OA-150M(3)		150±5	120±8
	OA-150-PCB			150±5	120±8
<b>CA-150</b>				120±6	150±7
<b>OA-160</b>				160±5	130±8
<b>CA-160</b>				130±6	160±7
<b>OA-170</b>				170±5	140±8
<b>CA-170</b>	CA-170QC (3)			140±6	170±7
<b>OA-175</b>				175±5	160±8
	OA-175-QC (3)			175±5	145±8
	CA-175-QC (3)			145±6	175±7
<b>OA-180</b>	OA-180-QC (4)			180±5	150±8
	OA-185-QC18(3)			185±5	168±8
<b>CA-180</b>	CA-180-RS (2)			150±6	180±7
			CA-185-ST	145±6	185±7
<b>OA-190</b>				190±5	160±8
	OA-190-QC (3)			190±5	172±8
	CA-190-QC (3)			172±6	190±7
	OA-194-QC (4)	OA-194M		194±7	164±8
	OA-194-QCC (3)			194±5	153±8
<b>OA-200</b>			OA-200-ST	200±5	170±8
<b>CA-200</b>				170±6	200±7
<b>CA-205</b>			CA-205-ST	175±6	205±8
<b>OA-210</b>	OA-210-QC (4)			210±6	180±8
	OA-210-QVC (3)			210±6	180±8
	CA-210-QC (4)			180±6	210±8
<b>OA-220</b>				220±6	190±8
<b>CA-225</b>				195±6	225±8
<b>OA-230</b>				230±6	200±8
			OA-239-ST	239±6	199±8
<b>CA-240</b>				140±6	240±10
<b>OA-250</b>	OA-250-QC (4)	OA-250M		250±7	220±8
	OA-250-QCA (3)(1)			250±7	220±8
		OA-265MA		265±7	MR
<b>CA-270</b>				240±6	270±7
<b>OA-280</b>	OA-280-QC (4)			280±7	250±8
		OA-285-MQC (3)		285±10	
<b>OA-300</b>	OA-300-QC (4)	OA-302M		300±7	270±8
<b>CA-300</b>				270±6	300±7

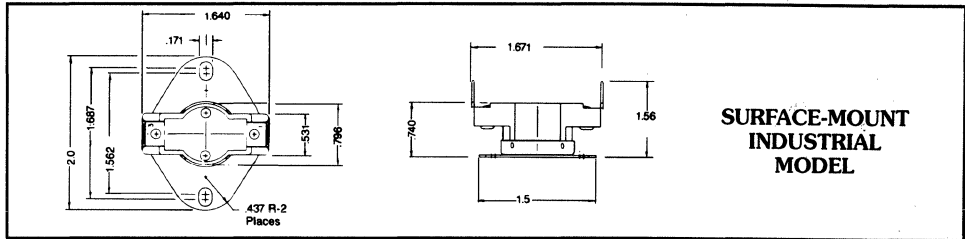
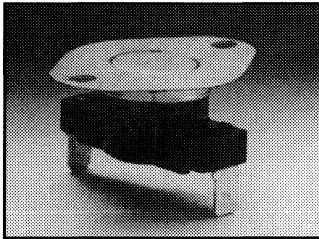
(1) air mount (2) rotating bracket (3) .250 quick connect (4) .187 quick connect



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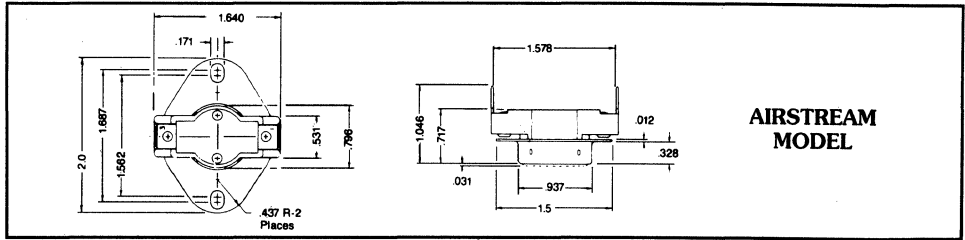
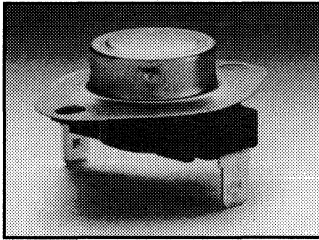
# SELCO 3/4" DISC THERMOSTATS

## KISO Series



**SURFACE-MOUNT INDUSTRIAL MODEL**

## KFSC/KHSO Series



**AIRSTREAM MODEL**

Direct sensing thermostats are larger giving them a powerful bimetallic disc & higher electrical rating. Ideal for H.V.A.C. systems & industrial applications.

### ELECTRICAL RATINGS:

120, 240, 277VAC, 25 Amps, resistive, 100,000 cycles  
 120VAC, 10F. L.A., 60L.R.A., inductive, 100,000 cycles  
 240VAC, 5F. L.A., 30L.R.A., inductive, 100,000 cycles

### Cross Reference Chart

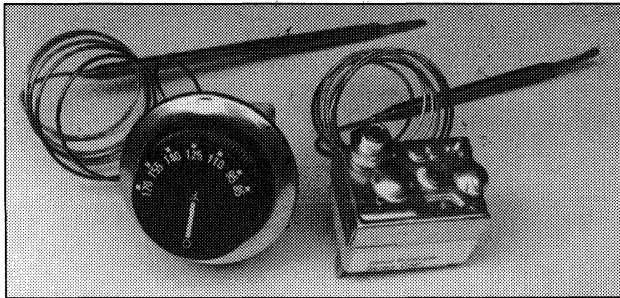
Thermodisc	Elmwood	Klixon
60T	2500	20600

### Models From Stock

Part No.	Open	Close
KFSC-120	100F. ±5F.	120F. ±5F.
KFSC-130	110F. ±5F.	130F. ±5F.
KHSO-120	120F. ±5F.	110F. ±5F.
KHSO-140	140F. ±5F.	100F. ±5F.
KHSO-180	180F. ±5F.	140F. ±5F.
KHSO-250	250F. ±5F.	210F. ±5F.
KISO-110	110F. ±5F.	100F. ±5F.
KISO-186H	186F. ±5F.	176F. ±5F.
KISO-190	190F. ±5F.	160F. ±5F.
KISO-300	300F. ±5F.	270F. ±5F.

# BULB & CAPILLARY CONTROLS

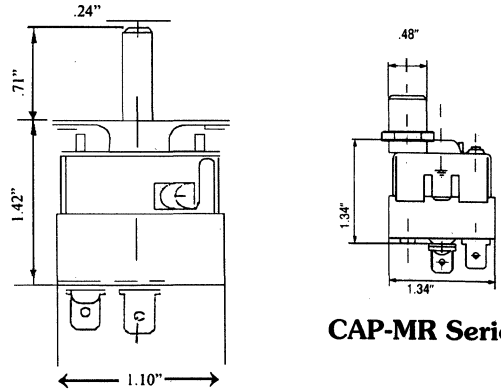
## CAP Series- Automatic Reset CAP-MR- Manual Reset (Trip Free)



These units open or close on rise. They offer very close differential. When the temperature rises the bulb fluid expands via a capillary tube to an expandable diaphragm activating an electrical switch at the set point. The cases are made of ceramic. Many bulb length and diameters available in copper or stainless. S.P.S.T. or S.P.D.T.

### ELECTRICAL RATINGS:

120/240VAC at 20 Amps  
 U.L. C.S.A., VDE, SEMKO, KEMA, E.C.



**CAP Series**

**CAP-MR Series**

### Models From Stock

Part No.	Temp. Range	Bulb Length	Bulb Dia.
CAP-85-195	85F. - 195F.	4"	.236"
CAP-85-230	85F. - 230F.	4.4"	.200"
CAP-120-570	120F. - 570F.	9.5"	.120"
CAP-MR-200	200F.	3.6"	.23"
CAP-MR-572	572F.	3"	.190"



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# SELCO THERMOSTATS

## APPLIANCE THERMOSTATS EP1, U12, UZ2

### Plastic Case Protectors, Snap Action Type

**Models:**

**EP1**

- High sensitivity to current
- Epoxy seal resin case
- Variations for built in heaters

**Temperature Settings:**

75°C to 150°C (167°F to 302°F)  
 125 VAC, 8A/250 VAC, 5A  
 10,000 cycles (resistive)

**U12**

- Designed for higher rated motors
- Reinforced PBT enclosure
- Insures sufficient insulation against overheating when mounted on windings

**Temperature Settings:**

55°C to 150°C (131°F to 302°F)  
 125 VAC, 10A/250 VAC, 10A  
 10,000 cycles (resistive)

**UZ2**

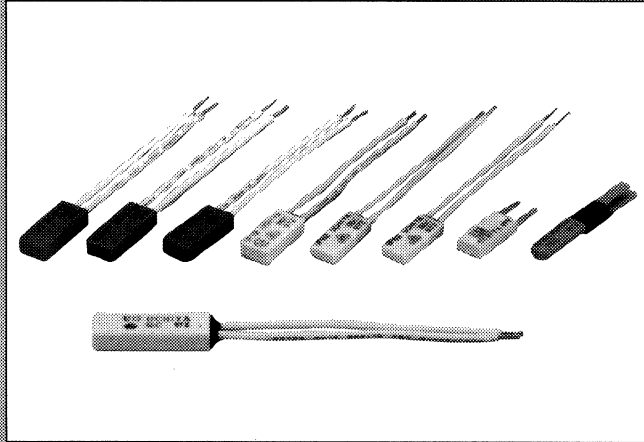
- PCB mount type & crimp terminal
- Dust proof case

**Temperature Settings:**

70°C to 130°C (158°F to 266°F)  
 125 VAC, 4A, 5000 cycles  
 250 VAC, 3A, 10,000 cycles

**Applications:**

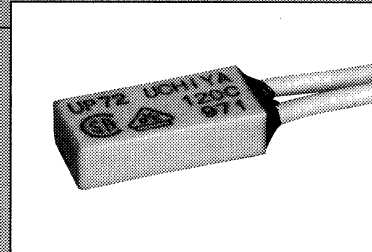
Overheat protection for motor, transformer, solenoid, electronic appliance (inverter ballast, switching power supply), battery pack



## THERMAL PROTECTORS UP7 Series

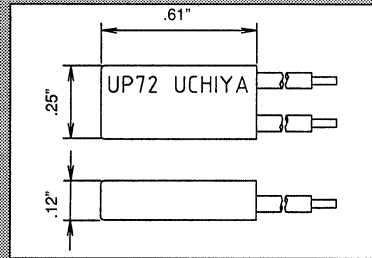
**Specifications**

<b>Operating temperature</b>	Setting range: from 55° to 150° C (131° to 302° F)
<b>Temperature tolerance</b>	±5° C, ±7° C, ±10° C (±9° F, ±12° F, ±18° F)
<b>Standard Differential</b>	30° ± 15° C (50° ± 25° F) (tighter diff. available)
<b>Contact Ratings</b>	4A 125V, 2.5A 250V AC, 10,000 cycles (resistive)
<b>Contact System</b>	(Normally closed) open on rise



The UP7 series (UP72, UP71, UP7) Thermal Protectors are the smallest 1/2HP (37.3W) motor protectors in the world. The engineering techniques of holding the bimetal disc result in excellent performance in heat response.

These snap-action, self-resetting Thermal Protectors feature a reinforced PBT-enclosure which makes extra insulation of the protector unnecessary.



**Features:**

- Low cost
- Highly automated production
- Stronger plastic case

**Applications:**

Small appliance motors, Transformers, Solenoids, Heating pads, Choke coils, Battery chargers, Air conditioners, Power supplies, PC Boards

Marketed in the U.S. by



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Appliance Thermostats - EP1, U12, UZ2 • Thermal Protectors - UP7 Series

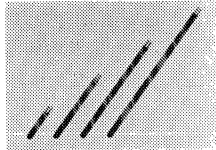


Semitec USA Corp.

NTC Thermistors

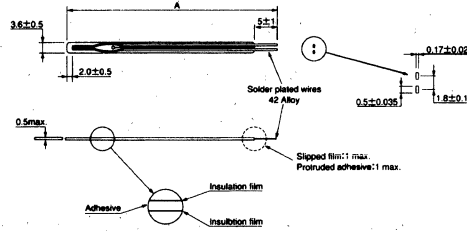
JT Thermistors

New Revolutionary Technology- 500µm Thin



Dimensions

Shape	Dimensions A
025	25 ± 1
050	50 ± 1
075	75 ± 1
100	100 ± 1



Unit (mm)

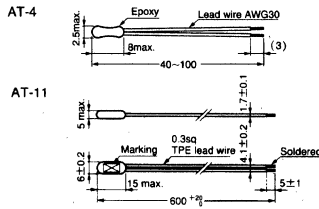
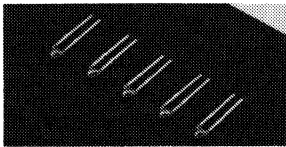
Specifications

Part No.	R25*1	B Value *2	Dissipation factor (mW/°C)	Thermal time Constant (s)*3	Rated power at 25°C (mW)	Operating temp. range (°C)
103JT-□□□	10.0kΩ ± 1%	3435K ± 1%	0.7	5	3.5	-50~90
104JT-□□□	100.0kΩ ± 1%	4390K ± 1%	0.7	5	3.5	-50~125

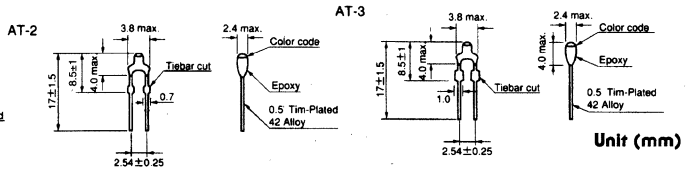
\*1 R25: Rated zero-power resistance value at 25°C, ±2% and 3% are also available.  
 \*2 B value: determined by rated zero-power resistance at 25°C and 85°C.  
 \*3 Time when thermistor temperature reaches 63.2% of the temperature difference. The value is measured in air.

AT Thermistors

High precision thermistor



Dimensions



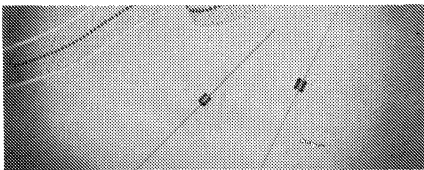
Unit (mm)

Specifications

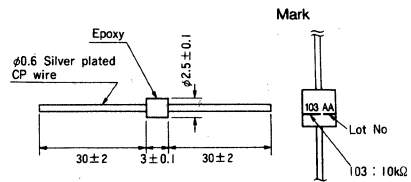
Part No.	R25*1	B Value *2	Dissipation factor (mW/°C)	Thermal time Constant (s)*3	Rated power at 25°C (mW)	Operating temp. range (°C)
102AT-2(11)	1.0k Ω ± 1%	3100K ± 1%	2(3)	15(75)	10(15)	-50~90(-50~90)
202AT-2(11)	2.0k Ω ± 1%	3182K ± 1%	2(3)	15(75)	10(15)	-50~90(-50~90)
502AT-2(11)	5.0k Ω ± 1%	3324K ± 1%	2(3)	15(75)	10(15)	-50~110(-50~105)
103AT-2(11)	10.0k Ω ± 1%	3435K ± 1%	2(3)	15(75)	10(15)	-50~110(-50~105)
104AT-2	100.0k Ω ± 1%	4665K ± 1%	2	15	10	-50~110
203AT-2	20.0k Ω ± 1%	4013K ± 1%	2	15	10	-50~110
503AT-2	50.0k Ω ± 3%	4060K ± 1%	2	15	10	-50~110
103AT-3	10.0k Ω ± 1%	3435K ± 1%	2	15	10	-50~110
103AT-4	10.0k Ω ± 1%	3435K ± 1%	2	10	10	-30~90

\*1 R25: Nominal zero-power resistance value at 25°C, ±2% and 3% are also available.  
 \*2 B value: determined by rated zero-power resistance at 25°C and 85°C.  
 \*3 Time when thermistor reaches 63.2% of temperature difference. The value is measured in air.

IT Thermistors



Dimensions



Unit (mm)

Specifications

Part No.	R25*1	B Value *2	Dissipation factor (mW/°C)	Thermal time Constant (s)*3	Rated power at 25°C (mW)	Operating temp. range (°C)
302IT	3.0k Ω ± 2%	3860K ± 1%	3.6	13.5	18.0	-50~125
502IT	5.0k Ω ± 2%	3860K ± 1%	3.6	13.5	18.0	-50~125
103IT	10.0k Ω ± 2%	3435K ± 1%	3.6	13.5	18.0	-50~100
203IT	20.0k Ω ± 2%	3760K ± 1%	3.6	13.5	18.0	-50~125
303IT	30.0k Ω ± 2%	3760K ± 1%	3.6	13.5	18.0	-50~125
503IT	50.0k Ω ± 2%	4055K ± 1%	3.6	13.5	18.0	-50~125
104IT	100.0k Ω ± 2%	4390K ± 1%	3.6	13.5	18.0	-50~125

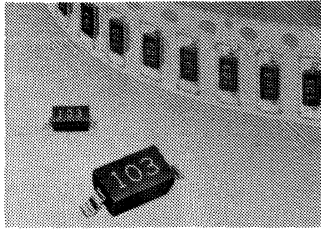
\*1 R25: Nominal zero-power resistance value at 25°C, ±1% and 3% are also available.  
 \*2 B value: determined by rated zero-power resistance at 25°C and 85°C.  
 \*3 Time when thermistor reaches 63.2% of temperature difference. The value is measured in air.



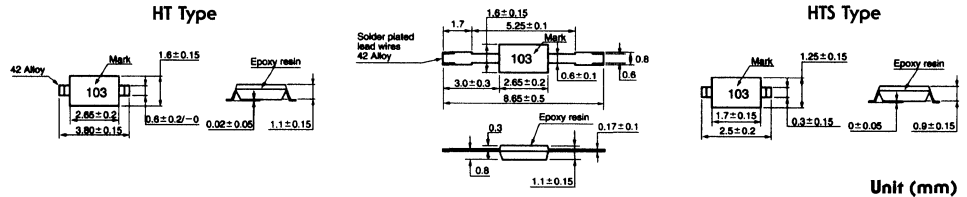
Semitec USA Corp. • Suite 332 • 400 West Main Street • Babylon, NY 11702 • 516-587-4086 • Fax: 516-321-9604  
 Regarding details specifications, visit us on the web at <http://www.semitec.co.jp/> • E mail: semitec@mail.idf.ner

**HT Thermistors**

**Surface mount type thermistor**



**Dimensions**



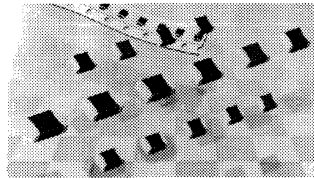
**Specifications**

Part No.	R25 <sup>*1</sup>	B Value <sup>*2</sup>	Dissipation factor (mW/°C)	Thermal time Constant (s) <sup>*3</sup>	Rated power at 25°C (mW)	Operating temp. range (°C)
302HT(F)	3.0k Ω ± 2%	3860K ± 1%	1.0	8.0	5.0	-50~125
502HT(F)	5.0k Ω ± 2%	3860K ± 1%	1.0	8.0	5.0	-50~125
103HT(F)	10.0k Ω ± 2%	3435K ± 1%	1.0	8.0	5.0	-50~100
203HT(F)	20.0k Ω ± 2%	3760K ± 1%	1.0	8.0	5.0	-50~125
303HT(F)	30.0k Ω ± 2%	3760K ± 1%	1.0	8.0	5.0	-50~125
503HT(F)	50.0k Ω ± 2%	4055K ± 1%	1.0	8.0	5.0	-50~125
104HT(F)	100.0k Ω ± 2%	4390K ± 1%	1.0	8.0	5.0	-50~125
103HTS	10.0k Ω ± 2%	3435K ± 1%	1.0	8.0	5.0	-50~100
503HTS	50.0k Ω ± 2%	4055K ± 1%	1.0	8.0	5.0	-50~125
104HTS	100.0k Ω ± 2%	4390K ± 1%	1.0	8.0	5.0	-50~125

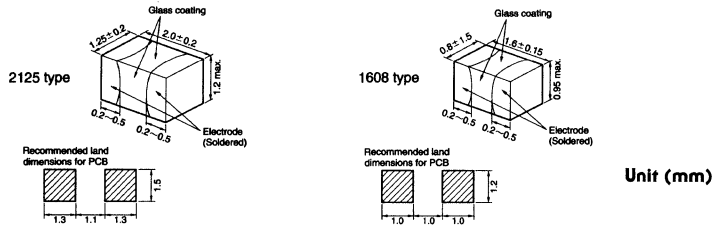
\*1 R25: Rated zero-power resistance value at 25°C, ±1% and 3% are also available.  
 \*2 B value: determined by nominal zero-power resistance at 25°C and 85°C.  
 \*3 Time when thermistor reaches 63.2% of temperature difference. The value is measured in the air.

**KT Thermistors**

**Chip Thermistor**



**Dimensions**



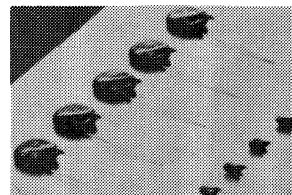
**Specifications**

Part No.	R25 <sup>*1</sup>	B Value <sup>*2</sup>	Dissipation factor (mW/°C)	Thermal time Constant (s) <sup>*3</sup>	Rated power at 25°C (mW)	Operating temp. range (°C)
103KT2125-1P	10.0k Ω ± 1%	3435K ± 1%	1.0	7.5	5.0	-40~125
103KT1608-1P	10.0k Ω ± 1%	3435K ± 1%	0.9	5.0	4.5	-40~125

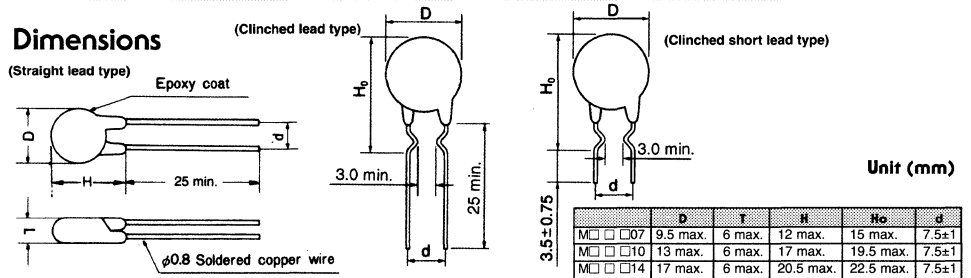
\*1 R25: Rated zero-power resistance value at 25°C, ±2% and 3% are also available.  
 \*2 B value: determined by rated zero-power resistance at 25°C and 85°C.  
 \*3 Time when thermistor temperature reaches 63.2% of temperature difference. The value is measured in air.

**Power Thermistor**

**Inrush current limiting thermistor**



**Dimensions**

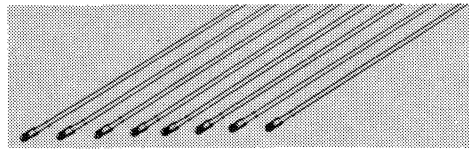


**Specifications**

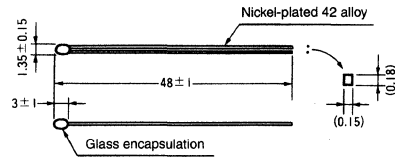
Part No.	R25 <sup>*1</sup>	B Value <sup>*2</sup>	Max. current at 25°C (A)	Residual Resistance (Ω)	Thermal time Constant (s) <sup>*3</sup>	Operating temp. range (°C)
M□□□07	5.1~22.0 Ω ± 10%	2900~3150 ± 10%	2.6~4.6	0.18~0.59	20~40	-40~200
M□□□10	2.2~10.0 Ω ± 10%	2900~3150 ± 10%	4.1~7.4	0.08~0.27	40~60	-40~200
M□□□14	1.0~5.1 Ω ± 10%	2900~3150 ± 10%	6.5~11.9	0.04~0.14	65~110	-40~200

\*1 R25: Rated zero-power resistance value at 25°C.  
 \*2 B value: determined by rated zero-power resistance at 25°C and 85°C.  
 \*3 Time when thermistor temperature reaches 63.2% of temperature difference. The value is measured in air.

**GT Thermistors High heat resistance and high sensitive thermistor**



**Dimensions**



Unit (mm)

**Specifications**

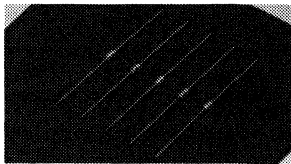
Part No.	R25 <sup>*1</sup>	B Value <sup>*2</sup>	Dissipation factor (mW/°C)	Thermal time Constant (s) <sup>*3</sup>	Rated power at 25°C (mW)	Operating temp. range (°C)
102GT-1	1.0k Ω ± 3%	3305K ± 1%	0.6	7(0.6)	3.0	-50~200
202GT-1	2.0k Ω ± 3%	3838K ± 1%	0.6	7(0.6)	3.0	-50~300
502GT-1	5.0k Ω ± 3%	3964K ± 1%	0.6	7(0.6)	3.0	-50~300
103GT-1	10.0k Ω ± 3%	4126K ± 1%	0.6	7(0.6)	3.0	-50~300
203GT-1	20.0k Ω ± 3%	4282K ± 1%	0.6	7(0.6)	3.0	-50~300
503GT-1	50.0k Ω ± 3%	4288K ± 1%	0.6	7(0.6)	3.0	-50~300
104GT-1	100.0k Ω ± 3%	4267K ± 1%	0.6	7(0.6)	3.0	-50~300
204GT-1	200.0k Ω ± 3%	4338K ± 1%	0.6	7(0.6)	3.0	-50~300
504GT-1	500.0k Ω ± 3%	4562K ± 1%	0.6	7(0.6)	3.0	-50~300
105GT-1	1.00M Ω ± 3%	4608K ± 1%	0.6	7(0.6)	3.0	-50~300

\*1 R25: Nominal zero-power resistance value at 25°C

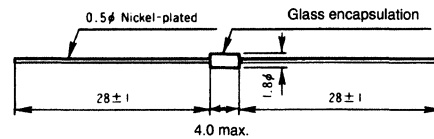
\*2 B value: determined by rated zero-power resistance at 25°C and 85°C.

\*3 Time when thermistor reaches 63.2% of temperature difference. The value is measured in air. (silicone oil)

**CT Thermistors**



**Dimensions**



Unit (mm)

**Specifications**

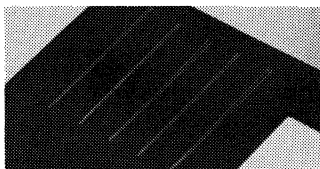
Part No.	R25 <sup>*1</sup>	B Value <sup>*2</sup>	Dissipation factor (mW/°C)	Thermal time Constant (s) <sup>*3</sup>	Rated power at 25°C (mW)	Operating temp. range (°C)
252CT-4	2.5k Ω ± 5%	3670K ± 2%	2.1	10~20	10.5	-50~250
512CT-4	5.1k Ω ± 5%	3200K ± 2%	2.1	10~20	10.5	-50~200
562CT-4	5.6k Ω ± 5%	3200K ± 2%	2.1	10~20	10.5	-50~200
912CT-4	9.1k Ω ± 5%	3270K ± 2%	2.1	10~20	10.5	-50~250
103CT-4	10.0k Ω ± 5%	3270K ± 2%	2.1	10~20	10.5	-50~250
113CT-4	11.0k Ω ± 5%	3270K ± 2%	2.1	10~20	10.5	-50~250
203CT-4	20.0k Ω ± 5%	3410K ± 2%	2.1	10~20	10.5	-50~250
473CT-4	47.0k Ω ± 5%	3610K ± 2%	2.1	10~20	10.5	-50~250
513CT-4	51.0k Ω ± 5%	3610K ± 2%	2.1	10~20	10.5	-50~250
563CT-4	56.0k Ω ± 5%	3610K ± 2%	2.1	10~20	10.5	-50~250
104CT-4	100.0k Ω ± 5%	3450K ± 2%	2.1	10~20	10.5	-50~250
204CT-4	200.0k Ω ± 5%	3500K ± 2%	2.1	10~20	10.5	-50~250

\*1 R25: Nominal zero-power resistance value at 25°C.

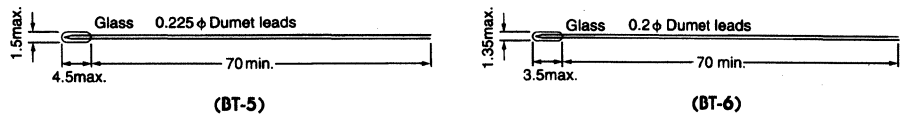
\*2 B value: determined by rated zero-power resistance at 25°C and 85°C.

\*3 Time when thermistor reaches 63.2% of temperature difference. The value is measured in air.

**BT Thermistors**



**Dimensions**



Unit (mm)

**Specifications**

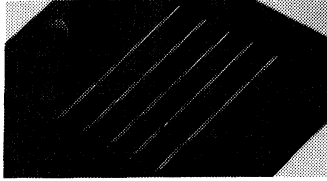
Part No.	R25 <sup>*1</sup>	B Value <sup>*2</sup>	Dissipation factor (mW/°C)	Thermal time Constant (s) <sup>*3</sup>	Rated power at 25°C (mW)	Operating temp. range (°C)
□ □BT-5	1k Ω~1300k Ω ± 10%	3250K~4380K ± 3%	0.5	4~12	2.5	-50~300
□ □BT-6	5.0k Ω~1300k Ω ± 10%	3250K~4380K ± 3%	0.4	3~8	2.0	-50~300

\*1 R25: Nominal zero-power resistance value at 25°C

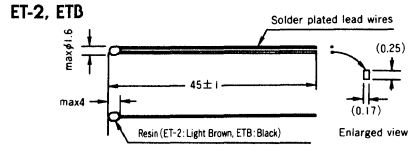
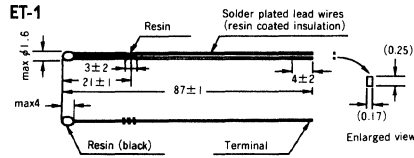
\*2 B value: determined by rated zero-power resistance at 25°C and 85°C.

\*3 Time when thermistor reaches 63.2% of temperature difference. The value is measured in air. (silicone oil)

**ET Thermistors**



**Dimensions**



Unit (mm)

**Specifications**

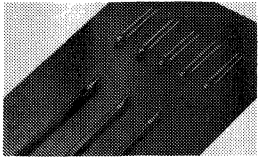
Part No.	R25*1	B Value *2	Dissipation factor (mW/°C)	Thermal time Constant (s)*3	Rated power at 25°C (mW)	Operating temp. range (°C)
402ET-1(2)	4.0k Ω ± 3%	3100k ± 1%	0.7	3.2(3.4)	3.5	-40-90
103ET-1(2)	10.0k Ω ± 3%	3250k ± 1%	0.7	3.2(3.4)	3.5	-40-90
303ET-1(2)	30.0k Ω ± 3%	3760k ± 1%	0.7	3.2(3.4)	3.5	-40-100
403ET-1(2)	40.0k Ω ± 3%	3525k ± 1%	0.7	3.2(3.4)	3.5	-40-100
413ET-1(2)	41.0k Ω ± 3%	3435k ± 1%	0.7	3.2(3.4)	3.5	-40-100
503ET-1(2)	50.0k Ω ± 3%	4055k ± 1%	0.7	3.2(3.4)	3.5	-40-100
593ET-1(2)	59.0k Ω ± 3%	3617k ± 1%	0.7	3.2(3.4)	3.5	-40-100
833ET-1(2)	83.0k Ω ± 3%	4013k ± 1%	0.7	3.2(3.4)	3.5	-40-100
104ET-1(2)	100.0k Ω ± 3%	4132k ± 1%	0.7	3.2(3.4)	3.5	-40-90
224ET-1(2)	226.0k Ω ± 3%	4021k ± 1%	0.7	3.2(3.4)	3.5	-40-100
234ET-1(2)	232.0k Ω ± 3%	4274k ± 1%	0.7	3.2(3.4)	3.5	-40-100
103ETB	10.0k Ω ± 2%	3435k ± 1%	0.7	3.4	3.5	-40-90

\*1 R25: Nominal zero-power resistance value at 25°C

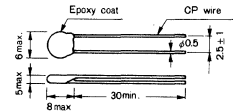
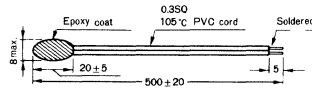
\*2 B value: determined by rated zero-power resistance at 25°C and 85°C.

\*3 Time when thermistor reaches 63.2% of temperature difference. The value is measured in air.

**DT Thermistors**



**Dimensions**



DT-1

DT-2

Unit (mm)

**Specifications**

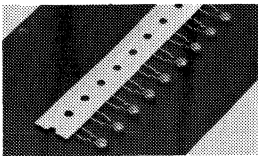
Part No.	R25*1	B Value *2	Dissipation factor (mW/°C)	Thermal time Constant (s)*3	Rated power at 25°C (mW)	Operating temp. range (°C)
□ □DT-1	1.0k Ω~100.0k Ω ± 5%	3230K~4870K ± 3%	8.5	60	42	-50-100
□ □DT-2	1.0k Ω~100.0k Ω ± 5%	3230K~4870K ± 3%	5.0	25	25	-50-110

\*1 R25: Nominal zero-power resistance value at 25°C.

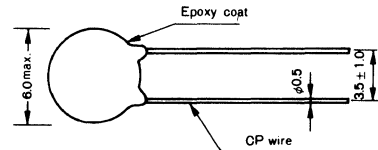
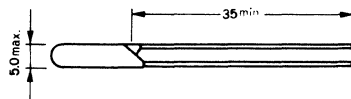
\*2 B value: determined by rated zero-power resistance at 25°C and 85°C.

\*3 Time when thermistor reaches 63.2% of temperature difference. The value is measured in air.

**D Thermistors**



**Dimensions**



Unit (mm)

**Specifications**

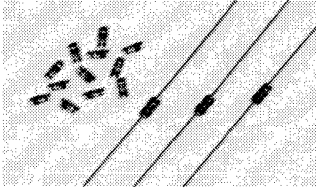
Part No.	R25*1	B Value *2	Dissipation factor (mW/°C)	Thermal time Constant (s)*3	Rated power at 25°C (mW)	Operating temp. range (°C)
□ □D-5	50.0 Ω~100.0k Ω ± 15%	3250K~4850K ± 5%	3.5	13	297	-40-110

\*1 R25: Rated zero-power resistance value at 25°C, ±10% are also available.

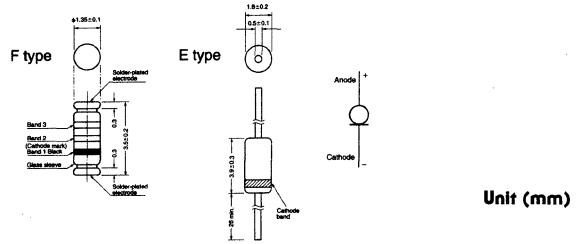
\*2 B value: determined by rated zero-power resistance at 25°C and 85°C.

\*3 Time when thermistor reaches 63.2% of temperature difference. The value is measured in air.

**CRD Current Regulative Diode**



**Dimensions**

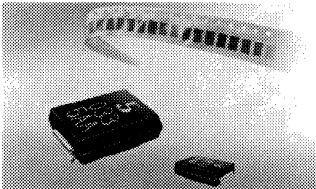


**Specifications**

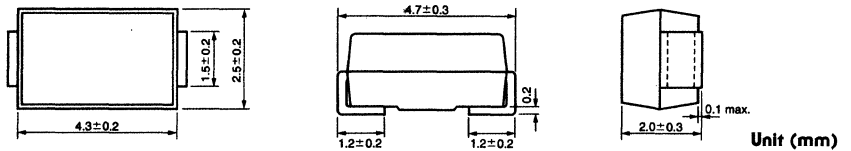
Part No.	Pinch-off <sup>*1</sup> current (mA)	Rating Power (mW)	Max. Rating Voltage (V)	Temp. <sup>*2</sup> coefficient (%/°C)	Operating temp range (°C)
E-□□□	0.01-18.0	300	25-100	-0.53-2.1	-30-150
F-□□□	0.01-18.0	400	28-100	-0.53-2.1	-30-150

\*1 Pinch-off current is measured by impulse wave at 25°C.  
 \*2 Temp. coefficient is measured between 25°C and 50°C.

**SMD VRD Transient voltage suppressor**



**Dimensions**



**Specifications**

Part No.	Breakdown voltage (V)	Stand-off voltage (V)	Steady state power (W)	Peak pulse power (W) 10X1000 μs	Storage temp. range	Note
ZS□□□	12-47V	9.72-38.1	1.0	300	-40-150°C	Bi-polar
ZS□□□U	12-47V	9.72-38.1	1.0	300	-40-150°C	Uni-polar
ZS□□□D	12-47V	9.72-38.1	1.0	300	-40-150°C	High reverse-Voltage

The Leading Manufacturer of Circuit Protectors & Thermal sensing Devices.

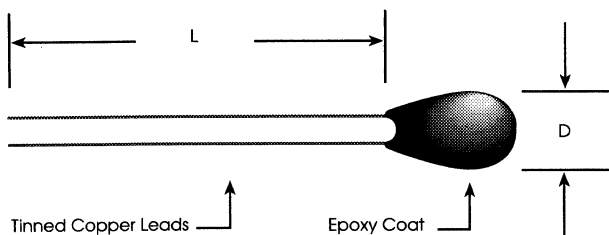
Regarding details & specifications, Visit us on the Web at  
<http://www.semitec.co.jp/>

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 TEL: 82-2-851-3127 FAX: 82-2-851-3129

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# Sensor Scientific, inc.

## WAFER THERMISTORS



### Features

#### INTERCHANGEABLE TOLERANCE WAFER THERMISTOR

- BEST CHOICE FOR APPLICATIONS REQUIRING HIGH ACCURACY OR INTERCHANGEABILITY OVER A WIDE TEMPERATURE RANGE
- VERY HIGH STABILITY
- INDUSTRY-STANDARD RESISTANCE VS. TEMPERATURE CURVES

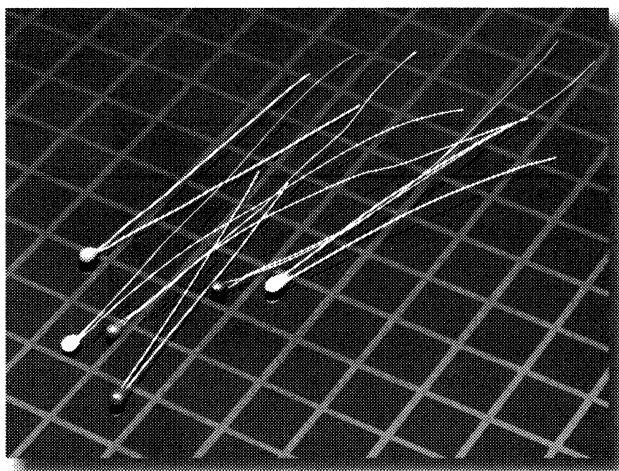
#### STANDARD TOLERANCE WAFER THERMISTOR

- BEST CHOICE FOR APPLICATIONS REQUIRING HIGH ACCURACY AT A SINGLE TEMPERATURE (STANDARD CALIBRATION TEMPERATURE IS 25°C; OTHER TEMPERATURES ARE AVAILABLE)
- HIGH STABILITY
- COST-EFFECTIVE

#### OPTIONS

- CUSTOMIZED LEAD AND TERMINATION OPTIONS
- NON-STANDARD RESISTANCE TOLERANCES
- NON-STANDARD INTERCHANGEABILITY AND OPERATING RANGES
- NON-STANDARD RESISTANCE VS. TEMPERATURE CURVES

Sensor Scientific wafer thermistors are ideally suited for applications requiring a high-precision temperature sensor, without high cost. Standard units are available with resistance values from 100 to 100k ohms @ 25°C. Values outside this range are available upon special order. A variety of custom options are available, including ready-to-use temperature probe assemblies. Design assistance is available.



For resistance temperature curve information - Contact Sensor Scientific, Inc. or see our website

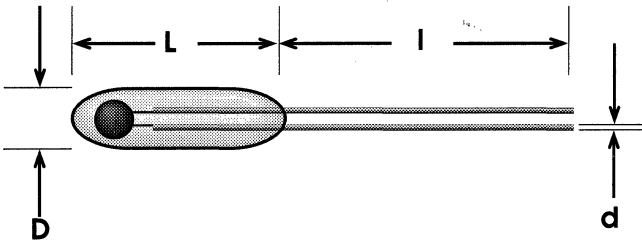
INTERCHANGEABLE TOLERANCES				STANDARD TOLERANCE				
Resistance @ 25 Deg C ohms	±0.2 Deg C tolerance	±0.5 Deg C tolerance	±1.0 Deg C tolerance	Replace * w/ Desired Tolerance in %	R. vs. Temp. Curve	Maximum Diameter (D) inches	Lead Diameter inches	Lead Length inches
100	<b>Special Order</b>			W101A*	A	0.250	0.016	1.5 min.
500				W501A*	A	0.125	0.0126	1.5 min.
1000				W102A*	A	0.095	0.0126	1.5 min.
1000				W102C*	C	0.150	0.0126	1.5 min.
2000	WM202C	WN202C	WP202C	W202C*	C	0.095	0.0126	1.5 min.
2252	WM222C	WN222C	WP222C	W222C*	C	0.095	0.0126	1.5 min.
3000	WM302C	WN302C	WP302C	W302C*	C	0.095	0.0126	1.5 min.
4000	WM402C	WN402C	WP402C	W402C*	C	0.095	0.0126	1.5 min.
5000	WM502C	WN502C	WP502C	W502C*	C	0.095	0.0126	1.5 min.
10000	WM103C	WN103C	WP103C	W103C*	C	0.095	0.0126	1.5 min.
10000	WM103Y	WN103Y	WP103Y	W103Y*	Y	0.095	0.0126	1.5 min.
30000	WM303D	WN303D	WP303D	W303D*	D	0.095	0.008	2.0 min.
30000	WM303E	WN303E	WP303E	W303E*	E	0.095	0.0126	1.5 min.
50000	WM503D	WN503D	WP503D	W503E*	D	0.095	0.008	2.0 min.
100000	WM104D	WN104D	WP104D	W104D*	D	0.095	0.008	2.0 min.

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# Sensor Scientific, inc.

## GLASS PROBE THERMISTORS (SP SERIES)

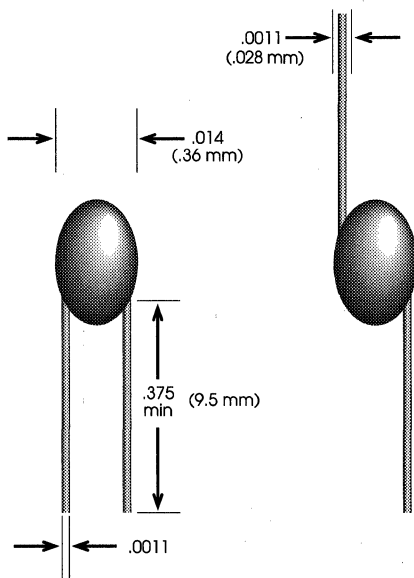


### FEATURES

- SUPERIOR STABILITY
- ROBUST GLASS SEAL CONSTRUCTION
- NON-STANDARD GLASS AND LEAD LENGTHS, RESISTANCE VALUES, AND VALUE-ADDED ASSEMBLIES ARE AVAILABLE

Sensor Scientific glass probe thermistors are ideal for applications requiring high stability and ruggedness. Typical applications include fluid flow and level measurement, temperature measurement, and temperature compensation

## SMALL BEAD THERMISTORS (S14 SERIES)



### FEATURES

- SUPERIOR STABILITY
- VERY FAST RESPONSE TIME
- LOW THERMAL MASS
- NON-STANDARD LEAD LENGTHS, RESISTANCE VALUES, AND VALUE-ADDED ASSEMBLIES ARE AVAILABLE

Sensor Scientific small bead thermistors are typically used in applications that require a sensor with low thermal mass and/or small physical size. Typical applications include biomedical assemblies, fluid flow and fluid level measurement, hot wire anemometry, and small surface area measurement.

For resistance Temperature curve information - Contact Sensor Scientific, Inc. or see our website

		<b>THERMISTOR TYPE</b>				
		<b>S14</b>	<b>SP43A</b>	<b>SP60A</b>	<b>SP80A</b>	<b>SP100A</b>
		<b>BODY DIMENSIONS</b>				
Diameter, nominal (D)	inches	0.014	0.043	0.060	0.080	0.100
	mm	0.36	1.09	1.52	2.03	2.54
Length, nominal (L)	inches	0.02	- 0.1	0.25 & 0.50 standard; other lengths available		
	mm	0.5		0.19 & 25.4 standard; other lengths available		
		<b>LEAD WIRES</b>				
Material		<b>Platinum Alloy</b>	<b>tinned Dumet</b>	<b>tinned Dumet</b>	<b>tinned Dumet</b>	<b>tinned Dumet</b>
Diameter, nominal (D)	inches	0.0011	0.008	0.008	0.0126	0.0126
	mm	0.028	0.20	0.20	0.32	0.32
Length, nominal (L)	inches	0.375	2.00	2.00	2.00	2.00
	mm	9.5	51	51	51	51
		<b>THERMAL PROPERTIES</b>				
Time constant, still air	sec.	1	5	10	15	21
Dissipation constant, still air	mW/Deg. C.	0.1	0.4	0.7	0.8	1

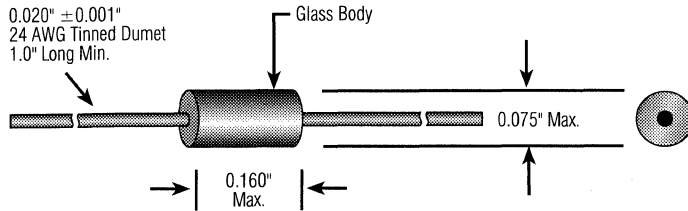
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# Sensor Scientific, inc.

## GLASS ENCAPSULATED THERMISTORS



### FEATURES:

- HIGH STABILITY
- LOW COST
- HIGH TEMPERATURE CAPABILITY
- HERMETICALLY SEALED DO-35 PACKAGE

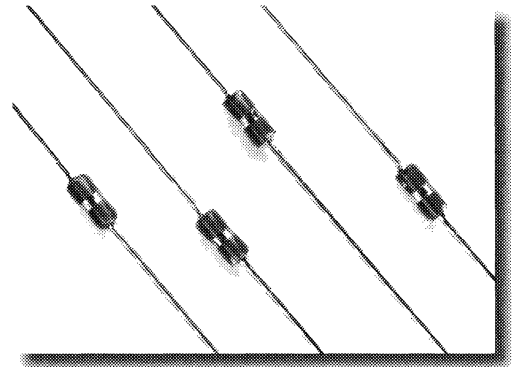
### OPTIONS:

- NON-STANDARD RESISTANCE VALUES
- NON-STANDARD TOLERANCES
- TAPE AND REEL PACKAGING
- VALUE ADDED CUSTOM PROBE ASSEMBLIES

### SPECIFICATIONS:

- THERMAL TIME CONSTANT: 5 SECONDS (STILL AIR), 0.5 SECONDS (STIRRED OIL)
- DISSIPATION CONSTANT: 2 mW/°C
- MAXIMUM OPERATING TEMPERATURE: 300°C

The SD series of glass encapsulated thermistors offer the tighter tolerances and low costs associated with wafer thermistors, with the reliability and high temperature capabilities normally associated with glass probe thermistors. The rugged DO-35 diode style package is resistant to environmental stress. Tape and reel packaging is available for auto-insertion applications.



Resistance @ 25 Deg C	Part Number	Resistance Tolerance ±%	R. vs. Temp. Curve
2500	SD252G10	10	G
3000	SD302G10	10	G
4000	SD402G10	10	G
5000	SD502G10	10	G
8200	SD822C10	10	C
10000	SD103C10	10	C
12000	SD123C10	10	C
20000	SD203C10	10	C
25000	SD253C10	10	C
30000	SD303C10	10	C
50000	SD503C10	10	C
75000	SD753C10	10	C
100000	SD104C10	10	C
250000	SD254C10	10	C
350000	SD354C10	10	C
500000	SD504D10	10	D
1000000	SD105D10	10	D

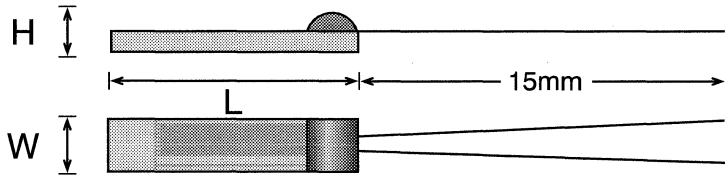
The standard resistance tolerance is ±10%. ±1%, 2%, and 5% are available upon request. To specify a tolerance other than number with the desired tolerance, ±10%, substitute the "10" suffix in the part

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# Sensor Scientific, inc.

## PLATINUM THIN FILM RTD ELEMENTS



### FEATURES

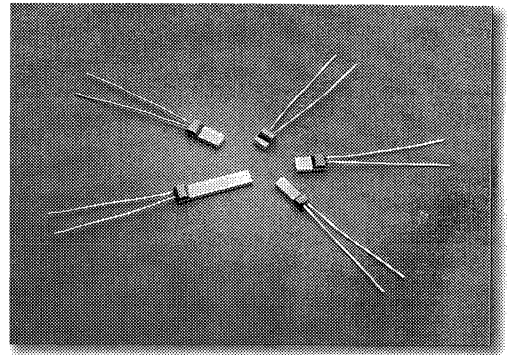
- AVAILABLE IN 100, 500, 1000, AND 2000 OHM RESISTANCE VALUES
- STANDARD IEC 751, ASTM E1137 AND NON-STANDARD TOLERANCES AVAILABLE
- WIDE CHOICE OF SIZES
- 2, 3, AND 4 WIRE EXTENSION LEADS AVAILABLE
- CUSTOM-ENGINEERED TEMPERATURE PROBE ASSEMBLIES

Sensor Scientific, Inc. Platinum Thin Film RTD Elements are fabricated using state-of-the-art thin film processing techniques, resulting in an element of exceptional quality and stability. The wide choice of resistance, tolerance, and size options allows for complete design flexibility.

RTD elements are available with extension leads, and incorporated in complete temperature probe assemblies. Please contact Sensor Scientific for additional information.

### Assemblies:

Generally, thin film RTD elements are incorporated into some type of assembly for protection. Extension leads may be attached via soldering, crimping, brazing or welding. The attachment method must be capable of withstanding the intended maximum operating temperature.



The following precautions must be taken when incorporating the element into an assembly:

- 1) Avoid straining the element leads.
- 2) If extension leads are attached via soldering or brazing, all flux residue must be removed.
- 3) The resistance of extension leads must be taken into consideration. Resistance value at 0°C calibrated 1mm from end of lead wire. DIN = IEC751
- 4) If elements are encapsulated in a potting compound, insure that the compound will not induce pressure loads, resulting in a strain-gage effect

Resistance at 0 Deg. C. ohms	L Length mm	W Width mm	H Height mm	Part Number
100	5.0 +/- 0.2	1.0 +/- 0.2	1.3 +/- 0.2	P01●●■1
100	5.0 +/- 0.2	1.5 +/- 0.2	1.3 +/- 0.2	P01●●■2
100	2.3 +/- 0.2	2.0 +/- 0.2	1.3 +/- 0.2	P01●●■3
100	5.0 +/- 0.2	2.0 +/- 0.2	1.3 +/- 0.2	P01●●■4
100	10.0 +/- 0.2	2.0 +/- 0.2	1.3 +/- 0.2	P01●●■5
100	5.0 +/- 0.2	4.0 +/- 0.2	1.3 +/- 0.2	P01●●■6
500	5.0 +/- 0.2	2.0 +/- 0.2	1.3 +/- 0.2	P05●●■1
500	10.0 +/- 0.2	2.0 +/- 0.2	1.3 +/- 0.2	P05●●■2
500	5.0 +/- 0.2	4.0 +/- 0.2	1.3 +/- 0.2	P05●●■3
1000	4.0 +/- 0.2	2.0 +/- 0.2	1.3 +/- 0.2	P10●●■1
1000	10.0 +/- 0.2	2.0 +/- 0.2	1.3 +/- 0.2	P10●●■2
1000	5.0 +/- 0.2	4.0 +/- 0.2	1.3 +/- 0.2	P10●●■3
2000	10.0 +/- 0.2	2.0 +/- 0.2	1.3 +/- 0.2	P20●●■4

Resistance value at 0°C calibrated 1mm from end of lead wire. DIN = IEC751

- - Tolerance
  - 01 = 1/10 DIN B at 0°C
  - 02 = 1/5 DIN B at 0°C
  - 03 = 1/4 DIN B at 0°C
  - 04 = 1/3 DIN B at 0°C
  - 0A = 1/2 DIN B (DIN A) at 0°C
- 0B = DIN B
- 05 = ASTM B
- 06 = 3/2 DIN B at 0°C
- 07 = 2 DIN B at 0°C
- 08 = 5 DIN B at 0°C
- 09 = 10 DIN B at 0°C

- - Temperature Range
  - L = -50 to + 400 Deg C
  - M = -50 to + 550 Deg C
  - H = -50 to + 600 Deg C

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# Sensor Scientific, inc.

## CUSTOM TEMPERATURE PROBE ASSEMBLIES

Sensor Scientific Temperature Probe Assemblies offer a specific Solution for a specific application. The designs depicted below are a sample of the many options available. If a standard configuration is not practical, our application engineers will assist you in designing or choosing the probe best suited to your application. Most of the designs depicted below are available with wafer (W type), glass encapsulated (SD type), or glass probe (SP type), NTC thermistors, and Platinum (P type) RTD elements. Contact Sensor Scientific for specific design capabilities.

### Maximum operating temperature:

- W type thermistors: 150°C (for best stability for interchangeable wafer thermistors, the operating temperature should be limited to 70°C Maximum)
- S, SP, & SD type thermistors: 200°C
- P type Platinum RTD elements: 400°C
- Standard and custom probe designs are available; consult factory for details

STD 1	STD2	STD3
<b>Air, Liquid, Soil</b>	<b>Gas, Liquid, HVAC</b>	<b>Gas, Air</b>
<p>TEFLON CABLE 1.0" 0.188" O.D. STAINLESS STEEL</p>	<p>0.44" HEX L 0.188" O.D. 1/8" NPT TEFLON CABLE STAINLESS STEEL</p>	<p>TEFLON CABLE 3.5" 0.25" O.D. MOUNTING FLANGE STAINLESS STEEL</p>
STD4	STD5	STD6
<b>Surface</b>	<b>HVAC/R Temperature</b>	<b>HVAC Duct Temperature, Appliance Temperature</b>
<p>0.25" HEX 0.25" STAINLESS STEEL OR ALUMINUM #8-32UNC-2A TEFLON CABLE</p>	<p>Vinyl Housing Zipcord Cable 0.225 MAX. .600 L</p>	<p>Stainless Steel L 0.188 Mounting Flange</p>
STD7	STD8	STD9
<b>Penetration Probe</b>	<b>Gas Temperature/ Fluid Level</b>	<b>Small Medical Temperature Probe</b>
<p>Phenolic Handle Pointed Tip Stainless Steel Probe</p>	<p>Glass Encapsulated Thermistor 0.300 1/8 - 27 MNPT Thread Gas-Tight Seal Faston-Type Connectors Insulated Leads Hex Brass fitting L</p>	<p>0.0185 MAX 0.080 0.100 38AWG BIFILAR LEADS 72 ± 1 Microchip Thermistor, encapsulated in polyamide tube</p>

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STD 10	STD 11	STD 12
<p><b>High Temp. Thermistor (200°C Max) Probe</b></p>	<p><b>Shrink Tubing Thermistor Assembly</b></p>	<p><b>Disposable Patient Temperature Probe</b></p>
STD 13	STD 14	STD 15
<p><b>Patient Skin Probe</b></p>	<p><b>Disposable Skin Temperature Probe</b></p>	<p><b>Wallmount Surface Sensor</b></p>
STD 16	STD 17	STD 18
<p><b>Duct Sensor</b></p>	<p><b>Surface Mount Duct Sensor</b></p>	<p><b>Immersion Sensor</b></p>

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# TEXAS INSTRUMENTS

34 Forest St. • Attleboro, MA 02703 • 508-236-3450

## PRECISION SNAP ACTING THERMOSTATS

### APPLICATIONS

#### COMMERCIAL THERMOSTATS

Series	Description	Common Applications
4344	Welded Hermetic Seal	Medical Equipment, Motor Protection
6786	Environmentally Sealed, Low Profile	Variable Speed Drive Compressors
7BT	Environmentally Sealed, High Current	Medical Equipment, Water Temperature Control
Probe Package	Immersion Type	Air & Fluid Temperature Sensing, Compressor Overheat Protection

#### MILITARY THERMOSTATS (MIL-S-24236)

Series	Description	Common Applications
3BT/4BT	Miniature Tiny Stat <sup>®</sup>	Medical Equipment, Circuit Boards
5BT	SPDT Welded, Hermetic Seal	Medical Equipment, Battery Packs
M2	Narrow Differential, Hermetic Seal	Satellites, Radar Systems
M1/11041	High Reliability, Hermetic Seal	Satellites, All Purpose Overheat Protection
Probe Package	Immersion Type	Air & Fluid Temperature Sensing, Compressor Overheat Protection

#### SPECIAL APPLICATIONS

Series	Description	Common Applications
4286	Narrow differential, Potted Seal	Guided Missiles
4391	Hermetically Sealed SPDT or SPST Automatic or Manual Reset	Motor Protection, Appliances
ACMP	Single, Three Phase Motor Protection	Various Aircraft Motors

#### FEATURE AND ADVANTAGES

- Fast, Snap-Action Switching
- Pre-Set, Non-Adjustable Calibration
- High Reliability, Long Life
- Custom Packaging and Value Added Services
- Hermetic and Environmental Seals
- Excellent Vibration and Shock Resistance
- Logic Level to 15 Amp Capacity

#### APPROVALS

MIL-S-24236

UL

CSA

VDE

GAMT1

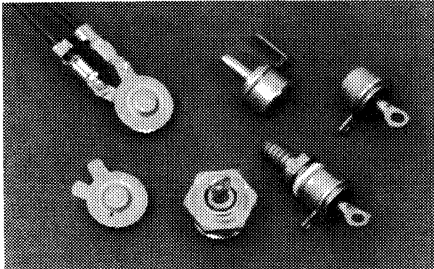
European Community Low Voltage Directive 73/23/EEC, 93/98/EEC

Various Satellite and Commercial & Military Aircraft OEMs

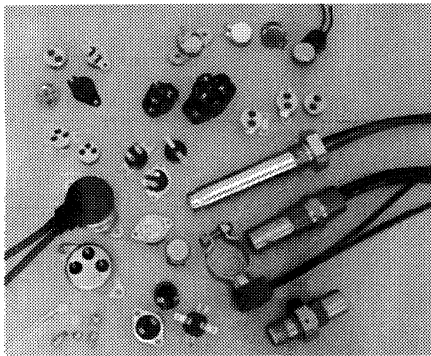
E34618 UL

LR24458 CSA

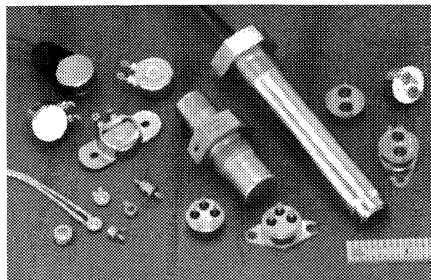
4464.4-451-1/A-1 VDE



TI offers a broad selection of styles for all aerospace, satellite, commercial & military aircraft, medical equipment, and HVAC markets. Designed for temperature protection or control in harsh environments.



- Preset temperature from -65°F to +550°F
- Ratings: Dry Circuit to 15 Amps, 30 VDC or 120 VAC
- Snap Action Switching
- Hermetically and Environmentally Sealed
- Excellent Vibration and Shock Resistance
- Qualified to MIL-S24236
- UL, CSA, and International Agency Approvals



Utilizing a bimetal, snap acting disc as the thermal sensing element, Klixon precision thermostats feature exceptionally high reliability and long life. Standard configurations, probe style packages, or custom packaging can meet most design requirements.

TEXAS INSTRUMENTS • 34 Forest St. • Attleboro, MA 02703 • 508-236-3450

# THERMODISC®

## TEMPERATURE CONTROLS

### Product Overview

Therm-O-Disc bimetal disc temperature controls are widely used in the appliance, HVAC and many other industries. They are powered by bimetal discs which open or close a set of electrical contacts when a predetermined temperature is reached.

Therm-O-Disc temperature controls combine reliability and performance with high volume production methods for maximum value at a low cost. Many terminals and mounting arrangements are available for application flexibility. These products are approved by most major testing agencies around the world.

In addition to the products shown, Therm-O-Disc offers a variety of other products designed to meet unique applications. We have the expertise and experience to custom design products to meet your application for temperature sensing and control, electric power control, water flow control and pressure control.

This chart contains an overview of some of the most widely used Therm-O-Disc products. Products with similar attributes are grouped so you may compare their features.

### Control Chart

Series	Type	General Description	Calibration Range °C	Calibration Range °F	Maximum Electrical Ratings	
					Volts	Res. Amp.
General Purpose	36T	1/2" Disc Multi-Purpose Control	2-220	35-428	120	15
	60T	3/4" Disc Multi-Purpose Control	-18-177	0-350	240	25
	49T	3/4" Disc High Temperature Control	27-288	80-550	240	25
	69T	3/4" Disc Heater Biased Control	-18-82	0-180	240	25
	37T	3/4" Disc Moisture Resistant Control	-18-149	0-300	120	10
	14T	1" Disc Moisture Resistant Control	-18-105	0-221	240	25
Special Purpose	58T	Adjustable Control	-1-66	30-150	277	25
	79T	Adjustable Control Thermal Cutoff	-1-66	30-150	120	9 FLA
	74T	3/4" Disc Adjustable Control	43-121	110-250	240	25
	59T/	3/4" Disc Adjustable Control	32-93	90-200	250	30
	66T	Electric Water Heater Limit	38-104	100-220	277	40
	12S/14S/15S	Sequence/Time Delay Relay	N/A	N/A	277	25
	10H	Linear Limit	66-177	150-350	277	25
	18T/19T	Glass Top Range Limiter Hot Light Indicator	500-750 75-150	932-1382 193-328	250 250	10 1
	10RS	Radiant Sensor	163 Max	325 Max	120	5.75
	20M	Fractional H.P. Motor Protector	80-150	176-302	240	37
	14M	Hermetic Motor Protector	80-150	176-302	240	37
	30M	Manual Reset Motor Protector	80-150	176-302	240	37
	Reed Switch	Temperature Sensitive Magnetic Reed Switch	-18-79	0-175	120	15
	44T	Low Voltage Control	49-149	120-300	12 (DC)	1
	HLX	High Capacity Limit	49-149	120-300	480	50
	75TF	Construction Control and Limit	27-177	80-350	600	25
	TCO	"One-Shot" Thermal Fuse	72-240	162-464	240	21
Microtemp® Thermal Cutoffs						

### 36T Series 1/2" Bimetal Disc



**36T**  
Manual Reset

**36T**

**36TMH**

**36T**—The 36T is the industry standard 1/2" bimetal disc thermostat for controlling or limiting temperature in appliances, HVAC and office equipment. It is available with automatic or manual reset switching action. A single operation version may be specified for applications requiring "one shot" protection. Board mount, surface, air stream and stud mount configurations are available.

**36TMH**—Typically used in coffee makers and tea kettles, the 36TMH is a ceramic version of our 36T. It is also available with a variety of mounting brackets and terminal configurations.

### 36T General Electrical Ratings\* and Worldwide Test Agency Recognitions

Thermostat Type	Maximum Temperature	Cycles	FLA	LRA	Pilot Duty VA	Resistive Amperes	Volts Ac	Recognized By
Automatic Reset Standard Construction	350°F	100,000	3	12	125	15	120	U.L.
	350°F	100,000	1.5	6	125	10	240	
	350°F	6,000	15(.75PF)	—	—	—	120	
Automatic Reset—High Temp Construction	428°F	100,000	—	—	—	15	120	U.L.
	428°F	100,000	—	—	—	10	240	
Manual Reset	350°F	6,000	5	25	125	15	120	U.L.
	350°F	6,000	1.5	6	125	10	240	
Single Operation	350°F	1	10	60	—	—	240	U.L.
	350°F	1	—	—	—	15	240	
	310°F	1	—	—	—	25	120	
Automatic Reset—Standard Construction	350°F	100,000	3	12	125	15	120	C.S.A.
	350°F	100,000	1.5	6	125	10	240	
Automatic Reset—High Temp Construction	400°F	100,000	—	—	—	15	120	C.S.A.
	400°F	100,000	—	—	—	10	240	
Manual Reset	350°F	6,000	5	25	125	15	120	C.S.A.
	350°F	6,000	1.5	6	125	10	240	
Automatic Reset	175°C	100,000	7	—	—	10	250	NEMKO
	220°C	100,000	7	—	—	10	250	
Auto Reset—High Temp Construction	175°C	200	—	—	—	10	250	NEMKO
Manual Reset	175°C	100,000	7	—	—	10	250	SEMKO
	175°C	200	—	—	—	10	250	
Automatic Reset	175°C	100,000	—	—	—	10	250	SEV
	175°C	15	—	—	—	10	250	
Automatic Reset	175°C	60,000	—	—	—	10	250	BEAB
	220°C	100,000	—	—	—	10	250	
Automatic Reset High Temp. Con.	175°C	100,000	1.66	—	—	10	250	DEMKO, UTE
	175°C	20	1.66	—	—	10	250	
Manual Reset	175°C	100,000	1.66	—	—	10	250	SETI
Automatic Reset	175°C	100,000	6	—	—	10	250	VDE
	220°C	100,000	6	—	—	10	250	
Automatic Reset—High Temp. Construction	175°C	20	6	—	—	10	250	KEMA
	175°C	200	7	—	—	10	250	
Manual Reset	175°C	200	1.6	—	—	10	250	KEMA

For further information on your specific design application, contact a Therm-O-Disc sales engineer at 419-525-8300.

# THERMODISC®

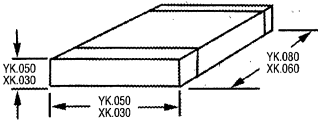
1320 South Main Street, Mansfield, Ohio 44907

Phone: 419-525-8300 Fax: 419-525-8344 Web Site Address: <http://www.thermodisc.com>

Therm-O-Disc, Inc. is a subsidiary of Emerson Electric Co.



# SURFACE MOUNT PTC CHIP THERMISTORS



PART NUMBER	@25°C
YK1102xxx	1,000
XK1102xxx	1,000
YK1202xxx	2,000
XK1202xxx	2,000
YK1402xxx	4,000
XK1402xxx	4,000

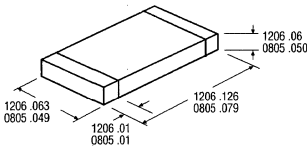
## SURFACE MOUNT PTC LINEAR TEMPSTOR®

### The Tempistor™

This linear PTC component has a linear increase in resistance with an increase in temperature. Though the range of 0°C-100°C, the tempistor slope is approximately .7% change in resistance per °C.

**Applications** with the linear resistance change, the Tempistor™ is ideal for temperature sensing. Designed into one leg of a wheatstone bridge, the output could be directly fed to an OP AMP or microprocessor.

The Tempistor™ is also ideal for temperature compensation with OP AMPS and other semiconductors. Consult our factory for other application information.



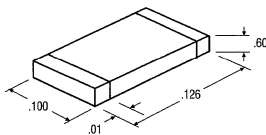
PART NUMBER	@25°C
200Z501M	500Ω
200Z701M	700Ω
200Z102M	1000Ω
200Z202M	2000Ω
200Y501M	500Ω
200Y102M	1000Ω
200Y202M	2000Ω

## SURFACE MOUNT PTC LOW VOLTAGE THERMISTORS 1206 and 0805 Packages

These switching PTC's are perfect for board level sensing of current and temperature.

### Applications

Ideal for current limiting as resettable fuse devices. Other applications include temperature compensation, over temperature protection and time delay devices.



PART NUMBER	@25°C
180VH501N	500Ω
180VH102N	1000Ω
180VH502N	5000Ω

## SURFACE MOUNT PTC HIGH VOLTAGE THERMISTORS Standard 1210 Packages

These surface mount ceramic PTC's are rated at up to 500 Volts which is much higher than polymer PTC's.

### Applications

Ideal for test equipment protection on multimeters, and oscilloscopes. Also for self-regulated heaters.

# SURFACE MOUNT NTC CHIP THERMISTORS

### Surface Mount End Banded Chip Thermistors

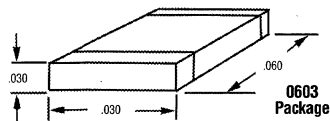
are designed for auto-placement with today's high speed processing equipment. These modern components use little board space which is so precious on the high density boards designed today.

### The End Bands

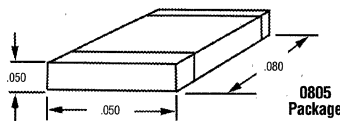
are nickel plated to prevent leaching and tin plated to enhance solderability (solder paste, wave, vapor phase or infrared soldering). It can withstand soldering temperatures of up to 260°C for up to 10 seconds during solder process.

### Packaging

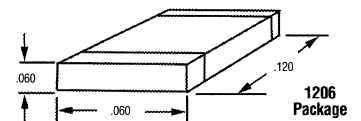
for these end banded chip thermistors, our standard package configuration is tape and reel per EIA specifications.



PART NUMBER	@25°C
XNB502xxx	5,000
XNM103xxx	10,000
XNH103xxx	10,000
XNL203xxx	20,000
XNA503xxx	50,000
XNE104xxx	100,000
XND504xxx	500,000



PART NUMBER	@25°C
YNH502xxx	5,000
YNK103xxx	10,000
YNU103xxx	10,000
YNL103xxx	10,000
YNA203xxx	20,000
YNE503xxx	50,000
YND204xxx	200,000



PART NUMBER	@25°C
ZNH502xxx	5,000
ZNK103xxx	10,000
ZNL103xxx	10,000
ZNA303xxx	30,000
ZNE503xxx	50,000
ZND304xxx	300,000

For complete engineering specifications visit our website at [www.todmcp.com](http://www.todmcp.com)

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# H-UNIT NTC THERMISTORS

Hermetically sealed thermistors resist harsh environments and provide the user a convenient prepackaged sensor ideal for temperature sensing and compensation.

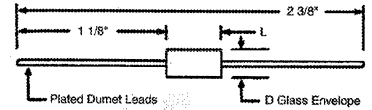
## H-Unit - Leaded Thermistors

H-unit thermistors are protected from environmental extremes by a glass capsule and a rugged glass-to-metal seal. Their small size results in a fast time response. Uniform design allows tape and reel packaging for automatic insertion.

### Applications:

- Appliance Control
- Battery Charge Sensor
- Ambient Sensor

GRADE	D	L	AWG
1H (3K-9K)2H(1K)	.095	.170	
1H (10K-100K)	.070	.150	24
2H (2K-20K)	.070	.150	24
4H (200K-2M)	.070	.150	24



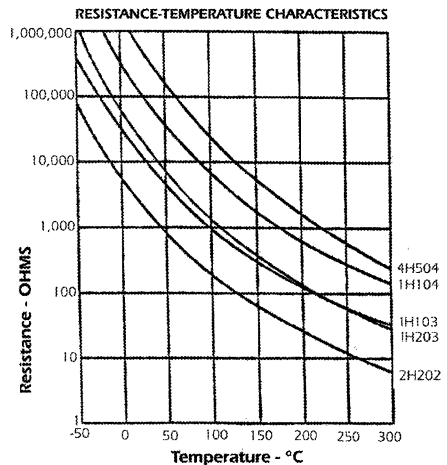
TYPICAL CHARACTERISTICS * **		CATALOG NUMBER				
SPECIFICATION	TEST CONDITION	1H	PIH	UH	2H	4H
Resistance @ 25°C (OHMS)	Zero Power	3K-100K	3K-100K	3K-100K	1K-20K	200K-2M
Resistance Ratio $\frac{R_{25^\circ C}}{R_{125^\circ C}}$		29.41	29.41	29.41	19.44	46.73
Interchangeability <sup>°C</sup>	0°C-100°C	N/A	1°C	.2°C	N/A	N/A
Stability (change in resistance)	1000 hours at 100°C	<.1%	<.1%	<.1%	N/A	N/A
Maximum Operating Temperature (°C)300		300	300	300	300	

\* Dissipation Constant — Free Air; 1H (3K-9K) — 5mw/°C; 1H (10K-100K) 2H-4H — 2mw/°C

\*\*Time Constant — Stirred Oil; 1H (3K-9K) — 1.5 sec. max; 1H (10K-100K) — 2H-4H — 1 sec. max.

RESISTANCE RATIO CHARACTERISTICS							
TEMP.		R <sub>t</sub> /R <sub>25</sub> Multiplier					
		1H		2H		4H	
°C	°F	Multiplier	Alpha	Multiplier	Alpha	Multiplier	Alpha
-40	-40	33.600	-6.6%	21.7000	-5.9%	45.5	-7.2%
-30	-22	17.700	-6.1%	12.3688	-5.5%	23.0	-7.0%
-20	-4	9.7060	-5.8%	7.31432	-5.3%	12.1	-6.4%
-10	14	5.5319	-5.4%	4.47247	-4.8%	6.60	-6.2%
0	32	3.2654	-5.2%	2.81947	-4.6%	3.716	-5.9%
10	50	1.9903	-4.8%	1.82766	-4.3%	2.1500	-5.5%
20	68	1.2493	-4.5%	1.21540	-4.1%	1.2820	-5.2%
25	77	1.0000	-4.4%	1.00000	-4.0%	1.0000	-5.0%
30	86	0.8056	-4.3%	0.827413	-3.9%	0.7853	-4.9%
40	104	0.5327	-4.0%	0.575566	-3.6%	0.4935	-4.6%
50	122	0.3603	-3.8%	0.408417	-3.4%	0.3175	-4.4%
60	140	0.2488	-3.6%	0.295179	-3.2%	0.2088	-4.1%
70	158	0.1752	-3.4%	0.216991	-3.1%	0.1402	-4.0%
80	176	0.1255	-3.3%	0.162045	-2.9%	0.0959	-3.8%
90	194	0.09150	-3.2%	0.122792	-2.8%	0.0668	-3.6%
100	212	0.06800	-3.0%	0.0943195	-2.6%	0.0473	-3.4%
110	230	0.05170	-2.8%	0.0733706	-2.5%	0.0340	-3.2%
120	248	0.03900	-2.6%	0.0577511	-2.4%	0.0249	-3.1%
130	266	0.03000	-2.5%	0.0459596	-2.3%	0.0184	-3.0%
140	284	0.02350	-2.4%	0.0369537	-2.1%	0.0138	-2.9%
150	302	0.01850	-2.3%	0.0300000	-2.0%	0.0105	-2.7%
160	320	0.01450	-2.2%	0.0245755	-1.9%	0.00806	-2.6%
170	338	0.01180	-2.2%	0.0203030	-1.8%	0.00626	-2.5%
180	356	0.00970	-2.1%	0.0169072	-1.7%	0.00491	-2.4%
190	374	0.00790	-2.0%	0.0141851	-1.7%	0.00388	-2.3%
200	392	0.00650	-1.9%	0.0119853	-1.6%	0.00310	-2.2%
210	410	0.005462	-1.8%	0.0101941	-1.5%	0.00250	-2.1%
220	428	0.004580	-1.8%	0.00872512	-1.5%	0.00203	-2.1%
230	446	0.003867	-1.7%	0.00751210	-1.5%	0.00166	-1.9%
240	464	0.003285	-1.6%	0.00650399	-1.5%	0.00137	-1.9%
250	482	0.002808	-1.5%	0.00566104	-1.4%	0.00114	-1.8%

For applications above 150°C, consult with a Therm-O-Disc Sales Engineer.



To find the resistance of a particular H-unit thermistor at any temperature in this table, multiply its 25°C resistance by the multiplier for that temperature.

For complete engineering specifications visit our website at [www.todmcp.com](http://www.todmcp.com)

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# NTC DISC THERMISTORS

## INRUSH CURRENT SUPPRESSORS FOR SWITCHING POWER SUPPLIES

Power supply filter capacitors present a high inrush current upon initial turn-on. Therm-O-Disc® current suppressors offer automatic resistance control to suppress excessive current. A broad array of sizes, styles, and electrical values can meet the most diverse design criteria. The quality built into our NTC discs assures reliability for the future.

### Available Options:

- Wide Resistance Choices
- Lead Styles
- Protective Coatings



Take advantage of our FREE *IN-A-RUSH*™ sample program for inrush current suppressors. Call or FAX your requirements to us today.

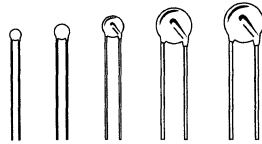
## TEMPERATURE COMPENSATION AND SENSING

The broad array of sizes and material temperature coefficients permits an almost unlimited selection of response times, current handling capabilities, and resistance values.

- Applications:**
- Meter Compensation
  - Gain Controls
  - Frequency Stabilization

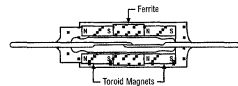
### Available Options:

- Tailored Electrical Design
- Lead Styles
- Protective Coatings



# TEMPERATURE SENSING SWITCHES

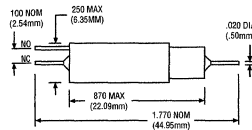
Miniature temperature switches utilize an electro-ceramic element to activate a reliable reed switch. This design provides low contact resistance, long life, and a hermetically sealed package. These are UL recognized components.



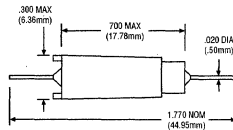
UL File #E8186(N)

- Applications:**
- Heating and Air Conditioning
  - Freeze Sensors
  - Computer Fan Control

## MOLDED SWITCHES



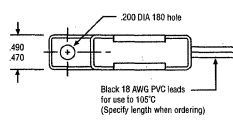
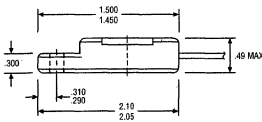
SPDT Form C



SPST Form B (NC)  
SPST Form A (NO)

SPECIFICATIONS	ST Form B (NC)	SPST Form A (NO)	SPDT Form C
<b>Contact Rating</b>	Watts – 10W max. Volt Amps – 12VA. max.	Watts – 3W max. Volt Amps – 3VA. max.	Watts – 3W max. Volt Amps – 3VA. max.
<b>Voltage</b>	Volts D.C. – 100 VDC max. Volts A.C. – 120 VAC max.	Volts D.C. – 100 VDC max. Volts A.C. – 120 VAC max.	Volts D.C. – 100 VDC max. Volts A.C. – 120 VAC max.
<b>Current</b>	Carry – 1 amp max. Break – 1 amp max. Make – .5 amp max.	Carry – 1 amp max. Break – 1 amp max. Make – .5 amp max.	Carry – 1 amp max. Break – 1 amp max. Make – .5 amp max.
<b>Open Temp. – Nominal</b>	5° increments starting at 0°C	5° increments starting at 0°C	5° increments starting at 0°C
<b>Tolerance</b>	± 5°C	± 5°C	± 5°C
<b>Reset Differential</b>	10°C max.	10°C max.	10°C max.

## REED SWITCHES – PMS SERIES



CONTACT ARRANGEMENT	SPST Form B (NC)	SPST Form A (NO)
<b>Contact Rating</b>	Watts – 10W max. Volt Amps – 12VA. max.	Watts – 10W max. Volt Amps – 12VA. max.
<b>Voltage</b>	Volts D.C. – 100 VDC max. Volts A.C. – 120 VAC max.	Volts D.C. – 100 VDC max. Volts A.C. – 120 VAC max.
<b>Current</b>	Carry – 1 amp max. Break – 1 amp max. Make – .5 amp max.	Carry – 1 amp max. Break – 1 amp max. Make – .5 amp max.
<b>Switch Temp. – Nominal</b>	5° increments starting at 0°C	5° increments starting at 0°C
<b>Tolerance</b>	± 5°C	± 5°C
<b>Reset Differential</b>	10°C max.	10°C max.

For complete engineering specifications visit our website at [www.todmcpj.com](http://www.todmcpj.com)

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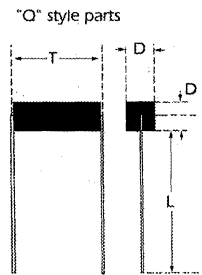
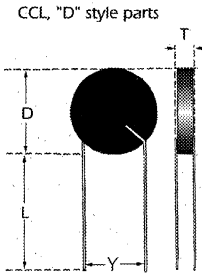
# CERAMIC CURRENT LIMITERS

**Background:** A popular application for PTC thermistors is self-resetting current limiting. Some refer to PTCs as solid state fuses. However, these "fuses" do not require replacement after tripping and are useful for a countless number of trip cycles. This can be a definite advantage in equipment that is hard to service or has a high maintenance cost associated with it.

**How does a PTC Thermistor limit current?** As long as the current does not exceed the hold current, think of the PTC as a fixed resistor. This is not entirely true, but for practical purposes, please consider it for a moment. When the current level exceeds the trip current, usually as the result of a fault in the circuit, the PTC will heat up to a point above its switch temperature. When this happens, the resistance increases dramatically — usually several orders of mag-

nitude. The PTC will continue to increase in resistance until the majority of the supply voltage is dropped across the PTC. While in the high resistance state, since the PTC is not a perfect open circuit, a small amount of residual current will still flow through the device. This residual current is, fortunately, a small percentage of the normal hold current. The PTC stays at the high resistance state until the overcurrent situation is corrected and part is allowed to cool.

## PHYSICAL DIMENSION KEY



d = lead diameter  
x = coating thickness

## NOMINAL DIMENSIONS

PART NUMBER	X inches	Y inches	d AWG	d mm	coating?	D inches	D mm	T inches	T mm	L inches	L mm
150Q80112	0	0.31	28	0.3	NO	.09X0.1	2.3X3.8	0.32	8.1	4	102
165Q80113	0	0.31	28	0.3	NO	.09X0.1	2.3X3.8	0.32	8.1	4	102
180Q10230	0	0.4	22	0.6	NO	.115X0.1	2.9X3.8	0.48	12.2	1	25
165Q12201	0	0.31	28	0.3	NO	0.19X0.15	2.3X3.8	0.33	8.4	0.75	19
180Q50100	0	0.4	22	0.6	NO	0.19X0.19	4.8X4.8	0.44	11.1	1.5	38
140D10102	0.1	0.1	24	0.5	YES	0.24	6.1	0.14	3.6	1.5	38
160D10116	0.1	0.1	24	0.5	YES	0.24	6.1	0.14	3.6	1.5	38
CCL020.01	0.1	0.1	24	0.5	YES	0.275	7	0.175	4.4	1.5	38
175Q15114	0	0.16	28	0.3	NO	.295X0.0	7.5X2.3	0.17	4.3	4	102
180D10113	0.06	0.1	24	0.5	YES	0.34	8.6	0.24	6.1	1.5	38
170D10117	0.08	0.1	24	0.5	YES	0.28	7.1	0.18	4.6	1.5	38
185D10102	0.1	0.1	24	0.5	YES	0.32	8.1	0.2	5.1	1.5	38
CCL060.01	0.22	0.25	22	0.6	YES	0.42	10.7	0.25	6.4	1.5	38
180D22012	0.07	0.2	20	0.8	YES	0.4	10.1	0.18	4.6	1.25	32
200D65011	0.2	0.25	22	0.6	YES	0.4	10.1	0.275	7	1.5	38
225D28011	0.09	0.125	24	0.5	YES	0.26	6.6	0.2	5.1	1.5	38
CCL100.01	0.13	0.25	22	0.6	YES	0.46	11.7	0.2	5.1	1.5	38
CCL140.01	0.13	0.25	22	0.6	YES	0.55	14	0.18	4.6	1.5	38
227D60010	0.13	0.25	22	0.6	YES	0.6	15.2	0.18	4.6	1.5	38
200D11011	0.075	0.25	22	0.6	YES	0.31	7.9	0.12	3	1.5	38
200D10001	0.075	0.25	22	0.6	NO	0.3	7.6	0.1	2.5	1.5	38
CCL150.01	0.15	0.25	22	0.6	YES	0.42	10.7	0.22	5.6	1.5	38
CCL300.01	0.07	0.25	22	0.6	YES	0.52	13.2	0.14	3.6	1.5	38
200D10002	0.135	0.25	22	0.6	YES	0.8	20.3	0.22	5.6	1.5	38
CCL450.01	0.14	0.25	20	0.8	YES	0.67	17	0.21	5.3	1.5	38
228D04001	0.07	0.25	22	0.6	YES	0.55	14	0.15	3.8	1.5	38
228D02001	0.09	0.25	18	1	YES	0.7	18	0.2	5.1	1.85	47

## ELECTRICAL SPECIFICATIONS

PART NUMBER	R25-OHMS	TOL +/- %	VDC MAX.	HOLD I mA	THRES. I mA	TRIP I mA	RESIDUAL AT VDC max	SWITCH TEMP °C
150Q80112	750	33	200	5	7	10	1.5	50
165Q80113	750	33	300(*)	7	10	14	1.5	65
180Q10230	1000	40	500(*)	8	12	16	1.5	80
165Q12201	1250	20	300(*)	9	14	18	2	65
180Q50100	500	33	500(*)	15	22	30	2	80
140D10102	100	40	30	17	26	34	1	40
160D10116	100	40	100	17	25	34	4.5	60
CCL020.01	105	30	125	20	29	40	6	128
175Q15114	150	30	75	20	31	40	4	75
180D10113	100	40	40	22	33	44	9	80
170D10117	100	40	70	26	40	52	6	70
185D10102	100	20	30(**)	35	49	70	13	85
CCL060.01	60	33	150	60	88	120	8	128
180D22012	22	30	28	63	95	126	25	80
200D65011	65	38	100	80	120	160	10	100
225D28011	28	27	50	87	130	174	15	125
CCL100.01	30	33	150	100	135	200	11	128
CCL140.01	55	30	150	105	148	210	13	128
227D60010	60	40	48	106	160	212	30	127
200D11011	11	54	50	113	170	226	20	100
200D10001	10	20	40	120	180	240	20	100
CCL150.01	17	30	150	125	180	250	14	128
CCL300.01	7.5	33	70	175	285	350	25	128
200D10002	9.5	26	150	183	275	366	18	100
CCL450.01	9	33	100	300	440	600	30	128
228D04001	4.7	15	40	320	480	640	35	128
228D02001	1.8	30	25	700	1050	1400	200	128

\* Max VDC for 1 minute only  
\*\* a 70VDC version is also available

### Additional Specifications:

-TR suffix to the part number designates tape and reel per EIA-468-B. Some slight deviation may be required due to lead spacing which is not always to 0.1" increments.  
Please note "Q" style parts are not available taped and reeled.

Coating is a blue epoxy, UL-94VO type.

Solderability is to MIL-STD-202, method 208.

Resistance to Solder Heat is 260+/-5°C for 10+/-2 seconds per MIL-STD-202, method 210.

Terminal Strength is to MIL-STD-202, method 211, test condition A and C, 2.25 lbs. min.

Mechanical shock: All parts will survive a 1.4 meter drop to a concrete floor without noticeable mechanical or electrical damage.

For complete engineering specifications visit our website at [www.todmcpq.com](http://www.todmcpq.com)

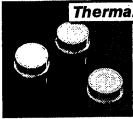
**THERMODISC®**  
MIDWEST COMPONENTS PRODUCT GROUP

For Application Assistance call: Phone 616-777-4100  
Fax 616-773-4214 • P.O. Box 3303 • Muskegon, MI 49443

**AtCom** ATLANTIC COMPONENTS

For Sales, Data Sheets & Samples call: 800-244-0051  
Fax 800-282-0670 Website: <http://www.atcomhq.com>

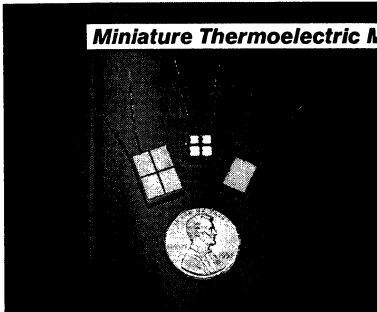
Thermal Reference Sources



# ThermoLyte

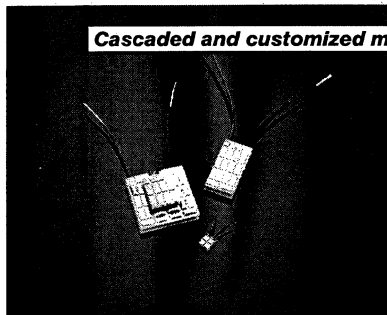
corporation

Miniature Thermoelectric Modules



ThermoLyte's extensive line of modules gives you the flexibility needed in designing your product. Modules range from 1.1 amps to 24 amps and can provide cyclic temperatures ranging from 130°C to 220°C.

Cascaded and customized modules

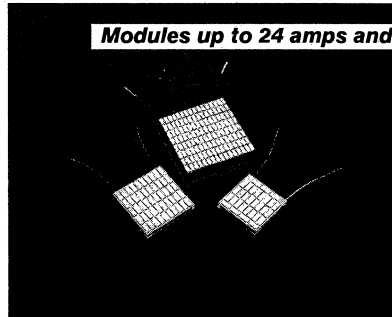


ThermoLyte is dedicated to advancing TE technology and will continue to create innovative ideas and products that benefit the industry. Our experts will work with you to pinpoint the right type of thermoelectric module for your needs.

**Call our design & engineering staff to assist with your project and to request ThermoLyte's TE Module Application Guide**

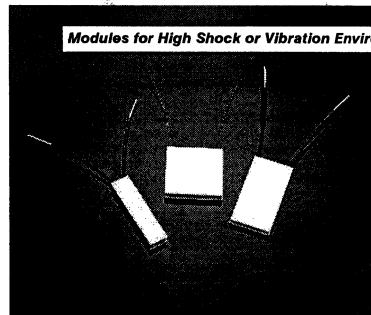
ThermoLyte develops and manufactures a comprehensive line of thermoelectric heating and cooling modules. Thermoelectrics can be used in a variety of different applications from picnic coolers to experiments on the Space Shuttle to calibrating infrared cameras.

Modules up to 24 amps and 220°C



As designers and manufacturers, we can work with you to develop the module for your needs. Thermoelectric modules can be ruggedized to withstand high shock or vibration applications.

Modules for High Shock or Vibration Environments



## ThermoLyte

corporation

45 First Avenue, Waltham, MA  
 Phone: 781-622-1391 Fax: 781-622-1027  
 ThermoLyte is a division of ThermoPower, a ThermoElectron Company



# NTC THERMISTORS and ASSEMBLIES

- Surface Mount
- Leaded
- Standard and Custom Assemblies

## EEM DESCRIPTIONS

### THERMISTORS:

- Surface Mount
- Negative Temperature Coefficient

### SENSORS:

- Temperature

### TRANSDUCERS:

- Proximity
- Temperature

## FLASHFAX<sup>SM</sup>

Fax 1-800-835-4272 for literature.

Or call Vishay's FlashFax<sup>SM</sup> at 1-800-487-9437. Request document 9999. This is a listing of data sheets you can order by fax in a flash!

10 Thermistor and Assembly data sheets are available.

## INTERNET



## SURFACE MOUNT



### Model NTHS

Wraparound terminations include: Nickel Barrier, Silver, Palladium/Silver and Platinum/Palladium Silver.

High-density monolithic ceramic construction.

R25 values: 5kΩ - 100kΩ.

Tolerance: ± 5%, ± 10%.

R-T curves: 1, 2, 14.

Design flexibility for use with hybrid circuitry. Available in 8mm tape and reel.

### Model W

Top and bottom surface terminations. Model W is a thermistor die with silver conductors fired on top and bottom surfaces.

High-density monolithic ceramic construction.

R25 values: 50Ω to 1MΩ.

Tol.: ± 5%, ± 10%.

R-T curves: 1, 2, 7, 8, 12. Design flexibility to use with hybrid circuitry.

Bottom surface can be reflow soldered to substrate and top surface wire bonded to complete circuit connection.

### Model J

Wraparound terminations of fired-on Platinum/Palladium Silver for mounting directly to the mounting pads of a hybrid substrate.

High-density monolithic ceramic construction.

R25 values: 5kΩ - 1MΩ.

Tolerance: ± 5%, ± 10%.

R-T curves: 1, 2, 7, 8. Design flexibility for use with hybrid circuitry. Available in 8mm tape & reel.

## LEADED



### Models M, C, T

Small size - baked-on phenolic conformal coating for durability and long-term stability.

Solid tinned copper leads (T models have solid nickel wire with Teflon<sup>®</sup> insulation).

Configured for PC board mounting or assembly in probes.

R25 values: 50Ω to 19.68MΩ.

Tolerance: ± 1%, ± 5%, ± 10%.

Available in 11 different R-T curves.

## STANDARD and CUSTOM ASSEMBLIES



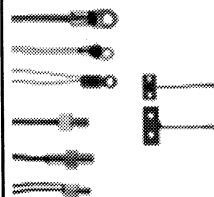
### Immersion Probes

Tubular stainless steel with thread mounting for pressured, closed systems or pointed tip for soft, semi-frozen materials. Tubular Pyrex<sup>®</sup> for lab use where a chemically inert probe is required. Aluminum housed, flexible PVC tubing for intermittent immersion - (hard to reach areas).



### General Purpose Sensors

Versatile, low-cost. Epoxy-tip probes, gold anodized sensors, pipe sensors and stainless steel rods. A wide choice of special housing materials including: Delrin<sup>®</sup>, ABS and polyester.

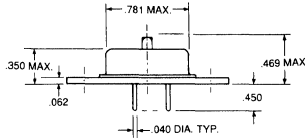
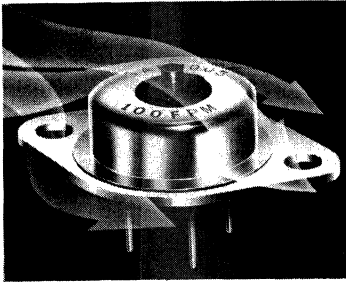


### Surface Sensors

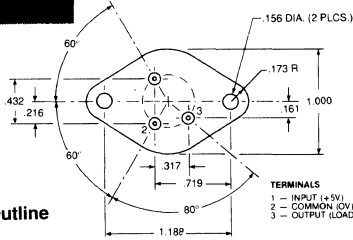
Products include: Ring Tongue Lug Sensors which are used where fast time response is required, aluminum Block Sensors which are used for measurement and control of large surface areas, and Heat Sink Sensors in brass, aluminum or stainless steel with various threads.

# STATE-OF-THE-ART THERMAL MANAGEMENT OF MODERN ELECTRONIC EQUIPMENT

## THE WARREN G-V SOLID STATE AIRFLOW SWITCH



SAF1005



T-03 Outline

The advanced SAF Series Airflow Switch provides early detection and protection from overheating in mainframe computers and peripherals, large power supplies; HVAC applications, medical diagnostic equipment, and other complex electronic systems requiring forced air cooling.

This highly innovative, low profile airflow sensor is also easily mountable directly on the most densely populated circuit boards, on equipment racks with as little as .625 inch spacing between boards, on sockets or bracket mount plenums. All SAF models are complete, self contained sensor/alarm devices – no additional circuitry or signal conditioning as required.

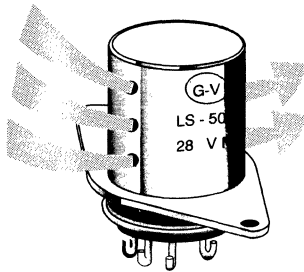
**Specifications**

- Input voltage:** +5 VDC ( $\pm 5\%$ )
- Power Dissipation:** 1/2 w max
- Output:** open collector, solid state, able to sink up to 100 MA to ground, from DC Sources up to 30V
- Sensing Range:** 50 to 1500 F.P.M.
- Sensing Tolerance:**  $\pm 25$  F.P.M. or  $\pm 10\%$ , whichever is greater
- Ambient Range:** +10°C to +60°C ambient temperature compensation curves available
- Sensitivity:**  $\pm 25$  F.P.M. from actual setting
- Hysteresis:** Series SAF1005 (standard Model) is typically 10% of the setting

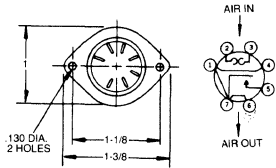
**Mounting Accessories**

- Military Socket Assembly with leads, no mounting bracket—PN 4-1-261 (Switch not included)
- Bracket only with leads attached to SAF Sensor—PN 4-1-270
- Socket Assembly with mounting bracket and leads—PN 4-1-260

### AIR FLOW SENSORS *LS Series*



MILITARY APPLICATIONS



Outline Dimensions

- Available for varied voltage sources
- Built in time delay interval ignores transient airflow interruptions
- Ambient compensated design provides stable performance under wide ambient
- Rugged design meets MIL shock/vibration/ambient requirements
- No additional circuitry required

**Specifications**

- Heater Voltage:** 5V., 12 V., 28 V., or 115 V. AC/DC  
Other voltages available
- Input Power:** 4 Watts, nominal
- Contact Rating:** 2 A. resistive up to 115V. AC  
1 A. resistive up to 32V. DC  
 $\pm 10\%$  of nominal, voltage variation chart available
- Usable Voltage Range:** 75 to 1000 F.P.M.
- Setting:** 75 to 1000 F.P.M.
- Response Time:** 1 to 20 seconds (depending on setting and air velocity prior to stoppage)
- Temperature Range:** -55°C-85°C, energized
- Vibration:** 10g to 500 Hz.
- Shock:** 50g for 11 msec.

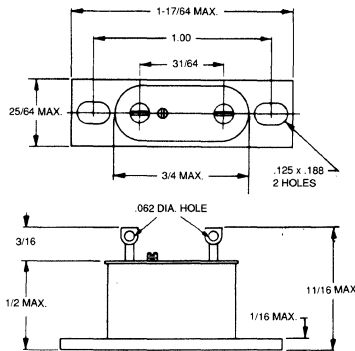
### TEMPERATURE SENSORS *Electrical Thermostats*

#### VE SERIES SURFACE TEMPERATURE SENSOR

VE Surface Temperature Sensors have a unique dual bimetal design which produces larger forces and contact motion than ordinarily found in devices of this size. Intimate coupling between the mounting base and actuating elements produce an exceptionally fast response time. Contact chatter is eliminated and the unit has no resonant points below 2000 Hz.

**Specifications**

- Setting Tolerance:**  $\pm 5^\circ\text{F}$  ( $\pm 3^\circ\text{C}$ )
- Contact:** SPST open on rise or SPST close on rise  
3 A. @ 115 V AC Resistive  
1 A. @ 32 V DC Resistive
- Vibration:** 25 g to 1000 Hz
- Shock:** 50 g, 11 ms
- Temperature Range:** 0°C to +150°C



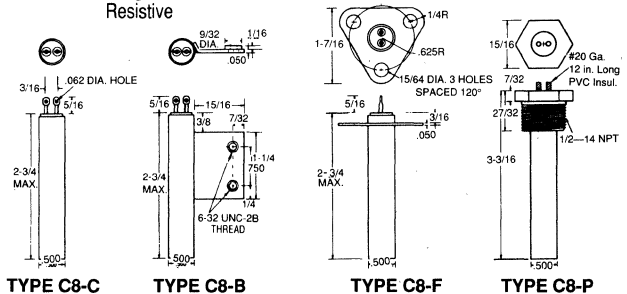
Direct replacement for Fenwal Series 32410/32411—The Fenwal Company discontinued this popular surface sensing series in 1987—The Warren G-V Series VE Thermostat mounts on the same 1.00" centerline as a direct replacement meeting all electrical and thermal requirements of the former unit.

#### C-8 SERIES AMBIENT TEMPERATURE SENSORS

C8 Sensors are based on a differential expansion principle, comparing the expansion or contraction of the outer shell in relation to an internal member that is not affected by temperature. The differential in expansion of these two members is then multiplied by the internal mechanism and transferred as a motion to the contacts. The contacts are built in a separate fused glass header with a minimum current path to reduce self-heating effects.

**Specifications**

- Setting Tolerance:**  $\pm 5^\circ\text{F}$  ( $\pm 3^\circ\text{C}$ )
- Contact:** SPST open on rise or close on rise  
Rating: 5A @ 115 VAC Resistive  
1A @ 32 VDC Resistive
- Vibration:** 10 g to 2000 Hz
- Shock:** 10 g 11 ms
- Temperature Range:** -25°C to +150°C



1 Apollo Drive • Whippany, NJ 07981 • 973-386-1200 • Fax: 973-386-9331 • <http://www.warrengv.com>

# YSI Precision Thermistors

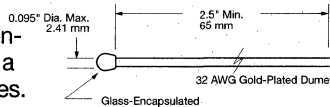
*If a standard probe doesn't fit your application, we'll design one that does. Call 800 747-5367. Fax 937 767-9353. Info@YSI.com. www.YSI.com.*

YSI precision thermistors provide accurate, stable temperature measurement, control and compensation. We offer 13 resistance curves in 6 styles for applications ranging from incubators to satellites. Not all resistances and accuracies are available in all styles.

## Precision interchangeable thermistors— ±0.05, ±0.1, ±0.2°C from 0 to 70°C

### Low-Cost Glass-Encapsulated

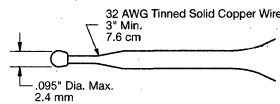
YSI 55000 GEM Series  
Manufactured with glass hermetic encapsulation, providing stability over a wide range of operating temperatures.



Time Constant	Stability at 25°C	Maximum Temperature
Still Air		
Oil Bath	10 months	100 months
≤ 15 sec	<0.01°C	stability testing in progress
≤ 1.5 sec		+200°C

### Epoxy Coat

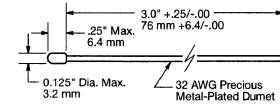
YSI 44000 Series



≤ 10 sec	<0.01°C	<0.02°C	+150°C
≤ 1 sec			

### Glass Coat

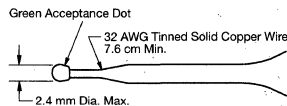
YSI 45000 & 46000 Series



≤ 2.5 sec	<0.01°C	<0.01°C	+250°C
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### Space-Qualified

YSI 44900 Series  
Goddard Space Flight Center specification GSFC S-311-P-18.



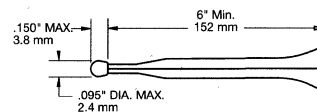
≤ 10 sec	<0.01°C	<0.02°C	+90°C
≤ 1 sec			

## YSI Thermiliners Provide Linear Outputs

If you need linear resistance or linear voltage output, specify YSI Thermilinear Components. The linear range and deviation from linearity for each network are listed below.

Network	Range	Deviation
YSI 44201	0 to +100°C	±0.216°C
YSI 44202	-5 to +45°C	±0.065°C
YSI 44203	-30 to +50°C	±0.16°C
YSI 44204	-2 to +38°C	±0.03°C

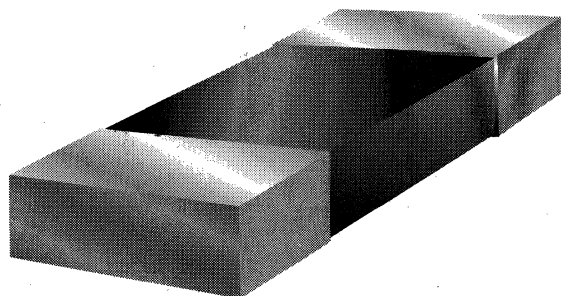
### Thermistor Component



## NEW precision thermistors in surface-mount packages

We offer YSI surface-mount thermistors with ±3% tolerances and 3 standard resistances in 0805 packages. Tighter tolerances and other resistance values are available.

The patented manufacturing process provides excellent stability. Fully glass-passivated ceramic elements reduce solder shift for improved stability and protection. Five-sided wraparound end bands provide additional mounting surfaces and better electrical and mechanical contact. Leach Guard terminations increase resistance to solder heat.



**YSI** incorporated  
Yellow Springs, Ohio 45387 USA



# YSI Precision Thermistors

If a standard probe doesn't fit your application, we'll design one that does. Call 800 747-5367. Fax 937 767-9353. Info@YSI.com. www.YSI.com.

## Custom Engineered Probes

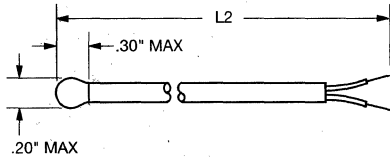
The probes below are just a few of the styles we offer. We'll help you choose a probe style, thermistor resistance and accuracy, lead style and length appropriate for your application.

- Custom assemblies
- YSI precision thermistors
- Temperatures to 200°C
- Accuracy to ±0.05°C
- Long-term stability



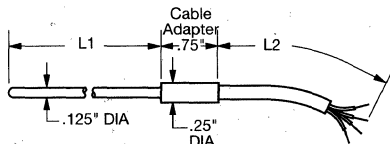
### General Purpose

Flat, round or individual leads



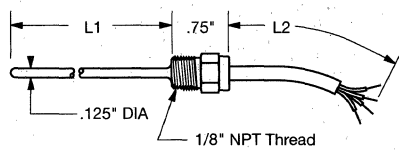
### Tubular

Stainless steel, Pyrex

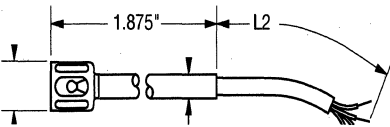


### Tubular with Fitting

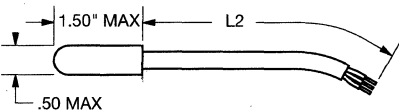
1/8", 3/16", 1/4" diameters



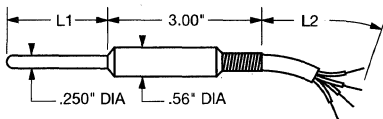
### Air Temperature



### Burial

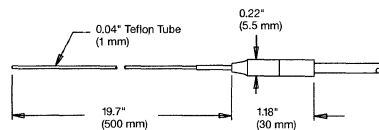


### Deep-Water



### Catheter

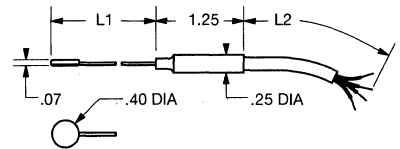
1-mm Teflon tubing



### Calibration Services & SPRTs

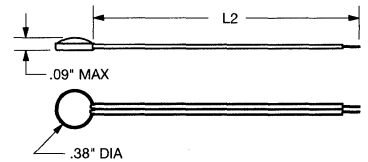
- Special test and calibration services traceable to the NIST
- Standard Platinum Resistance Thermometers (SPRTs)

### Banjo Surface Temperature

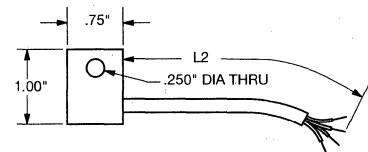


### General Surface Temperature

3/8", 3/16" diameters

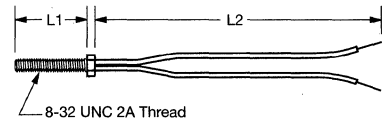


### Attachable Surface Temperature



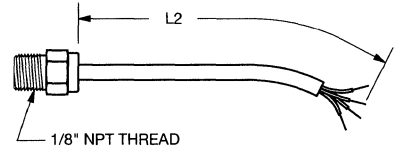
### Screw

8-32, 10-32 in brass or stainless steel

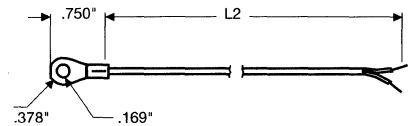


### Pipe Plug

1/8" in brass or stainless steel



### Ring Lug Surface Temperature



YSI incorporated  
Yellow Springs, Ohio 45387 USA

## ELECTRICAL SENSORS

Manufacturer	Starting EEM Page No.	Current - DC			Current - AC		Power		Power Factor	Phase Angle	Frequency	Voltage		Other
		Magnitude	Level Sensing	Bidirectional	Ampl./RMS	Level Sensing	True (W)	Apparent (VAR)				DC	AC	
Aleph International Corp.	B•1739	√	√	√	√	√	√	√			√	√		
American Aerospace Controls	B•1744	√	√	√		√	√	√			√		√	
Approved Purification Corp.	B•1738		√			√						√	√	
AYA-Instruments, Inc.	B•1748	√		√	√		√	√	√	√	√	√	√	Hall-Effect, AC/DC Current Transducers.
CR Magnetics Inc.	B•1756				√	√							√	
E-T-A Circuit Breakers	B•1758		√	√		√								
GMW Associates	B•1767	40A to 10kA.  10mA to 2A.		√	√	10mA to 2A. RF & Pulse. Pulse-Charge.					dc to 500 kHz  dc to 4kHz. 1kHz to 2GHz. From 1ps.			Analog output, 5ppm linearity, 50ppm accuracy. Analog output, large aperture. Analog output into 50 ohm. Analog output, 0.5nC resolution.
Hamlin Inc.	B•1771		√											
Ohio Semitronics, Inc.	B•1781	√	√	√	√	√	√	√	√	√	√	√	√	
Omega Engineering	B•1802	√	√	√	√	√	√	√	√	√	√	√	√	
Servo-Tek Products Company	B•1793	√		√								√		Velocity
Sunx Sensors	B•1797		√			√						√	√	Fiber-Optic.
Yaskawa Electric America	B•1800		√			√						√	√	

## ENCODERS, SHAFT ANGLE

Manufacturer	Starting EEM Page No.	Optical			Contact			Other
		Abs.	Diff.	Incr.	Abs.	Diff.	Incr.	
BEI Sensors and Systems	B•1750	√		√				
Bourns, Inc.	B•1751			√			√	
Canon U.S.A.	B•1753			√				Linear encoder
CUI Stack, Inc.	B•1757	√	√	√			√	
Data Technology, Inc.	B•1762			√				
Dynamics Research Corp.	B•1764	√		√				
Grayhill Inc.	B•1769			√	√		√	High Resolution
Gurley Precision Instruments	B•1770	√	√	√				
Oakgrigsby, Inc.	B•1780			√	√		√	Contact analog
Sequential Electronic Systems Inc.	B•1792	√		√	√		√	
Servo-Tek Products Company	B•1793			√				Encoder/Tachometer Pulsers
Spectrol Electronics Corp.	B•1796				√			
Sunx Sensors	B•1797			√				
U.S. Digital Corp	B•1798	√		√				
Vernitron Corp.	B•1799	√		√	√		√	



## SENSORS/TRANSDUCERS

Manufacturer	Starting EEM Page No.	Audio	Force/Weight	Magnetic Field	Pressure	Temperature	Position		Position Velocity	Velocity	Other
							ABS	Displacement			
Aleph International Corp.	B•1739		√	√	√	√	√	√	√	√	
Altech Corp.	B•1740							√			Proximity sensors
Amecon	B•1747			√							Hall-Effect
Approved Purification Corp.	B•1738				√	√		√			
BEI Sensors and Systems Company	B•1750				√		√	√	√	√	Gyroscope
Bourns, Inc.	B•1751				√			√			
Canon U. S. A.	B•1753							√	√	√	
Cherry Electrical Products	B•1754			√					√	√	Hall-Effect
Collmer Semiconductor, Inc.	B•1755			√							Hall-Effect
Data Instruments, Inc.	B•1759				√		√	√			
Dresser Instrument Div.	B•1763				√						
Dynamics Research Corp.	B•1764							√	√		
E-T-A Circuit Breakers	B•1758				√	√				√	Flow
F.W. Bell	B•1765			√							Hall-Effect
Gurley Precision Instruments	B•1770						√	√	√	√	
Hamlin Inc.	B•1771			√				√			
Hermetic Switch	B•1772			√			√				
Honeywell / Micro Switch	B•1774		√	√	√	√					
Honeywell / Solid State	B•1776			√	√		√	√	√		Proximity
Meder Electronic, Inc.	B•1779										Proximity
Omegadyne	B•1791		√		√						
Omega Engineering	B•1802		√	√	√	√		√	√	√	Humidity, level and solid level, ph, ionic concentration, flow of liquids and gases
Servo-Tek Products Company	B•1793								√	√	Tachometers
Setra Systems, Inc.	B•1794		√		√						
Spectrol Electronics Corp.	B•1796						√				
Sunx Sensors	B•1797				√			√			Laser.
U.S. Digital Corp.	B•1798										Inclinometers
Vernitron Corp.	B•1799				√		√	√	√		
Yaskawa Electric America	B•1800			√			√				Power Switching

## ACCELEROMETERS

Manufacturer	Starting EEM Page No.	Acceleration	Vibration	Shock
Aleph International Corp.	B•1739	√		√
Canon U.S.A.	B•1753	√		
Hamlin Inc.	B•1771	√		√
Omega Engineering	B•1802	√	√	√
Setra Systems, Inc.	B•1794	√	√	√

## TRANSCIEVERS: Ultrasonic

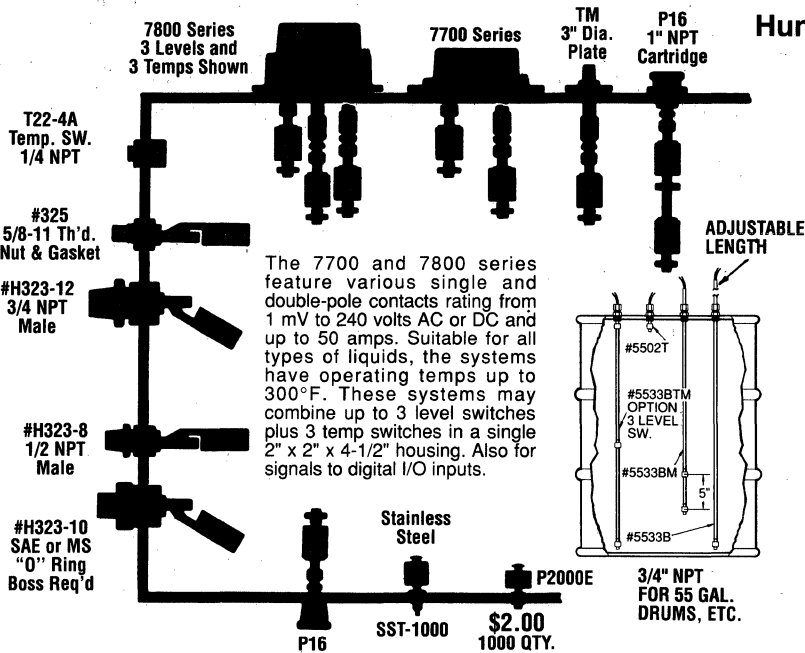
Manufacturer	Starting EEM Page No.	High Resolution	Narrow Beam	Other
Sunx Sensors	B•1797		√	Liquid level

# MANUFACTURERS OF TEMPERATURE AND LIQUID LEVEL SENSORS & SYSTEMS FOR ALL INDUSTRIES & BUDGETS

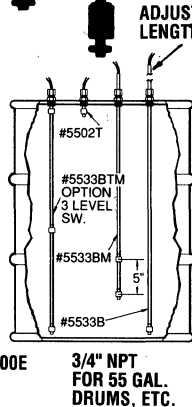
**Hundreds of Combinations From Stock—Up To Six Sensors In A Single Housing As Standard**

**Manufacturers & Designers of:**

- Combination Temperature and Level Switches and Controls
- Liquid Level Switches
- Temperature Sensors & Thermocouple Assembly
- Single, Double and Triple Assy's
- Standard or Custom and Military Options
- Used in Medical, Industrial, Marine, Mobile, Chemical & Food Processing, etc.
- Used to Monitor Electronic Sensors at Hi-Lo Points, Switch Repeatability ±.005



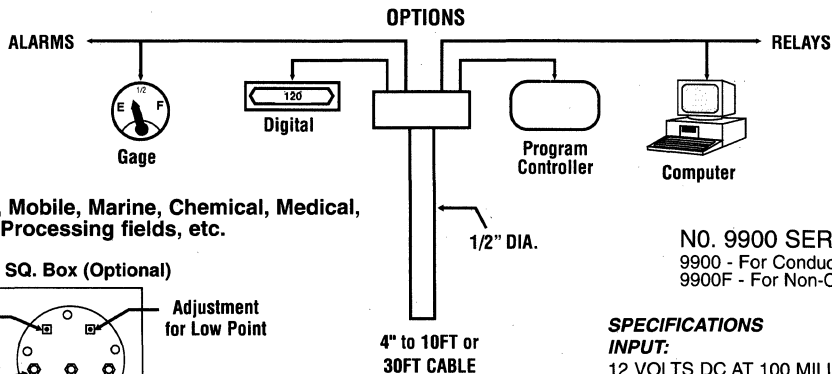
The 7700 and 7800 series feature various single and double-pole contacts rating from 1 mV to 240 volts AC or DC and up to 50 amps. Suitable for all types of liquids, the systems have operating temps up to 300°F. These systems may combine up to 3 level switches plus 3 temp switches in a single 2" x 2" x 4-1/2" housing. Also for signals to digital I/O inputs.



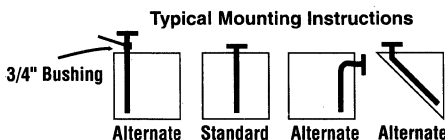
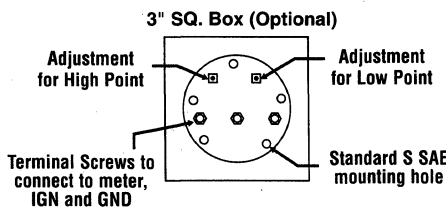
## 9900 SERIES - LIQUID LEVEL TRANSDUCER

**ELECTRONIC SENDING & CONTROL UNITS FOR FUEL, OIL, AND WATER... ETC.**  
**RUGGED - RELIABLE - LONG LIFE - RECOGNIZED**

The Electronic Sending Unit provides a continuous readout of the liquid level in your containers. The unit consists of a sensor probe and an amplifier. The amplifier components, which are located in the mounting plate assembly, are encapsulated in an epoxy resin compound to seal out moisture and other contaminants which could effect the operation.



**NOTE:** Used in Industrial, Mobile, Marine, Chemical, Medical, Military and Food Processing fields, etc.



**NO. 9900 SERIES**  
 9900 - For Conductive Fluids  
 9900F - For Non-Conductive Fluids

**SPECIFICATIONS**

**INPUT:**  
 12 VOLTS DC AT 100 MILLIAMPS ( 0.1 AMPS)  
 24 AND 32 VOLTS, ETC ( OPTIONAL)

**OUTPUT:**

1. 0 TO 6 VOLT DC ADJUSTABLE OUTPUT FOR DC METERS.
2. 4 TO 20 MADC ADJUSTABLE OUTPUT.
3. OHMS TO SUIT GAGE...ETC.
4. PLEASE, SPECIFY FOR CONNECTION TO COMPUTERS, RELAYS, DIGITAL, AND ANALOG...ETC.

**Manufacturers of Temp. & Liquid Level Sensors & Systems for all Industries & Budgets**

**APCO**

**"MAKING SMART MACHINES SMARTER"**

TEL: 203-384-2240 FAX: 203-384-9060

APPROVED PURIFICATION CORP. - 640 KNOWLTON ST., BRIDGEPORT, CT 06608

# ALEPH INTERNATIONAL

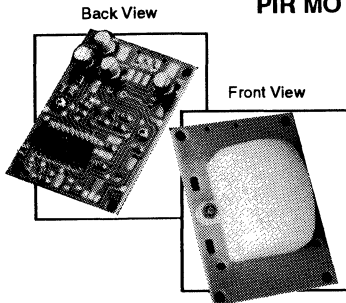
1026 Griswold Avenue • San Fernando, CA 91340  
Telephone: (800) 423-5622 • (818) 365-9856  
Fax: (818) 365-7274

## SPECIALTY SENSORS

### MINIATURE

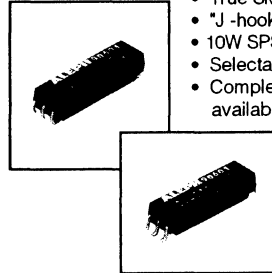
Technical information is subject to revision without notice. For critical applications, please call to verify specifications.

#### PIR MOTION SENSOR MODULE



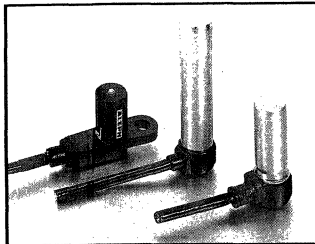
- Miniature/low cost design.
- 3VDC Supply Voltage.
- Low power consumption, can be battery powered.
- Various output modes available including one shot and retrigger
- Optional high current (1 amp. max) open collector output.
- Long range and wide angle models available.
- For point of sale displays, HVAC and light control

#### SMT PROXIMITY SENSORS



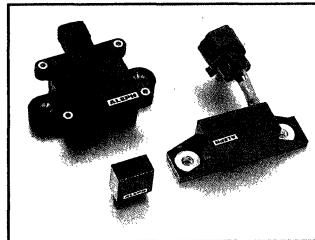
- True SMT technology.
- "J-hooks" or "gull wing" terminals.
- 10W SPST, 3W SPDT contacts.
- Selectable sensitivity.
- Complementary magnet selection available.
- Ideal for applications requiring reliable SMT reed switches.
- Designed for wireless equipment, cellular "flip" phones and laptop computers.

#### SPEED SENSOR (REV SENSOR)

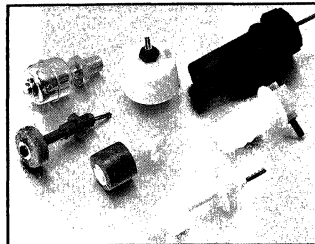


This electromagnetic induction-type rev sensor detects the change in magnetic flux caused by the revolution of a rotor mounted on the vehicle shaft. The signal pulse is transmitted to the control unit and used to control the ABS and active suspension.

#### G SENSOR



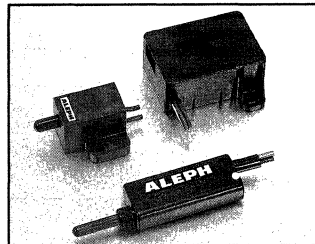
The G sensor detects abrupt deceleration. When a certain level is exceeded it activates the antilock braking control system which is coupled to the speed system. There are two versions of the G sensor: the mercury switch type and a capacitive type which detects the change of G force in relation to the change of capacitance.



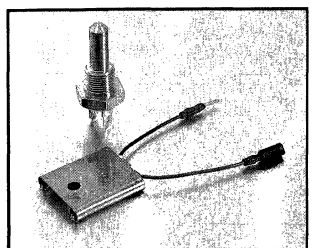
#### FLUID LEVEL DETECTION

*Level Sensors*  
These sensors warn if the liquid levels in the brake master cylinder, cooling system and wash/wipe reservoir fall. Also custom built hygienic models for medical and food processing industries.

#### OPEN/CLOSED DOOR PROTECTION



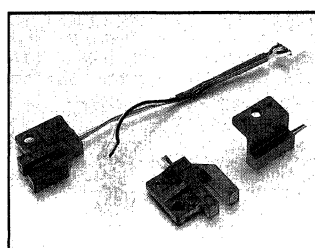
*Proximity Sensors*  
A reed switch-type proximity sensor detects whether the door is open or closed and can be linked to an alarm system or internal lighting for security and convenience. Contact and non-contact sensing models available.



#### TEMPERATURE DETECTION

*Thermal Reed Switches*  
Abnormal radiator water temperature and 4WD transmission system temperature can be detected by thermal reed switches, which are a combination of a normal reed switch in a heat-

sensitive ferrite casing. These devices can be manufactured to switch at specific temperatures.



#### OPTOSENSORS

Actuator, interrupter and reflection type photosensors offer the advantages of fast response, ease of use, competitive price and compact size. Used for sensing of paper movement, timing position, etc., in copiers, printers and other equipment. Also for coin, metal, paper detection and bar code applications.

Aleph International is wholly owned subsidiary of Nippon Aleph Corporation, headquartered in Yokohama, Japan. Having led the field with advanced technology and manufacturing techniques for more than 20 years, Aleph is the first choice of OEM manufacturers worldwide for:

- Magnetic Proximity (reed switch) Sensors
- Optoelectronic Sensors (interrupter and reflective mode)
- Reed Relays Including Special Purpose
- Reed Switches Including Mercury Type
- PIR Motion Sensors
- Security/Access Control Devices
- Hall-effect Sensors
- MagnetoResistive Sensors
- Inductive Sensors
- Deceleration/Crash (mercury tilt switch) Sensors
- Thermal (reed switch) Sensors
- Specialty Computer Peripherals
- Specialty Automotive Sensors
- Opto Push Switches
- Medical Equipment Sensors

In addition to our standard catalog products, we can custom engineer and manufacture sensors designed to meet your exact specifications and performance requirements. We offer state of the art, fully automated, low cost manufacturing facilities in China, Hong-Kong, Japan & U.K. Please call or write to receive comprehensive engineering catalogs on any or all Aleph products.



**Free evaluation samples and design assistance to qualified OEM Designers**

For specifications & information on additional Aleph Products, see our catalog pages in EEM Sections 3700 (Electro-Optical Equipment); 4500 (Relays); 5100 (Switches).

# Altech Corp.

35 Royal Road • Flemington, NJ 08822-6000  
 Phone (908) 806-9400 • Fax (908) 806-9490 • www.altechcorp.com

## INDUCTIVE PROXIMITY SENSORS

Inductive Proximity Sensors are used to detect metal objects in many applications including automotive, automation systems, machine tools, conveyor systems, metal working, the knitting industry, etc. Altech offers a broad line of sensor products in four packaging styles; cylindrical, limit style, block and ring. Sensors are available with a wide variety of quick-disconnect connectors or 2 meter (6 ft., 6 in.) cables. Other cable lengths are available. Inductive Proximity Sensors are available in AC, DC and AC/DC, 2 wire and 3 wire systems, flush and non-flush mount, PNP and NPN versions, Normally Open (NO) and Normally Closed (NC) configurations. Most sensors listed feature IP 67 (NEMA 1, 2, 3, 4, 5, 6, 12, 13) protection, total circuit protection (short circuit, overload, reverse polarity and wire break) and temperature range of -20 to 70°C (-4 to 158°F). Additional products not shown include weld immune, extended temperature range, NAMUR and mini sensors (4.0, 5.0 and 6.5 mm (.16, .20 and .26 in.). All sensors are manufactured in a certified ISO 9001 facility and all carry the CE mark (European Directive 93/68/EEC).

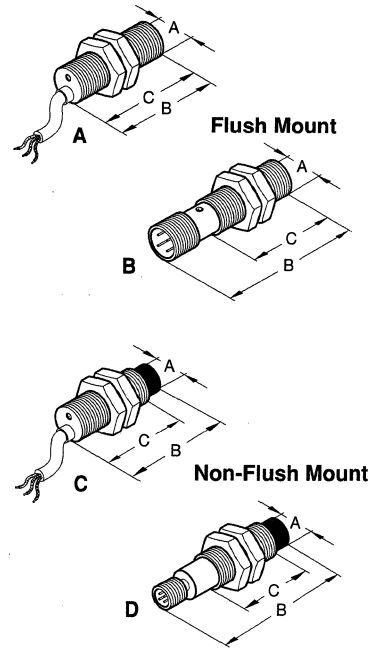
### DC Cylindrical Proximity Sensors

- Brass, Nickel Plated (BN) Housing
- LED (1 for L and Standard, 2 for GL)
- Normally Open (NO) Configuration
- 2 Meter (6 ft., 6 in.) PVC Polyvinylchloride Cable or Quick-Disconnect Connectors
- Total Circuit Protection (Short Circuit, Overload, Reverse Polarity and Wire Break)
- 3 Wire Sensors

### L-Series (Most Economical Series)

10-30V DC, 200mA (8mm (.31 in.)); 18-30V DC, 120mA (12mm (.47 in.), 18mm (.71 in.) and 30mm (1.18 in.)), IP 67 (NEMA 1, 2, 3, 4, 5, 6, 12, 13) Protection, 1 LED

Type	Dia. (A) mm (in.)	Sensing Dist. mm (in.)	Body Length (B) mm (in.)	Thread Length (C) mm (in.)	Mount	DC Type	Drawing	Connection Type*
9981-2000	8.0 (.31)	1.5 (.06)	35.0 (1.38)	35.0 (1.38)	Flush	PNP	A	2M PVC Cable
9981-2064	8.0 (.31)	1.5 (.06)	50.0 (1.97)	24.0 (.94)	Flush	PNP	B	64 Connector
9981-2100	8.0 (.31)	1.5 (.06)	35.0 (1.38)	35.0 (1.38)	Flush	NPN	A	2M PVC Cable
9981-2164	8.0 (.31)	1.5 (.06)	50.0 (1.97)	24.0 (.94)	Flush	NPN	B	64 Connector
9981-2200	8.0 (.31)	2.0 (.08)	35.0 (1.38)	35.0 (1.38)	Non-Flush	PNP	C	2M PVC Cable
9981-2264	8.0 (.31)	2.0 (.08)	50.0 (1.97)	24.0 (.94)	Non-Flush	PNP	D	64 Connector
9981-2300	8.0 (.31)	2.0 (.08)	35.0 (1.38)	35.0 (1.38)	Non-Flush	NPN	C	2M PVC Cable
9981-2364	8.0 (.31)	2.0 (.08)	50.0 (1.97)	24.0 (.94)	Non-Flush	NPN	D	64 Connector
9982-2000	12.0 (.47)	2.0 (.08)	35.0 (1.38)	35.0 (1.38)	Flush	PNP	A	2M PVC Cable
9982-2064	12.0 (.47)	2.0 (.08)	50.0 (1.97)	30.0 (1.18)	Flush	PNP	B	64 Connector
9982-2065	12.0 (.47)	2.0 (.08)	50.0 (1.97)	30.0 (1.18)	Flush	PNP	B	65 Connector
9982-2100	12.0 (.47)	2.0 (.08)	35.0 (1.38)	35.0 (1.38)	Flush	NPN	A	2M PVC Cable
9982-2164	12.0 (.47)	2.0 (.08)	50.0 (1.97)	30.0 (1.18)	Flush	NPN	B	64 Connector
9982-2165	12.0 (.47)	2.0 (.08)	50.0 (1.97)	30.0 (1.18)	Flush	NPN	B	65 Connector
9982-2200	12.0 (.47)	4.0 (.16)	35.0 (1.38)	29.0 (1.14)	Non-Flush	PNP	C	2M PVC Cable
9982-2264	12.0 (.47)	4.0 (.16)	50.0 (1.97)	24.0 (.94)	Non-Flush	PNP	D	64 Connector
9982-2265	12.0 (.47)	4.0 (.16)	50.0 (1.97)	24.0 (.94)	Non-Flush	PNP	D	65 Connector
9982-2300	12.0 (.47)	4.0 (.16)	35.0 (1.38)	29.0 (1.14)	Non-Flush	NPN	C	2M PVC Cable
9982-2364	12.0 (.47)	4.0 (.16)	50.0 (1.97)	24.0 (.94)	Non-Flush	NPN	D	64 Connector
9982-2365	12.0 (.47)	4.0 (.16)	50.0 (1.97)	24.0 (.94)	Non-Flush	NPN	D	65 Connector
9984-2000	18.0 (.71)	5.0 (.20)	35.0 (1.38)	35.0 (1.38)	Flush	PNP	A	2M PVC Cable
9984-2065	18.0 (.71)	5.0 (.20)	50.0 (1.97)	30.0 (1.18)	Flush	PNP	B	65 Connector
9984-2100	18.0 (.71)	5.0 (.20)	35.0 (1.38)	35.0 (1.38)	Flush	NPN	A	2M PVC Cable
9984-2165	18.0 (.71)	5.0 (.20)	50.0 (1.97)	30.0 (1.18)	Flush	NPN	B	65 Connector
9984-2200	18.0 (.71)	8.0 (.31)	35.0 (1.38)	27.0 (1.06)	Non-Flush	PNP	C	2M PVC Cable
9984-2265	18.0 (.71)	8.0 (.31)	50.0 (1.97)	30.0 (1.18)	Non-Flush	PNP	D	65 Connector
9984-2300	18.0 (.71)	8.0 (.31)	35.0 (1.38)	27.0 (1.06)	Non-Flush	NPN	C	2M PVC Cable
9984-2365	18.0 (.71)	8.0 (.31)	50.0 (1.97)	30.0 (1.18)	Non-Flush	NPN	D	65 Connector
9986-2000	30.0 (1.18)	10.0 (.39)	35.0 (1.38)	35.0 (1.38)	Flush	PNP	A	2M PVC Cable
9986-2065	30.0 (1.18)	10.0 (.39)	50.0 (1.97)	30.0 (1.18)	Flush	PNP	B	65 Connector
9986-2100	30.0 (1.18)	10.0 (.39)	35.0 (1.38)	35.0 (1.38)	Flush	NPN	A	2M PVC Cable
9986-2165	30.0 (1.18)	10.0 (.39)	50.0 (1.97)	30.0 (1.18)	Flush	NPN	B	65 Connector
9986-2200	30.0 (1.18)	15.0 (.59)	35.0 (1.38)	23.0 (.91)	Non-Flush	PNP	C	2M PVC Cable
9986-2265	30.0 (1.18)	15.0 (.59)	50.0 (1.97)	18.0 (.71)	Non-Flush	PNP	D	65 Connector
9986-2300	30.0 (1.18)	15.0 (.59)	35.0 (1.38)	23.0 (.91)	Non-Flush	NPN	C	2M PVC Cable
9986-2365	30.0 (1.18)	15.0 (.59)	50.0 (1.97)	18.0 (.71)	Non-Flush	NPN	D	65 Connector

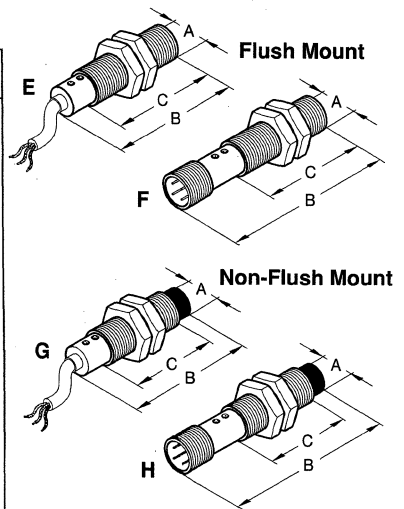


\*The 64 Connector is a 3 Pin, 8mm (.31 in.) Pico Style Connector. The 65 Connector is a 4 Pin, 12mm (.47 in.) Micro Style Connector.

### GL-Series (Extended Current and Voltage Range)

10-60V DC, 400mA, IP 67 (NEMA 1, 2, 3, 4, 5, 6, 12, 13) Protection, 2 LED (1 for Power, 1 for Output Energized)

Type	Dia. (A) mm (in.)	Sensing Dist. mm (in.)	Body Length (B) mm (in.)	Thread Length (C) mm (in.)	Mount	DC Type	Drawing	Connection Type*
9982-4000	12.0 (.47)	2.0 (.08)	45.0 (1.77)	35.0 (1.38)	Flush	PNP	E	2M PVC Cable
9982-4065	12.0 (.47)	2.0 (.08)	60.0 (2.36)	35.0 (1.38)	Flush	PNP	F	65 Connector
9982-4100	12.0 (.47)	2.0 (.08)	45.0 (1.77)	35.0 (1.38)	Flush	NPN	E	2M PVC Cable
9982-4165	12.0 (.47)	2.0 (.08)	60.0 (2.36)	35.0 (1.38)	Flush	NPN	F	65 Connector
9982-4200	12.0 (.47)	4.0 (.16)	45.0 (1.77)	29.0 (1.14)	Non-Flush	PNP	G	2M PVC Cable
9982-4265	12.0 (.47)	4.0 (.16)	60.0 (2.36)	29.0 (1.14)	Non-Flush	PNP	H	65 Connector
9982-4300	12.0 (.47)	4.0 (.16)	45.0 (1.77)	29.0 (1.14)	Non-Flush	NPN	G	2M PVC Cable
9982-4365	12.0 (.47)	4.0 (.16)	60.0 (2.36)	29.0 (1.14)	Non-Flush	NPN	H	65 Connector
9984-4000	18.0 (.71)	5.0 (.20)	45.0 (1.77)	35.0 (1.38)	Flush	PNP	E	2M PVC Cable
9984-4065	18.0 (.71)	5.0 (.20)	60.0 (2.36)	35.0 (1.38)	Flush	PNP	F	65 Connector
9984-4100	18.0 (.71)	5.0 (.20)	45.0 (1.77)	35.0 (1.38)	Flush	NPN	E	2M PVC Cable
9984-4165	18.0 (.71)	5.0 (.20)	60.0 (2.36)	35.0 (1.38)	Flush	NPN	F	65 Connector
9984-4200	18.0 (.71)	8.0 (.31)	45.0 (1.77)	27.0 (1.06)	Non-Flush	PNP	G	2M PVC Cable
9984-4265	18.0 (.71)	8.0 (.31)	60.0 (2.36)	27.0 (1.06)	Non-Flush	PNP	H	65 Connector
9984-4300	18.0 (.71)	8.0 (.31)	45.0 (1.77)	27.0 (1.06)	Non-Flush	NPN	G	2M PVC Cable
9984-4365	18.0 (.71)	8.0 (.31)	60.0 (2.36)	27.0 (1.06)	Non-Flush	NPN	H	65 Connector
9986-4000	30.0 (1.18)	10.0 (.39)	45.0 (1.77)	35.0 (1.38)	Flush	PNP	E	2M PVC Cable
9986-4065	30.0 (1.18)	10.0 (.39)	60.0 (2.36)	35.0 (1.38)	Flush	PNP	F	65 Connector
9986-4100	30.0 (1.18)	10.0 (.39)	45.0 (1.77)	35.0 (1.38)	Flush	NPN	E	2M PVC Cable
9986-4165	30.0 (1.18)	10.0 (.39)	60.0 (2.36)	35.0 (1.38)	Flush	NPN	F	65 Connector
9986-4200	30.0 (1.18)	15.0 (.59)	45.0 (1.77)	23.0 (.91)	Non-Flush	PNP	G	2M PVC Cable
9986-4265	30.0 (1.18)	15.0 (.59)	60.0 (2.36)	23.0 (.91)	Non-Flush	PNP	H	65 Connector
9986-4300	30.0 (1.18)	15.0 (.59)	45.0 (1.77)	23.0 (.91)	Non-Flush	NPN	G	2M PVC Cable
9986-4365	30.0 (1.18)	15.0 (.59)	60.0 (1.77)	23.0 (.91)	Non-Flush	NPN	H	65 Connector



\*The 65 Connector is a 4 Pin, 12mm (.47 in.) Micro Style Connector.

We have only shown a small sampling of our inductive proximity sensor line here. Please request our full line catalog.

SEE OUR ENCLOSURES IN SECTION C-1400 / SEE OUR CIRCUIT BREAKERS IN SECTION B-4300

# Altech Corp.

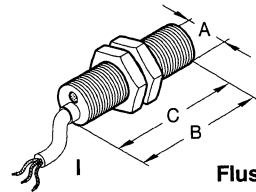
35 Royal Road • Flemington, NJ 08822-6000

Phone (908) 806-9400 • Fax (908) 806-9490 • www.altechcorp.com

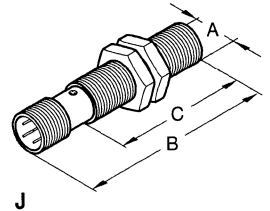
## Standard-Series

10-30V, 200mA, IP 67 (NEMA 1, 2, 3, 4, 5, 6, 12, 13) Protection, 1 LED

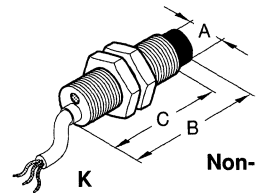
Type	Dia. (A) mm (in.)	Sensing Dist. mm (in.)	Body Length (B) mm (in.)	Thread Length (C) mm (in.)	Mount	DC Type	Drawing	Connection Type*
9961-0200	8.0 (.31)	1.5 (.06)	43.0 (1.69)	40.0 (1.57)	Flush	PNP	I	2M PVC Cable
9961-0263	8.0 (.31)	1.5 (.06)	50.0 (1.97)	28.0 (1.10)	Flush	PNP	J	63 Connector
9961-0264	8.0 (.31)	1.5 (.06)	50.0 (1.97)	34.0 (1.34)	Flush	PNP	J	64 Connector
9961-0265	8.0 (.31)	1.5 (.06)	50.0 (1.97)	28.0 (1.10)	Flush	PNP	J	65 Connector
9961-0300	8.0 (.31)	1.5 (.06)	43.0 (1.69)	40.0 (1.57)	Flush	NPN	I	2M PVC Cable
9961-0363	8.0 (.31)	1.5 (.06)	50.0 (1.97)	28.0 (1.10)	Flush	NPN	J	63 Connector
9961-0364	8.0 (.31)	1.5 (.06)	50.0 (1.97)	34.0 (1.34)	Flush	NPN	J	64 Connector
9961-0365	8.0 (.31)	1.5 (.06)	50.0 (1.97)	28.0 (1.10)	Flush	NPN	J	65 Connector
9961-0400	8.0 (.31)	2.0 (.08)	43.0 (1.69)	35.0 (1.38)	Non-Flush	PNP	K	2M PVC Cable
9961-0463	8.0 (.31)	2.0 (.08)	50.0 (1.97)	23.0 (.91)	Non-Flush	PNP	L	63 Connector
9961-0464	8.0 (.31)	2.0 (.08)	50.0 (1.97)	29.0 (1.14)	Non-Flush	PNP	L	64 Connector
9961-0465	8.0 (.31)	2.0 (.08)	50.0 (1.97)	23.0 (.91)	Non-Flush	PNP	L	65 Connector
9961-0500	8.0 (.31)	2.0 (.08)	43.0 (1.69)	35.0 (1.38)	Non-Flush	NPN	K	2M PVC Cable
9961-0563	8.0 (.31)	2.0 (.08)	50.0 (1.97)	23.0 (.91)	Non-Flush	NPN	L	63 Connector
9961-0564	8.0 (.31)	2.0 (.08)	50.0 (1.97)	29.0 (1.14)	Non-Flush	NPN	L	64 Connector
9961-0565	8.0 (.31)	2.0 (.08)	50.0 (1.97)	23.0 (.91)	Non-Flush	NPN	L	65 Connector
9962-4000	12.0 (.47)	2.0 (.08)	40.0 (1.57)	40.0 (1.57)	Flush	PNP	I	2M PVC Cable
9962-4063	12.0 (.47)	2.0 (.08)	60.0 (2.36)	40.0 (1.57)	Flush	PNP	J	63 Connector
9962-4064	12.0 (.47)	2.0 (.08)	60.0 (2.36)	40.0 (1.57)	Flush	PNP	J	64 Connector
9962-4065	12.0 (.47)	2.0 (.08)	60.0 (2.36)	40.0 (1.57)	Flush	PNP	J	65 Connector
9962-4100	12.0 (.47)	2.0 (.08)	40.0 (1.57)	40.0 (1.57)	Flush	NPN	I	2M PVC Cable
9962-4163	12.0 (.47)	2.0 (.08)	60.0 (2.36)	40.0 (1.57)	Flush	NPN	J	63 Connector
9962-4164	12.0 (.47)	2.0 (.08)	60.0 (2.36)	40.0 (1.57)	Flush	NPN	J	64 Connector
9962-4165	12.0 (.47)	2.0 (.08)	60.0 (2.36)	40.0 (1.57)	Flush	NPN	J	65 Connector
9962-4200	12.0 (.47)	4.0 (.16)	40.0 (1.57)	34.0 (1.34)	Non-Flush	PNP	K	2M PVC Cable
9962-4263	12.0 (.47)	4.0 (.16)	60.0 (2.36)	34.0 (1.34)	Non-Flush	PNP	L	63 Connector
9962-4264	12.0 (.47)	4.0 (.16)	60.0 (2.36)	34.0 (1.34)	Non-Flush	PNP	L	64 Connector
9962-4265	12.0 (.47)	4.0 (.16)	60.0 (2.36)	34.0 (1.34)	Non-Flush	PNP	L	65 Connector
9962-4300	12.0 (.47)	4.0 (.16)	40.0 (1.57)	34.0 (1.34)	Non-Flush	NPN	K	2M PVC Cable
9962-4363	12.0 (.47)	4.0 (.16)	60.0 (2.36)	34.0 (1.34)	Non-Flush	NPN	L	63 Connector
9962-4364	12.0 (.47)	4.0 (.16)	60.0 (2.36)	34.0 (1.34)	Non-Flush	NPN	L	64 Connector
9962-4365	12.0 (.47)	4.0 (.16)	60.0 (2.36)	34.0 (1.34)	Non-Flush	NPN	L	65 Connector
9964-4000	18.0 (.71)	5.0 (.20)	40.0 (1.57)	40.0 (1.57)	Flush	PNP	I	2M PVC Cable
9964-4063	18.0 (.71)	5.0 (.20)	60.0 (2.36)	40.0 (1.57)	Flush	PNP	J	63 Connector
9964-4065	18.0 (.71)	5.0 (.20)	60.0 (2.36)	40.0 (1.57)	Flush	PNP	J	65 Connector
9964-4100	18.0 (.71)	5.0 (.20)	40.0 (1.57)	40.0 (1.57)	Flush	NPN	I	2M PVC Cable
9964-4163	18.0 (.71)	5.0 (.20)	60.0 (2.36)	40.0 (1.57)	Flush	NPN	J	63 Connector
9964-4165	18.0 (.71)	5.0 (.20)	60.0 (2.36)	40.0 (1.57)	Flush	NPN	J	65 Connector
9964-4200	18.0 (.71)	8.0 (.31)	40.0 (1.57)	32.0 (1.26)	Non-Flush	PNP	K	2M PVC Cable
9964-4263	18.0 (.71)	8.0 (.31)	60.0 (2.36)	32.0 (1.26)	Non-Flush	PNP	L	63 Connector
9964-4265	18.0 (.71)	8.0 (.31)	60.0 (2.36)	32.0 (1.26)	Non-Flush	PNP	L	65 Connector
9964-4300	18.0 (.71)	8.0 (.31)	40.0 (1.57)	32.0 (1.26)	Non-Flush	NPN	K	2M PVC Cable
9964-4363	18.0 (.71)	8.0 (.31)	60.0 (1.57)	32.0 (1.26)	Non-Flush	NPN	L	63 Connector
9964-4365	18.0 (.71)	8.0 (.31)	60.0 (1.57)	32.0 (1.26)	Non-Flush	NPN	L	65 Connector
9966-4000	30.0 (1.18)	10.0 (.39)	40.0 (1.57)	40.0 (1.57)	Flush	PNP	I	2M PVC Cable
9966-4063	30.0 (1.18)	10.0 (.39)	60.0 (2.36)	40.0 (1.57)	Flush	PNP	J	63 Connector
9966-4065	30.0 (1.18)	10.0 (.39)	60.0 (2.36)	40.0 (1.57)	Flush	PNP	J	65 Connector
9966-4100	30.0 (1.18)	10.0 (.39)	40.0 (1.57)	40.0 (1.57)	Flush	NPN	I	2M PVC Cable
9966-4163	30.0 (1.18)	10.0 (.39)	60.0 (2.36)	40.0 (1.57)	Flush	NPN	J	63 Connector
9966-4165	30.0 (1.18)	10.0 (.39)	60.0 (2.36)	40.0 (1.57)	Flush	NPN	J	65 Connector
9966-4200	30.0 (1.18)	15.0 (.59)	40.0 (1.57)	28.0 (1.10)	Non-Flush	PNP	K	2M PVC Cable
9966-4263	30.0 (1.18)	15.0 (.59)	60.0 (2.36)	40.0 (1.57)	Non-Flush	PNP	L	63 Connector
9966-4265	30.0 (1.18)	15.0 (.59)	60.0 (2.36)	40.0 (1.57)	Non-Flush	PNP	L	64 Connector
9966-4300	30.0 (1.18)	15.0 (.59)	40.0 (1.57)	28.0 (1.10)	Non-Flush	NPN	K	2M PVC Cable
9966-4365	30.0 (1.18)	15.0 (.59)	60.0 (2.36)	40.0 (1.57)	Non-Flush	NPN	L	65 Connector



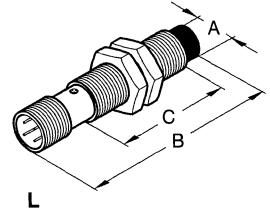
Flush Mount



J



Non-Flush Mount



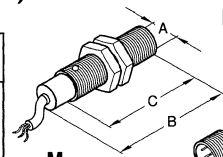
L

\*The 63 Connector is a 4 Pin, 12mm (.47 in.) clear Micro Style Connector with 360° LED viewing. The 64 Connector is a 3 Pin, 8mm (.31 in.) Pico Style Connector. The 65 Connector is a 4 Pin, 12mm (.47 in.) Micro Style Connector.

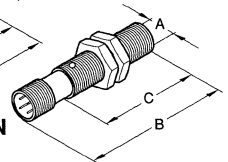
## Extended Range Plus (2 1/2 times the sensing distance of standard senses)

10-30V, 200mA, IP 67 (NEMA 1, 2, 3, 4, 5, 6, 12, 13) Protection, 1 LED

Type	Dia. (A) mm (in.)	Sensing Dist. mm (in.)	Body Length (B) mm (in.)	Thread Length (C) mm (in.)	Mount	DC Type	Drawing	Connection Type*
9981-5000	8.0 (.31)	3.0 (.12)	45.0 (1.77)	45.0 (1.77)	Flush	PNP	M	2M PVC Cable
9981-5200	8.0 (.31)	6.0 (.24)	49.0 (1.93)	45.0 (1.77)	Non-Flush	PNP	O	2M PVC Cable
9981-5064	8.0 (.31)	3.0 (.12)	60.0 (2.36)	46.0 (1.81)	Flush	PNP	N	64 Connector
9981-5264	8.0 (.31)	6.0 (.24)	64.0 (2.52)	46.0 (1.81)	Non-Flush	PNP	P	64 Connector
9981-5065	8.0 (.31)	3.0 (.12)	66.0 (2.60)	44.0 (1.73)	Flush	PNP	N	65 Connector
9981-5265	8.0 (.31)	6.0 (.24)	70.0 (2.76)	44.0 (1.73)	Non-Flush	PNP	P	65 Connector
9982-5000	12.0 (.47)	6.0 (.24)	50.0 (1.97)	40.0 (1.57)	Flush	PNP	M	2M PVC Cable
9982-5200	12.0 (.47)	10.0 (.39)	56.0 (2.20)	40.0 (1.57)	Non-Flush	PNP	O	2M PVC Cable
9982-5065	12.0 (.47)	6.0 (.24)	60.0 (2.36)	40.0 (1.57)	Flush	PNP	N	65 Connector
9982-5265	12.0 (.47)	10.0 (.39)	66.0 (2.60)	40.0 (1.57)	Non-Flush	PNP	P	65 Connector
9984-5000	18.0 (.71)	12.0 (.47)	50.0 (1.97)	40.0 (1.57)	Flush	PNP	M	2M PVC Cable
9984-5200	18.0 (.71)	20.0 (.79)	60.0 (2.36)	40.0 (1.57)	Non-Flush	PNP	O	2M PVC Cable
9984-5065	18.0 (.71)	12.0 (.47)	64.0 (2.52)	40.0 (1.57)	Flush	PNP	N	65 Connector
9984-5265	18.0 (.71)	20.0 (.79)	74.0 (2.91)	40.0 (1.57)	Non-Flush	PNP	P	65 Connector
9986-5000	30.0 (1.18)	22.0 (.87)	60.0 (2.36)	50.0 (1.97)	Flush	PNP	M	2M PVC Cable
9986-5200	30.0 (1.18)	40.0 (1.57)	70.0 (2.76)	50.0 (1.97)	Non-Flush	PNP	O	2M PVC Cable
9986-5065	30.0 (1.18)	22.0 (.87)	74.0 (2.91)	50.0 (1.97)	Flush	PNP	N	65 Connector
9986-5265	30.0 (1.18)	40.0 (1.57)	84.0 (3.31)	50.0 (1.97)	Non-Flush	PNP	P	65 Connector

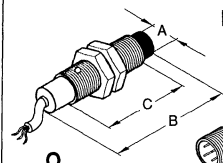


Flush Mount

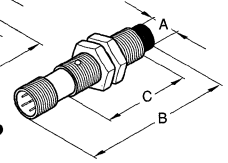


M

N



Non-Flush Mount



O

P

\*The 65 Connector is a 4 Pin, 12mm (.47 in.) Micro Style Connector. The 64 Connector is a 3 PIN, 8mm (.31 in.) Pico Style Connector.

We have only shown a small sampling of our inductive proximity sensor line here. Please request our full line catalog.

SEE OUR ENCLOSURES IN SECTION C-1400 / SEE OUR CIRCUIT BREAKERS IN SECTION B-4300

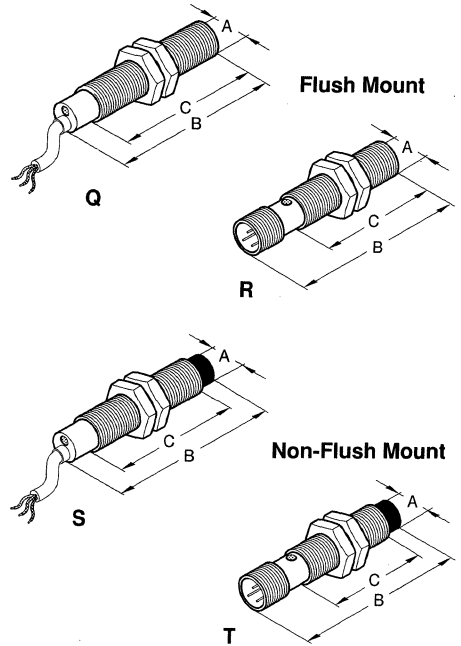
# Altech Corp.

35 Royal Road • Flemington, NJ 08822-6000  
 Phone (908) 806-9400 • Fax (908) 806-9490 • www.altechcorp.com

## AC CYLINDRICAL PROXIMITY SENSORS

- Brass, Nickel Plated (BN) Housing
- 1 LED
- Normally Open (NO) Configuration
- 2 Meter (6 ft., 6 in.) PVC Polyvinylchloride Cable or Quick-Disconnect Connectors
- 90-250V AC, 180mA, IP 67 (NEMA 1, 2, 3, 4, 5, 6, 12, 13) Protection

Type	Dia. (A) mm (in.)	Sensing Dist. mm (in.)	Body Length (B) mm (in.)	Thread Length (C) mm (in.)	Mount	Drawing	Connection Type*
9952-0500	12.0 (.47)	2.0 (.08)	60.0 (2.36)	50.0 (1.97)	Flush	Q	2M PVC Cable
9952-0562	12.0 (.47)	2.0 (.08)	90.0 (3.54)	55.0 (2.17)	Flush	R	62 Connector
9952-0566	12.0 (.47)	2.0 (.08)	60.0 (2.36)	40.0 (1.57)	Flush	R	66 Connector
9952-0567	12.0 (.47)	2.0 (.08)	60.0 (2.36)	40.0 (1.57)	Flush	R	67 Connector
9952-0568	12.0 (.47)	2.0 (.08)	60.0 (2.36)	40.0 (1.57)	Flush	R	68 Connector
9952-0400	12.0 (.47)	4.0 (.16)	60.0 (2.36)	44.0 (1.73)	Non-Flush	S	2M PVC Cable
9952-0462	12.0 (.47)	4.0 (.16)	90.0 (3.54)	49.0 (1.93)	Non-Flush	T	62 Connector
9952-0466	12.0 (.47)	4.0 (.16)	60.0 (2.36)	34.0 (1.34)	Non-Flush	T	66 Connector
9952-0467	12.0 (.47)	4.0 (.16)	60.0 (2.36)	34.0 (1.34)	Non-Flush	T	67 Connector
9952-0468	12.0 (.47)	4.0 (.16)	60.0 (2.36)	34.0 (1.34)	Non-Flush	T	68 Connector
9954-2200	18.0 (.71)	5.0 (.20)	60.0 (2.36)	50.0 (1.97)	Flush	Q	2M PVC Cable
9954-2262	18.0 (.71)	5.0 (.20)	90.0 (3.54)	55.0 (2.17)	Flush	R	62 Connector
9954-2266	18.0 (.71)	5.0 (.20)	60.0 (2.36)	40.0 (1.57)	Flush	R	66 Connector
9954-2267	18.0 (.71)	5.0 (.20)	60.0 (2.36)	40.0 (1.57)	Flush	R	67 Connector
9954-2268	18.0 (.71)	5.0 (.20)	60.0 (2.36)	40.0 (1.57)	Flush	R	68 Connector
9954-1900	18.0 (.71)	8.0 (.31)	60.0 (2.36)	42.0 (1.65)	Non-Flush	S	2M PVC Cable
9954-1962	18.0 (.71)	8.0 (.31)	90.0 (3.54)	47.0 (1.85)	Non-Flush	T	62 Connector
9954-1966	18.0 (.71)	8.0 (.31)	60.0 (2.36)	32.0 (1.26)	Non-Flush	T	66 Connector
9954-1967	18.0 (.71)	8.0 (.31)	60.0 (2.36)	32.0 (1.26)	Non-Flush	T	67 Connector
9954-1968	18.0 (.71)	8.0 (.31)	60.0 (2.36)	32.0 (1.26)	Non-Flush	T	68 Connector
9956-1500	30.0 (1.18)	10.0 (.39)	60.0 (2.36)	50.0 (1.97)	Flush	Q	2M PVC Cable
9956-1562	30.0 (1.18)	10.0 (.39)	90.0 (3.54)	55.0 (2.17)	Flush	R	62 Connector
9956-1566	30.0 (1.18)	10.0 (.39)	70.0 (2.76)	50.0 (1.97)	Flush	R	66 Connector
9956-1567	30.0 (1.18)	10.0 (.39)	70.0 (2.76)	50.0 (1.97)	Flush	R	67 Connector
9956-1568	30.0 (1.18)	10.0 (.39)	70.0 (2.76)	50.0 (1.97)	Flush	R	68 Connector
9956-1400	30.0 (1.18)	15.0 (.59)	60.0 (2.36)	38.0 (1.50)	Non-Flush	S	2M PVC Cable
9956-1462	30.0 (1.18)	15.0 (.59)	90.0 (3.54)	43.0 (1.69)	Non-Flush	T	62 Connector
9956-1466	30.0 (1.18)	15.0 (.59)	70.0 (2.76)	38.0 (1.50)	Non-Flush	T	66 Connector
9956-1467	30.0 (1.18)	15.0 (.59)	70.0 (2.76)	38.0 (1.50)	Non-Flush	T	67 Connector
9956-1468	30.0 (1.18)	15.0 (.59)	70.0 (2.76)	38.0 (1.50)	Non-Flush	T	68 Connector



\*The 62 Connector is a 3 Pin, 25.4mm (1.0 in.) Mini Style Connector. The 66 Connector is a 4 Pin, 12mm (.47 in.) Micro Style Connector. The 67 Connector is a 4 Pin, 12mm (.47 in.) Micro Style Connector with 360° LED Viewing. The 68 Connector is a 3 Pin 12mm (.47 in.) Micro Style Connector.

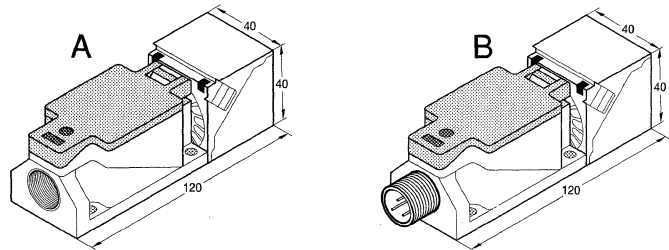
## LIMIT STYLE PROXIMITY SENSORS

- 17 Position Sensing Head
- Switch Programmable Normally Open (NO) or Normally Closed (NC)
- Threaded Opening: 1/2" - 14 NPT and Micro Style Connector
- Rigid Snap Together Construction - No Screws
- 3 LEDs for LS/GLDC Sensors, all other models have 2 LEDs
- Total Circuit Protection (Short Circuit, Overload, Reverse Polarity Wire Break) for DC and AC/DC versions only

### LS/LDC Limit Style Sensors

10-30V DC, 120mA, IP 67 (NEMA 1, 2, 3, 4, 5, 6, 12, 13) Protection

Type	Sensing Dist. mm (in.)	Mount	DC Type	Style
9883-2033	20.0 (.79)	Flush	PNP	A
9883-2233	40.0 (1.57)	Non-Flush	PNP	A
9883-2333	20.0 (.79)	Flush	NPN	A
9883-2533	40.0 (1.57)	Non-Flush	NPN	A
9883-2065	20.0 (.79)	Flush	PNP	B
9883-2265	40.0 (1.57)	Non-Flush	PNP	B
9883-2365	20.0 (.79)	Flush	NPN	B
9883-2565	40.0 (1.57)	Non-Flush	NPN	B



### LS/GLDC Limit Style Sensors

10-60V DC, 400mA, IP 67 (NEMA 1, 2, 3, 4, 5, 6, 12, 13) Protection

Type	Sensing Dist. mm (in.)	Mount	DC Type	Style
9883-3033	20.0 (.79)	Flush	PNP	A
9883-3233	40.0 (1.57)	Non-Flush	PNP	A
9883-3333	20.0 (.79)	Flush	NPN	A
9883-3533	40.0 (1.57)	Non-Flush	NPN	A
9883-3065	20.0 (.79)	Flush	PNP	B
9883-3265	40.0 (1.57)	Non-Flush	PNP	B
9883-3365	20.0 (.79)	Flush	NPN	B
9883-3565	40.0 (1.57)	Non-Flush	NPN	B

### AC/DC Limit Style Sensors

20-250V AC/DC, 500mA, IP 67 (NEMA 1, 2, 3, 4, 5, 6, 12, 13) Protection

Type	Sensing Dist. mm (in.)	Mount	Style
9873-0031	20.0 (.79)	Flush	A
9873-0231	40.0 (1.57)	Non-Flush	A

### LS/GLAC Limit Style Sensors

20-250V AC, 500mA, IP 67 (NEMA 1, 2, 3, 4, 5, 6, 12, 13) Protection

Type	Sensing Dist. mm (in.)	Mount	Style
9873-3031	20.0 (.79)	Flush	A
9873-3231	40.0 (1.57)	Non-Flush	A

We have only shown a small sampling of our inductive proximity sensor line here. Please request our full line catalog.  
**SEE OUR ENCLOSURES IN SECTION C•1400 / SEE OUR CIRCUIT BREAKERS IN SECTION B•4300**

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Phone (908) 806-9400 • Fax (908) 806-9490 • www.altechcorp.com

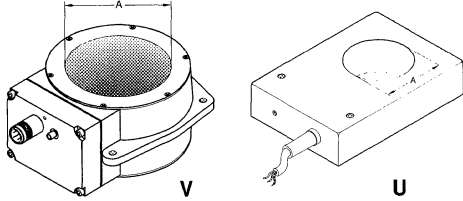
## DC RING PROXIMITY SENSORS

- Detect Small Precision Parts
- Use in Stamping/Punching Operations

### DC Ring, Plastic Body

Normally Open (NO), PNP,  
10-30V DC, IP 67 (NEMA 1, 2, 3, 4, 5, 6, 12, 13) Protection

Type	Ring Dia. (A) mm (in.)	Min. Target Detection Steel Ball dia. mm (in.)	Drawing	Output Current
9702-0400	12.0 (.47)	2.5 (.10)	U	400mA
9702-0500	20.0 (.79)	6.0 (.24)	U	200mA
9705-0500	43.0 (1.69)	9.0 (.35)	U	200mA



### DC Ring, Normal Sensitivity

Complementary NO/NC Outputs, Metal Body, 10-30V DC,  
IP 67 (NEMA 1, 2, 3, 4, 5, 6, 12, 13) Protection

Type	Ring Dia. (A) mm (in.)	Min. Target Detection Steel Ball dia. mm (in.)	Dwg	Output Current	DC type
9705-0259	50.0 (1.97)	3.0 (.12)	V	80mA	NPN
9708-0059	100.0 (3.94)	8.0 (.31)	V	80mA	NPN
9708-0159	100.0 (3.94)	6.0 (.24)	V	80mA	NPN
9706-0159	200.0 (7.87)	15.0 (.59)	V	80mA	NPN
9707-0159	300.0 (11.81)	30.0 (1.18)	V	80mA	NPN
9705-0659	50.0 (1.97)	3.0 (.12)	V	80mA	PNP
9708-0559	100.0 (3.94)	8.0 (.31)	V	80mA	PNP
9708-0659	100.0 (3.94)	6.0 (.24)	V	80mA	PNP
9706-0659	200.0 (7.87)	15.0 (.59)	V	80mA	PNP
9707-0659	300.0 (11.81)	30.0 (1.18)	V	80mA	PNP

Sensitivity is adjustable.  
Note: Can be Operated with 8300-0100 Amplifier/Power Supply.

## DC Ring, High Sensitivity

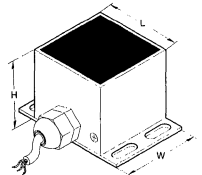
Complementary NO/NC Outputs, Metal Body, NPN,  
20-30V DC, IP 67 (NEMA 1, 2, 3, 4, 5, 6, 12, 13) Protection

Type	Ring Dia. (A) mm (in.)	Min. Target Detection Steel Ball dia. mm (in.)	Drawing	Output Current
9702-0259	20.0 (.79)	0.5 (.02)	V	50mA
9701-0259	50.0 (1.97)	1.0 (.04)	V	50mA
9701-0759	50.0 (1.97)	0.8 (.03)	V	50mA
9711-0059	70.0 (2.76)	1.1 (.04)	V	50mA
9700-0159	100.0 (3.94)	1.6 (.06)	V	50mA
9703-0159	200.0 (7.87)	3.0 (.12)	V	50mA
9704-0159	300.0 (11.81)	5.0 (.20)	V	50mA

Sensitivity is adjustable.  
Note: Must be Operated with 8102-0900 Amplifier/Power Supply.

## BLOCK PROXIMITY SENSORS

- For Large Sensing Distances up to 70mm (2.76 in.)
- Normally Open (NO) Configuration
- 2 Meter (6 ft., 6 in.) PVC Polyvinylchloride Cable Outputs
- DC, AC, and AC/DC Available
- Some Models Offer Adjustable Sensing Distance



IP 67 (NEMA 1, 2, 3, 4, 5, 6, 12, 13) Protection, 1 LED

Type	Size (LxWxH) mm (in.)	Sensing Dist mm (in.)	Operation Voltage	Max. Current	Mount	AC/DC Type
9963-0400	40x12x26 (1.57x.47x1.02)	2.0 (.08)	10-30V DC	400mA	Flush	DC-PNP
9863-2100	40x12x26 (1.57x.47x1.02)	2.0 (.08)	10-30V DC	400mA	Flush	DC-NPN
9863-2700	40x12x26 (1.57x.47x1.02)	4.0 (.16)	10-30V DC	200mA	Non-Flush	DC-PNP
9864-0200	53x22x9.5 (2.09x.87x.37)	6.0 (.24)	10-30V DC	400mA	Flush	DC-PNP
9863-4000	34x34x80 (1.34x1.34x3.15)	13.0 (.51)	10-30V DC	400mA	Flush	DC-PNP
9802-0900	50x50x47* (1.97x1.97x1.85)	40.0 (1.57)	10-30V DC	400mA	Flush	DC-PNP
9802-0100	50x50x47* (1.97x1.97x1.85)	40.0 (1.57)	10-30V DC	400mA	Flush	DC-NPN
9865-1100	80x80x40* (3.15x3.15x1.57)	40.0 (1.57)	10-30V DC	200mA	Flush	DC-PNP
9865-1000	80x80x40* (3.15x3.15x1.57)	50.0 (1.97)	10-30V DC	200mA	Non-Flush	DC-PNP
9809-0100	100x50x40* (3.94x1.97x1.57)	70.0 (2.76)	10-30V DC	400mA	Non-Flush	DC-PNP
9809-0300	100x50x40* (3.94x1.97x1.57)	70.0 (2.76)	10-30V DC	400mA	Non-Flush	DC-NPN
9853-2400	40x12x26 (1.57x.47x1.02)	2.0 (.08)	90-250V AC	180mA	Flush	AC
9853-3800	34x34x80 (1.34x1.34x3.15)	13.0 (.51)	20-280V AC	500mA	Non-Flush	AC
9803-3000	70x70x60 (2.76x2.76x2.36)	40.0 (1.57)	20-250V AC	500mA	Flush	AC
9855-1000	80x80x40 (3.15x3.15x1.57)	50.0 (1.97)	20-250V AC	500mA	Non-Flush	AC
9875-0000	80x80x40 (3.15x3.15x1.57)	50.0 (1.97)	20-250V AC/DC	400mA	Non-Flush	AC/DC

\*Adjustable Sensing Distance.

## ANALOG PROXIMITY SENSORS

- Detect Target Distance from the Sensing Head
- Provide an Analog Output Voltage
- Cylindrical and Limit Style Available
- Shielded Cable on Cylindrical Models

### DC Limit Style

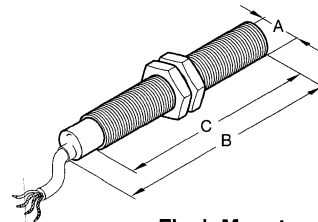
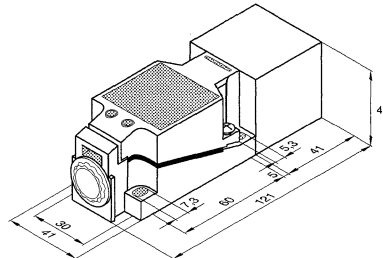
18-30V DC, Analog Output: 1-9V DC, 5mA Maximum Load Current,  
IP 67 (NEMA 1, 2, 3, 4, 5, 6, 12, 13) Protection

Type	Sensing Range mm (in.)	Mount
9814-1133	10.0 - 20.0 (.39 - .79)	Non-Flush

### DC Cylindrical Series

18-30V DC, Analog Output: 1-9V DC, 5mA Maximum Load Current,  
IP 67 (NEMA 1, 2, 3, 4, 5, 6, 12, 13) Protection

Type	Dia. (A) mm (in.)	Sensing Dist. mm (in.)	Body Length (B) mm (in.)	Thread Length (C) mm (in.)	Mount
9914-0800	12.0 (.47)	.5 - 2.5 (.02 - .01)	80.0 (3.15)	70.0 (2.76)	Flush
9914-0900	18.0 (.71)	1.0 - 4.0 (.04 - .16)	80.0 (3.15)	70.0 (2.76)	Flush
9914-1000	30.0 (1.18)	7.0 - 14.0 (.28 - .55)	80.0 (3.15)	58.0 (2.28)	Non-Flush



Flush Mount

## ACCESSORIES

### DC Cables with Connectors

2 Meter (6 ft., 6 in.) Length, PVC Polyvinylchloride  
Make last digit 5 for 5 meter length

Type	Connector Style	Description
8000-5030	62	Straight
8000-5110	63/65	Straight
8000-5120	63/65	90° (right angle)
8000-5150	63/65	90° - 2 LED for NPN
8000-5160	63/65	90° - 2 LED for PNP
8000-5220	64	Straight
8000-5230	64	90° - 2 LED for PNP
8000-5240	64	90° - 2 LED for NPN

### AC Cables with Connectors

2 Meter (6 ft., 6 in.) Length, PVC Polyvinylchloride  
Make last digit 5 for 5 meter length

Type	Connector Style	Description
8000-5040	62	Straight
8000-5060	66/67	90°
8000-5070	66/67	Straight
8000-5130	68	Straight
8000-5140	68	90°

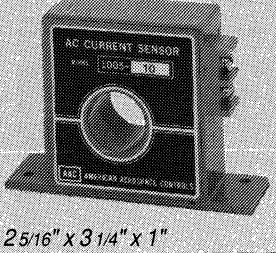
We have only shown a small sampling of our inductive proximity sensor line here. Please request our full line catalog.

SEE OUR ENCLOSURES IN SECTION C•1400 / SEE OUR CIRCUIT BREAKERS IN SECTION B•4300

**AAC****American Aerospace Controls Inc.**

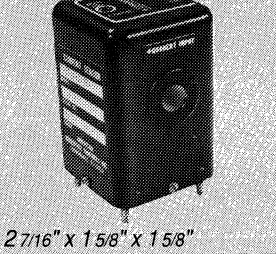
570 SMITH STREET, FARMINGDALE, NEW YORK 11735 □ PHONE: (516) 694-5100 □ FAX: (516) 694-6739

Fig: 1



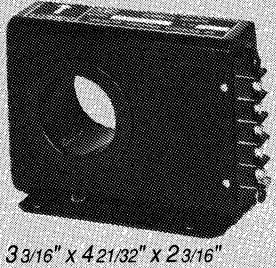
2 5/16" x 3 1/4" x 1"

Fig: 2



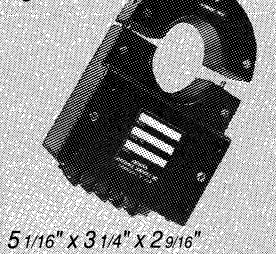
2 7/16" x 1 5/8" x 1 5/8"

Fig: 3



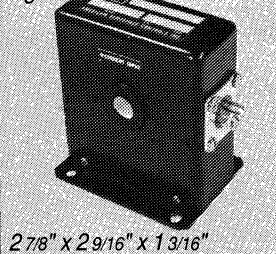
3 3/16" x 4 21/32" x 2 3/16"

Fig: 4



5 1/16" x 3 1/4" x 2 9/16"

Fig: 5



2 7/8" x 2 9/16" x 1 3/16"

**BI-DIRECTIONAL CURRENT TRANSDUCERS**

Series	Full Scale (FS) Input Current Ranges	FS Output	Accuracy	Response	Fig
S458	±5, 10, 20, 50, 100, 200, 500mA & ±1, 2, 5A	±5V	2% FS	40μs	-
905B	±50, 100, 200, 500mA & ±1, 2, 5A	±5V	1% FS	50ms	5
926	±5, 10, 15, 20, 25A	±5V	0.25% FS	5ms	5
S273	±25, 50, 100, 150, 200, 250, 300, 350A	±5V	0.5% FS	1μs	5
S449	±25, 49, 50, 60A DC to 100 KHz	±5V	0.5% FS	1μs	-
907A	±25, 50, 100, 150, 200, 250, 300A	±5V	2% FS	40μs	-
943	±100, 200, 300, 400, 500A	±5V	0.5% FS	1μs	3
947	±100, 200, 300, 400, 500, 600A	±5V	0.5% FS	1μs	10
944	±600, 800, 1000, 1500, 2000A	±5V	1% FS	2μs	3
948	±600, 800, 1000, 1500, 2000A	±5V	1% FS	2μs	10
909M4	±150, 250, 500, 750, 1000, 1500, 2000, 2500A	±5V	1% FS	200μs	4
9000	±150, 250, 500, 750, 1000, 1500, 2000, 2500A	±5V	1% FS	200μs	-

**DC CURRENT TRANSDUCERS**

Series	Full Scale (FS) Input Current Ranges	FS Output	Accuracy	Response	Fig
904B	0.1, 0.2, 0.5, 1, 2, 5mAdc In-line connection	+5Vdc	1% FS	50ms	5
903B	5, 10, 20, 50, 100, 200, 500mAdc & 1, 2, 5Adc	+5Vdc	1% FS	50ms	5
936	10, 20, 50, 100, 200, 250, 500mAdc & 1, 2, 5Adc	+5Vdc	1% FS	100ms	-
S218	100, 200, 500mAdc & 1, 2, 5Adc	+5Vdc	1% FS	50ms	3
913A	10, 20, 25, 30, 40, 50, 75, 100Adc	+5Vdc	1% FS	1ms	2
913B	10, 20, 25, 30, 40, 50, 75, 100Adc	+5Vdc	1% FS	1ms	5
950	10, 20, 30, 40, 50Adc	+5Vdc	0.5% FS	10ms	5
951	10, 15, 20, 30, 40, 50Adc Hi Rel	+5Vdc	0.5% FS	30ms	-
952	100, 200, 250, 300, 400, 500, 600, 750Adc	+5Vdc	0.5% FS	50μs	5
S465	150, 250, 500, 750, 1000, 1500, 2000, 2500Adc	4 - 20mA	1% FS	200μs	4
S338	150, 250, 500, 750, 1000, 1500, 2000, 2500Adc	4 - 20mA	1% FS	200μs	4
S444	200, 225, 250, 300, 500, 750, 1000, 1500, 2000, 2500Adc	+5Vdc	1% FS	200μs	4
S347	100, 150, 250, 500, 750, 1000, 1500, 2000, 2500, 5000Adc	+5Vdc	1% FS	200μs	4

**DC CURRENT LEVEL DETECTORS**

Series	Full Scale (FS) Input Current Ranges	FS Output	Accuracy	Response	Fig
901B	20, 50, 100, 200, 250, 500mAdc & 1, 2, 5Adc	5V & SW	1% FS	50ms	-
S204	100, 150mAdc & 2, 3, 5Adc 10Adc Overload	RELAY	4% FS	3ms	5
S58	200mAdc 10Adc Overload	S.S. SW.	20% FS	1ms	-
S201	1Adc 100Adc Overload	RELAY	±150mA	200ms	5

**FREQUENCY TRANSDUCERS**

Series	Full Scale (FS) Input Frequency Ranges	FS Output	Accuracy	Response	Fig
S343	360 to 440 Hz 102-127Vac or 200-250Vac	+5Vdc	±0.8Hz	250ms	-
S350L	100, 200, 300, 500, 1K, 2K, 3K, 5K, 10K & 20K Hz	+5Vdc	0.1% FS	3-300ms	-

In addition to AAC's standard products, application specific modifications and custom design transducers are available for industrial, laboratory, defense and space applications.



# CURRENT, VOLTAGE, POWER AND FREQUENCY TRANSDUCERS

## CALL 516-694-5100

### AC CURRENT TRANSDUCERS

Series	Full Scale (FS) Input Current Ranges	FS Output	Accuracy	Response	Fig
1002M1	0.25, 0.5, 1, 5, 10, 20, 25, 50, 100, 150, 200, 250Aac @400Hz	±5Vdc	0.5% FS	10ms	5
S402	0.25, 0.5, 1, 2, 5, 10, 20, 50, 100, 150, 200, 250Aac @60Hz	+5Vdc	0.5% FS	100ms	5
C	1, 2, 5, 10, 20Aac in-line connection	+1mAac	0.25% FS	400ms	6
CX	1, 2, 5, 10, 20Aac in-line connection	4 - 20mA	0.5% FS	400ms	6
S383 1055	2, 5, 10, 15, 20, 25, 30, 40, 50, 75, 100, 200, 250Aac @60Hz	4 - 20mA	0.5% FS	200ms	-
1004	2, 5, 10, 20, 50, 100, 150, 200, 250, 300Aac @ 400Hz	+5Vdc	0.5% FS	150ms	5
1003AM1	2, 5, 10, 15, 20, 25, 30, 50, 75, 100Aac @ 60Hz	+5Vdc	1% FS	150ms	-
1003AM2	10, 15, 25, 30, 50, 75, 100, 150, 200, 250, 300Aac @ 60Hz	+5Vdc	1% FS	150ms	5
1005	2, 5, 10, 20, 30, 50, 75, 100, 150, 200, 250, 300Aac @ 60Hz	+5Vdc	1% FS	80ms	1
1006	10, 25, 50, 100, 200, 400, 500, 600, 800, 1000Aac @ 60Hz	+5Vdc	0.5% FS	130ms	10
1006X	10, 25, 50, 100, 200, 400, 500, 600, 800, 1000Aac @ 60Hz	4 - 20mA	0.5% FS	130ms	10
S461 1001	100, 150, 250, 500, 750, 1000, 1500, 2000, 2500, 3000Aac	+5Vdc	1% FS	100µs	4

Fig. 6

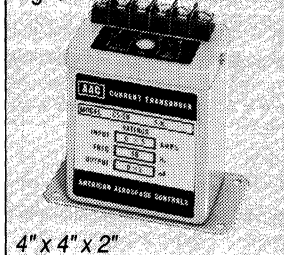


Fig. 7

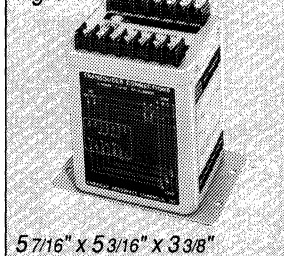


Fig. 8

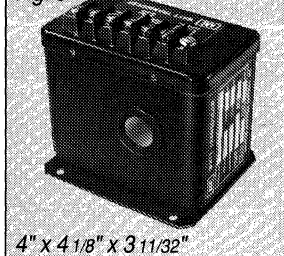


Fig. 9

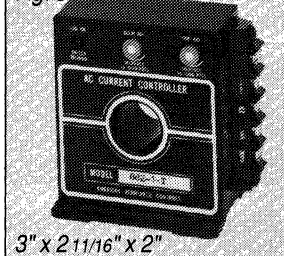
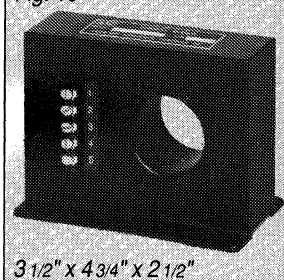


Fig. 10



### AC CURRENT LEVEL DETECTORS

Series	Full Scale (FS) Input Current Ranges	FS Output	Accuracy	Response	Fig
S212	500mAac 75Aac Overload	RELAY	±75mAac	200ms	5
882	1, 2, 5, 10, 15, 20, 50, 100, 150, 200, 250, 300Aac	RELAY	0.5% FS	500ms	9
870 871	1, 2, 5, 10, 15, 20, 50, 100, 150, 200, 250, 300Aac	RELAY	0.5% FS	500ms	8
880B	12, 50, 120, 250Aac	S.S. SW.	1% FS	200ms	9
881	12, 50, 120, 250Aac	RELAY	1% FS	200ms	9

### AC VOLTAGE TRANSDUCERS

Series	Full Scale (FS) Input Voltage Ranges	FS Output	Accuracy	Response	Fig
108	130, 150, 270, 500, 600Vac @ 47-420HZ (0 to FS)	+5Vdc	0.5% FS	300ms	-
108X	130, 150, 270, 500, 600Vac @ 57-63HZ (0 to FS)	4 - 20mA	0.5% FS	300ms	-
S190	130, 150, 270, 300, 600Vac @ 47-63HZ (0 to FS)	+10Vdc	1% FS	200ms	-
V	150, 300, 500Vac @ 47-1000HZ (0 to FS)	+1mAac	0.25% FS	400ms	6
VX	150, 300, 500Vac @ 47-1000HZ (0 to FS)	4 - 20mA	0.5% FS	400ms	6
101M3	90-150Vac @ 60HZ Suppressed Zero	+5Vdc	0.5% FS	17ms	-
102M3	90-175Vac, 105-130Vac or 175-225 Vac @ 400Hz	+5Vdc	0.5% FS	3ms	-
105	390-490Vac, 430-530Vac or 455-505 Vac @ 60Hz	+5Vdc	0.5% FS	17ms	-

### WATT & VAR TRANSDUCERS

Series	Full Scale (FS) Input Power Ranges	FS Output	Accuracy	Response	Fig
415A 416A	1-200KW 120, 200 or 440Vac	+5Vdc	2% FS	400ms	8
S217	2-80KW 220 & 440Vac	+5Vdc	2% FS	400ms	8
S73	0-100KW 0 to 150Vac or 0 to 300Vac	+5Vdc	2% FS	400ms	8
W or Q 106	0.5-2KW (1 element) 120, 220 or 440Vac	+1mAac	0.25% FS	400ms	7
W or Q 206	1-4KW (2 elements) 120, 220 or 440Vac	+1mAac	0.25% FS	400ms	7
W or Q 256	1-4KW (2 1/2 elements) 120, 220 or 440Vac	+1mAac	0.25% FS	400ms	7
W or Q 306	1-4KW (3 elements) 120, 220 or 440Vac	+1mAac	0.25% FS	400ms	7

Write, fax or call for a complete catalog. Application engineering is available to assist you.



# Standard Series of HALL EFFECT CURRENT SENSORS

Primary connectors may be located on opposite sides or same side anywhere on dashed circumference.

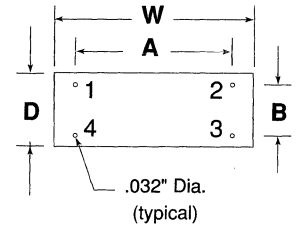
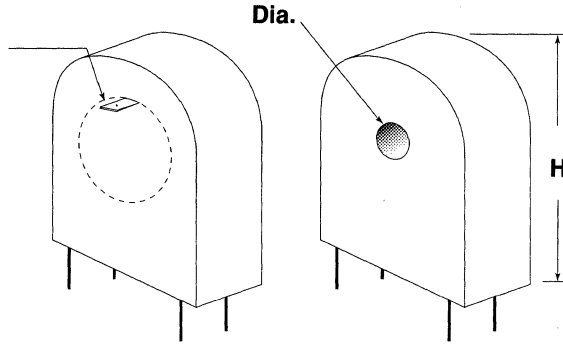
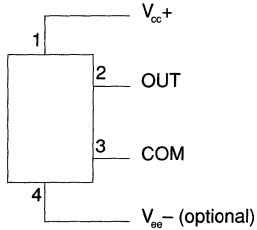


Figure 1

Figure 2

Bottom View

Part No.	Fig.	I <sub>p</sub>	V <sub>0</sub> @I <sub>p</sub>	I <sub>0</sub> Max.	V <sub>cc</sub>	H	W	D	Dia.	A	B
530H-A050	1	5	±4V*	10 mA	+5V	1.5	1.2	0.63	-	0.6	0.3
530H-A100	1	10	±4V*	10 mA	+5V	1.5	1.2	0.63	-	0.6	0.3
530H-A250	1	25	±4V*	10 mA	+5V	1.5	1.2	0.63	-	0.6	0.3
530H-A500	1	50	±4V*	10 mA	+5V	1.5	1.2	0.63	-	0.6	0.3
530H-A101	2	100	±4V*	10 mA	+5V	1.5	1.2	0.63	0.63	0.6	0.3
530H-A251	2	250	±4V*	10 mA	+5V	1.63	1.25	0.75	0.75	0.9	0.3
530H-A501	2	500	±4V*	10 mA	+5V	3.2	2.9	1	1.5	1.5	0.6
530H-A102	2	1000	±4V*	10 mA	+5V	3.5	3.2	1	1.7	1.5	0.6
530H-A252	2	2500	±4V*	10 mA	+5V	3.5	3.2	1	1.7	1.5	0.6
530H-B050	1	5	±4V	10 mA	±5V	1.5	1.2	0.63	-	0.6	0.3
530H-B100	1	10	±4V	10 mA	±5V	1.5	1.2	0.63	-	0.6	0.3
530H-B250	1	25	±4V	10 mA	±5V	1.5	1.2	0.63	-	0.6	0.3
530H-B500	1	50	±4V	10 mA	±5V	1.5	1.2	0.63	-	0.6	0.3
530H-B101	2	100	±4V	10 mA	±5V	1.5	1.2	0.63	0.63	0.6	0.3
530H-B251	2	250	±4V	10 mA	±5V	1.63	1.25	0.75	0.75	0.9	0.3
530H-B501	2	500	±4V	10 mA	±5V	3.2	2.9	1	1.5	1.5	0.6
530H-B102	2	1000	±4V	10 mA	±5V	3.5	3.2	1	1.7	1.5	0.6
530H-B252	2	2500	±4V	10 mA	±5V	3.5	3.2	1	1.7	1.5	0.6
530H-C050	1	5	±4V**	10 mA	±9-18V	1.5	1.2	0.63	-	0.6	0.3
530H-C100	1	10	±4V**	10 mA	±9-18V	1.5	1.2	0.63	-	0.6	0.3
530H-C250	1	25	±4V**	10 mA	±9-18V	1.5	1.2	0.63	-	0.6	0.3
530H-C500	1	50	±4V**	10 mA	±9-18V	1.5	1.2	0.63	-	0.6	0.3
530H-C101	2	100	±4V**	10 mA	±9-18V	1.5	1.2	0.63	0.63	0.6	0.3
530H-C251	2	250	±4V**	10 mA	±9-18V	1.63	1.25	0.75	0.75	0.9	0.3
530H-C501	2	500	±4V**	10 mA	±9-18V	3.2	2.9	1	1.5	1.5	0.6
530H-C102	2	1000	±4V**	10 mA	±9-18V	3.5	3.2	1	1.7	1.5	0.6
530H-C252	2	2500	±4V**	10 mA	±9-18V	3.5	3.2	1	1.7	1.5	0.6

\* Positive-only voltage supply is adequate for these sensors.

\*\* Other outputs and non-amplified versions are available. Please contact the factory.

PARAMETER	SYMBOL	SPECIFICATION
Output Voltage	V <sub>O</sub>	±1% @ I <sub>p</sub>
Linearity		±1% of V <sub>O</sub> /A, 1% of I <sub>p</sub> to 100% I <sub>p</sub>
Zero current offset	V <sub>OFF</sub>	±.03V
Zero thermal drift	T <sub>D</sub>	±2mV/°C Max.
Hysteresis		±40mV Max.
Dielectric strength		2kV @ 60Hz for 1 Min.
Operating Temp.		-10 to +85 °C
Storage Temp.		-50 to +150 °C
Cutoff Frequency	F <sub>C</sub>	-3dB >20kHz

**Abbreviations Used**

I <sub>p</sub>	Rated Current
V <sub>O</sub>	Output Voltage
I <sub>0</sub>	Output Current
V <sub>cc</sub>	Drive Voltage
V <sub>ee</sub>	Drive Voltage
H	Height
W	Width
D	Depth
Dia.	Diameter

- "Made 100% in the USA" with USA Materials
- Established in 1972
- Custom configurations available



# HALL EFFECT CURRENT SENSOR

## SPECIFICATIONS:

Supply Voltage: 4.5 to 16 VDC.  
 Supply Current: 20 mA  
 Output Current: 2 mA  
 Operating Temperature: -20 to +125 °C  
 Storage Temperature: -50 to +130 °C  
 Output Voltage @  $I_p=0$ : \*  $V_{cc}/2$   
 Output Voltage @  $I_p$ : \*  $V_{cc}/2 \pm V_{cc}/4$   
 Tolerance on Output Voltage:  $\pm 1\%$   
 Dielectric Withstanding Voltage: 4000 V 1min.  
 Frequency Response: DC to 100kHz.  
 Temp. Stability (25 to 100 °C):  $\pm 1.5\%$

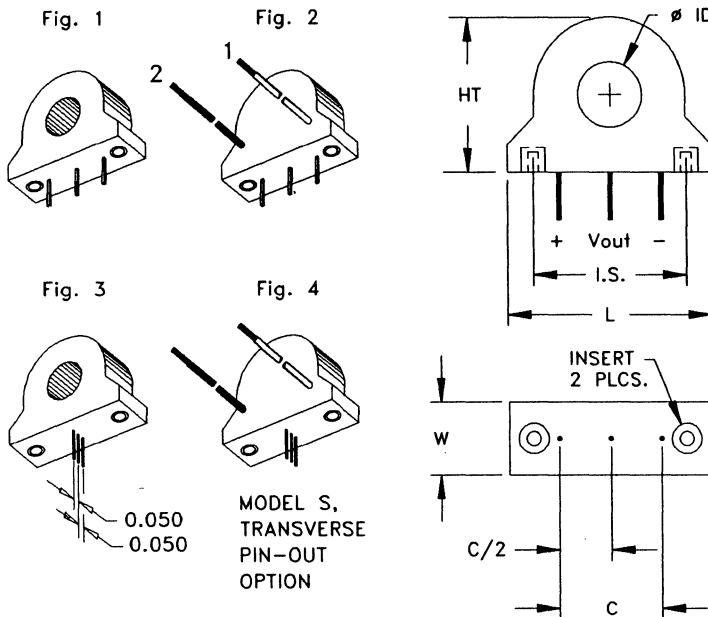
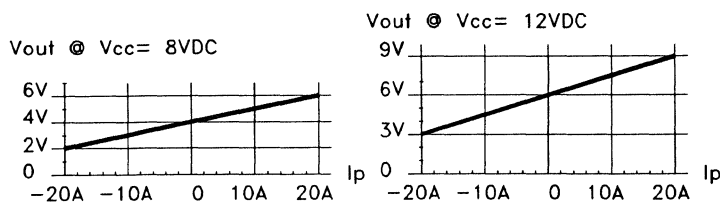
\* See example A

## FEATURES

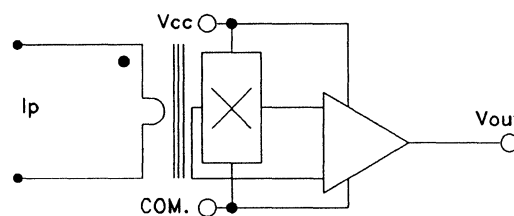
- High Accuracy.
- High Isolation.
- Will not be damaged by overcurrent.
- Wide supply voltage range allows for wide control over sensitivity.
- Very low drift with time and temperature.
- Transverse pin out available. Add S to P/N (eg. 5701-S) ( see figs. 3&4)

### Example A

Typical output for P/N 5704 at two different supply voltages.



Typical Schematic of Device.



P/N	$I_p$ ( $\pm$ ) A	Sensitivity mV/A @ 8VDC	L (in)	ID(Min) (in)	HT (in)	W (in)	C (in)	I.S. (in)	Fig.
5701	5	400.0	1.600	-	1.180	0.562	0.800	1.200	2, 4
5702	10	200.0	1.600	-	1.180	0.562	0.800	1.200	2, 4
5703	15	133.3	1.600	-	1.180	0.562	0.800	1.200	2, 4
5704	20	100.0	1.600	-	1.180	0.562	0.800	1.200	2, 4
5705	25	80.0	1.600	-	1.180	0.562	0.800	1.200	2, 4
5706	30	66.7	1.600	-	1.180	0.562	0.800	1.200	2, 4
5707	40	50.0	1.600	0.500	1.180	0.562	0.800	1.200	1, 3
5708	50	40.0	1.600	0.500	1.180	0.562	0.800	1.200	1, 3
5709	60	33.3	1.600	0.500	1.180	0.562	0.800	1.200	1, 3
5710	75	26.7	1.600	0.500	1.180	0.562	0.800	1.200	1, 3
5711	100	20.0	1.600	0.500	1.180	0.562	0.800	1.200	1, 3
5712	150	13.3	1.600	0.500	1.180	0.562	0.800	1.200	1, 3
5713	200	10.0	1.600	0.500	1.180	0.562	0.800	1.200	1, 3
5714	400	5.0	2.000	0.625	1.500	0.562	1.000	1.500	1, 3
5715	800	2.5	2.000	0.625	1.500	0.562	1.000	1.500	1, 3
5716	1200	1.7	2.400	0.750	1.800	0.562	1.200	1.800	1, 3
5717	2000	1.0	2.400	0.750	1.800	0.562	1.200	1.800	1, 3

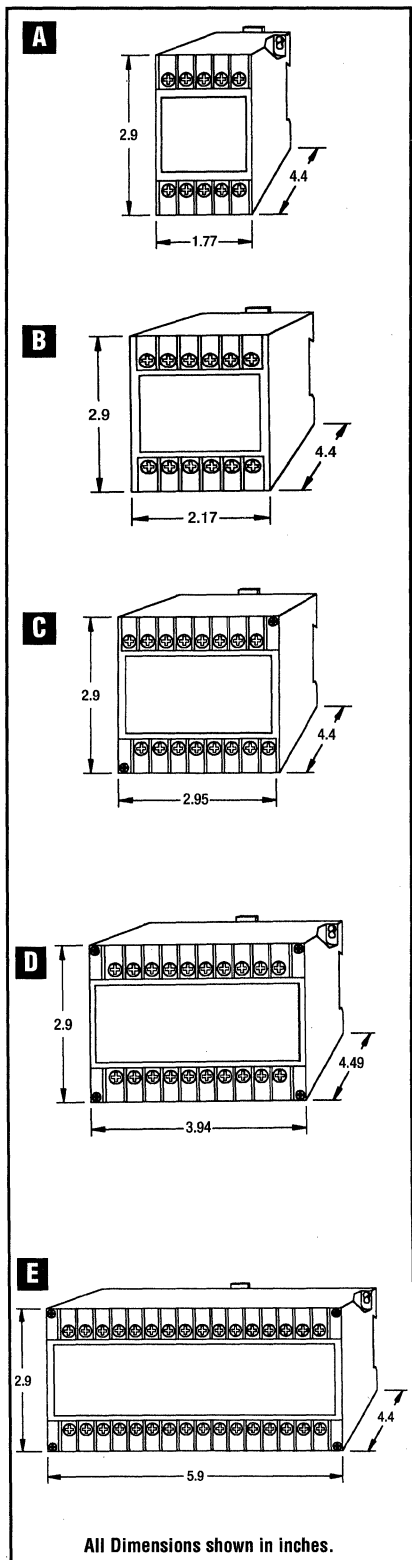
1900 CHRIS LANE, ANAHEIM, CA 92805 TEL: (714)634-2220 FAX: (714)634-0905



# AYA - Instruments, Inc.

5001 BAUM BOULEVARD • PITTSBURGH, PA 15213

## Transducers and Current Transformers



All Dimensions shown in inches.

### ELECTRICAL TRANSDUCERS SPECIFICATIONS

Input Signal Range:	Full Scale - Continuous	Temperature Range:	0 to 50 Deg. C
50% overrange:	3 minutes	Storage Temperature:	-20 to +80 Deg. C
Accuracy Class:	0.5% of Full Scale	Power:	120 VAC 50/60 Hz (240 VAC Optional)
Output Ripple:	1% Peak-to-Peak Maximum	Enclosure:	DIN RAIL TYPE 46277
Isolation Test:	1kV - 1 minute		

AC VOLTAGE TRANSDUCERS						
SERIES	SIZE	DESCRIPTION	INPUT	OUTPUT	ACCURACY	FREQUENCY
RV	A	Single Channel	1, 10,	1, 5, 10 VDC	0.2%	50 - 400 Hz
RMSV	A	Single Channel	100, 150,	1, 10, 20,	0.5%	
RV3	E	Three Channel	300, 600	4-20 mADC	1.0%	
RMSV3	E	Three Channel	VAC			

AC and AC/DC CURRENT TRANSDUCERS						
SERIES	SIZE	DESCRIPTION	INPUT CURRENT	OUTPUT	ACCURACY	FREQUENCY
RMSHI	A	Single Channel	1, 5,	1, 5, 10 VDC	0.2%	DC-10 KHz
RMSHI3	E	Three Channel	10 AAC	1, 10, 20	0.5%	
RMSI	A	Single Channel	1 VAC*	4-20 mADC	1.0%	50 - 400 Hz
RMSI3	E	Three Channel				

AC WATTS TRANSDUCERS							
SERIES	SIZE	DESCRIPTION	INPUT VOLTAGE	INPUT CURRENT	OUTPUT	ACCURACY	FREQUENCY
RW	B	Single Phase	150, 300	1, 5	1, 5, 10 VDC	0.2%	50-400 Hz
RW32	E	3 Phase - Delta	or	10 AAC or	1, 10, 20	0.5%	
RW43	E	3 Phase - WYE	600 VAC	1 VAC*	4-20 mADC	1.0%	

DC TRANSDUCERS						
SERIES	SIZE	DESCRIPTION	INPUT	OUTPUT	ACCURACY	FREQUENCY
RVDC	B	DC Voltage	1, 10, 60, 100, 150 & 300 VDC	1, 5, 10 VDC	0.2%	DC-2000 Hz
RIDC	B	DC Current	0.05, 0.1 and 1 VDC*	1, 10, 20 mADC	0.5%	
RWDC	B	DC Watts	(See Above V and I Input options)	4-20 mADC	1.0%	

FREQUENCY TRANSDUCERS					
SERIES	SIZE	INPUT FREQUENCY	INPUT VOLTAGE	OUTPUT	ACCURACY
RF A	B	45 - 55, 55 - 65, 40 - 80 or 350 - 450 Hz	1 - 10, 5 - 50, or 20 - 80 VAC	1, 5, 10 VDC	1.0%, 0.2%
RF B	B	0 - 55, 0 - 100, 0 - 450 or 0 - 1000 Hz	80 - 150, 150 - 300, or 300 - 600 VAC	1, 10, 20 4-20 mADC	or 0.5%

Note: Special Input and Output Ranges are Available.

\* Modules requiring current transformers that have a Voltage Output  
\*\* Larger size enclosure required for 20mADC or 4-20mADC output

# AYA - Instruments, Inc.

5001 BAUM BOULEVARD • PITTSBURGH, PA 15213

## Transducers and Current Transformers

TEL:  
**412-622-5500**

FAX:  
**412-681-3773**

### MULTI-FUNCTION TRANSDUCERS

SERIES	SIZE**	DESCRIPTION	VOLTAGE INPUT	CURRENT INPUT	OUTPUT	ACCURACY	FREQUENCY
RVI	B or C	AVG Volts & Amps	150, 300, 600 VAC	1, 5 AAC & 1 VAC*	1, 5, 10 VDC 1, 10, 20, 4-20 mADC	0.2% 0.5% 1.0%	50-400 Hz
RMSVI	B or C	RMS Volts & Amps					
RVA	C or E	VA, RMS Volts & Amps					
RVAR	C or E	VAR, RMS Volts & Amps					
RWVI	C or E	Watts, Volts & Amps					

### CTX CURRENT TRANSFORMERS - WOUND PRIMARY

Used with Current Transducers

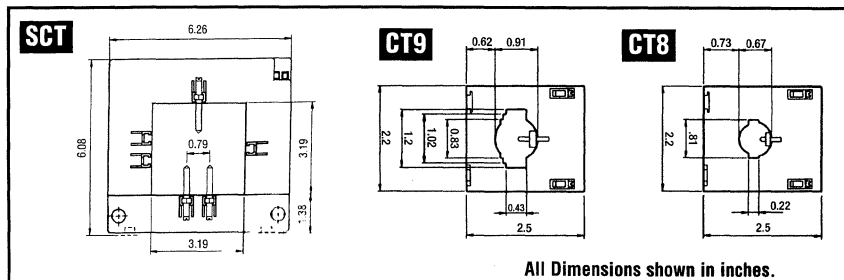
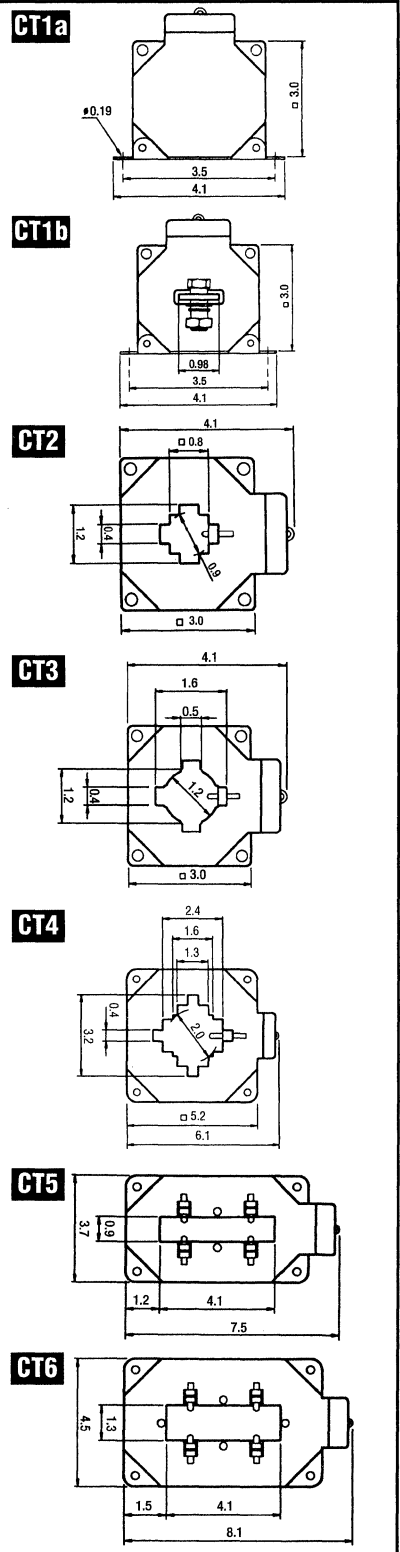
SERIES	INPUT	OUTPUT	SIZE			ACCURACY CLASS
			CIRCULAR OPENING	BUSBAR	CASE SIZE	
CT1 (a)	5, 10, 15, 20, 25 AAC	1 OR 5 AAC	n/a	n/a	3"x4.1"x1.5"	0.5%
CT1 (b)	30, 40, 50, 60, 75, 100, 125, 150 AAC		n/a	n/a	3"x4.1"x1.5"	0.5%
CT2	50, 60, 75, 100, 150, 200, 250, 300, 400, 500, 600 AAC		0.94"	1.2"x0.4" or 0.75"x0.75"	3"x4.1"x1.5"	0.5%
CT3	250, 300, 400, 500, 600, 750, 800, 1000 AAC		1.2"	1.6"x0.5"	3.0"x4.1"x1.5"	0.5%
CT4	400, 500, 600, 750, 800, 1000, 1200, 1500, 2000 AAC		2.0"	3.1"x0.43" or 2.4"x1.25"	5.2"x6.1"x1.8"	0.5%
CT5	750, 800, 1000, 1200, 1500, 2000, 2500 AAC		n/a	4"x0.85"	3.7"x7.5"x1.6"	0.5%
CT6	1500, 2000, 2500, 3000, 4000 AAC		n/a	4"x1.25"	4.5"x8.1"x1.8"	0.5%
CT8	50, 60, 75, 100, 125, 150, 200 AAC		0.63"	0.79"x0.2"	2.2"x2.5"x1.14"	0.5, 1%
CT9	200, 250, 300, 400, 500, 600 AAC		0.87"	1.18"x0.39"	2.2"x2.5"x1.14"	0.5, 1%

### SPLIT-CORE CURRENT TRANSFORMERS

SCT	INPUT	OUTPUT	CIRCUIT	SIZE	ACCURACY
SCT	100, 150, 200, 250, 300, 400, 500, 600, 750, 800, 1000, 1200, 1500 AAC	1 OR 5 AAC	3"	3.1"x3.1"	6.25"x6.1"x1.5" 0.5, 1.0 or 3.0%

Note: Special Input and Output Ranges are Available.

\* Modules requiring current transformers that have a Voltage Output  
\*\* Larger size enclosure required for 20mADC or 4-20mADC output



All Dimensions shown in inches.

# BEI... For All your Sensors and Motion Systems Needs

## OPTICAL ENCODERS INDUSTRIAL

Industrial encoders designed for the abusive machine tool environment. Rugged cast housing, heavy-duty shaft and bearings. Available in models that are sealed against liquid entry and for shaftloads up to 200 lbs. and 200G shocks.



2-day ship on express series encoders. Over 160 resolutions in stock - up to 200,000 cpt incremental. Many mechanical and electrical options are available.

2 year limited warranty.

Typical applications: Process control, factory automation, robotics, machine tool, instrumentation, lumber and oil field machinery.



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Absolute encoders in single and multi-turn versions with wide variety of output drivers to interface with most PLCs and controllers.



Resolutions from 512 to 65,536 counts-per-turn. Hollow shaft incremental encoders available with brushless motor commutation and solid shaft, size 15 units with 2500 cpt and selection of mounting options.

Products also include industrial-grade and military trackball systems featuring 2", 2 1/4", 3" or 35mm ball diameters and multiple interfaces.

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## BRUSHLESS MOTORS, VOICE COIL ACTUATORS, SPECIALTY ELECTROMAGNETICS

Linear and rotary voice coil actuators, brushless DC motors and specialty electromagnetic devices. Reliable, long-life brushless DC motors offer improved performance characteristics and advantages over comparably sized PM DC brush motors.



Voice coil actuators pack power, speed and precise control into limited stroke motion. Specialty electromagnetic devices including AC motors and clutches are also available.



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FAX: 760-744-8815

## POTENTIOMETERS AND ENCODERS HIGH VOLUME OEMs

Precision potentiometric sensors for automotive, industrial, medical and military markets. Modular, kit and light duty enclosed encoders for office automation, automotive and instrumentation markets.



Precision position sensors are custom designed packages to fit specialized applications. Duncan's thick film conductive plastic potentiometric sensors stand up to heavy wear, high temperature and exposure to chemicals.

High volume, low cost encoders incorporate proprietary monolithic phased array opto IC ASIC technology for high reliability and excellent performance.



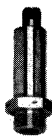
Typical applications: Automotive position sensors, machine positioning and servo motor feedback.

### DUNCAN ELECTRONICS DIVISION

15771 Red Hill Avenue  
Tustin, CA 92680  
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## PRESSURE SENSORS AVIONIC AND INDUSTRIAL

Pressure sensors, pressure switches and pressure vacuum pumps for avionic, industrial, medical and oil and gas industries.



Technologies include solid state micromachined silicon, thick film potentiometric and thin film strain gage pressure sensors for absolute, gage and differential measurement.

Off-the-shelf and custom designs are available. Sensors are made for superior performance in rugged environments whether measuring gasses or liquid. Pressure ranges from 0-1 to 0-20,000 PSI.

Typical applications: Measurement of hydraulic pressure, engine pressure, downhole pressure, liquid or gas pressure.



### EDCLIFF INSTRUMENTS DIVISION

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## ADVANCED INERTIAL SENSORS AEROSPACE, MILITARY AND COMMERCIAL

Specialists in solid state rate gyroscopes, multiaxis inertial sensor packages, inertial measurement units and linear and angular accelerometers for aerospace, military and commercial precision guidance, control and instrumentation applications. A unique line of aircraft structural fatigue and engine vibration monitors is also available.



Proprietary solid state quartz technology provides completely self-contained, high reliability, low cost precision inertial sensor designs for linear and angular motion measurement applications. Markets include military, aerospace, automotive, medical and communications.

Typical applications: Stabilization, navigation, guidance and motion sensing.



### SYSTRON DONNER INERTIAL DIVISION

2700 Systron Drive  
Concord, CA 94518  
1-800-227-1625 or 510-671-6601  
FAX: 510-671-6647

## PRECISION ENCODERS AND SERVOS AEROSPACE AND DEFENSE

Spacecraft encoders, encoder/motors, servo systems and gimbal systems. Largest number of heritage models for space. High resolution (to 25-bits), high accuracy absolute encoders for radar, optical tracking and telescope applications. Small size, rugged, high reliability encoders for Military/Aerospace programs.

The Division is in compliance with MIL-I-45208, MIL-Q-9858, and NASA NHB5300.4(1B) for quality assurance, NASA NHB5300.4(1F) for reliability and MIL-STD-454, MIL-STD-2000 and NASA NHB5300.4(3A-1) for workmanship.

Typical applications: Precision servo systems, range instrumentation, pointing/tracking gimbal systems and precision indexing.



### PRECISION SYSTEMS and SPACE DIVISION

P.O. Box 3838  
Little Rock, AR 72203  
501-851-4000  
FAX: 501-851-5476

## For Further Information Or Quote, Call The Division That Matches Your Application

BEI Sensors & Systems Company is a wholly owned subsidiary of BEI Technologies, Inc., a diversified technology company providing advanced sensors to the industrial, defense, medical and scientific communities. Products include: Optical Encoders • Precision Potentiometers • Pressure Sensors • Brushless Motors • Voice Coil Actuators • Accelerometers • Solid State Gyros and Vibration Meters. For information on our products and services, call the division that matches your application.

# BEI SENSORS & SYSTEMS COMPANY

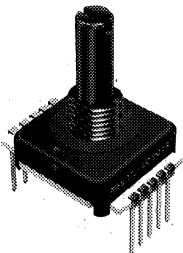
1-800-959-0506

URL: [www.beisensors.com](http://www.beisensors.com)



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 For technical assistance call (801) 786-6200.  
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## ABSOLUTE CONTACTING ENCODERS (ACE™)



### Absolute Encoder/Gray Code Output

- Digital Output
- High operating temperature capabilities - up to 125°C
- Sturdy construction
- Bushing mount
- Available with PC board

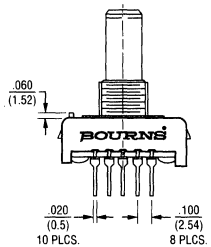
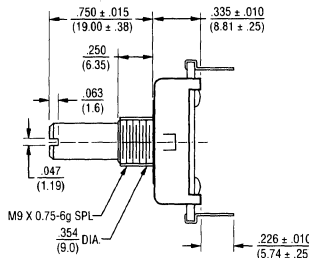
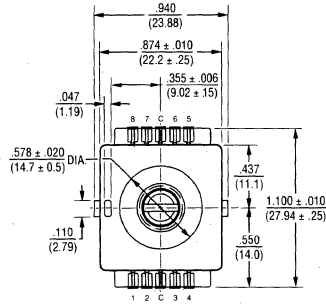
**Electrical Characteristics**  
 Output.....8-bit gray code, with 128 absolute states  
 Closed Circuit Resistance .....5 ohms maximum  
 Open Circuit Resistance .....100K ohms minimum  
 Contact Rating .....10 milliamp @ 10 VDC or 0.1 watt maximum  
 Insulation Resistance (500 VDC) .....1,000 megohms minimum

Dielectric Withstanding Voltage .....MIL-STD-202 Method 301  
 Sea Level.....1,000 VAC minimum  
 Electrical Travel .....Continuous  
 Contact Bounce (60 RPM) .....2.7 milliseconds maximum  
 RPM (Operating) .....120 maximum

**Environmental Characteristics**  
 Operating Temperature Range .....-25°C to +125°C  
 Vibration .....15G  
 Contact Bounce .....0.1 millisecond maximum

Shock .....50G  
 Contact Bounce .....0.1 millisecond maximum  
 Rotational Life .....50,000 shaft revolutions  
**Mechanical Characteristics**  
 Mechanical Angle.....Continuous  
 Torque .....0.75 to 2.50 oz-in

BUSHING MOUNTED: HOUSING A

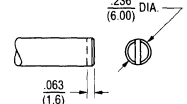
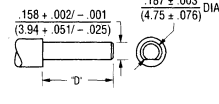
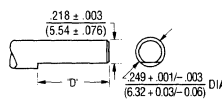
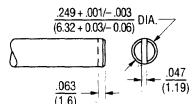


SHAFT STYLE B

SHAFT STYLE C

SHAFT STYLE J

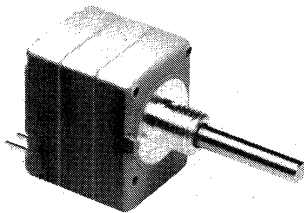
SHAFT STYLE R



"D" DIMENSION EXTENDS FROM SHAFT END TO BUSHING FACE  
 "D" = (SHAFT LENGTH, FMS) - (BUSHING LENGTH)

"D" DIMENSION EXTENDS FROM SHAFT END TO BUSHING FACE "D" = (SHAFT LENGTH, FMS) - (BUSHING LENGTH)  
 Specifications are subject to change without notice.

## ROTARY OPTICAL ENCODER

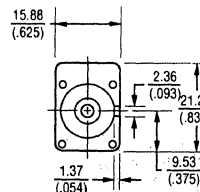
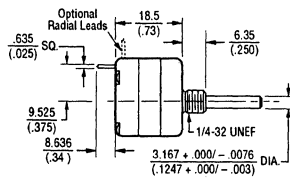
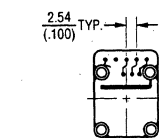


### EN Series Rotary Optical Encoders

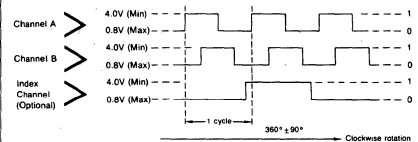
- Small size
- CMOS and TTL compatible
- Two channel quadrature output
- Square wave signal
- High operating speed
- Long life

**Electrical Characteristics**  
 Output .....2-bit gray code, Channel A leads Channel B by 90° (electrical) with clockwise rotation  
 Supply Voltage .....5.0 VDC ± 0.25 VDC\*  
 Supply Current .....26 mA maximum  
 Output Voltage Low Output .....0.8V maximum  
 High Output .....4V minimum  
 Output Current Low Output .....25 mA minimum  
 Insulation Resistance (500 VDC) .....1,000 megohms  
 Rise/Fall Time .....200ns (typical)  
 Shaft RPM (Ball Bearing) .....3,000 rpm maximum  
 Power Consumption .....136mW maximum  
 Pulse Width (Electrical Degrees, Each Channel) .....180° ± 45° TYP.  
 Pulse Width (Index Channel) .....360° ± 90°  
 Phase (Electrical Degrees, Channel A to Channel B) .....90° ± 45° TYP.  
 Index Channel Centered on 1-1 State Combination of A and B Channels .....0° ± 45°

\* Consult factory for other voltages up to 15 VDC.



### OUTPUT TABLE



### STANDARD RESOLUTIONS AVAILABLE

(Full quadrature output cycles per shaft revolution.)

25*	128
50*	200
64	256
100	

For Non-Standard Resolutions - Consult Factory

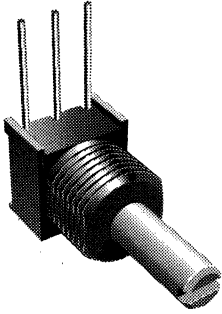
\*channel B leads channel A

\*Consult factory for other available options. Specifications are subject to change without notice.



BOURNS, INC., • 2533 NORTH 1500 WEST, OGDEN, UTAH 84401  
 For technical assistance call (801) 786-6200.  
 www.bourns.com

## MINIATURE ENCODERS (INCREMENTAL)

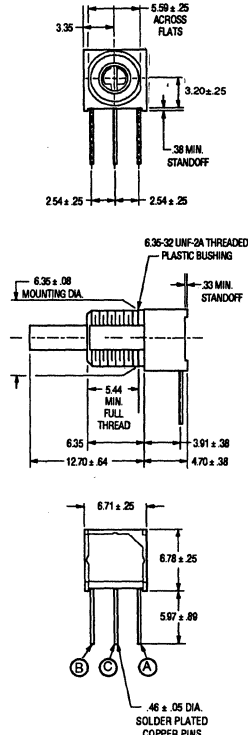


**Model 3375**  
 1/4" (6mm) Square  
 Sealed

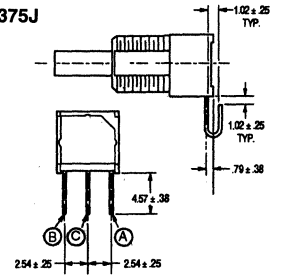
- Long operating life
- High operating temperature capabilities
- Bushing or PCB mount
- Conductive plastic element

**Electrical Characteristics**  
 Output .....2-bit gray code,  
 Channel A leads  
 Channel B by 90°  
 electrically turning  
 clockwise (CW)  
 Closed Circuit Resistance  
 .....2 ohms maximum  
 Open Circuit Resistance  
 .....100K ohms minimum  
 Contact Rating  
 .....10 milliamp @ 10 VDC  
 or 0.1 watt maximum  
 Insulation Resistance (500 VDC)  
 .....1,000 megohms minimum  
 Dielectric Withstanding Voltage  
 Sea Level  
 .....900 VAC minimum  
 Electrical Travel  
 .....Continuous  
 Contact Bounce (15 RPM)  
 .....5 milliseconds maximum  
 RPM (Operating)  
 .....120 maximum  
**Environmental Characteristics**  
 Temperature Range  
 .....-55°C to +125°C  
 Vibration .....50G  
 Contact Bounce  
 .....0.1 millisecond maximum  
 Shock .....100G  
 Contact Bounce  
 .....0.1 millisecond maximum  
 Rotational Life .....100,000 cycles  
**Mechanical Characteristics**  
 Mechanical Angle.....Continuous  
 Torque .....5 oz-in. maximum

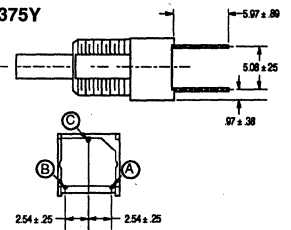
### COMMON DIMENSIONS 3375C



### 3375J



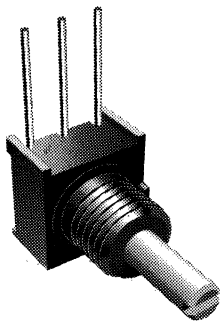
### 3375Y



### HOW TO ORDER

3375 C - 1 - 006

Model \_\_\_\_\_  
 Style \_\_\_\_\_  
 Standard or Modified \_\_\_\_\_  
 Product Indicator  
 -1 = Standard Product  
 Pulses Per Revolution \_\_\_\_\_  
 Consult factory for other available options.  
 Specifications are subject to change without notice.

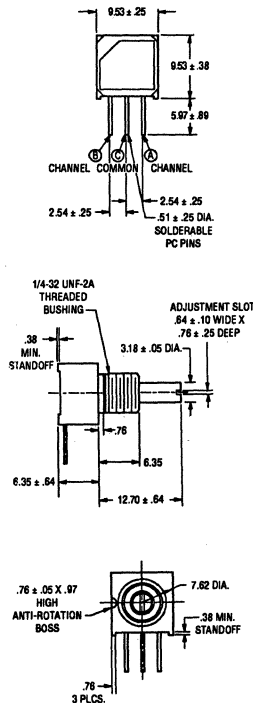


**Model 3315**  
 3/8" (9mm) Square  
 Sealed

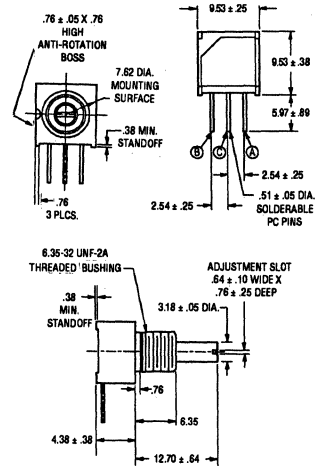
- Long operating life
- High operating temperature capabilities
- Bushing or PCB mount
- Conductive plastic element

**Electrical Characteristics**  
 Output .....2-bit gray code,  
 Channel A leads  
 Channel B by 90°  
 electrically turning  
 clockwise (CW)  
 Closed Circuit Resistance  
 .....2 ohms maximum  
 Open Circuit Resistance  
 .....100K ohms minimum  
 Contact Rating  
 .....10 milliamp @ 10 VDC  
 or 0.1 watt maximum  
 Insulation Resistance (500 VDC)  
 .....1,000 megohms minimum  
 Dielectric Withstanding Voltage  
 Sea Level  
 .....900 VAC minimum  
 Electrical Travel  
 .....Continuous  
 Contact Bounce (15 RPM)  
 .....5 milliseconds maximum  
 RPM (Operating)  
 .....120 maximum  
**Environmental Characteristics**  
 Temperature Range  
 .....-55°C to +125°C  
 Vibration .....30G  
 Contact Bounce  
 .....0.1 millisecond maximum  
 Shock .....100G  
 Contact Bounce  
 .....0.1 millisecond maximum  
 Rotational Life .....100,000 cycles  
**Mechanical Characteristics**  
 Mechanical Angle.....Continuous  
 Torque .....5 oz-in. maximum

### COMMON DIMENSIONS 3315



### COMMON DIMENSIONS 3315-1



### HOW TO ORDER

3315 C - 1 - 006

Model \_\_\_\_\_  
 Style \_\_\_\_\_  
 Standard or Modified \_\_\_\_\_  
 Product Indicator  
 1 = Plastic Bushing (Standard)  
 2 = Metal Bushing  
 Pulses Per Revolution \_\_\_\_\_  
 Consult factory for other available options.  
 Specifications are subject to change without notice.



# Canon

## SPINSTAND SYSTEMS • LDV SENSORS • ENCODERS

### SPINSTAND SYSTEMS

The compact RS-5216 Spinstand System is ideal for low cost head assembly testing. The system eliminates parts acquisition efforts and subsystem integration. RS-5216 incorporates a laser rotary encoder Canon KP-1M160 + SC-01H/PC rotary positioning system and motor, as well as a Canon SP Series Spindle air bearing motor.

The Canon rotary positioning system offers a resolution of 0.0039 arc seconds (0.98nm at R52mm) with a maximum speed of 60 degrees per second. Seek time is less than 2 msec.

The RS-5216's spindle motor features a low index jitter of 0.01% (@ 0 -15,000 rpm). Ramp up time and ramp downtime are extremely fast, both 1.0 seconds. Loading stage resolution is less than 1µm.

RS-5216S Spinstand measures only 225mm (L) x 300mm (W).

### LDV SENSORS

Ultra compact and economical, Canon LDV Sensors enable highly accurate, non-contact measurements of moving objects. Semiconductor laser measures velocities from -12 to 120m/min. @ 300Hz or less. Laser wavelength is 680nm @ ±1% (FS) precision. Ideal for measuring moving objects from fluids, powders and chemicals to paper, wire, fabric, and cables.

### Typical LDV Applications

- Chemical processing
- Fabric and carpeting
- Food processing
- Metal fabricating
- Paper & cardboard
- Petroleum refining
- Plastics manufacturing
- Timber & lumber
- Wire & cable

### LASER ROTARY ENCODERS

MODEL	RESOLUTION (ppr)	With INTERPOLATION	MAXIMUM FREQUENCY RESPONSE (KHz)	MAXIMUM ANGULAR VELOCITY (rps)	SIGNAL OUTPUT		SIZE mm
					Analog or digital	Output Circuit	
X-1M	225,000	18,000,000 C 230,000,000 D	675	3 (180 rpm)	Analog	Op Amp Serial Resistor (Balanced)	140 x 50
K-1	81,000	1,296,000 A 3,240,000 B 5,184,000 C 6,480,000 D	500	6.2 (372 rpm)	Analog	Op Amp Serial Resistor (1 Vp-p)	36 x 48
R-10	81,000		500	6.2 (372 rpm)	Digital	Open Collector	36 x 48
R-1L	81,000		500	6.2 (372 rpm)	Digital	Line Driver (Balanced)	36 x 58
M-1	50,000		2,000	40 (2400 rpm)	Digital	Line Driver (Balanced)	56 x 70
TR-36	3,600		300	83 (5000 rpm)	Digital	Line Driver	40 x 17

All models are incremental.  
 A With CI 16-2, IU-16 (16 x output pulse) Interpolator.  
 B With IU-40/120 CI 40 (40 x output pulse) Interpolator.

C With CI 64-A (64 x output pulse) Interpolator.  
 D With IU-80/120 (80 x output pulse) Interpolator.  
 E With IU-1024 (1024 x output pulse) Interpolator.

### LINEAR ENCODERS

MICRO LINEAR ENCODERS	ML-08	ML-08	ML-08	ML-08	ML-16	ML-16	ML-16	ML-16
INTERPOLATOR UNITS	none	CI 16-2 IU-16	CI 40-2 IU-40	CI 80-A IU-80	none	CI 16-2 IU-16	CI 40-2 IU-40	CI 80-A IU-80
RESOLUTION	*0.8µm	0.05µm	0.02µm	0.01µm	**1.6µm	0.01µm	0.04µm	0.02µm
MAX. SPEED	240mm/sec. (100) KHz	160mm/sec.	160mm/sec.	80mm/sec. 75mm/sec	480mm/sec.	320mm/sec.	320mm/sec.	320mm/sec

\*0.02 µm with 4-way splitting    \*\*0.04 µm with 4-way splitting

Please contact CANON directly for special application in O.E.M. quantities

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# Selection: Hall Effect Sensors

## HE-6151

Gear Tooth Sensor Module

### Description

The HE-6151 Gear Tooth Speed Sensor contains an integrated circuit Hall Effect sensor in conjunction with a permanent magnet which supplies a bias field. The Hall sensor is protected against reverse battery conditions and transients and operates over wide temperature and supply voltage range. This unique integrated solution makes it less susceptible to supply and ground noise interference.

### Features

Senses motion of ferrous targets, offers zero speed sensing capabilities, digital output signal, large operational air gap, wide operating temperature range, requires no additional conditioning electronics, immune to hostile environments, operates from 6.5 to 24 volts DC supply.

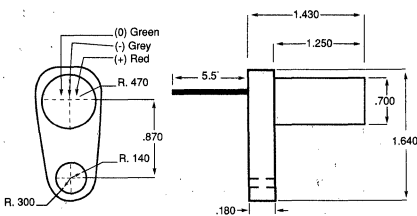
### Applications

The HE-6151 Series directly senses rotating ferrous gear-type targets such as web speed gears, power transmission gears, and gear-based shaft encoders used in applications such as conveyor speed and other similar gear-based shaft encoders.

### Absolute Maximum Ratings

Power Supply, $V_{CC}$	24 V
Output OFF Voltage	24 V
Output ON Current, $I_{SINK}$	20 mA
Operating Temperature, $T_A$	-40° to +85°C
Storage Temperature, $T_S$	-40° to +85°C

### Dimensions and Wiring Connection



#24 Wire  
 $V_{CC}$  = Red  
 Gnd = Grey  
 Out = Green

## HE-6450

Digital Vane Switch

### Description

Each Type HE-6450 Vane Switch includes on a single monolithic chip a voltage regulator, a quadratic Hall voltage generator, temperature compensation circuitry, a signal amplifier, an open collector output transistor and a Schmitt trigger.

### Features

Rugged replacement for optical vane switch, immune to dust and dirt, reliable and repeatable — no mechanical contacts to wear out, on-chip Schmitt trigger provides hysteresis, digital output compatible with all logic families, 4.5 to 24 V operation.

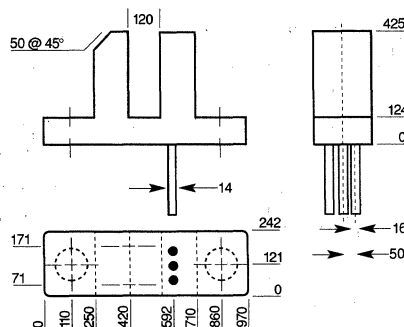
### Applications

Suitable for applications in hostile electrical, chemical and mechanical environments.

### Absolute Maximum Ratings

Power Supply, $V_{CC}$	24 V
Output OFF Voltage	24 V
Output ON Current, $I_{SINK}$	25 mA
Operating Temperature, $T_A$	-20° to +85°C
Storage Temperature, $T_S$	-40° to +105°C

### Dimensions (mils)



## HE-6103

Hall Effect Switch

### Description

The HE-6103 Hall Effect Switch is an easy-to-install threaded barrel assembly intended for sensing the proximity of a magnetic field. The sensor is activated by exposing the face end of the assembly to a South magnetic field (south seeking field) of sufficient magnitude to cause the output of the sensor to turn on. The amount of field required is typically 300 gauss at the face of the sensor. The magnetic field may be supplied by either a permanent magnet or an electromagnetic field.

### Features

Rugged Aluminum Housing, Digital Open Collector Output, Robust Solid State Sensor Electronics, Easy to Adjust Threaded Barrel Housing

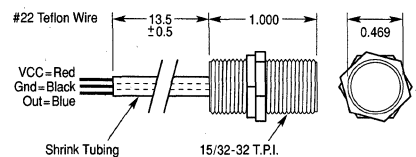
### Applications

Limit Switches, Interlock Sensing, Tachometer Sensor, Proximity Detector, Flowmeter Pickup

### Absolute Maximum Ratings

Supply Voltage	24 volts DC
Output Sink Current	20 mA
Operating Temperature	-20° to +85°C
Storage Temperature	-40° to +125°C

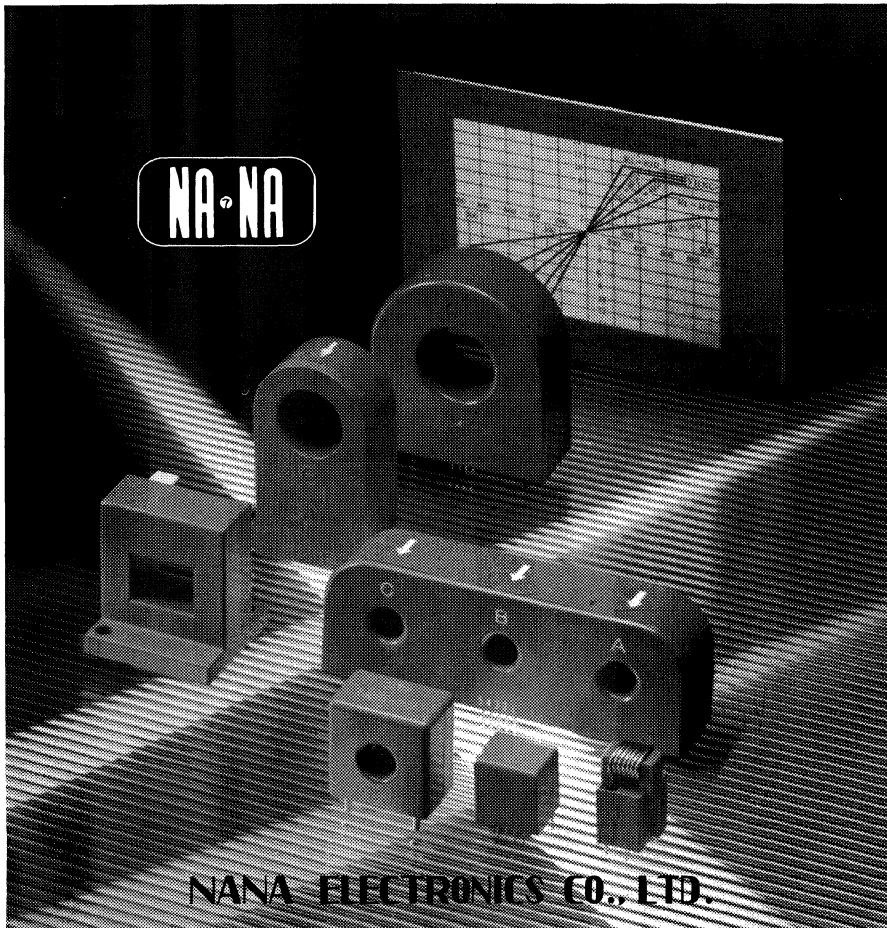
The HE-6103 is capable of operation from 4.5 volts to 24 volts DC. The output of the device is an Open Collector NPN transistor capable of sinking 20 mA of current. A pull-up resistor is recommended in most typical applications. The resistor value is determined by the output voltage present in the circuit. This output configuration can be easily configured to drive LED's, relays, power transistors, Triacs and SCRs.



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Cherry Electrical Products  
 3600 Sunset Avenue  
 Waukegan, IL 60087  
 Phone: 847-662-9200  
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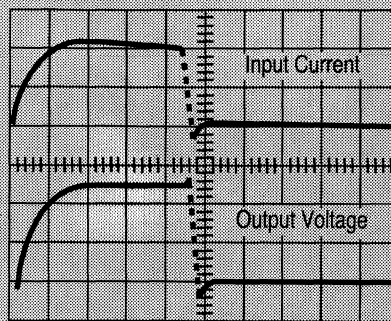


## Hall Current Sensors

### OPEN and CLOSED LOOP

#### Features:

- 1.25A to 30kA current ratings
- 1 $\mu$ sec response time
- 500kHz bandwidth
- 0.5% linearity
- Good temperature stability
- -10 to +85°C temperature range
- Low temperature drift
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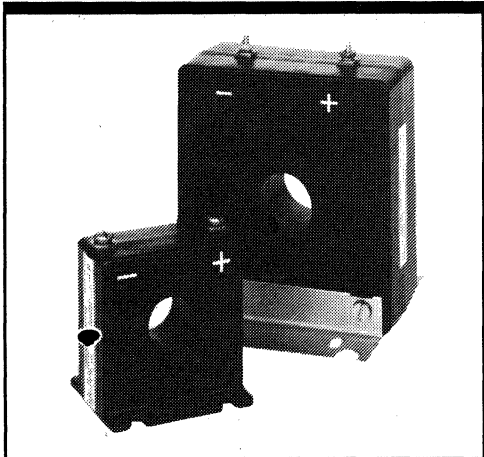
**MOV  
MODULES**

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- 100% UL Approved Components

# CURRENT TRANSDUCERS

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OUR AWARD WINNING WEB SITE  
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“Specialist in Electrical Current Monitoring”



## 2-WIRE AC CURRENT TO 4-20 mA



### FEATURES

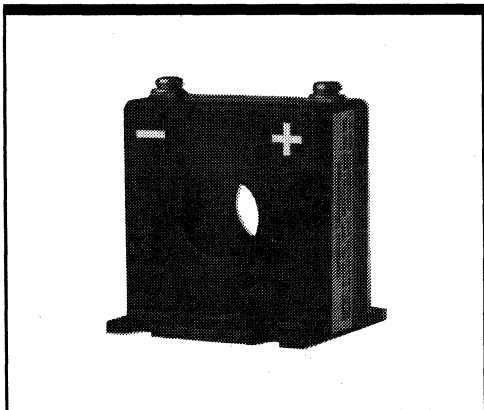
- Permanently calibrated
- Loop-powered
- Fully isolated
- 12 different ranges
- 2 case styles, .93" and 1.25" window opening
- Output overload protected

4-WIRE UNIT ALSO AVAILABLE

### PART NUMBERS

CR4320 - □ □ □ 4-20 MA CURRENT TRANSMITTER

	Full-Scale (FS) Range in AC Amps	Case Style
5	0-5	1
10	0-10	1
15	0-15	1
20	0-20	1
30	0-30	1
50	0-50	1
75	0-75	1
100	0-100	1
150	0-150	1
200	0-200	1
300	0-300	2
400	0-400	2



## AC CURRENT TO 0-5 VOLTS DC



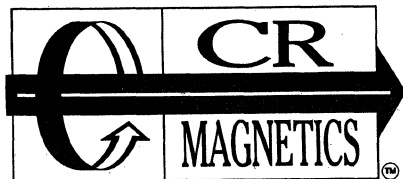
### FEATURES

- Permanently calibrated
- Output overload protected
- Fully isolated
- 10 different ranges
- Self-powered, requires no external power source

### PART NUMBERS

CR4310- □ □ □ CURRENT TO VOLTAGE TRANSDUCER

	Range in AC Amps	Accuracy % FS	Minimum Load Resistance in OHMS
5	0-5	1.0	1MEG
10	0-10	0.75	800K
15	0-15	0.75	800K
20	0-20	0.5	400K
30	0-30	0.5	400K
50	0-50	0.5	160K
75	0-75	0.5	160K
100	0-100	0.5	80K
150	0-150	0.5	80K
200	0-200	0.5	80K



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# encoders

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## Incremental Optical

MES

NSB

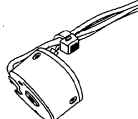
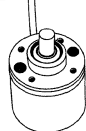
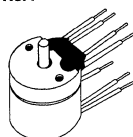
NSC



NSA

NSE

SEH



Body sizes from Ø0.472"

-10° to +85°C typical op. temp

200 kHz frequency response

Resolutions to 10,000 pulses per revolution per channel

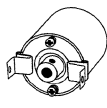
Wide Variety of input & output options

## Hollow Shaft

MEH

NHD

NHG



Body Sizes from Ø0.52

Many input & output formats

-10° to +85°C typical op. temp

200 kHz frequency response

Resolutions to 32,400 pulses per revolution per channel

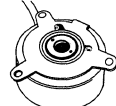
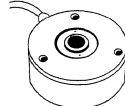
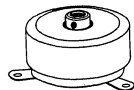
Bore sizes from Ø2 to Ø75mm

## Magnetostrictive

JR55

JR205

JR305



Ideal for rough, contaminated environments

Differential, quadrature output

Resolutions up to 2048 PPR/channel

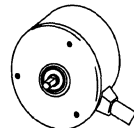
Up to 200 kHz frequency response

Ø6, 6.35 & 8mm bore

Economy model to 600 PPR

## Absolute

MA



2<sup>8</sup>, (256)

2<sup>10</sup>, (360)

2<sup>12</sup>, (4096, 3600, 1000) resolution

Shaft, dual shaft or hollow shaft

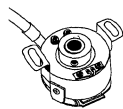
Natural binary, gray or BCD code output

Economy protection per IP65

## Servomotor Feedback

NHA

NHY



Sizes from Ø1.11"

Differential, quadrature output

Commutation channels for 4,6,& 8 poles

200 kHz frequency response

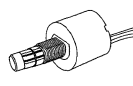
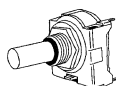
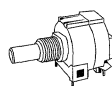
Resolutions to 5,000 PPR/channel

## Manual Optical

EC202A

RE20

NMC



Resolutions to 500 PPR/channel

Quadrature output

Extremely low noise

10<sup>7</sup> cycle typical life

Low current models available

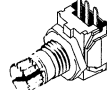
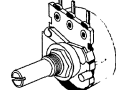
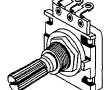
With or without detent

## Mechanical

AEC16

AAB

EC09



Incremental to 75 PPR/channel

Economical

Panel or PCB mount

Various shaft lengths available

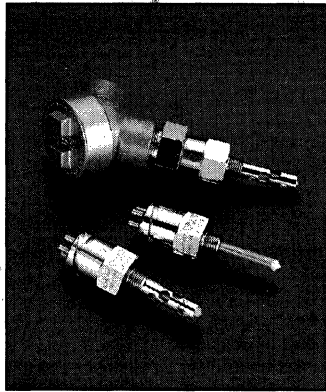
**E-T-A<sup>®</sup>****"WE CHALLENGE THE IMPOSSIBLE"**

## NU/NR60 Point Level Controllers Capacitance

### SOLID STATE THICK FILM HYBRID CIRCUIT DESIGN

E-T-A's Point Level Controllers are smallest - yet the most advanced - virtually maintenance-free point level controllers ever developed. Low in cost. Very high reliability. Definitely the point level controllers of the 90's.

- Virtually maintenance free
- Explosion-proof and weatherproof sensors
- Industrial and OEM versions
- Three year warranty
- Available from stock
- Capacitance

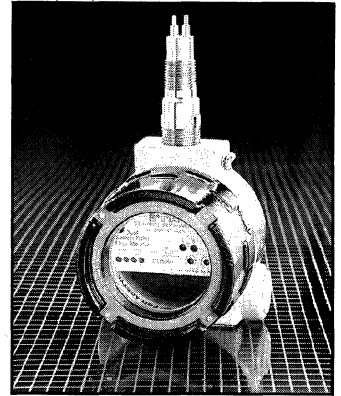


## Thermally Actuated Fastest Response Mass Flow and Level Switches

### ONLY E-T-A SENSORS ARE ... GUARANTEED NOT TO BURN OUT

E-T-A flow switches can be made intrinsically safe without compromising fast response. Durably built for unmatched longevity. Explosion-proof. Weatherproof. Available with corrosion resistant sensors for particularly harsh environments.

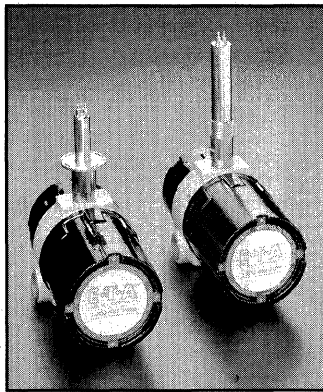
- No moving parts
- Single/dual switchpoints
- Lowest wattage heater
- Thermally actuated
- Available from stock
- Hasteloy PVDF and SS Probes
- LED indicators



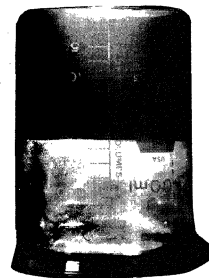
## Mass Flow Meters

### ONLY E-T-A SENSORS ARE... GUARANTEED NOT TO BURN OUT

- Thermal dispersion type
- Ideal for liquids or gases
- Outputs for flow and temperature
- ±1% repeatability
- Fast response
- Thick film hybrid circuit design
- Two year warranty
- Digital readouts

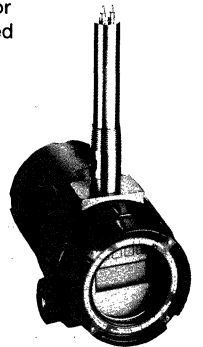


## Introducing the only thermally actuated Mass Flow Transmitter that can measure liquids and gases.



E-T-A's new FTU5000 is the first Mass Flow Transmitter to incorporate thick film hybrid circuitry for precise measurement of liquids or gases. This advanced technological design features dual linear outputs for flow and temperature, extremely fast response, with a sensing probe that can be installed directly into standard pipe fittings. The FTU5000 can also be configured to any mounting specification.

- Fastest possible response
- 100 - 1 Turndown ratio
- 1% Repeatability
- Compact size
- Easily field calibrated
- Independent linear outputs:  
4 - 20 mA for mass flow  
4 - 20 mA for temperature



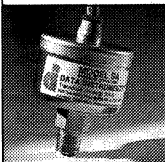
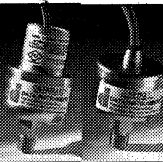
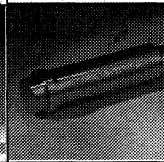
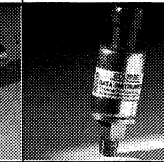
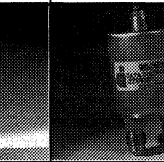
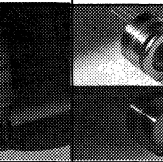
Call us today to find out more about the FTU5000 and FTU6000 sanitary transmitters.

Circuit Protection and Control

1551 Bishop Court, Mount Prospect, IL 60056 • 847-827-7600 • FAX: 847-827-7655  
236 Hood Road, Markham, Ontario Canada L3R 3K8 • 905-475-5886 • FAX: 905-475-5889

For more information call 1-800-462-9979

# PRESSURE TRANSDUCERS

	MODEL SA PSIA, PSIG, PSIS	DATAMATE <sup>®</sup> XPRO <sup>®</sup> PSIA, PSIG, PSIS	MODELS BL, BF PSIA, PSIG, PSIS	ECLIPSE <sup>®</sup> PSIA, PSIG	DELTAMATE <sup>®</sup> PSID	MODEL SR, BX PSIG
	Rugged Steel Housing	Two-Wire Transmitters	Flush Diaphragm, Amplified	Low Cost, Amplified	Wet/Wet Differential	Small Size, Flush Mount, Oil-Free
						
<b>Pressure Range</b>	0-15, 25, 50, 100, psig/a 100, 300, 500, 1000, 2000, 3000, 5000, 7112 psig	0-15, 25, 50 psig/a 100, 200 psis/a 500, 1000, 2000, 5000, 7112 psis	0-5, 15, 25, 50 psig/a 0-100, 200, 300, 500, 1000, 2000, 3000, 5000, 10000, 20000 psis	0-15, 25, 50 psig 0-100, 200, 300, 500, 1000, 2000, 3000, 5000, 7112 psig	0-25, 50, 100, 200 psid	SR: 0-15, 25, 50, 100, 200, 300, 500, 1000, 2000 psig BX: 0-15, 25, 50, 100 psig
<b>Accuracy</b>	±1% FSO	±1% FSO	±1% FSO	±1% FSO	±1% FSO	±1% FSO
<b>Signal Output</b>	1 to 6 Vdc	4 to 20 mA	BL: 4 to 20 mA BF: 0 to 5 Vdc	Voltage: 0.5 to 4.5 Vdc Current: 4 to 20 mA	Voltage: 1 to 6 Vdc Current: 4 to 20 mA	SR: 0 to 100 mV BX: 0 to 50 mV
<b>Excitation</b>	9 to 24 Vdc	12 to 40 Vdc linear derating to 35 Vdc from 25° to 100°C	BL: 12 to 36 Vdc BF: 12 to 20 Vdc or 20 to 32 Vdc	Voltage: 5 Vdc Current: 10 to 40 Vdc	Voltage: 9 to 24 Vdc Current: 10 to 40 Vdc	SR: 4 mA BX: 5 Vdc
<b>Operating Temp Range</b>	-55° to 105°C (-67° to 221°F)	-18° to 100°C (-0° to 212°F)	BL: -40° to 82°C (-40° to 180°F) BF: -45° to 93°C (-50° to 200°F)	-40° to 105°C (-40° to 221°F)	-40° to 105°C (-40° to 221°F)	-40° to 100°C (-40° to 212°F)
<b>Compensated Temp Range</b>	-1° to 85°C (30° to 185°F)	-1° to 54°C (-30° to 130°F)	-1° to 54°C (-30° to 130°F)	-18° to 82°C (0° to 180°F)	Voltage: -1° to 85°C (30° to 185°F) Current: -1° to 54°C (30° to 130°F)	0° to 75°C (32° to 167°F)
<b>Thermal Effect On Zero</b>	≤±1% FSO any 55°C change within the compensated range	≤±1% FSO any 55°C change within the compensated range	≤±2% FSO any 55°C change within the compensated range	≤±1% FSO typical	≤±1% FSO any 55°C change within the compensated range	≤±1% FSO any 50°C change within the compensated range
<b>Thermal Effect On FSO</b>	≤±1% any 55°C change within the compensated range	≤±1% any 55°C change within the compensated range	≤±1% any 55°C change within the compensated range	≤±1% FSO typical	≤±1% any 55°C change within the compensated range	≤±1% any 50°C change within the compensated range
<b>Options</b>	Hirschmann connector, 3/8-24 UNF Port High overload capability	Hirschmann connector for XPRO Standard Intrinsic Safety, XPRO - UL, CUL DATAMATE - FM	Accuracy to 0.25%	Hirschmann connector		BX - Teflon coating

## Special Features Available With Select Transducer Models

- Bi-Directional Model AB, EA or SA for vacuum measurements
- Metric calibrated pressure ranges for the Model XPRO
- High impedance bridge for lower power consumption
- Special case materials for high corrosion resistance
- Welded pressure ports
- Special calibration or temperature performance and data
- External zero balance circuit for the Model BL and Model BF
- Hirschmann connector, a quick-disconnect for Model SA, Mediamate, Eclipse and XPRO
- Mating connectors for Model AB, BF and BL with Bendix PTIH-10-6P connector

## How To Order

Always order by name of product, and full description. State in detail any special features required. All orders are subject to final acceptance by Data Instruments Inc.

## Terms

Net 30 days upon credit approval; otherwise payment must be received in advance of shipment, or C.O.D shipment.

 **DATA INSTRUMENTS**

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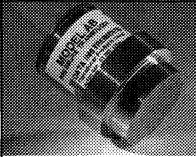
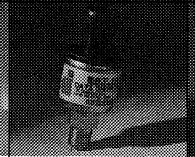
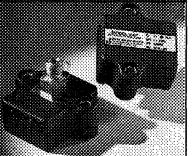
# PRESSURE TRANSDUCERS

## Features

- **Pressure ranges:**  
5 to 20,000 PSI
- **Types:** general purpose, gauge, absolute, differential, sealed, self-amplified, two-wire transmitters, depth sensors and flush mount
- **Outputs:** voltage, current or frequency
- 2x rated pressure without damage, 5x to 20x rated pressure without bursting
- Unit-to-unit interchangeability assured through factory calibration to  $\pm 1\%$ .
- Life greater than 100 million full pressure cycles.
- FM approval on BL and Datamate<sup>®</sup>
- UL approval on SA, EA and XPRO<sup>®</sup>. CUL approval on XPRO<sup>®</sup>
- AGA/CGA approval on Eclipse<sup>®</sup>
- CE Compliant Models

## Applications

- Medical instruments
- Air conditioning and refrigeration
- Hydraulic controls
- Compressor Controls
- Aircraft hydraulics
- Agricultural sprayers and dusters
- Geophysical
- Oceanography
- Robotics
- Water management
- Transmissions
- Process control equipment
- Exercise machines
- Physiological monitors
- Environmental control systems
- Engine controls, monitors
- Automotive test stands
- HVAC/R

	MEDIAMATE <sup>®</sup> PSIG	MODELS AB, ABHP PSIA, PSIG, PSIS	MODEL SST PSIG	MODELS EA, EAF PSIG
	Low Cost, Compact	High Performance, Flush Mount	Amplified, Low Cost, Compact	Low Profile Package, Frequency Output
				
<b>Pressure Range</b>	0-15, 25, 50, 100, 500, 1000, 2000, 5000, 7112 psig	0-6, 15, 25, 50 psig/a 0-100, 200, 500, 1000, 2000, 3000, 5000, 10,000, 15,000, 20,000 psis	0-25, 50, 100, 150 psig	0-6, 15, 25, 50, 100, 200, 300, 500, 1000, 2000, 5000 psig
<b>Accuracy</b>	$\pm 0.5, \pm 1\%$ span	ABHP: $\pm 0.25\%$ 0.5% FSO AB: $\pm 1\%$ FSO	$\pm 1\%$ FSO	$\pm 1\%$ FSO
<b>Signal Output</b>	0 to 50 mV	0 to 100 mV	0.5 to 4.5 Vdc	EA: 1 to 6 Vdc EAF: 1 to 6 kHz
<b>Excitation</b>	5 Vdc recommended (6 Vdc maximum)	5 Vdc recommended (6 Vdc maximum)	5 Vdc	EA: 8 to 24 Vdc EAF: 10 to 20 Vdc
<b>Operating Temp Range</b>	-40° to 100°C (-40° to 212°F)	-54° to 93°C (-65° to 199°F)	-40° to 105°C (-40° to 221°F)	EA: -55° to 100°C (-67° to 212°F) EAF: -40° to 85°C (-40° to 185°F)
<b>Compensated Temp Range</b>	-1° to 82°C (30° to 180°F)	ABHP: -1° to 70°C (-30° to 160°F) AB: -1° to 54°C (-30° to 130°F)	0° to 85°C (-32° to 185°F)	-1° to 85°C (-30° to 185°F)
<b>Thermal Effect On Zero</b>	$< \pm 1\%$ FSO any 55°C change within the compensated range	ABHP: $< \pm 1\%$ FSO any 55°C change within the compensated range AB: $< \pm 5\%$ span within the compensated range	$< \pm 2\%$ FSO any 55°C change within the compensated range	$< \pm 1\%$ any 55°C change within the compensated range
<b>Thermal Effect On FSO</b>	$< \pm 1\%$ any 55°C change within the compensated range	ABHP: $< \pm 1\%$ any 55°C change within the compensated range AB: $< \pm 2\%$ within the compensated range	$< \pm 1\%$ any 55°C change within the compensated range	$< \pm 1\%$ any 55°C change within the compensated range
<b>Options</b>	Port with 1/8" BSPP thread 12 mm hex nut Protective boot Hirshmann connector	Longer cable lengths Bendix connector Teflon <sup>®</sup> coated diaphragms		Locking connector

# PRESSURE TRANSDUCER ACCESSORIES AND OPTIONS

## Adapters For Pressure Transducers

These adapters are simple two-piece fittings which house the AB, BF and BL Models. They not only interface with the working system, but also shield the transducer from the mechanical environment.

Model	Description	Max. Pressure	Burst Pressure
AD-1SS	300 Series Stainless Steel, 1/4" NPT male	10,000 PSI	20,000 PSI
AD-1SF	300 Series Stainless Steel, 1/4" NPT, male w/ 40 micron snubber	10,000 PSI	20,000 PSI
AD-1N	Nylon 1/4" NPT male	200 PSI	400 PSI
AD-2SS	300 Series Stainless Steel, 1/4 Tube Fitting	3,000 PSI	6,000 PSI
AD-3SS	300 Series Stainless Steel, 1" NPT male flush diaphragm	10,000 PSI	20,000 PSI
AD-4N	Nylon, barbed fitting for 1/4" ID hose	100 PSI	200 PSI
AD-5SS	17-4PH Series Stainless Steel Autoclave Fitting	20,000 PSI	40,000 PSI
AD-6SS	300 Series Stainless Steel 7/16-20 UNF	10,000 PSI	20,000 PSI
AD-7SS	17-4PH Stainless Steel, 1/4" NPT male, high pressure	20,000 PSI	40,000 PSI



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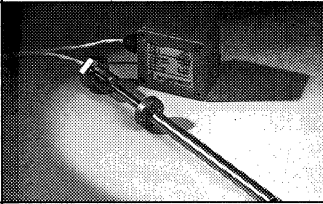
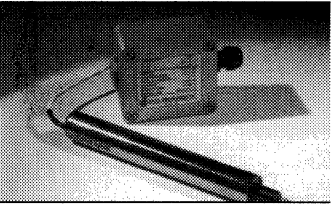
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# FASTAR® POSITION TRANSDUCERS

## FASTAR NON-CONTACT DISPLACEMENT

	DC HydraStar	DC Fastar
		
Linear Range	2 to 24" (51 to 610mm)	3/4 to 24" (19 to 610mm)
Frequency Response	DC to 10 kHz	DC to 10 kHz
Response Time	35 μs	35 μs
Output	4-20 mA or 0-10 Vdc (choice of one)	4-20 mA or 0-10 Vdc (choice of one)
Excitation	10 to 36 Vdc @ 30 to 50 mA	10 to 36 Vdc @ 30 to 50 mA
Shock	100 g 6 ms half sine	100 g 6 ms half sine
Vibration	Meets Mil-STD 810C (overall g rms = 20.7)	Meets Mil-STD 810C (overall g rms = 20.7)
Life	Infinite	Infinite
Linearity	0.1 or 0.05%	0.15 or 0.10%
Repeatability	0.003% FSO	0.003% FSO
Resolution	0.001% FSO	0.001% FSO
Processor Temp. Coefficients	FSO = -0.016%/°C Null = -0.004%/°C	FSO = -0.010%/°C Null = -0.002%/°C
Transducer Temp. Coefficients	FSO = ±0.010%/°C Null = ±0.010%/°C	FSO = ±0.004%/°C FSO = ±0.004%/°C
Transducer Compensated Temp. Range	-5°C to 80°C (25° to 175°F)	-5°C to 80°C (25° to 175°F)
Transducer Operating Temp. Range	-51°C to 105°C (-60° to 221°F)	-51°C to 105°C (-60° to 221°F)
Processor Operating Temp. Range	-34°C to 60°C (-30° to 140°F)	-34°C to 60°C (-30° to 140°F)
Insulation Resistance	1000 MΩ @ 500 Vdc	1000 MΩ @ 500 Vdc
Electrical Connection	Right-angle connector	Right-angle connector

**Fastar** is a precision inductive displacement and position transducer. Available in two mechanical configurations, **Fastar** and **HydraStar**, it offers shorter body lengths and faster response compared to LVDT's and magnetostrictive devices.

The two mechanical configurations and two models of signal processors allow **Fastar** to readily be used in applications ranging from laboratory research to volume OEM. When used with the patented signal processors shown in this brochure, the **Fastar** family provides the following key features.

### FEATURES:

- Displacements of 0.75 to 24"
- Fastar body length approximately 2" longer than linear range; HydraStar body length approximately 1.8" longer
- Excellent stroke to stroke repeatability
- 0.10% or 0.05% linearity
- Unequaled response time of <40μsec between core motion and change in output
- A unique dynamic compensation technique to reduce temperature errors at the transducer
- HydraStar designed specifically to fit cylinders machined to mount a Temposonics® type transducer
- Wide operating temperature range
- Fastar versions resistant to EMI
- Maximum Operating Pressure: 5000 PSI (350b)



**DATA INSTRUMENTS**

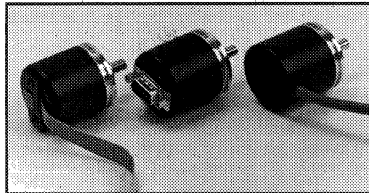
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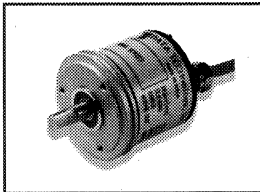
# TAKE CONTROL OF YOUR POSITION!

**But don't do it alone! Ask Torque Systems specialists for help. Have us specify the exact encoder solution to fit your needs from our broad new line of high performance Data Technology Encoders!**



**SM15 Advanced Small Industrial Encoder**

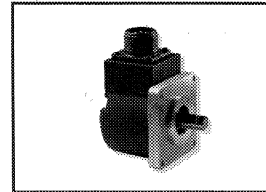
\* Available in line counts up to 2000 PPR \* Miniature shielded ball bearings \* Fast operating speeds (200 kHz)  
\* Shaft loading max: Radial 4.4 lbs., Axial 2.2 lbs. \* Bearing life:  $11.2 \times 10^9$  revolutions \* Dual channel 90°phased with optional index pulse \* Available with differential outputs \* Line driver a standard \* TTL & CMOS compatible



**New SM16 Low Cost Advanced, Industrial Encoder**

\* Available in line counts up to 2500 \* Sealed to IP65 Ratings \* 200 kHz standard frequency inclusive of A, B and Z outputs \* Shaft loading up to 10 lbs. axial and radial \* RS-422A compatible

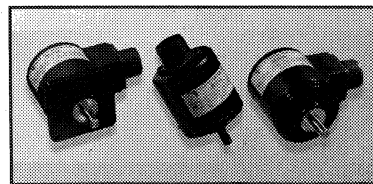
# New!



**New DT20 IP65 Rated Encoder**

\* Sealed to IP65 Standards \* Available in line counts up to 2500 \* Frequency response up to 200 kHz \* Shaft loading up to 80 lbs. axial and radial \* Power inputs up to 24V \* RS-422 compatible \* Many terminations available

The encoders displayed here are just a representative sample of the broad new line of Data Technology Encoders manufactured at CMC's Torque Systems Division. Ask us to provide the exact encoder solution to fit your needs and expect expedited service to ensure maximum satisfaction.



**DT25 Industrial Sealed Heavy Duty Encoder**

\* Available in line counts up to 5400 on the disc (up to 86,400 PPR with multiplier logic) \* Operating frequency 200 kHz or 3000 RPM, whichever occurs first \* Bearing thrust max: 40 lbs. (156 N) \* Radial force max: 35 lbs. (156 N) \*TTL & CMOS compatible

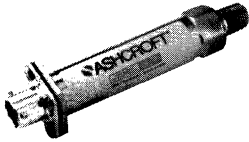

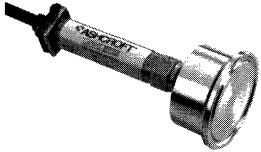
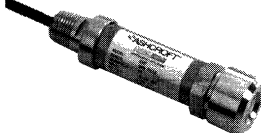
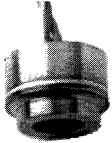
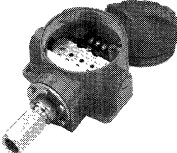
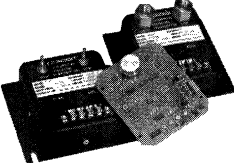

## Torque Systems Division

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## Pressure Transducers

Models	Applications	Features	Ranges	Accuracy	Wetted Material	Output Signal
 K1	General/Industrial OEM	UL/FM Intrinsically safe options Polysilicon sensor Multiple process and electrical connections	15-300 psig 500-20,000 psis Vacuum Compound	0.5% 1.0%	316 SS and 17-4 PH SS	4-20 mA 1-5 Vdc 1-6 Vdc 1-11 Vdc
 V1/V2	Industrial OEM Automotive OEM Refrigeration Railroad systems CNG pressure monitor	Hermetically sealed Temp output available Operating -40°F to 250°F RFI protection 20V/m High overpressure	100-20,000 psis Compound	0.5% 1.0%	17-4PH 316 SS Hastelloy	1-5 Vdc 1-6 Vdc 0.5-4.5 Vdc 4-20 mA millivolt
 KS	Sanitary Tank level Pharmaceutical Dairy Brewery	316L SS electropolished diaphragm 1½" & 2" seals NEMA-4X Polysilicon sensor	30-1000 psig Vacuum Compound	1.0%	316 SS	4-20 mA 1-5 Vdc 1-6 Vdc 1-11 Vdc
 KX	Paper and pulp Paint	316 SS flush diaphragm with weld nut or O-ring seal Polysilicon sensor	60-1000 psig Compound	1.0%	316 SS	4-20 mA 1-5 Vdc 1-6 Vdc 1-11 Vdc
 K8	Industrial OEM	Polysilicon strain gauge bridge	45 to 300 psig 500 to 10,000 psis	0.5% 1.0%	316 SS and 17-4 PH SS	millivolt
 HD 953	Process Petrochemical	316SS wetted FM/CSA for intrinsically safe 3:1 Turndown, Dampening	45-20,000 psi Compound	0.25%	316SS Hastelloy	4-20 mA
 XLdp	Energy management system Clean room monitoring Leak detection Laminar flow Dry gases	NEMA-2 case 25 psis proof pressure Zero and span	±0.5" W.C. to +50" W.C. dp Unidirectional and bidirectional ranges available	0.25% 0.5% 1.0%	Glass, Silicon Aluminum Valox, RTV	4-20 mA 1-5 Vdc 1-6 Vdc
 IXLdp	Fume hood control Emission flow monitoring Stack monitoring Room pressurization Dry gases	NEMA-4X intrinsically safe (optional) noninteractive 50 psis proof pressure 5:1 turndown Variable dampening	±0.05" W.C. to +200" W.C. dp Unidirectional and bidirectional ranges available	0.25% 0.5%	Glass, Silicon RTV, Aluminum	4-20 mA 0-5 Vdc 1-5 Vdc 1-6 Vdc ±2.5 Vdc ±5.0 Vdc

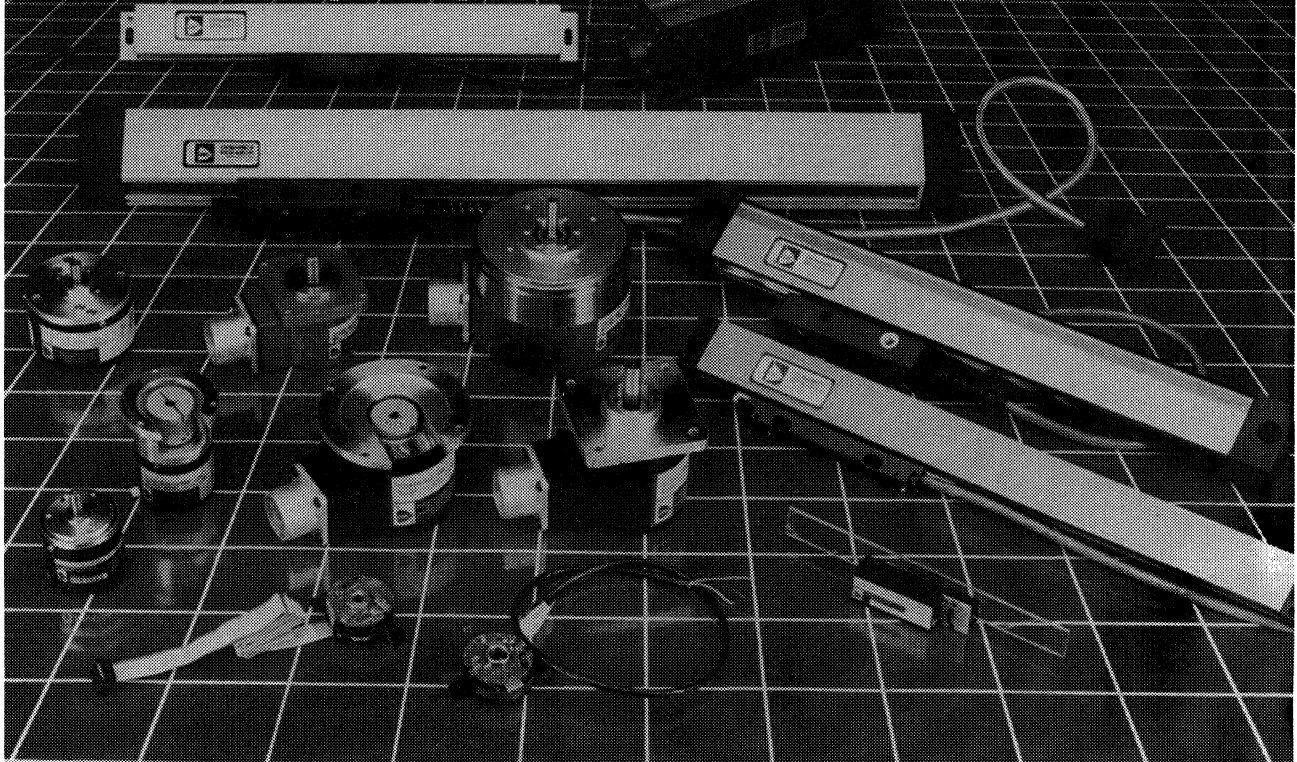
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TEL: (203) 783-6650 • FAX: (203) 783-6659

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ENCODER DIVISION

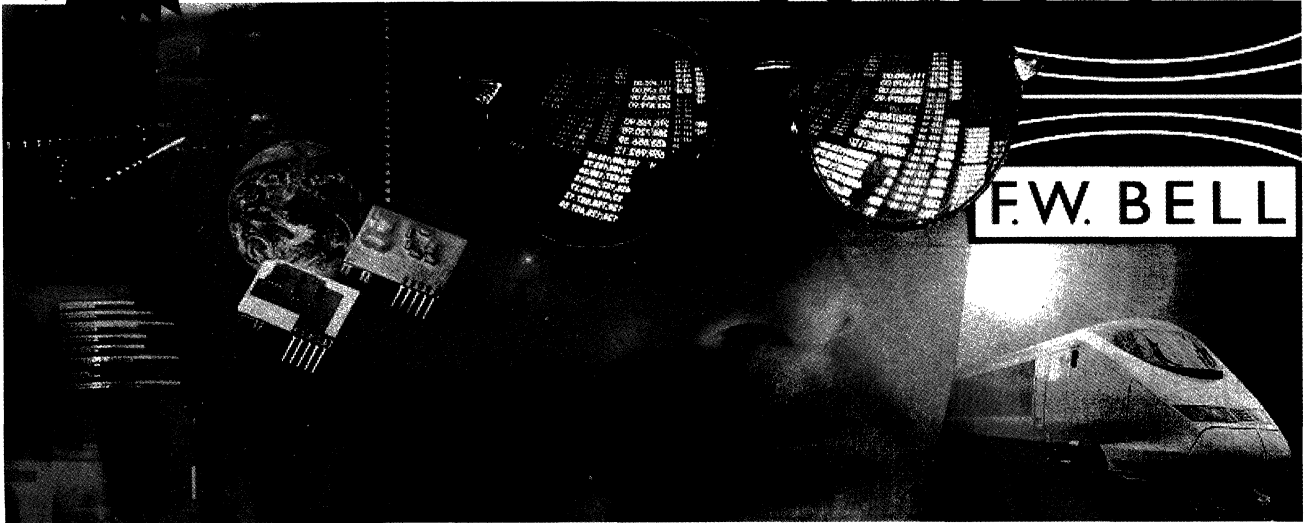


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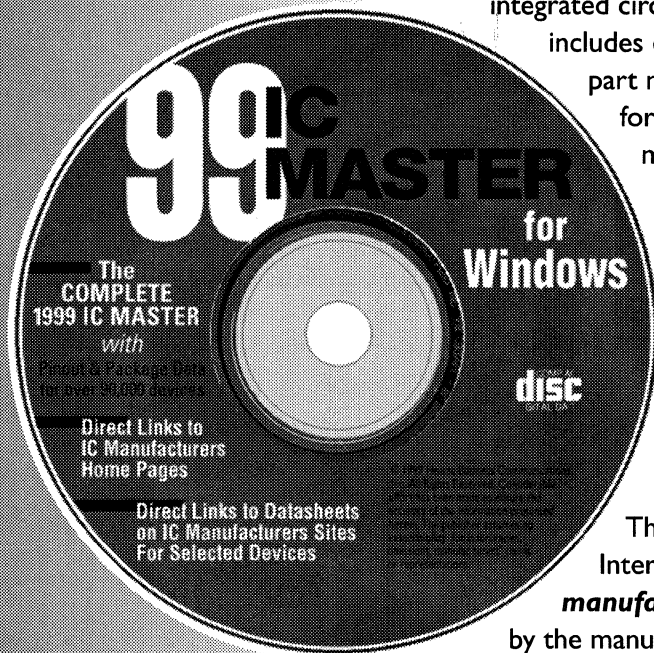


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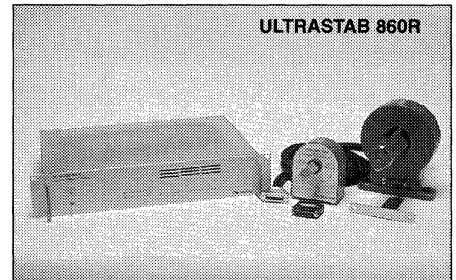
# Current Transducers For DC and AC Current Measurement and Control

## ISOLATED CURRENT MEASUREMENT

Danfysik ULTRASTAB current transducers provide isolated measurement of current with much greater precision and stability than resistive shunts or Hall effect transducers. They operate by exactly compensating the magnetic field around a current carrying conductor with a compensation current in a multturn secondary winding on a toroidal core. This "zero flux" technique achieves stability and linearity in the ppm range with frequency response from dc to over 100kHz.

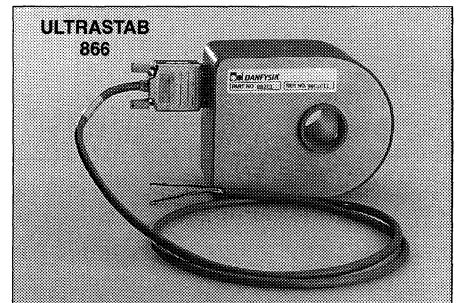
## Laboratory Current Transducer Systems to 10,000A

Two Danfysik ULTRASTAB Current Transducer Systems are offered for laboratory development, quality assurance and calibration applications. They consist of a sensing head and a 19 inch rack mounting control with a stabilized temperature oven for the burden resistor and output amplifier circuitry. The Model 860R system provides a  $\pm 10V$  output for full-scale currents of  $\pm 40A$  to  $\pm 2,000A$ . The Model 861R system is for full-scale currents to  $\pm 10,000A$ . Absolute calibration accuracy is better than  $\pm 50ppm$  with long term stability of better than 5ppm/month. Frequency response is from dc to 500kHz at lower currents.



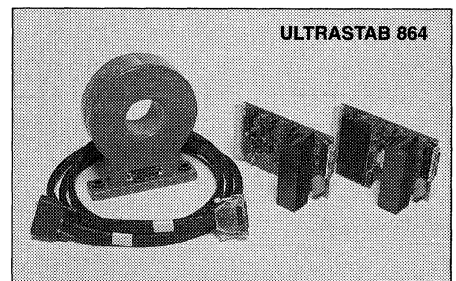
## Integrated Transducers to 600A

The Danfysik ULTRASTAB 866 Current Transducer range is a replacement for resistive shunts or Hall effect current transducers in precision current regulated power supplies or amplifiers. Full-scale primary current ranges are  $\pm 150A$  and  $\pm 600A$ . The output is  $\pm 200mA$  or  $\pm 400mA$  full-scale. Linearity and stability are better than 1ppm and the operating bandwidth is from dc to 100kHz with an output slew rate of better than 10kA/ms (effective input). A voltage signal output option with slightly degraded performance is also available. Full scale ranges are  $\pm 75A$ ,  $\pm 150A$ ,  $\pm 300A$ ,  $\pm 600A$  with  $\pm 10V$  output.



## Modular Transducers to 2,000A

The Danfysik ULTRASTAB 864 Current Transducers consist of a separate sensing head and an Eurocard control module. Full-scale current ranges are  $\pm 1,000A$ ,  $\pm 1,500A$ , and  $\pm 2,000A$ . Two module options are offered: the 864I has a full-scale output of  $\pm 1A$ ; the 864U has a precision burden resistor and voltage amplifier to give a full-scale output of  $\pm 10V$ . Frequency response is from dc to over 300kHz at lower currents.



Refer to EEM 2900 for Precision Magnetic Field Measurement

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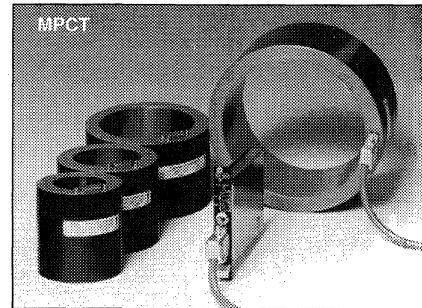
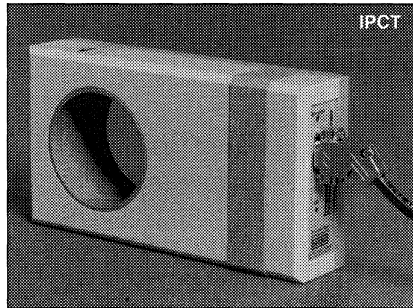
# Current Transducers for High Sensitivity Measurement of Current or Charge

## NON-CONTACTING MEASUREMENTS

*Bergoz current transducers have been developed for the non-destructive measurement of dc and pulsed currents in particle accelerators and electron beam equipment. They may be applied to the measurement of any electric current where ohmic isolation is required.*

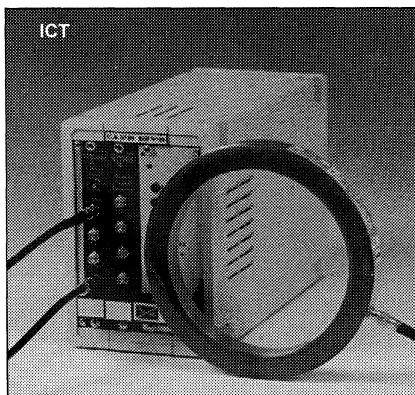
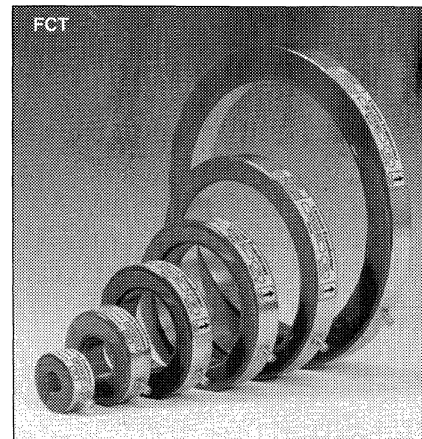
### DC and Low Frequency Current

The Bergoz Parametric Current Transformer (PCT) operates using the flux compensation principle with very high permeability magnetic cores to produce high accuracy measurements of currents in the frequency range dc to 4kHz. The IPCT has a 69mm aperture diameter and full-scale current ranges from 1mA to 2A. Applications include measurement of ground currents, standby charging currents, currents at high voltage, differential currents on multiple cables and electrochemically induced currents. The MPCT series has sensor heads with inside diameters up to 1m and a separate electronic module. Full-scale current can be selected from 10mA to 5A with resolution of approximately 10 $\mu$ A.



### Pulse and RF Current

Bergoz Fast Current Transformers (FCT) are passive current transformers with amorphous alloy ribbon toroidal cores to achieve very high frequency response flat to over 1.3GHz. This produces faithful reproduction without ringing, of current pulses with rise times to less than 0.3ns. Output impedance is 50ohm for driving a terminated 50ohm cable. Winding ratios can be selected from 250:1 to 5:1 to provide a maximum 500V output pulse for currents from 5kA to 100A. With an output amplifier option the sensitivity can be increased to 500mV/mA with a frequency response up to about 200MHz.



### Pulse Charge (Integrated Current)

The Bergoz ICT (Integrating Current Transformer) is a unique passive transformer whereby very fast current pulses with rise times of less than 1ps are integrated on a single turn winding and read out as a current or voltage pulse proportional to the input pulse charge. For standard ICT the output pulse is approximately 70ns (at 1% of full maximum) which can readily be handled by conventional electronic amplifiers. With the Bergoz BCM (Beam Charge Monitor) signals from the ICT can be processed down to a noise level of approximately 0.5pC.

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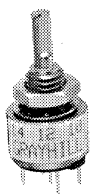




# Optical and Mechanical Encoders

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## 26 SERIES BINARY CODED MECHANICAL ENCODER



- Shaft and Panel Seal
- 1 Pole with Adjustable Stops
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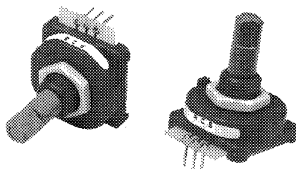
### 1/2" DIAMETER FRONT PANEL SWITCH

26 Series switch is rated to make and break logic compatible loads for 25,000 operation; a cycle is 360° and a return thru all positions. The four output terminals are on 0.3x0.2" (7.62x5.08) centers with

the common terminal in the center; terminals are marked on the switch. The switch may have continuous rotation, or be adjusted to limit the rotation. All switches have shaft and panel seal. The panel seal ring can be removed to expose the stop pin holes on the front of the switch. Two stop pins are supplied with the switch. One or both may be used to limit the rotation as desired. Approx. .322 (8,43) behind panel plus terminals. Shaft projects .625 (15,88)

Type	Positions
26ASD22-01-1-AJS	16
26ASD45-01-1-AJS	8

## 25L SERIES MECHANICAL ENCODERS

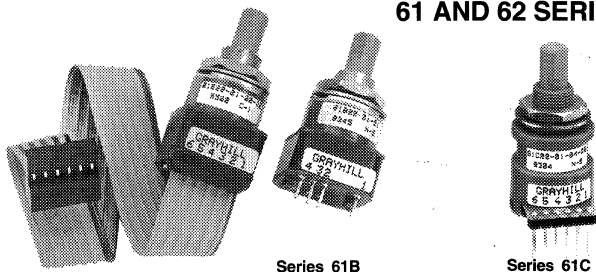


25L Series switch is less than 1" square and is available in multiple code and indexing choices. Life expectancy is 100,000 cycles of operation.

Type	Pos.	Code
25LR10-Q	36	Quadrature
25LR15-Q	24	Quadrature
25LR22-Q	16	Quadrature
25LR22-H	16	Hexadecimal
25LR22-G	16	Gray

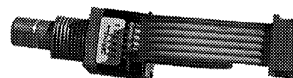
Custom codes, rotational stops, shaft and panel seal, custom shaft length, diameters and styles, custom bushing lengths and diameters, and custom terminations are available upon request.

## 61 AND 62 SERIES OPTICAL ENCODERS



Series 61B

Series 61C

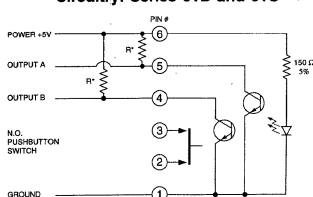


Series 62A

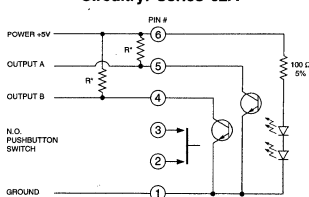
Light passage is allowed or interrupted as switch is operated. Provides million cycle life. Encoders produce a two bit, four state, quadrature code illustrated below. The code repeats every four positions. Number of changes and direction of rotation can be sensed. Panel mount, operator input versions are available in economical (thermoplastic shaft and bushing), type 61C and ruggedized (zinc, die cast bushing), type 61B. Panel mount versions require user supplied pull-up resistors dependent on the type of logic that is used. Switching current: 30 mA max. Temperature range: -40°C. to +65°C.

Type 62A is a compact, 1/2" package with proven reliability. Available with or without integrated pushbutton in 16, 24 and 32 detent positions, with maximum 24" cable available in 1/2" increments with connector or stripped wire (contact Grayhill for special lengths).

Circuitry: Series 61B and 61C



Circuitry: Series 62A



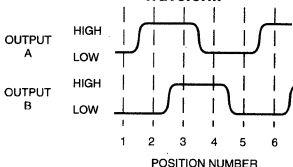
\*External pull-up resistors required for operation. 8.2 kΩ is suggested for TTL; 3.3 kΩ is suggested for CMOS.

\*External pull-up resistors required for operation. 8.2 kΩ is suggested for TTL; 3.3 kΩ is suggested for CMOS.

Output (as related to switch position)

CW Position	Output	
	A	B
1		
2	•	
3	•	•
4		•

Waveform



Series 61B, Ruggedized Panel Mount		
Type	Pos.	Termination
61B22-01-02	16	Switch Pins
61B22-01-02-050	16	5" Cable/Connector
61B22-01-02-075	16	7.5" Cable/Connector
61B11-01-02	32	Switch Pins
61B11-01-02-050	32	5" Cable/Connector
61B11-01-02-075	32	7.5" Cable/Connector
Series 61C, Economical Panel Mount		
61C22-01-04-02	16	Switch Pins
61C11-01-08-02	32	Switch Pins
Series 62A, Economical, 1/2" with Integrated Pushbutton		
62A11-02-060C	32	6" Cable/Connector
62A11-02-060S	32	6" Stripped Cable
62A15-02-060C	24	6" Cable/Connector
62A15-02-060S	24	6" Stripped Cable
62A22-02-060C	16	6" Cable/Connector
62A22-02-060S	16	6" Stripped Cable

Other available options include different cable lengths, termination means, resolution, etc. Bearing assist and concentric shafts available on custom 61D Series, contact Grayhill.

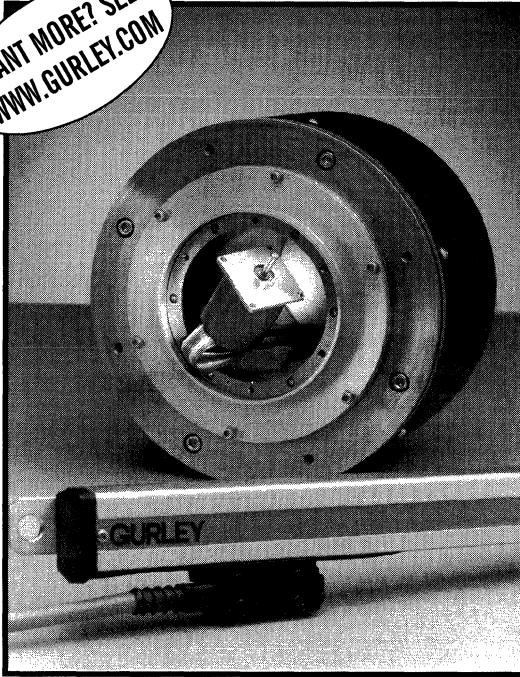
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# ENCODERS

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ENCODER TYPE	MODELS OFFERED	SPECIFICATIONS
Rotary Incremental Shaft	814, 825, 835, 911, 920, R135 & R137	Up to 225,000 cycles/rev, choice of outputs & sizes
Rotary, Metrology-grade	8460	0.36 arcsec resolution, $\pm 1$ arcsec accuracy
Rotary Incremental Hollow Shaft	835H, 920	Up to 225,000 cycles/rev, choice of outputs & sizes
Rotary Absolute Shaft	A25S (with optional serial interface card)	131,072 ( $2^7$ ) words/turn, fully accurate up to 600 rpm
Rotary Absolute Hollow Shaft	60/25H	Up to 21-bit resolution (2,097,152 words/turn)
Linear Encoders (closed or open)	LE18 & LE25, P20 & P40 measuring gages	To 3m or spring-loaded plunger to 40mm; to 0.1 $\mu$ m res.
Modular Incremental	8710, 8717, 9710	Up to 36,000 lines, up to 30 dia. Discs
Miscellaneous	Heavy duty enclosure, HR2 high-resolution interpolator, virtual absolute technology and more!	

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**Magnetic Proximity Sensors UL File # E61760(N)**

Sensor contacts are activated by an approaching magnetic activator or selected magnet and release as it is withdrawn. Sensors are connected in series with the load. No additional power is required for operation. They are

unaffected by any non-ferrous material placed between the sensor and activator. Contacts are hermetically sealed for protection in hostile environments.

**OPERATING CHARACTERISTICS**

Typical operate time: 1ms  
 Operate and Storage Temp: -20 to +105 Deg. C.  
 Shock without false operation: 50G's 11ms,  
 1/2 sine wave  
 Typical Life @ 5Vdc, 10ma...50 x 106

**ELECTRICAL CHARACTERISTICS**

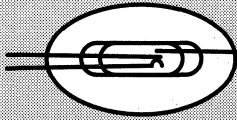
CONTACT TYPE	MAX. WATTS RATING	MAX. Vdc	MAX. AMPS
-010 SPST-NO	10	200	.500
-020 SPST-NO H.V.	10	300	.500
-030 SPDT-CO	5	175	.250
-040 SPST-NC	5	175	.250

**SENSORS**

**ACTUATORS**

TYPE	MUST OPERATE DISTANCE	MUST RELEASE DISTANCE	MILLIMETERS IN ( ) ALL TOLERANCES ARE ±.015"	TYPE	MILLIMETERS IN ( ) ALL TOLERANCES ARE ±.015"
59025-020	.150	.800		57025-000	
59025-030	.150	.800		57025-000	
59045-010	.075	.550		57045-000	
59050-010	.150	.750		57050-000	
59050-030	.150	.750		57050-000	
59065-010	.150	.800		57065-000	
59065-030	.150	.150		57065-000	
59135-010	.350	1.150		57135-000	
59135-020	.350	1.150		57135-000	
59135-030	.350	1.150		57135-000	
59140-010	.175	.800		57140-000	
59140-030	.175	.800		57140-000	
59145-010	.225	.800		57145-000	
59145-030	.225	.800		57145-000	

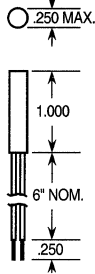
Terminations 1) All except 59045, 59050, 59135: 12" 24AWG PVC, 105 deg. C, 300V, UL 1430 or UL 1569 wire.  
 2) 59135 termination: 12" 20 AWG Teflon, 200 Degrees C, 300Vdc, UL 1180



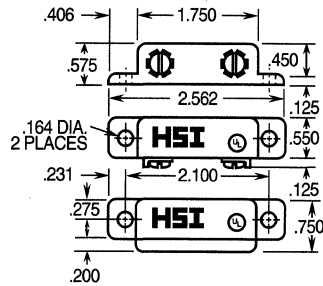
# Hermetic Switch, Inc.

## PROXIMITY SENSORS

PART # 1700, 1800, or 1900



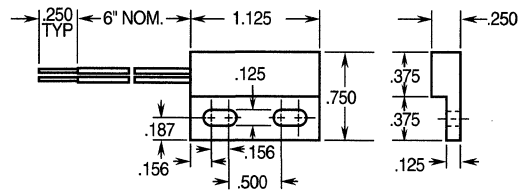
PART # 5100, 5200 or 5300



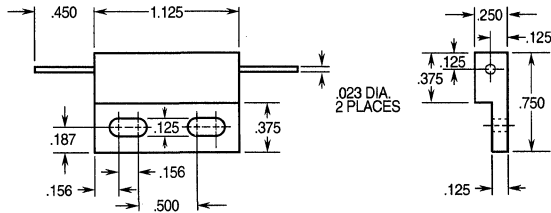
PART # 7100, 7200 or 7300



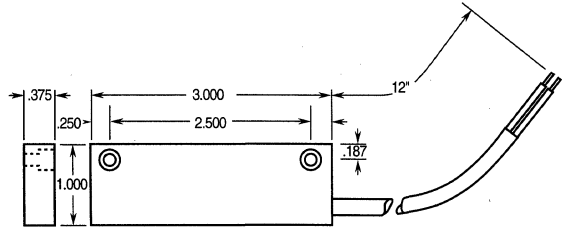
PART # 8200, 8300 or 8500



PART # 8400 or 8600

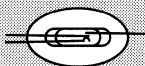


PART # 9100-9350



Custom Finishing Available On All Models.

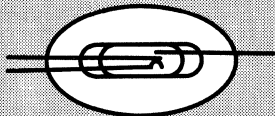
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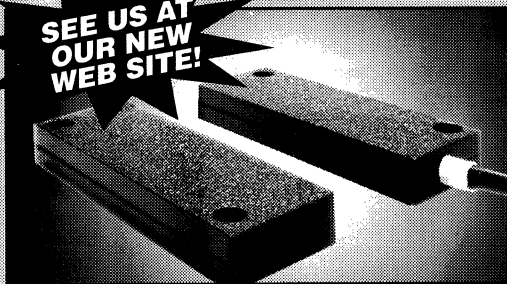
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# Hermetic Switch, Inc.

## PROXIMITY SENSORS

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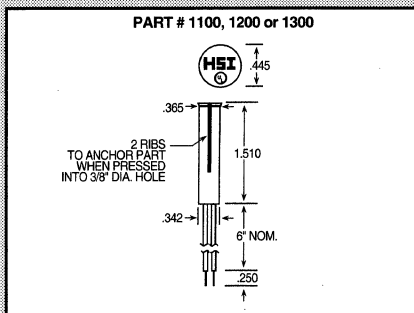


Hermetic Switch, Inc. manufactures a variety of two part magnetic proximity sensors (sensor and actuator). All sensors feature hermetically sealed reed switch contacts that can survive harsh environments. Specially selected epoxy potting materials and rugged plastic cases withstand the impacts and forces of the real world.

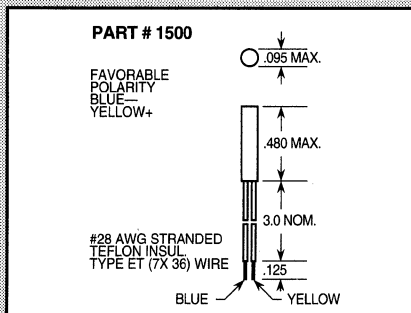
Many models are listed with Underwriters Laboratories, verifying that they have passed rigorous testing. Custom sensors not shown in our catalog may be required for your application. Consult factory for complete operate data, catalogs, and engineering assistance.

SENSOR MODEL	RECOMMENDED ACTUATOR	CONTACT FORM	SWITCHING RATINGS		
			MAX VOLTS DC	MAX AMPS DC	MAX WATTS DC
1100	1000	SPST-NO	30	.25	3.0
1200	1000	SPST-NC	30	.25	3.0
1300	1000	SPDT	30	.25	3.0
1500	1005	SPST-NO	30	.01	0.25
1700	1007	SPST-NO	100	.25	7.0
1800	1007	SPST-NC	100	.25	3.0
1900	1007	SPDT	100	.25	3.0
5100	5000	SPST-NO	30	.25	3.0
5200	5000	SPST-NC	30	.25	3.0
5300	5000	SPDT	30	.25	3.0
7100	7000	SPST-NO	30	.25	3.0
7200	7000	SPDT	30	.10	3.0
7300	7000	SPST-NC	30	.10	3.0
8200	8100	SPST-NO	200	.50	10.0
8300	8100	SPDT	100	.25	3.0
8400	8100	SPST-NC	100	.25	3.0
8500	8100	SPST-NO	—	—	360 VA*
8600	8100	SPST-NO	200	.50	10
9100	9000	SPST-NO	120	1.0	25
9200	9000	SPST-NC	120	1.0	25
9300	9000	SPDT	120	1.0	25
9150	9000	SPST-NO	240	3.0	200
9250	9000	SPST-NC	240	3.0	200
9350	9000	SPDT	240	3.0	200

\*AC only NOTE: Magnetic actuators are in similar housings per each sensor model.



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www.hermeticswitch.com



### MICRO SWITCH Solid State Hall Sensors

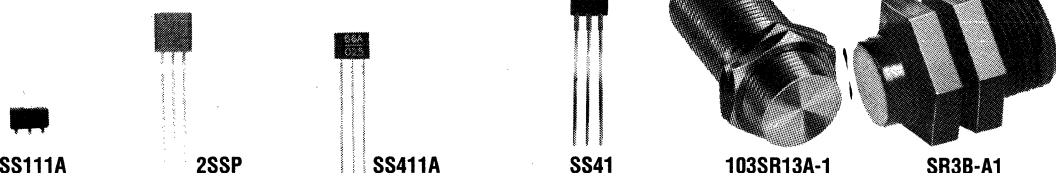
Hall effect sensors respond to a magnetic field, or—in the case of Hall vane sensors—to the interruption of a magnetic field. Hall sensors are not rate sensitive. They operate at extremely high speed and include signal condi-

tioning. They offer high reliability, long life, and compatibility with microprocessors and other electronic circuitry. Request Catalog 20.

**Sensors are used in:**

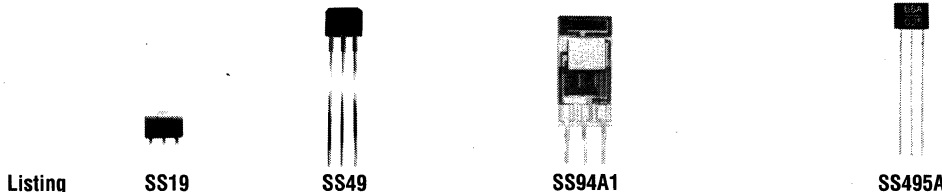
- Ignition systems
- Brushless DC motors
- Utility meters
- Water softeners
- Gasoline pumps
- Welding equipment
- Balance scales
- Interlocks
- Flowmeters
- Magnetic card readers
- Vending machines
- Home appliances
- Computer equipment
- Medical instruments
- Copy machines
- Laboratory equipment

### MAGNETIC POSITION SENSORS-DIGITAL OUTPUT



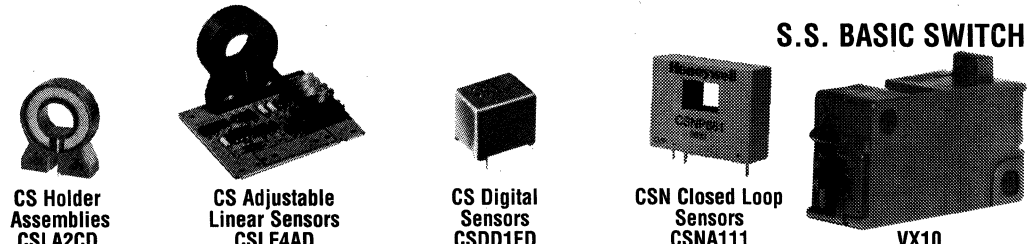
Listing	SS111A	2SSP	SS411A	SS41	103SR13A-1	SR3B-A1
Operation	Proximity to external magnet					
Supply Voltage	3.8 to 30 VDC	6 to 24 VDC	3.8 to 30 VDC	4.5 to 24 VDC	4.5 to 24 VDC	
Construction	Molded plastic SOT 89 style	Molded plastic package			Threaded aluminum	Thermoplastic
Termination	PCB				Leadwires/Cable	
Operating Speed	0 to over 100 kHz					
Gauss (25°C Typ.)	60 Op. -60 Rel.	15 Op. 11 Rel.	60 Op. -60 Rel.	40 Op. -40 Rel.	400 Op. 200 Rel.	90 Op. -90 Rel.
Output Type	NPN 20mA	NPN 20mA		NPN 10mA	NPN 20mA	NPN 10mA
Other Options	Unipolar, latching	≈ 1" sensing distance.	Unipolar, latching	Operating gauss	Stainless steel housing	Bipolar

### MAGNETIC POSITION SENSORS-Analog Output



Listing	SS19	SS49	SS94A1	SS495A
Operation	Proximity to external magnet			
Supply Voltage	4 to 10 VDC		6.6 to 12.6 VDC	4.5 to 10.5 VDC
Construction	Molded plastic		Ceramic hybrid circuit	Molded plastic
Termination	PCB			
Operating Speed	1.5 µsec response time		3 µsec response time	1.5 µsec response time
Span (25°C typical)	Span (-400 to +400) 1.75 to 2.25V @ 5V		Span (-500 to +500) .63Vs.	-670 to +670G, Span 0.2 to (Vs - 0.2)
Output Type	Analog, sourcing		Ratiometric, sink or source	

### CURRENT SENSORS



Listing	CS Holder Assemblies CSLA2CD	CS Adjustable Linear Sensors CSLF4AD	CS Digital Sensors CSDD1ED	CSN Closed Loop Sensors CSNA111	S.S. BASIC SWITCH VX10
Operation	Current sensor				Mechanical plunger
Supply Voltage	6 to 12 VDC	10.5 to 24 VDC	4.5 to 24 VDC	±15 VDC	4.5 to 24 VDC
Termination	PCB	PCB, Quick conn.	PCB	PCB	AMP connector
Operating Speed	3 µ sec.	8 µ sec.	1msec.	<1 µ sec.	Depends on actuator
Sensed Current, max.	72A AC/DC	57A DC	3.5A op., 2.5A rel.	70A AC/DC	-40 to 100°C
Output Type	Linear, ratiometric	Linear, 4-20mA	Digital NPN 40 mA	Linear, ratiometric	Digital, NPN Normally high 10mA
Other Options	Up to 950A sensing, side mount.	1-5 V output. AC or DC sensing. Enclosed.	5V or 6-16V supply. Thru-hole design. 0.5 to 11.4 sensing	Sense up to 600 A. AC, DC, impulse currents. High elect. isolation.	Normally low output. Many lever actuator.

### SALES AND SERVICE

For application assistance, current specifications, pricing or name of the nearest Authorized Distributor, contact a nearby sales office. Or call: 1-800-537-6945 USA 1-800-737-3360 Canada 1-815-235-6847 International

**FAX: 1-815-235-6545 USA**  
**Internet:** <http://www.honeywell.com/sensing/>  
**Email:** [info@micro.honeywell.com](mailto:info@micro.honeywell.com)



# MICRO SWITCH Piezoresistive Pressure Sensors

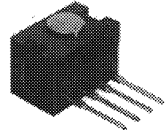
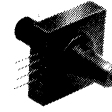
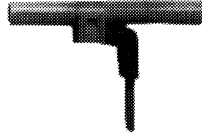
## UNAMPLIFIED SENSORS

Piezoresistive pressure sensors convert air or liquid pressure to an analog signal. MICRO SWITCH pressure sensors are small, low cost and reliable, with excellent repeatability, high accuracy, and reliability under varying

environmental conditions, highly consistent operating characteristics from one sensor to the next and interchangeability without recalibration. Low cost to keep your systems costs down. Request Catalog 15.

### UNAMPLIFIED SENSORS

### FORCE SENSORS



**20PC Series**  
22/24/26PC Series

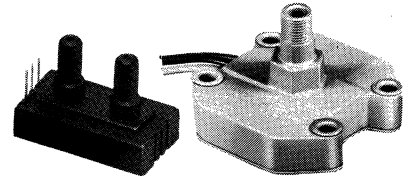
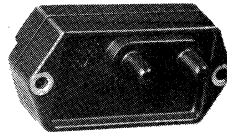
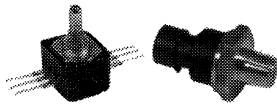
**Flow-through 20PC Series**  
24/26PC Series

**176PC Series**

**FS Series**

Listing	20PC Series 22/24/26PC Series	Flow-through 20PC Series 24/26PC Series	176PC Series	FS Series
<b>Operation</b>	Deflection of silicon diaphragm			
<b>Supply Voltage</b>	10 VDC			8 VDC, typ.
<b>Pressure Range (psi)</b>	1, 15, 100, 22PC 0.5, 1, 5, 15, 30, 100, 250, 24PC 1, 5, 15, 30, 100, 26PC	.5, 1, 5, 15, 30, 100, 250, 24PC 1, 5, 15, 30, 38 (@ 15psi), 100, 26PC	7, 14" H <sub>2</sub> O	1500 grams
<b>Measurement Type</b>	Gage, Differential	Gage	Gage	Force
<b>Construction</b>	Thermoplastic housing			
<b>Termination</b>	PCB	PCB, Wire harness	PCB	
<b>Output</b>	mV			
<b>Calibrated Null &amp; Span</b>	No-22PC, No-24PC, Yes-26PC	No-24PC, Yes-26PC	Yes	No
<b>Temperature Comp.</b>	No-22PC, No-24PC, Yes-26PC	No-24PC, Yes-26PC	Yes	No

### AMPLIFIED SENSORS



**Listing**      **40PC Series**      **4000PC Series**

**140/160PC Series**

**180PC Series**

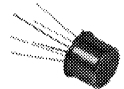
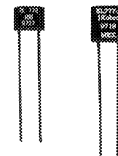
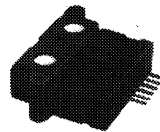
**249/240 Series**

Listing	40PC Series	4000PC Series	140/160PC Series	180PC Series	249/240 Series
<b>Operation</b>	Deflection of silicon diaphragm				
<b>Supply Voltage</b>	5 VDC		8 VDC, typ.		
<b>Pressure Range</b>	± 50 mmHg, 15 100, 150, 200 psi	150 psi	1, 2, 5, 15, 30, ±2.5, ±5, ±15 (140PC) 27.68" H <sub>2</sub> O, -20 to +120 cm H <sub>2</sub> O (160PC)	5, 15, 30, ±2.5, ±5, ±15	3-15, 100, 250 (249PC) ±15, 5, 15, 30, 60, 100 150, 250 (240PC)
<b>Measurement Type</b>	Gage		Gage, Absolute, Differential		Gage, Pressure-to-Current
<b>Construction</b>	Thermoplastic, Stainless steel		Thermoplastic		Die-cast aluminum
<b>Termination</b>	PCB				
<b>Output</b>	Volts				mA, Volts
<b>Calibrated Null &amp; Span</b>	Yes				
<b>Temperature Comp.</b>	Yes				

### HARSH DUTY PRESSURE SENSOR

### AIRFLOW SENSORS

### TEMPERATURE / MOISTURE SENSORS



**Listing**      **SSP Series**

**AWM3000V/40000/5000**

**TD/HEL Series**

**HIH Series**

Listing	SSP Series	AWM3000V/40000/5000	TD/HEL Series	HIH Series
<b>Operation</b>	Deflection of diaphragm	Silicon bridge heat loss	Temperature	Humidity
<b>Supply Voltage</b>	115 VAC, 12 to 36 VDC	10 VDC	1 to 2 mA (supply current)	
<b>Op. Range</b>	15, 100, 250 psig, max.	30, 200, 1000 sccm, .5, 2" H <sub>2</sub> O (AWM3000), ±25, ±1000, +1000 sccm, 6 SLPm (AWM40000), 5, 10, 15, 20 SLPm (AWM5000)	-55 to +150°C	-40 to +85°C
<b>Construction</b>	Die-cast zinc, NEMA 3, 3R, 4, 13	Plastic housing	Plastic, ceramic	Ceramic, aluminum
<b>Termination</b>	Screw/Receptacle	PCB	PCB	
<b>Temp. Range</b>	-25 to 85°C	-25 to 85°C, -20 to 70°C (AWM5000)	-55 to 150°C	-40 to +85°C
<b>Output</b>	Digital, Adj. Set point, Linear 4-20 mA proportional to pressure	Analog, 1-5V (AWM3000), Analog, mV, Volts (AWM40000), Linear, 1-5V (AWM5000)	Linear RTD	Linear

## Honeywell Smart Transducers

# FAMILY *of* Magnetic Sensors

*Honeywell offers the most sensitive magneto-resistive sensors within the earth's magnetic field. These sensors measure magnetic field in the tens of uGauss range for sensitive applications that Hall effect sensors cannot handle. Due to their small size and ability to withstand rugged applications, Honeywell sensors are often used to replace flux gate sensors.*

### FEATURES

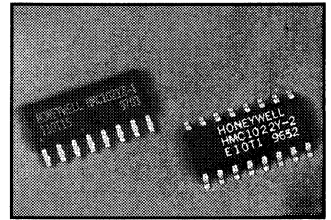
- High Sensitivity
- Low Noise
- Automatically Calibrated
- On-Chip Set/Reset Straps
- Easy to Mount
- Easy to Use
- Temperature Compensated
- High Reliability

### APPLICATIONS

- Compassing
- Traffic Detection
- Navigation Systems
- Virtual Reality
- Laboratory Instruments
- Medical Instruments
- Mineral Prospecting
- Food Processing and Others

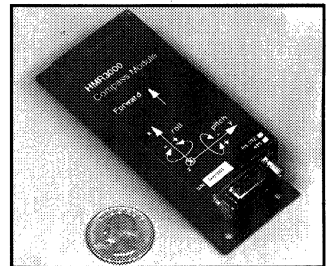
### One & Two Axis Magneto-resistive Magnetometers

Highly sensitive 1021/1022 sensors convert magnetic fields to a differential output voltage, capable of sensing magnetic fields as low as 85  $\mu$ Gauss. These new cost effective sensors are smaller and use less power. Devices reduce board assembly costs and improve reliability.



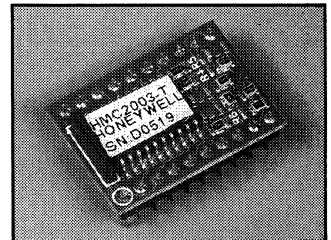
### Digital Compass Module

New electronic compass module (HMR3000) provides heading output (roll, pitch, yaw) via RS232/485 in NMEA format. Solid state magneto-resistive sensors provide fast response time to 20 Hertz and high heading accuracy of 0.5° with resolutions to 0.1°. Tilt range of  $\pm 45^\circ$  provides a wider range of accurate operation.



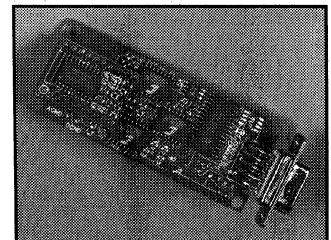
### Three Axis Magnetic Hybrid

The HMC2003 is designed for easy-to-use analog output applications. The magnetic sensors are sensitive to fields along the length, width and height (x, y, z axis) of the 20-pin dual-in-line package. The small size of 1" x 0.75" allows insertion into standard printed circuit boards.



### Smart Digital Magnetometer

The HMR2300 detects the strength and direction of a magnetic field and communicates the x, y, and z component directly to a computer. The magnetic field is converted to three 16-bit values using the HMC2003 magnetic sensor hybrid, three 16-bit A/D converters and a microprocessor.



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## Honeywell Smart Transducers

# FAMILY *Of* Precision Pressure Transducers

*Honeywell has developed a family of very affordable precision pressure transducers – the PPT and PPT-R. These high accuracy, smart transducers take the burden off the control system, and can be customized to your particular application. The PPT is designed for air and dry gas applications while the PPT-R, with its stainless steel diaphragm, is offered for harsh media.*

### FEATURES

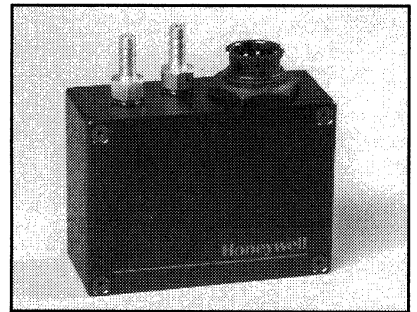
- High Accuracy over Temperature  
**PPT:** 0.05% or 0.1% of full scale typical including temperature errors from -40 to 85°C  
**PPT-R:** 0.1% of full scale typical including temperature errors from -40 to 85°C
- Analog 0.5V and Serial Digital Data
- Configured and Calibrated with a Personal Computer
- Communicates over a Serial bus
- Individually Addressable and Networkable
- Smart

### APPLICATIONS

- Laboratory and Medical Instruments
- Avionics Instruments
- Aircraft Manufacturer Test Facilities
- Weather Instruments
- Machine Control
- Environmental Monitors
- Gas, Diesel, and Turbine Engine Test Stands
- Pressure Measurements and Calibrators

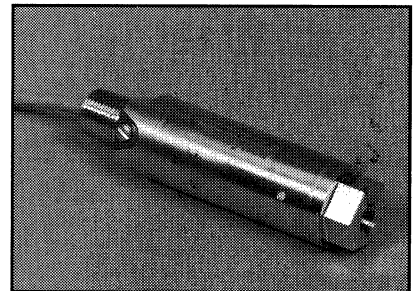
### Precision Pressure Transducer (PPT)

The basic model PPT is a high accuracy, smart pressure transducer which uses a Honeywell silicon piezoresistive sensor coupled with a microprocessor to perform digital signal processing. Each unit is individually characterized over temperature and pressure. Absolute, gauge and differential pressure models are offered covering full scale ranges from 1 psi to 500 psi.



### Precision Pressure Transducer – Ruggedized (PPT-R)

The ruggedized model PPT-R is a high accuracy, smart pressure transducer designed for harsh media. It also uses a Honeywell silicon piezoresistive sensor coupled with a microprocessor to perform digital signal processing. This sensor is isolated from the media by a stainless steel barrier diaphragm which transmits force to the sensor through an oil-filled cavity. Absolute and gauge pressure models are offered covering full scale ranges from 20 psi to 3000 psi.

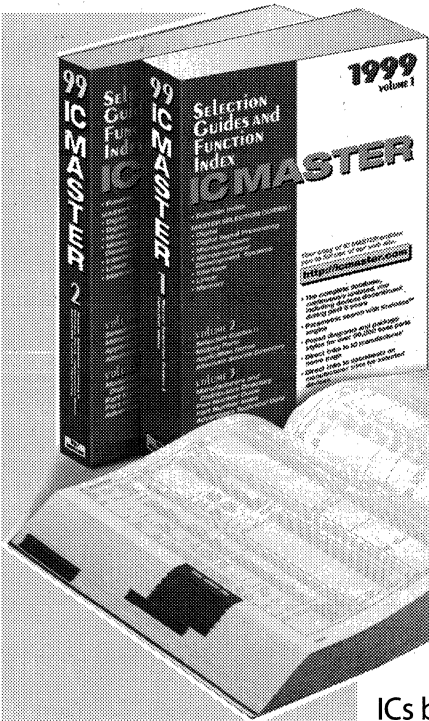


Explosion proof models, certified to Factory Mutual, CSA and GENELEC standards are now available.

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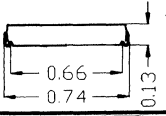

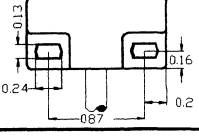

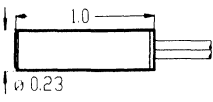

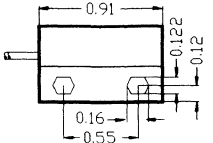

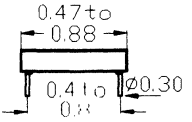

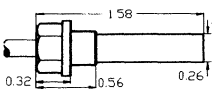

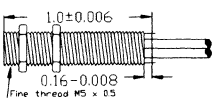

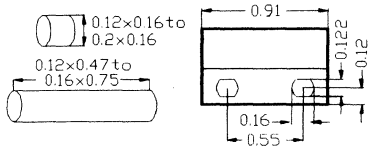







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Drawing Dimensions in Inch	Description	Avail. Contact Forms	Extra Features	Application	Model
	Surface mounted Reed Sensor	1A Up to 15W 200VDC	Very small	Cell Phone Microphone Security	 MK1
	Screw down Sensor	1A, 1B, 1C Up to 30W 500VDC	Available with or without internal Magnet	Security Position Sensor	 MK2
	Cylindrical Sensor	1A, 1B, 1C Up to 15W 500VDC	Various Cable avail. welded or potted	Security Position Sensor	 MK3
	Screw mounted Sensor similar to MK5 + MK13	1A, 1B, 1C Up to 15W 500VDC	Available with round Cable	Security Door Interlock	 MK4
	For PC Boards	1A, 1B, 1C Up to 15W 200VDC	Standard 0.1 Inch Spacing	Sensor for Test Equip. Thru-Hole PC Boards	 MK6
	Threaded	1A, 1B, 1C Up to 30W 500VDC	Various Cables Mounting Nut incl.	Limit and Position Sensor	 MK7
	Threaded	1A Up to 15W 500VDC	Various adjustable Positions	Limit and Position Sensor	 MK11
	Actuating Magnets Custom Moldings available				
Contact Meder electronic for available options using customer specified cable or standard cable to customer specified length and installation of standard or custom connectors.					
<b>CUSTOM SENSORS</b>					
					

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Tel: 860-887-9662 \* Fax: 860-887-9669 \* email: [meder@ids.net](mailto:meder@ids.net)

# Encoders

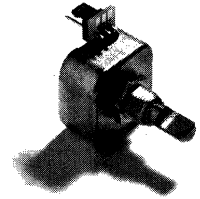
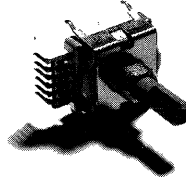
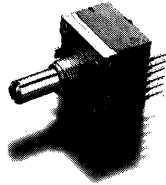
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## Mechanical Encoders:

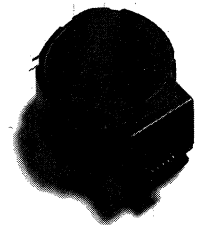
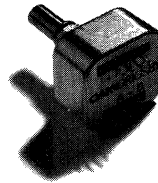
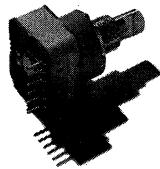
### MMP/Rel Series

### 700 Series

### 750 Series

	MMP/Rel Series	700 Series	750 Series
**Output Codes - Absolute	Hexadecimal, B.C.D., Gray	Gray	Gray
**Output Codes - Incremental	Quadrature, A/B	Quadrature, A/B	Quadrature, A/B
**Output Codes - Analog	Not applicable	Resistive	Resistive
Rotational Life (Cycles)	50,000	50,000	50,000
Rotational Torque	7 to 20 in/oz	4.5 to 7.5 in/oz	4.5 to 7.5 in/oz
Operating Temperature	-55 °C to +85 °C	-40 °C to +85 °C	-40 °C to +85 °C
**Number of Positions	4 to 36 and non-detent	12 to 36 and non-detent	12 to 36 and non-detent
Pulses Per Revolution	32	96	96
Operating Speed	30 rpm	30 rpm	30 rpm
Push-Button	Yes	Yes	No
Current Carrying Capacity	250 mA @ 28 VDC	150 mA	150 mA
Switching Loads	1.5 mA @ 115 VAC	1 mA @ 115 VAC	1 mA @ 115 VAC
	150 mA @ 14 VDC	15 mA @ 14 VDC	15 mA @ 14 VDC
Dielectric Strength	1,000 volts	750 volts	750 volts
Size	.865" square	.830" x .890"	1.0" square
Mounting Bushing Diameter	1/4" or 3/8"	3/8"	3/8"
**Shaft Material	Cold rolled or stainless steel	Molded plastic	Stainless steel
Contact Resistance	75 milliohms	1 ohm	1 ohm
Contact Bounce	5 ms @ 15 rpm	5 ms @ 15 rpm	5 ms @ 15 rpm
Contacts	Phosphor-bronze	Phosphor-bronze	Phosphor-bronze
Shock Humidity	MIL-STD 202E	MIL-STD 202E	MIL-STD 202E
**Stop Strength	15 in/lb	5 in/lb	5 in/lb

\*\*Custom Available



## Optical Encoders:

### OE2 Series

### 900 Series

### 920 Series

	OE2 Series	900 Series	920 Series
**Output Codes - Incremental	Quadrature	Quadrature	Quadrature
Rotational Life (Cycles)	3 to 10 million	5 to 100 million	Not applicable
Rotational Torque	.1 to 2 in/oz	1 to .25 in/oz	Not applicable
Operating Temperature	-40 °C to +85 °C	-40 °C to +85 °C	0 °C to +70 °C
**Number of Positions	16 to 32 and non-detent	Non-detent	Non-detent
Pulses Per Revolution	4 to 8	32 to 128	100 to 512
Operating Speed	30 rpm	200 to 3,000 rpm	1,000 to ,6000 rpm
Push-Button	Yes	No	No
Size	.760" square	1.0" square	2.5" diameter
Mounting Bushing Diameter	3/8"	1/2" or 3/8"	Not applicable
**Shaft Material	Stainless steel	Die cast or stainless steel	Not applicable
Shock Humidity	MIL-STD 202B	MIL-STD 202B	MIL-STD 202B

\*\*Custom Available



# AC WATT TRANSDUCERS

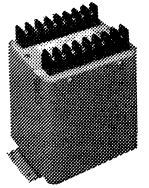
## Model PC5 SINGLE PHASE 50/60 HERTZ

### FEATURES

- Accurate regardless of phase, voltage unbalance, current unbalance, or power factor.
- Output is proportional to true power delivered to a load;  $P=EI(\cos \phi)$ . Provides bi-directional operation.
- Calibrated with standards traceable to NIST.

### APPLICATIONS

- Equipment power consumption.
- For use with SCR controls, chopped waveforms, or where harmonic components exist.
- Standard outputs provide signal for interface with meters, recorders, or data acquisition equipment.



**5 YEAR WARRANTY**

### MODELS WITH INTEGRAL CURRENT SENSOR

NOTE: Current Ranges Available from 1AMP to 20AMP

INPUTS		F.S. IN (WATTS)	PHASE CONFIG.	MODEL NUMBER PC5 — STANDARD OUTPUTS							
VOLTAGE	CURRENT			0 - 1mAdc*	0 - 1mAdc	0 - 10Vdc *	0 - 10Vdc	4-20mA	4-20mAdc**	0 - 5Vdc *	0 - 5Vdc
0 to 150	0 to 5	500	1PH-2W	001A	001B	001C	001D	001E	001E2	001CX5	001X5
		1000	3PH-3W	004A	004B	004C	004D	004E	004E2	004CX5	004X5
		1500	3PH-4W	007A	007B	007C	007D	007E	007E2	007CX5	007X5
	0 to 20	2000	1PH-2W	117A	117B	117C	117D	117E	117E2	117CX5	117X5
		4000	3PH-3W	112A	112B	112C	112D	112E	112E2	112CX5	112X5
		6000	3PH-4W	115A	115B	115C	115D	115E	115E2	115CX5	115X5
0 to 300	0 to 5	1000	1PH-2W	002A	002B	002C	002D	002E	002E2	002CX5	002X5
		2000	3PH-3W	005A	005B	005C	005D	005E	005E2	005CX5	005X5
		3000	3PH-4W	008A	008B	008C	008D	008E	008E2	008CX5	008X5
	0 to 20	4000	1PH-2W	110A	110B	110C	110D	110E	110E2	110CX5	110X5
		8000	3PH-3W	113A	113B	113C	113D	113E	113E2	113CX5	113X5
		12000	3PH-4W	116A	116B	116C	116D	116E	116E2	116CX5	116X5
0 to 600	0 to 5	2000	1PH-2W	003A	003B	003C	003D	003E	003E2	003CX5	003X5
		4000	3PH-3W	006A	006B	006C	006D	006E	006E2	006CX5	006X5
		8000	1PH-2W	111A	111B	111C	111D	111E	111E2	111CX5	111X5
	0 to 20	16000	3PH-3W	114A	114B	114C	114D	114E	114E2	114CX5	114X5

### MODELS SUPPLIED WITH EXTERNAL CURRENT SENSORS

NOTE: Current Ranges Available from 50AMP to 1000AMP

INPUTS		F.S. IN (WATTS)	PHASE CONFIG.	MODEL NUMBER PC5 — STANDARD OUTPUTS							
VOLTAGE	CURRENT			0 - 1mA *	0 - 1mA	0 - 10Vdc *	0 - 10Vdc	4-20mA	4-20mA **	0 - 5Vdc *	0 - 5Vdc
0 to 150	0 to 100	10K	1PH-2W	058A	058B	058C	058D	058E	058E2	058CX5	058X5
		20K	3PH-3W	061A	061B	061C	061D	061E	061E2	061CX5	061X5
		30K	3PH-4W	064A	064B	064C	064D	064E	064E2	064CX5	064X5
	0 to 400	40K	1PH-2W	076A	076B	076C	076D	076E	076E2	076CX5	076X5
		80K	3PH-3W	079A	079B	079C	079D	079E	079E2	079CX5	079X5
		120K	3PH-4W	082A	082B	082C	082D	082E	082E2	082CX5	082X5
0 to 300	0 to 100	20K	1PH-2W	059A	059B	059C	059D	059E	059E2	059CX5	059X5
		40K	3PH-3W	062A	062B	062C	062D	062E	062E2	062CX5	062X5
		60K	3PH-4W	065A	065B	065C	065D	065E	065E2	065CX5	065X5
	0 to 400	80K	1PH-2W	077A	077B	077C	077D	077E	077E2	077CX5	077X5
		160K	3PH-3W	080A	080B	080C	080D	080E	080E2	080CX5	080X5
		240K	3PH-4W	083A	083B	083C	083D	083E	083E2	083CX5	083X5
0 to 600	0 to 100	40K	1PH-2W	060A	060B	060C	060D	060E	060E2	060CX5	060X5
		80K	3PH-3W	063A	063B	063C	063D	063E	063E2	063CX5	063X5
		160K	1PH-2W	078A	078B	078C	078D	078E	078E2	078CX5	078X5
	0 to 400	320K	3PH-3W	081A	081B	081C	081D	081E	081E2	081CX5	081X5

\* Denotes self-powered unit, limiting input voltage ranges to: 85-135 for 150V models • 200-280 for 300V models • 380-550 for 600V models  
 \*\* 4-20mA loop-powered unit, (15-40Vdc).

### SPECIFICATIONS

#### INPUT

- VOLTAGE & CURRENT: See Tables
- FREQUENCY RANGE: 48 to 70 Hz.
- RESPONSE (Transient 90%): With integral sensors: Less than 100 microSeconds • With current transformers: 1 ms
- BURDEN: Voltage: 1.25 VA  
Current: 1.25 VA  
Output amplifier: 2 Watts

- CURRENT OVERLOAD: 2 times full scale (cont.); 6 times full scale (10 Sec.)
- DIELECTRIC TEST (Input / Output / Case): 1500VAC (RMS)
- SURGE: Withstands IEEE SWC test

#### OUTPUT

- OUTPUT RIPPLE: Less than 1% F.S.
- RESPONSE TIME (90%): 250 ms

- OUTPUT LOADING (OHMS):  
0 - 1mA: 0 - 10K  
0 - 10V, 0 - 5V: Greater than 2K  
0 - 4-20mA: 0-1.5K
- FIELD ADJUSTABLE CAL.: +/-10%

#### ACCURACY +/-0.5%

Includes combined effects of power factor, linearity, repeatability, & current sensor.  
 TEMPERATURE EFFECT (-10°C to 60°C): +/-1.0% of reading, +/- 0.1% F.S. output

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# AC WATT TRANSDUCERS

## Model **GW5** ACCURATE TO 0.2% OF READING

### FEATURES

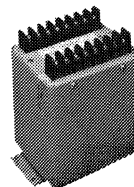
- Accurate regardless of variations in voltage, current, power factor, or load.
- Available with 1, 2, 2 1/2, or 3 element configurations. Provides bi-directional operation.
- Accuracy maintained over wide temperature range.
- Calibrated with standards traceable to NIST.

### APPLICATIONS

- Equipment monitoring for process control.
- Integration into energy management systems, or a variety of sub-metering applications.
- Measurement using direct-connection, current, transformers, or potential transformers.

## AC WATT TRANSDUCER-INTEGRAL CURRENT SENSOR

INPUT		F.S. IN (WATTS)	PHASE CONFIG.	MODEL NUMBER GW5 — STANDARD OUTPUTS							
VOLTAGE	CURRENT			0 - 1mA*	0 - 1mA	0 - 10Vdc*	0 - 10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 5	500	1 Ph.-2W	001A	001B	001C	001D	001E	001E2	001CX5	001X5
		1000	3 Ph.-3W	004A	004B	004C	004D	004E	004E2	004CX5	004X5
		1500	3 Ph.-4W	007A	007B	007C	007D	007E	007E2	007CX5	007X5
		1500	3 Ph.-4W	7.5A	7.5B	7.5C	7.5D	7.5E	7.5E2	7.5CX5	7.5X5
	0 to 10	1000	1 Ph.-2W	010A	010B	010C	010D	010E	010E2	010CX5	010X5
		2000	3 Ph.-3W	013A	013B	013C	013D	013E	013E2	013CX5	013X5
		3000	3 Ph.-4W	016A	016B	016C	016D	016E	016E2	016CX5	016X5
	0 to 20	2000	1 Ph.-2W	019A	019B	019C	019D	019E	019E2	019CX5	019X5
		4000	3 Ph.-3W	022A	022B	022C	022D	022E	022E2	022CX5	022X5
6000		3 Ph.-4W	025A	025B	025C	025D	025E	025E2	025CX5	025X5	
0 to 300	0 to 5	1000	1 Ph.-2W	002A	002B	002C	002D	002E	002E2	002CX5	002X5
		2000	3 Ph.-3W	005A	005B	005C	005D	005E	005E2	005CX5	005X5
		3000	3 Ph.-4W	008A	008B	008C	008D	008E	008E2	008CX5	008X5
	0 to 10	2000	1 Ph.-2W	011A	011B	011C	011D	011E	011E2	011CX5	011X5
		4000	3 Ph.-3W	014A	014B	014C	014D	014E	014E2	014CX5	014X5
		6000	3 Ph.-4W	017A	017B	017C	017D	017E	017E2	017CX5	017X5
	0 to 20	4000	1 Ph.-2W	020A	020B	020C	020D	020E	020E2	020CX5	020X5
		8000	3 Ph.-3W	023A	023B	023C	023D	023E	023E2	023CX5	023X5
		12000	3 Ph.-4W	026A	026B	026C	026D	026E	026E2	026CX5	026X5
0 TO 600	0 to 5	2000	1 Ph.-2W	003A	003B	003C	003D	003E	003E2	003CX5	003X5
		4000	3 Ph.-3W	006A	006B	006C	006D	006E	006E2	006CX5	006X5
	0 to 10	4000	1 Ph.-2W	012A	012B	012C	012D	012E	012E2	012CX5	012X5
		8000	3 Ph.-3W	015A	015B	015C	015D	015E	015E2	015CX5	015X5
	0 to 20	8000	1 Ph.-2W	021A	021B	021C	021D	021E	021E2	021CX5	021X5
		16000	3 Ph.-3W	024A	024B	024C	024D	024E	024E2	024CX5	024X5



**5 YEAR WARRANTY**

### ORDERING INFORMATION

Example: Self-powered, single-phase, 120V, 5A input with 0-5Vdc output.

**GW5-001CX5**

OPTIONAL 50 Hz. OPERATION — CONSULT FACTORY.

NOTES: 1) 0.3 class current transformers are available. 2) \* Denotes self-powered unit, limiting input voltage range to: 85-135 for 150V models, 200-280 for 300V models, 380-550 for 600V models. 3) \*\* 4-20mA loop powered requires (15-35Vdc). 4) Options B, D, E, X5 require 115VAC inst. pwr. 5) Watt-hour models GH series are available. 6) UL Watt and Watt-hour Transducers are available. 7) All outputs are dc and bi-directional. (4-12-20mA) available.

## SPECIFICATIONS

### INPUT

- SEE TABLES FOR VOLTAGE AND CURRENT RANGES
- FREQUENCY RANGE: 58 to 62 Hz.
- POWER FACTOR: Any
- BURDEN: Voltage: Less than 0.1VA  
Current: Less than 0.28VA per element
- DIELECTRIC TEST (Input / Output / Case): 1800VAC

### OUTPUT

- OUTPUT RIPPLE: Less than 0.5% F.S.
- OUTPUT LOADING (OHMS):  
0 - 1mA: 0 - 10K  
0 - 10Vdc, 0 - 5Vdc: Greater than 2K  
4 - 20mA: 0-500
- RESPONSE TIME(99%): Less than 400 ms
- COMPLIANCE VOLTAGE: 12Vdc min.
- OPEN CIRCUIT VOLTAGE:  
0-1mA or voltage outputs: ±15Vdc  
4 - 20mA output: 30Vdc

### ACCURACY +/-0.2% RDG., +/-0.04%F.S.

- TEMPERATURE EFFECT (-20°C to 60°C):  
+/-0.005% °C

**For VAR Transducers  
Contact Factory**

**TO REQUEST A CATALOG OR PLACE AN ORDER CALL 1-800-853-2537**

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# AC VOLTAGE TRANSDUCERS

## Model VT LOW COST AC VOLTAGE TRANSDUCER

### FEATURES

- Accuracy reliable voltage measurement over a wide frequency range.
- Input/output isolation.
- 0.25% Accuracy.



5 YEAR WARRANTY

### APPLICATIONS

- Designed for use in OEM applications where inexpensive voltage measurement is required.
- Line voltage monitoring.

### MODEL VT

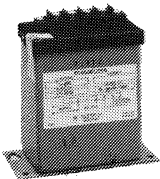
INPUT	MODEL NUMBER VT — STANDARD OUTPUTS			
AC VOLTAGE	0 - 1 mAdc	4 - 20 mAdc	4 - 20mAdc *	0 - 10Vdc
0 to 150	120A	120E	120E2	Requires OSI Resistor LRB-10000
0 to 300	240A	240E	240E2	
0 to 600	3940A	3940E	3940E2	

NOTES: 1) Three phase Voltage Transducers are available, add 3 in front of model number.  
Example: 3VT-120A 2) 1mA option "A", self powered. 3) \* 4-20mA loop power option "E2" requires 15 to 35 Vdc. 4) 4-20mA option "E", requires 115VAC inst. pwr.

## Model AVT UL LISTED AC VOLTAGE TRANSDUCER

### FEATURES

- Accurate, reliable voltage measurement over a wide frequency range.
- 0.25% Accuracy.



5 YEAR WARRANTY

### APPLICATIONS

- Can be used with potential transformers.

### MODEL AVT

AC VOLTAGE INPUT		MODEL AVT-120A OUTPUT
RANGE	NOMINAL	
0 to 150	85 to 135	0 to 1 mA dc

Unit is self-powered from measured AC input line.

Listed 87 X 9  
Energy Management  
Equipment Accessory  
E134941

## Model MVT DIN RAIL MOUNTED AC VOLTAGE TRANSDUCER

### FEATURES

- Ruggedized Polyamide DIN mount case.
- Slim profile allows maximum use of available space.
- Field selectable analog outputs.
- Recessed terminals provide increased safety.
- 0.25% Accuracy.



5 YEAR WARRANTY

### APPLICATIONS

- Ideal for use in enclosures with dimensional constraints.
- Designed for industrial environments.
- OEM measurement systems.
- Designed for use with potential transformers.
- Easily integrated into control systems.

### MODEL MVT

INPUT	MODEL NUMBER MVT — STANDARD OUTPUTS		
AC VOLTAGE	0 - 1 mAdc*	4 - 20 mAdc	4 - 20mAdc**
0 to 150	150A	150E	150E2
0 to 300	300A	300E	300E2
0 to 600	600A	600E	600E2

\* Models are self-powered from measured AC input line with DIP switch selectable 0-5Vdc, or 0-10Vdc output.  
\*\* Denotes 4-20mA loop-powered unit, (15-35Vdc). All other units require 85-135VAC instrument power.

NOTE: 600V models supplied with OSI potential transformer.

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# RMS VOLTAGE TRANSDUCERS

## Model VTR ACCURATE TO 0.25% FULL SCALE

### FEATURES

- Accurate measurement of the true RMS value of input signals over a wide frequency range.

### APPLICATIONS

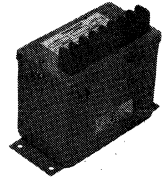
- For use in applications where measurement of non-sinusoidal waveforms is required.

#### ORDERING INFORMATION

Example: Single phase 120VAC input with 0-10Vdc output  
**VTR-001D**

INPUT AC VOLTAGE	MODEL NUMBER VTR — OPTIONAL OUTPUTS			
	0 - 1mAdc	4 - 20mAdc	0 - 10Vdc	0 - 5Vdc
0 to 150	001B	001E	001D	001X5
0 to 300	002B	002E	002D	002X5
0 to 600	004B	004E	004D	004X5

All units require 85-135VAC instrument power. (50-400Hz.).



**5 YEAR WARRANTY**

### SPECIFICATIONS

#### INPUT

- VOLTAGE: See tables
- FREQUENCY RANGE: 50 to 400 Hz.
- BURDEN: 0.12VA
- OVERLOAD: Full scale rating
- DIELECTRIC TEST (Input/Output/Case): 1500VAC

- INSTRUMENT POWER: 85-135VAC (50-400Hz.)

- OPTION: -22 (220VAC)

#### OUTPUT

- OUTPUT RIPPLE: Less than 1.0% F.S.
- OUTPUT LOADING (OHMS):  
0 - 1mA: 0 - 10K  
0 - 10Vdc, 0 - 5Vdc: 2K min.

4 - 20mA: 0 - 1.5K

- RESPONSE: 100 ms
- FIELD ADJUSTABLE CAL: +/-10%

**ACCURACY +/-0.25% F.S.** (at 60Hz)  
Includes effects of linearity.

- TEMPERATURE EFFECT (-20°C to 60°C): +/-1.0%RDG.

## Model VT8 DC TO 10000 HERTZ FREQUENCY RANGE

### FEATURES

- Provides DC output which is proportional to RMS value of AC and/or DC input signal.
- Input/output isolation.

### APPLICATIONS

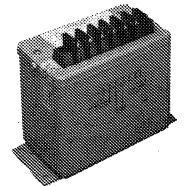
- Accurate measurement of voltage that may contain DC and non-sinusoidal AC components.
- Monitoring of RMS voltage.

#### ORDERING INFORMATION

Select input voltage range & output required from table at right.  
Example: 120 VAC input with 4 - 20mAdc output proportional to RMS value of input.  
**VT8-005E**

INPUT AC VOLTAGE	MODEL NUMBER VT8 — STANDARD OUTPUTS			
	0 - 1mAdc	4 - 20mAdc	0 - 10Vdc	0 - 5Vdc
0 to 10	001B	001E	001D	001X5
0 to 25	002B	002E	002D	002X5
0 to 50	003B	003E	003D	003X5
0 to 100	004B	004E	004D	004X5
0 to 150	005B	005E	005D	005X5
0 to 250	006B	006E	006D	006X5
0 to 300	007B	007E	007D	007X5
0 to 400	008B	008E	008D	008X5
0 to 500	009B	009E	009D	009X5
0 to 600	010B	010E	010D	010X5

NOTES: 1) For models which provide an output directly proportional to the dc. input, substitute VT7 in model number. 2) Voltage ranges from 50mV to 1000V available. 3) DC instrument power models available.



**5 YEAR WARRANTY**

### SPECIFICATIONS

#### INPUT

- VOLTAGE: See tables
- FREQUENCY RANGE: dc to 10000 Hz.
- BURDEN: Greater than 100K
- OVERLOAD:  
.05 - 700V: 2 times full scale rating  
800 - 1000V: 1500V

- DIELECTRIC TEST (Input/Output/Case): 1500VAC

#### OUTPUT

- OUTPUT LOADING (OHMS):  
0 - 1mA: 0-10K  
0 - 10V, 0 - 5V: Greater than 2.0K  
4 - 20mA: 0 - 500
- RESPONSE TIME (90%): 100 ms

- FIELD ADJUSTABLE CAL: +/-10%

**ACCURACY +/-0.25% F.S. (50-400Hz)**  
Includes effects of linearity & repeatability

- TEMPERATURE EFFECT (-10°C to 60°C): +/-1.0%RDG.
- INSTRUMENT POWER: 85-135VAC, (50-70Hz.).
- OPTION: -22 for 220VAC

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# AC CURRENT TRANSDUCERS

## Model CT5 LOW COST AC CURRENT TRANSDUCER

### FEATURES

- 0.25% Accuracy.
- Frequency range 50-400Hz.

### APPLICATIONS

- Designed for use in OEM applications which require inexpensive current measurement.



**5 YEAR WARRANTY**

### ORDERING INFORMATION

Example: 20 Amp  
AC input with 4  
20mA output  
**CT5-020E**

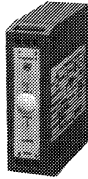
INPUT AC CURRENT	SENSOR SIZE	MODEL NUMBER CT5 — OPTIONAL OUTPUTS				
		0 - 1mAdc	4 - 20mAdc	4 - 20mAdc*	0 - 10 Vdc	0 - 5Vdc
0 to 1.0	N/A	001A	001E	001E2	Order with OSI Resistor Model LRB-10000	Order with OSI Resistor Model LRB-5000
0 to 5.0		005A	005E	005E2		
0 to 10.0		010A	010E	010E2		
0 to 20		020A	020E	020E2		

NOTES: 1) Higher currents 0 to 5000A are available. 2) Three phase current transducers are available, add 3 in front of model number. Example: 3CT5-005A. 3) 1mA option "A" self-powered. 4) \* 4-20mA loop powered option "E2" require 15 to 35 Vdc. 5) 4-20mA option "E", requires 115VAC inst. pwr. 6) UL approved model ACT5-001A 5AMPS, 1mA Available.

## Model MCT5 DIN RAIL MOUNTED AC CURRENT TRANSDUCERS

### FEATURES

- Ruggedized Polyamide DIN mount case.
- 0.25% Accuracy.



### APPLICATIONS

- Ideal for use in enclosures with dimensional constraints.

### MODEL MCT5

INPUT AC CURRENT (AMPS)	MODEL MCT5 — STANDARD OUTPUTS		
	0 - 1 mAdc *	4 - 20 mAdc**	4 - 20 mAdc
0 to 0.1	001A	001E2	001E
0 to 5.0	005A	005E2	005E

\* Models are self-powered from measured AC input line with DIP switch selectable 0-5Vdc, or 0-10Vdc output.

\*\* Denotes 4-20mA loop-powered unit, (15-35Vdc). E option 4-20mA requires 115VAC instrument power.

Transducer output is derived from the average absolute value of the input and calibrated as the RMS value of a sine wave input.

## Model CTD 50 TO 500 HERTZ FREQUENCY RANGE

### DESCRIPTION

The CTD series of AC Current Transducers provide a dc output which is proportional to the AC current. The output is derived from the average absolute value of the input and calibrated as the RMS value of the sine wave.

Standard outputs of 0 to 1 mAdc or 4-20mAdc "loop powered" are available, with full scale current ranges of 25 through 1000 amperes.

AC INPUT (AMPS)	OUTPUT		AC INPUT (AMPS)	OUTPUT	
	0 - 1mAdc	4-20 mAdc		0 - 1mAdc	4-20 mAdc
25	CTD-25A	CTD-25E2	400	CTD-400A	CTD-400E2
50	CTD-50A	CTD-50E2	500	CTD-500A	CTD-500E2
100	CTD-100A	CTD-100E2	600	CTD-600A	CTD-600E2
200	CTD-200A	CTD-200E2	800	CTD-800A	CTD-800E2
300	CTD-300A	CTD-300E2	1000	CTD-1000A	CTD-1000E2

NOTES: 1) 4-20mA option "E2" loop powered requires 15-40Vdc instrument power. 2) Higher currents up to 1000A available. 3) Accuracy 0.5% standard 0.25% available.

### INSTALLATION

All transducers have a 1.56 inch window and are equipped with a mounting foot. Output terminals are #8-32 studs, with X1 the positive terminal.

Loop powered 4-20mA models require an external power supply of 15V to 40Vdc, nominally 24 Vdc.



**5 YEAR WARRANTY**

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# RMS CURRENT TRANSDUCERS

## Model **CTR** LOW COST RMS CURRENT MEASUREMENT

### FEATURES

- Accurate measurement of the true RMS value of input signals over a wide frequency range.

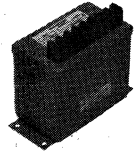
### APPLICATIONS

- For use in applications where measurement of non-sinusoidal waveforms is required.

#### ORDERING INFORMATION

Example: 15 Amp  
AC input with 0-  
10 Vdc output  
**CTR-015D**

INPUT CURRENT (AMPS)	MODEL NUMBER CTR — OPTIONAL OUTPUTS			
	0 - 1mA <sub>dc</sub>	4 - 20mA <sub>dc</sub>	0 to 10V <sub>dc</sub>	0 - 5V <sub>dc</sub>
0 to 0.1	001B	001E	001D	001X5
0 to 5.0	005B	005E	005D	005X5
0 to 10.0	010B	010E	010D	010X5
0 to 15.0	015B	015E	015D	015X5
0 to 20.0	020B	020E	020D	020X5



For higher currents, consult with the CTL & CTA models in this section

**5 YEAR WARRANTY**

### SPECIFICATIONS

#### INPUT

- CURRENT: See table
- FREQUENCY RANGE: 48 to 420 Hz.
- BURDEN: 0.28VA F.S.
- CURRENT OVERLOAD:  
Continuous: 2 Times F.S.  
10 Second Transient: 50A  
(All Ranges Except 1A)
- DIELECTRIC TEST (Input/Output/Case): 1500VAC

- INSTRUMENT POWER: 85-135VAC (50-400Hz.)
- OPTION: -22 for 220VAC

- RESPONSE: 100 ms
- FIELD ADJUSTABLE CAL: +/-10%

#### OUTPUT

- OUTPUT RIPPLE: Less than  $\pm 1.0\%$  F.S.
- OUTPUT LOADING (OHMS):  
0 - 1mA: 0-10K  
0 - 10V<sub>dc</sub>, 0 - 5V<sub>dc</sub>: Greater than 2.0K  
4 - 20mA: 0-500

- ACCURACY +/-0.25% F.S.** (at 60 Hz.)  
Includes effects of linearity +/-0.5% over entire frequency range
- TEMPERATURE EFFECT (-20°C to 60°C): +/-1.0%RDG.

## Model **CT8** DC TO 500 HERTZ FREQUENCY RANGE

### FEATURES

- Provides output which is directly proportional to RMS value of AC and/or DC input signal.
- Input/output isolation.

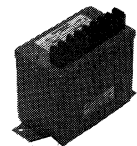
### APPLICATIONS

- Accurate measurement of current waveforms containing DC and non-sinusoidal AC components.
- Low current measurement.

#### ORDERING INFORMATION

Example: 500 mA  
AC input with 4-  
20mA<sub>dc</sub> output.  
**CT8-004E**

INPUT CURRENT (AMPS)	MODEL NUMBER CT8 — STANDARD OUTPUTS			
	0 - 1mA <sub>dc</sub>	4 - 20mA <sub>dc</sub>	0 - 10V <sub>dc</sub>	0 - 5V <sub>dc</sub>
0 to 0.1	002B	002E	002D	002X5
0 to 0.5	004B	004E	004D	004X5
0 to 1.0	006B	006E	006D	006X5
0 to 1.5	007B	007E	007D	007X5
0 to 2.0	008B	008E	008D	008X5
0 to 5.0	014B	014E	014D	014X5
0 to 10.0	015B	015E	015D	015X5
0 to 20.0	017B	017E	017D	017X5



**5 YEAR WARRANTY**

NOTES: 1) For models which provide an output directly proportional to the dc. input, substitute CT7 in model number. 2) For higher currents, consult with the CTL & CTA models in this section. 3) DC instrument power models available.

### SPECIFICATIONS

#### INPUT

- CURRENT: See table
- FREQUENCY RANGE: dc to 500 Hz.
- BURDEN (OHMS):  
0.1 to 5 Amp models: 0.1  
10 to 20 Amp models: Less than 0.005
- OVERLOAD: Full scale rating

- DIELECTRIC TEST (Input/Output/Case): 1500VAC

#### OUTPUT

- RESPONSE: (90%): 100 mSec
- OUTPUT LOADING (OHMS):  
0-1mA: 0-10K  
0-10V<sub>dc</sub>, 0-5V<sub>dc</sub>: 2K min.  
4-20mA: 0-500

- FIELD ADJUSTABLE CAL: +/-10%

- ACCURACY +/-0.25% F.S.** (50-400 Hz.)  
Includes effects of linearity & repeatability
- TEMPERATURE EFFECT (-10°C to 60°C): +/-1.0%RDG.
  - INSTRUMENT POWER (STD):  
85-135VAC, 50-70Hz.
  - OPTION: -22 for 220VAC.

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# HALL EFFECT CURRENT SENSORS

## Model CTL/CTA

### FEATURES

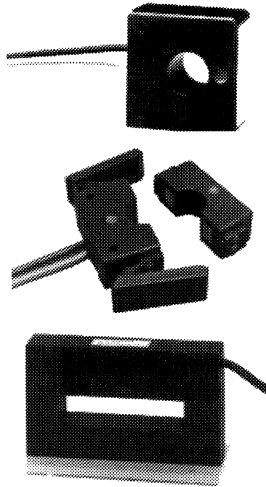
- ❑ 5000 Volt line-to-output isolation.
- ❑ DC to 5KHz response, dc to 1KHz operating frequency.
- ❑ Linearity .1% F.S.
- ❑ Available in split-core configurations.
- ❑ Response time less than 200 microseconds.
- ❑ Output is proportional in **direction and magnitude** to the current flow through the window.

### APPLICATIONS

- ❑ Overload capability to **50** times rating (at 60 Hz.).
- ❑ Stability maintained during severe vibration.
- ❑ Models available to 40KA.
- ❑ Replaces shunts.
- ❑ No insertion loss.
- ❑ For use with model CTA signal conditioners.
- ❑ Ideal for use on AC systems with DC components and/or chopped waveforms.

### CIRCULAR WINDOW MODELS: .5% F.S.

Current Range	Model Number	Typical Output	Sensor Size
0-35A	CTL-51/35	35mV	A
0-50A	CTL-51/50	50mV	A
0-75A	CTL-101/75	75mV	C
0-100A	CTL-101/100	100mV	C
0-150A	CTL-201/150	75mV	D
0-200A	CTL-201/200	100mV	D
0-300A	CTL-401/300	75mV	D
0-400A	CTL-401/400	100mV	D
0-500A	CTL-601/500	40mV	E
0-600A	CTL-601/600	50mV	E
0-800A	CTL-202/800	40mV	E
0-1000A	CTL-202/1000	50mV	E
0-1500A	CTL-202/1500	75mV	E
0-2000A	CTL-202/2000	100mV	E



### RECTANGULAR WINDOW MODELS: 1% F.S.

Current Range	Model Number	Typical Output	Sensor Size
0-500A	CTL-202H/500	50mV	Z
0-1000A	CTL-202H/1000	100mV	Z
0-1500A	CTL-202H/1500	150mV	Z
0-2000A	CTL-202H/2000	200mV	Z
	CTL-502H/2500	60mV	Z
0-2500A	CTL-502/2500	75mV	G
	CTL-502H/2500	75mV	Z
0-3000A	CTL-502/3000	90mV	G
	CTL-502H/3000	90mV	Z
0-4000A	CTL-502/4000	120mV	G
	CTL-502H/4000	120mV	Z
0-5000A	CTL-502/5000	150mV	G
	CTL-502H/5000	150mV	Z
	CTL-103/5000	50mV	H
0-6000A	CTL-103/6000	60mV	H
0-7000A	CTL-103/7000	75mV	H
0-8000A	CTL-103/8000	75mV	H

### ORDERING INFORMATION

Example: 7000 Amp rectangular split-core current sensor with extended temperature range, RMS output from signal conditioner of 0 - 10Vdc.

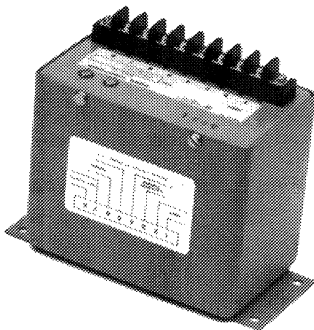
ITEM 1: CTL-401/300TS    ITEM 2: CTA213P

### CTA SIGNAL CONDITIONERS

**Direct models** - Output proportional to ac or dc input. Standard ac or dc outputs.

**RMS models** - Output proportional to RMS ac or dc input. Standard dc outputs.

CTL Model	±5V	±10	4-20mA*	±1ma	0 - 5V	0 - 10V	4-20mA	±1ma
CTL-51/35	201RX5	201R	212R	201RA	213RX5	213R	215R	214R
CTL-51/50	201X5	201	212	201A	213X5	213	215	214
CTL-101/75	201HX5	201H	212H	201HA	213HX5	213H	215H	214H
CTL-101/100	201PX5	201P	212P	201PA	213PX5	213P	215P	214P
CTL-201/150	201HX5	201H	212H	201HA	213HX5	213H	215H	214H
CTL-201/200	201PX5	201P	212P	201PA	213PX5	213P	215P	214P
CTL-401/300	201HX5	201H	212H	201HA	213HX5	213H	215H	214H
CTL-401/400	201PX5	201P	212P	201PA	213PX5	213P	215P	214P
CTL-601/500	201X5	201	212	201A	213X5	213	215	214
CTL-601/600	201X5	201	212	201A	213X5	213	215	214
CTL-202/800	201X5	201	212	201A	213X5	213	215	214
CTL-202/1000	201X5	201	212	201A	213X5	213	215	214
CTL-202/1500	201HX5	201H	212H	201HA	213HX5	213H	215H	214H
CTL-202/2000	201PX5	201P	212P	201PA	213PX5	213P	215P	214P
CTL-202H/500	201X5	201	212	201A	213X5	213	215	214
CTL-202H/1000	201PX5	201P	212P	201PA	213PX5	213P	215P	214P
CTL-202H/1500	201KX5	201K	212K	201KA	213KX5	213K	215K	214K
CTL-202H/2000	201LX5	201L	212L	201LA	***Use CTL-502H/2000 for 2000A ac models.			
CTL-502/2500	201HX5	201H	212H	201HA	213HX5	213H	215H	214H
CTL-502/3000	201PX5	201P	212P	201PA	213PX5	213P	215P	214P
CTL-502/4000	201PX5	201P	212P	201PA	***Use CTL-103/4000 for 4000A ac models.			
CTL-502/5000	201KX5	201K	212K	201KA	***Use CTL-103/5000 for 5000A ac models.			
CTL-502H/2500	201HX5	201H	212H	201HA	213X5	213	215	214
CTL-502H/3000	201PX5	201P	212P	201PA	213HX5	213H	215H	214H
CTL-502H/4000	201NX5	201N	212N	201NA	213PX5	213P	215P	214P
CTL-502H/5000	201KX5	201K	212K	201KA	*Use CTL-103/4000 for 4000A ac models.			
CTL-103/4000	*Use CTL-502H / 502 for ac/dc models.				*Use CTL-103/5000 for 5000A ac models.			
CTL-103/5000	201X5	201	212	201A	213X5	213	215	214
CTL-103/6000	201X5	201	212	201A	213X5	213	215	214
CTL-103/7000	201HX5	201H	212H	201HA	213HX5	213H	215H	214H
CTL-103/8000	201HX5	201H	212H	201HA	***Not available in ac models.			



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# VARIABLE FREQUENCY WATT TRANSDUCERS

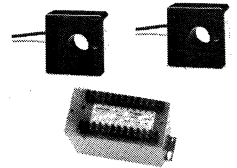
## Model P VARIABLE FREQUENCY (5 TO 500 HERTZ)

### FEATURES

- Accurate from 5 to 500 Hz., Factory calibrated.
- Available in both single phase and three phase configurations.
- Available with split-core current sensors.

### APPLICATIONS

- Accurate monitoring of power that contains DC and non-sinusoidal AC components.
- Ideal for use in phase angle firing circuits or where ASD's are present.
- Bi-directional output.



**5 YEAR WARRANTY**

S I N G L E P H A S E	INPUTS		F.S. IN (WATTS)	SENSOR SIZE	STANDARD OUTPUTS MODEL NUMBER P-					
	VOLTAGE	CURRENT			+/-1mAdc	+/-10Vdc	4-20mAdc	4-12-20mAdc	0-20mAdc	+/-5Vdc
	One Element	0 to 150	0 to 100 0 to 200 0 to 400 0 to 600 0 to 1000 0 to 2000	20K 40K 80K 120K 200K 400K	C D D E E E	121B 124B 127B 130B 133B 136B	121D 124D 127D 130D 133D 136D	121E 124E 127E 130E 133E 136E	121EM 124EM 127EM 130EM 133EM 136EM	121EA 124EA 127EA 130EA 133EA 136EA
	0 to 300	0 to 100 0 to 200 0 to 400 0 to 600 0 to 1000 0 to 2000	40K 80K 160K 240K 400K 800K	C D D E E E	122B 125B 128B 131B 134B 137B	122D 125D 128D 131D 134D 137D	122E 125E 128E 131E 134E 137E	122EM 125EM 128EM 131EM 134EM 137EM	122EA 125EA 128EA 131EA 134EA 137EA	122X5 125X5 128X5 131X5 134X5 137X5
	0 to 600	0 to 100 0 to 200 0 to 400 0 to 600 0 to 1000 0 to 2000	80K 160K 320K 480K 800K 1600K	C D D E E E	123B 126B 129B 132B 135B 138B	123D 126D 129D 132D 135D 138D	123E 126E 129E 132E 135E 138E	123EM 126EM 129EM 132EM 135EM 138EM	123EA 126EA 129EA 132EA 135EA 138EA	123X5 126X5 129X5 132X5 135X5 138X5

T H R E E P H A S E	INPUTS		F.S. IN (WATTS)	SENSOR SIZE	STANDARD OUTPUTS MODEL NUMBER P-					
	VOLTAGE	CURRENT			+/-1mAdc	+/-10Vdc	4-20mAdc	4-12-20mAdc	0-20mAdc	+/-5Vdc
	Two Element	0 to 150	0 to 100 0 to 200 0 to 400 0 to 600 0 to 1000 0 to 2000	20K 40K 80K 120K 200K 400K	C D D E E E	142B 145B 148B 151B 154B 157B	142D 145D 148D 151D 154D 157D	142E 145E 148E 151E 154E 157E	142EM 145EM 148EM 151EM 154EM 157EM	142EA 145EA 148EA 151EA 154EA 157EA
	0 to 300	0 to 100 0 to 200 0 to 400 0 to 600 0 to 1000 0 to 2000	40K 80K 160K 240K 400K 800K	C D D E E E	143B 146B 148B 152B 155B 158B	143D 146D 148D 152D 155D 158D	143E 146E 148E 152E 155E 158E	143EM 146EM 148EM 152EM 155EM 158EM	143EA 146EA 148EA 152EA 155EA 158EA	143X5 146X5 148X5 152X5 155X5 158X5
	0 to 600	0 to 100 0 to 200 0 to 400 0 to 600 0 to 1000 0 to 2000	80K 160K 320K 480K 800K 1600K	C D D E E E	144B 147B 150B 153B 156B 159B	144D 147D 150D 153D 156D 159D	144E 147E 150E 153E 156E 159E	144EM 147EM 150EM 153EM 156EM 159EM	144EA 147EA 150EA 153EA 156EA 159EA	144X5 147X5 150X5 153X5 156X5 159X5

All units 85-135VAC instrument power, (50,400Hz.).

Three Phase Four Wire Units are Available — Consult Factory • Optional Split-Core Current Sensor — Add Suffix "S" to Part Number

### SPECIFICATIONS

#### INPUT

- VOLTAGE & CURRENT: See tables
- FREQUENCY RANGE: 5 to 500 Hz.
- RESPONSE (TRANS. 90%): 50 µsec.
- POWER FACTOR: Any
- BURDEN:  
Voltage: Less than 0.1VA.  
Current: Less than 0.1VA.  
dc insertion loss: None
- OVERLOAD:  
Voltage: 600VAC maximum  
Current: 50 times full scale.

- DIELECTRIC TEST (Input / Output / Case): 1500VAC
- SURGE: Withstands IEEE SWC test.

#### OUTPUT

- OUTPUT RIPPLE: Less than 1.0% F.S. at 60 Hz.
- OUTPUT LOADING (OHMS):  
+/-1mA: 0-10K  
+/-10Vdc: 2K min.  
4-20mA, 4-12-20mA, 0-20mA: 0-500  
+/-5Vdc: 2K min.
- RESPONSE TIME (90%): 500 ms

- FIELD ADJUSTABLE CAL.: +/-10%
- ACCURACY +/-1.0% F.S.**  
Includes combined effects of linearity, repeatability, & frequency.
- TEMPERATURE EFFECT (0°C to 40°C): +/-1.0% RDG, +/-0.1% F.S. Output.
  - INSTRUMENT POWER:  
85-135VAC, 50-400 Hz.

#### ORDERING INFORMATION

Example: Three-phase, 120V, 100A input, split-core sensor, with 0-5Vdc output, proportional to 0-20kW. / **P-142X5S**

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# AC WATT/WATTHOUR TRANSDUCER

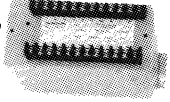
Model **GH** ACCURATE TO 0.2% OF READING

## FEATURES

- Accurate regardless of variations in voltage, current, power factor, or load.
- Available with 1, 2, 2 1/2, or 3 element configurations. Provides bi-directional operation.
- Accuracy maintained over wide temperature range.
- Calibrated with standards traceable to NIST.

## APPLICATIONS

- Equipment monitoring for process control.
- Integration into energy management systems, or a variety of sub-metering applications.
- Measurement using direct-connection, current transformers or potential transformers.



## AC WATT/WATTHOUR TRANSDUCER - INTEGRAL CURRENT SENSOR

INPUTS		F.S. IN (WATTS)	PHASE CONFIG.	MODEL NUMBER GH-			F.S. COUNT PER HR	STANDARD WATTHOUR OUTPUTS				
VOLTAGE	CURRENT			+/- 1mA	+/- 10Vdc	4-20mA		CONTACT	5V PULSE	BI-DIR.	FORM C	FORM C
0 to 150	0 to 5	500	1 Ph.-2W	001B	001D	001E	500	STANDARD OUTPUT FOR WATT HOURS. N/O SPST RELAY CONTACT	TTL OUTPUT ADD SUFFIX TO PART NUMBER	BI DIRECT. HOUR MEASMT. ADD SUFFIX "-R"	MERCURY WETTED RELAY-HORIZ. MOUNTED ADD SUFFIX "-N"	MERCURY WETTED RELAY-VERTICAL MOUNTED ADD SUFFIX "-P"
		1000	3 Ph.-3W	004B	004D	004E	1000					
		1500	3 Ph.-4W	007B	007D	007E	1500					
0 to 300	0 to 5	1000	1 Ph.-2W	002B	002D	002E	1000					
		2000	3 Ph.-3W	005B	005D	005E	2000					
		3000	3 Ph.-4W	008B	008D	008E	4000					
0 to 600	0 to 5	2000	1 Ph.-2W	003B	003D	003E	2000					
		4000	3 Ph.-3W	006B	006D	006E	4000					

NOTE 1) 10, 15, 20A Models and .3 Class Current Transformers available.

2) UL Models available.

### INPUT

- See Voltage and Current Tables.
- Frequency 60Hz.
- Power Factor Any

### OUTPUT

- WH Relay N/O SPST 120V, .5A
- Analog ±1mA, ±10V, or 4-20mA

### ACCURACY

- ±0.2% of Reading.

Model **WL40R** WATTHOUR TRANSDUCERS

## FEATURES

- Low cost.
- Split-Core Transformers.
- True Power Measurement.
- Small Package.
- Relay Pulse Output

## APPLICATIONS

- Sub-Metering.



INPUTS		STANDARD MODEL WL40R-				INPUTS		WL40R-		INPUTS		WL40R-	
VOLTAGE	CURRENT	1Ø 2W	1Ø 3W	3Ø 3W	kWH/C	VOLTAGE	CURRENT	3Ø 3W	kWH/C	VOLTAGE	CURRENT	3Ø 4W	kWH/C
120/240	50	049	052	053	.01	480	50	054	.01	120/277 L/N	50	056	.01
	100	058	061	062	.01		100	063	.01		100	065	.01
	200	067	070	071	.01		200	072	.1		200	074	.1
	500	085	088	089	.1		500	090	.1		500	092	.1

### INPUT

- See Voltage and Current Tables.
- Frequency 50Hz. -60Hz.
- Power Factor .5 lead to .5 lag

### OUTPUT

- WH Relay dry contact 120V, .3A, N/O
- LED to indicate relay closure

### ACCURACY

- ±0.5% FS (Includes Current Transformers)

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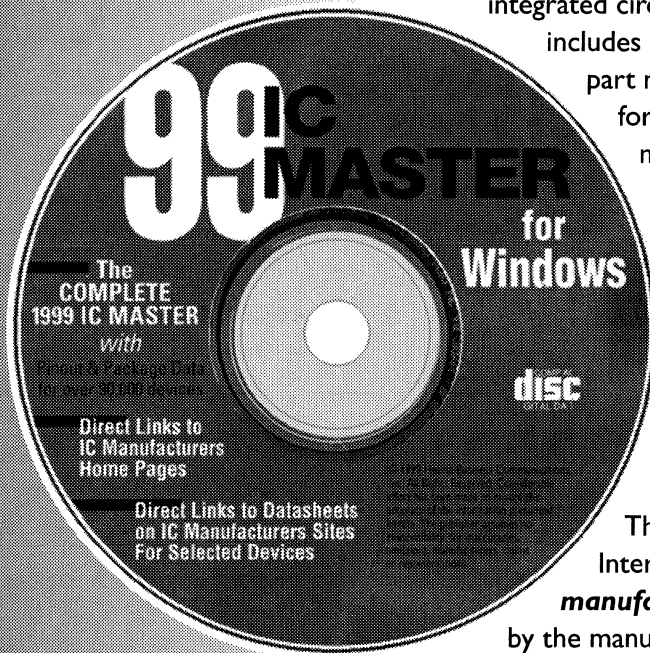
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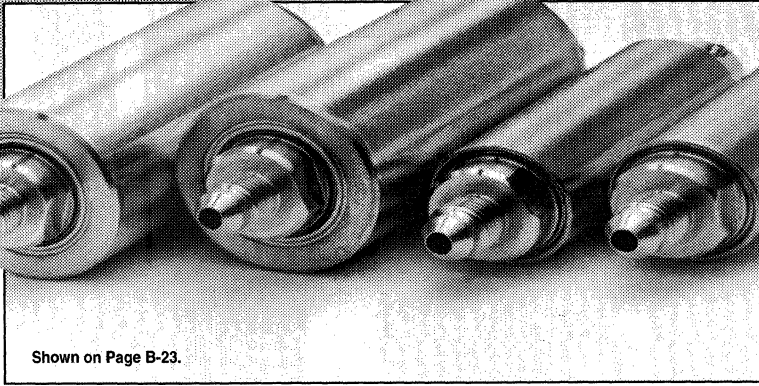
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# PRESSURE TRANSDUCERS

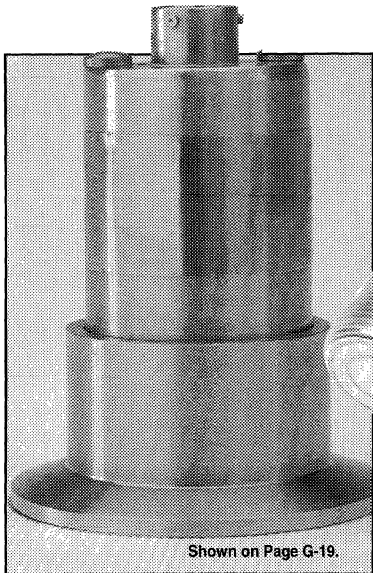


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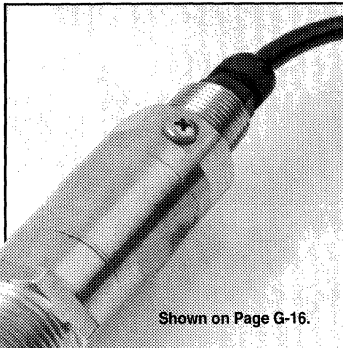


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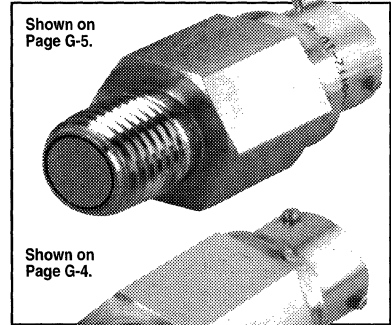
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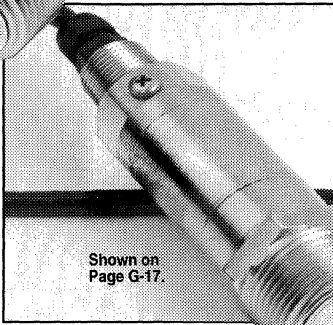


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Shown on Page G-4.



Shown on Page G-17.



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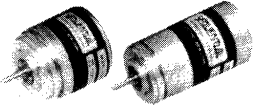
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# OPTICAL ENCODERS

**INCREMENTAL • ABSOLUTE • MULTI-TURN • HOLLOW SHAFT  
INDUSTRIAL • MILITARY • AEROSPACE  
UP TO 2 MILLION COUNTS**

## INCREMENTAL ENCODERS

### Miniature Series 11A & 15A



**Size:** 1.1" dia. x 2" L (11A), 1.5" dia x 1 3/8" L (15A)  
**Resolution:** to 1024 cyc/rev (11A), to 2048 cyc/rev (15A)  
**Output Formats:** Single Channel, 2-Channel in Quadrature, 2-Channel Quadrature plus Zero Index  
**Output Levels:** TTL or C-MOS Compatible  
**Illumination Source:** Single LED  
**Detectors:** Phototransistors

### Heavy Duty NEMA 13 Series 25GN & 30GN



**Size:** 2.5" dia x 2.5" L (25GN); 3" dia x 3" L (30GN)  
**Mounting:** Servo, Face (Bolt Circle) or Flange  
**Resolution:** To 16384 cyc/rev  
**Output Format/Levels:** TTL, HI Vol., Diff., 2-Channels Quadrature plus Zero Index  
**Shaft Diameter:** 3/8" (25GN); 1/2" (30GN)  
**Radial Shaft Loading:** 35 lbs (25GN); 40 lbs (30GN)  
**Shaft Seal:** Buna N Rubber  
**Illumination Source:** Single LED  
**Detectors:** Phototransistors

### Encoder With Integral Coupling & Flanges



**Size:** 2.5" dia encoder x 3", 2 1/2" or 2"L (depends on output). Flange dia: 3 1/4".  
**Resolution:** Same as 25GN  
**Output Formats:** Same as 25GN  
**Electrical Specs:** Same as 25GN  
**Axial Motion:** ±0.030" max.  
**Parallel Offset:** ±0.010" max.  
**Angular Misalign:** 5° max.

**Incremental & Absolute Units Are Available In: Industrial, Instrument, High Resolution & Economy Packages Including Encoders With Integral Couplings**

## ABSOLUTE ENCODERS

### Series 25H



**Size:** 2.625" dia x L (depends on output)  
**Resolution:** to 13 bit CB or NB to 3599 Binary Coded Decimal  
**Output Formats:** CB, NB, CBCD & BCD standard  
**Output Levels:** TTL or C-MOS, Open collector (30 vdc, 40 ma. max)  
**Output Options:** Gated, Serial, Differential  
**Illumination Source:** Single LED  
**Detectors:** Phototransistors

### NEMA 13 Programmable Controller Series 40HDN/PC



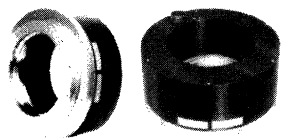
**Size:** 4" DIA  
**Resolution:** 359 BCD, 999 BCD, 2<sup>10</sup> NB  
**Output Levels:** TTL or C-MOS, Open collector (30 vdc, 40 ma. max)  
**Shaft Diameter:** 1/2"  
**Radial Shaft Loading:** 40 lbs  
**Shaft Seal:** Buna N Rubber  
**Illumination Source:** Single LED  
**Detectors:** Phototransistors  
**Note:** Data Hold Input, Data Ready Output, Direction Input Select & Multiplex Control Input Signals for direct hand-shaking capability with most Programmable Controllers.

### Heavy Duty NEMA 13 Series 25HN



**Size:** 2.5" dia x L (depends on output)  
**Resolution:** to 13 bit CB or NB to 3599 Binary Coded Decimal  
**Output Formats:** CB, NB, CBCD & BCD standard  
**Output Levels:** TTL or C-MOS, Open collector (30 vdc, 40 ma. max)  
**Output Options:** Gated, Serial, Differential  
**Illumination Source:** Single LED  
**Detectors:** Phototransistors

## HI-RES ENCODERS



Sequential offers a full line of absolute encoders with resolutions to 21 bits. Package sizes range from 3.5" to 12" dia. Hollow-shaft models are available with thru-holes to 7".

Sequential Encoders offer the highest resolution and accuracy available today!

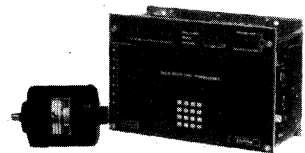
## MULTI-TURN ENCODERS

### Heavy Duty Absolute Multi-Turn Encoder Model 40RMT



**Resolution:** 4096 bits/turn, 4096 turns (NB code), 3600 bits/turn, 1000 turns (BCD Code)  
**Code:** Natural Binary or BCD  
**Output Level:** TTL compatible, Open collector & High Level, directly interfaces with process computers & programmable controllers  
**Size:** 4" dia. x 5" axial length  
**Note:** Data ready signal for PC; provision for multiplexing multiple encoders

## OTHER PRODUCTS



- Limit Programmers
- Encoded Motors
- Explosionproof Encoders
- Industrial Control Systems
- Hollow Shaft Incremental & Absolute Industrial Encoders

All Models Include More Than 150 Resolutions In Stock With A Wide Variety Of Mechanical & Electrical Options.



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# Tachometers, Encoders Brushless Tach/Commutators.

## dc tach generators

### Make Velocity Feedback Simple.

They provide a continuous linear DC voltage from Zero to 12,000 RPM. Bi-directional analog signal is used to measure and control the speed of motors or any other rotating shaft. From conveyor belts to aircraft wheel speed sensors, our tach generators offer a simple solution to velocity feedback. Select from a wide range of standard and stock models up to 45 volts/1000 RPM; or we can design a tach generator to satisfy your requirements. Standard 7 and 20.8 volt models provide an analog signal for direct input into D.C. motor controls.



## pt series encoder

### Low Cost Solution For Measuring Shaft Speed/Position

When mounted to any rotating shaft, the PT Series Encoder provides a single channel square wave output for speed/position control. The Encoder can be used to supply digital feedback for motor speed control and speed indication.

The small size of the PT Series Encoder (2.0" dia., .900" long) makes it easy to use where space is limited. The hollow shaft design is easy to mount with no coupling or tedious alignment procedures.



## tachsyn® brushless tach/commutators

Does your brushless dc drive require

- High-accuracy commutation?
- Linear, low-noise tach signal?
- Elevated-temperature operation?
- No electronics in the motor?
- Low-inertia rotor?

The new patented Tachsyn tach/commutator from Servo-Tek may be the ideal transducer for your exacting requirements.

The Tachsyn brushless three-phase transducer is available in 4-, 6-, and 8-pole configurations to match your motor. With remote signal conditioning electronics, it provides accurate 6-step Hall-equivalent or sine-wave signals plus a low-ripple analog dc tachometer output.

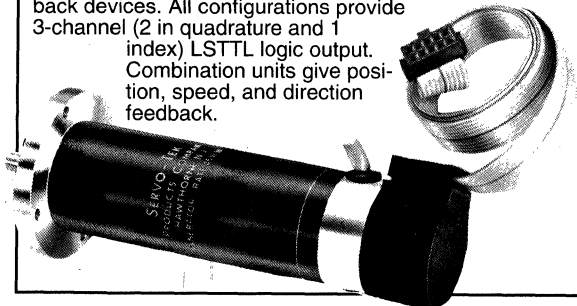
The rotor is a low-inertia, passive component suitable for high speeds. Overhung mounting eases addition to your motor-no extra bearings or couplings are required.



## incremental encoders

These high-resolution (100 to 512 pulses/revolution) optical encoders are offered both as options on 1.135" Servo-Tek rotating components (pictured) and as stand-alone feedback devices. All configurations provide

3-channel (2 in quadrature and 1 index) LSTTL logic output. Combination units give position, speed, and direction feedback.



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**SERVO-TEK®**  
SERVO-TEK PRODUCTS COMPANY

# Setra Systems, Inc.

## Product Line Summary

### Pressure Transducers and Transmitters

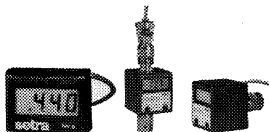
Model	Applications	Type of Pressure Measurement	Pressure Ranges	Accuracy (RSS Method) ±% FS	Thermal Effect ±% FS/100°F (±%FS/100°C)	Media Compatibility	Output
 <b>204</b> <b>204D</b>	R & D Laboratories Vacuum Systems Hazardous Environments Dynamometers Engine Test Cells	Absolute Gage Vacuum Differential	25 to 5000 psia 25 to 10,000 psig 0 to 14.7 psiv 25 to 10,000 psid ±10 to 500 psid	0.11 <b>10,000 psid</b> 0.14 <b>Bidirectional</b> 0.22 <b>Option</b> .073	<b>204/C204</b> 0.4 (0.7) max Zero 0.3 (0.5) max Span <b>204D</b> 1.0 (1.8) max Zero 1.0 (1.8) max Span	Gas or liquid compatible with stainless steel	<b>204/204D</b> 0-5 VDC <b>204D</b> Bidirectional ±2.5 VDC <b>C204</b> 4-20 mA
 <b>206/207</b>	Equipment Automation Compressor Control Chillers Paper Converting Machines Hydraulics & Pneumatics	Gage	25 to 10,000 psig M206 Avail. in 1.6 to 700 bar	0.13	1.0 (1.8) max Zero 1.5 (2.7) max Span	Gas or liquid compatible with stainless steel	<b>206/207</b> 0.1-5.1 VDC <b>C206/C207</b> 4-20 mA
 <b>209</b> <b>OEM</b>	Off Road Equipment Hydraulic Systems Compressor Control HVAC/R Equipment Industrial Engines	Gage Compound	1 to 5000 psig -14.7 to 5000 psig Common bar ranges	0.25	2.0 (3.6) max Zero 1.5 (2.7) max Span	Gas or liquid compatible with stainless steel	<b>209</b> .5-5.5 VDC 0.2-5.2 VDC 0.5-4.5 VDC 1.0-5.0 VDC <b>C209</b> 4-20 mA
 <b>280E</b>	Hydraulics & Pneumatics Process Control P/I Range Level Measurement	Absolute Gage P/I Compound	25 to 5000 psia 15 to 10,000 psig 3 to 15 psig -14.7 to 35, 50, 100 psig	0.11 <b>Option</b> .073	0.75 (1.4) Typ. Zero 1.5 (2.7) Typ. Span 2.0 (3.6) max Zero 2.0 (3.6) max Span	Gas or liquid compatible with stainless steel	<b>280E</b> 0-5 VDC <b>C280E</b> 4-20 mA
 <b>270</b>	Weather Data Systems Laser Interferometers Altimeter Setting Indicators Transfer Pressure Standard	Barometric Gage Absolute	600-1100 hpa/mb 800-1100 hpa/mb 5 to 100 psig 10 to 100 psia	0.05 <b>Option</b> 0.03	0.1(0.18) max Zero (0.2 (0.36) Baro.) 0.1(0.18) max Span	Dry air/gas compatible w/aluminum, alumina ceramics, gold, fluoro-carbon elastomer sealant & Buna-N O-Ring	0-5 VDC
 <b>276</b>	Environmental Monitoring Barometric Pressure Automotive Emissions Test Equip. Weather & Altitude Systems	Barometric Absolute	600-1100 hpa/mb 800-1100 hpa/mb 0 to 20 psia	0.25 <b>Option</b> 0.1	1.0 (1.8) max Zero 1.0 (1.8) max Span	Wet or dry air or other media compatible with stainless steel, alumina ceramics, gold & elastomer	0.1-5.1 VDC <b>Option</b> 0.5-4.5
 <b>210</b>	Medical Equipment Paint Mixing Equipment Pneumatic Systems	Gage Absolute	1 to 250 psig 25 to 100 psia	1.0 0.5 0.25	2.0 (3.6) max Zero 1.5 (2.7) max Span	Gas or liquid compatible with stainless steel and nylon	0.5-4.5 VDC <b>Optional</b> 1.0-5.0 VDC 0.1-5.1 VDC 1.0-6.0 VDC
 <b>C230</b>	Process Control Filter Condition Monitoring Refrigeration Equipment Pump Speed Control HVAC Equipment	Differential (can be wet both sides)	1 to 100 psid ±0.5 to ±50 psid	0.25	2.0 (4.0) max Zero 2.0 (4.0) max Span	Gas or liquid compatible with 17-4 PH stainless steel, 300 Series stainless steel & Viton "O" rings (both pressure & reference sides)	<b>C230</b> 4-20 mA
 <b>239</b>	HVAC Control Leak Detection Environmental Testing R & D Scientific Fume Hood Control	Differential	0.5" to 30" WC ±0.25" to ±15" WC 5 to 10 psid ±2.5 to ±5 psid	0.14 <b>Option</b> .073	1.0 (1.8) max Zero 1.0 (1.8) max Span	High Pressure Port Gas or liquid compatible with stainless steel, aluminum & Buna-N Low Pressure Port Clean dry air or inert gas	<b>239</b> 0-5 VDC Bidirectional ±2.5 VDC <b>C239</b> 4-20 mA
 <b>264</b>	HVAC and VAV Control Energy Management Systems Clean Room Control Medical Instrumentation Filter Condition Monitoring	Very low Differential	0.1" to 10" WC ±0.1" to ±5" WC (Pa, mbar & mmWC ranges available) <b>Model 264</b> 0 to 25" WC	1.00 <b>Option</b> 0.25 & 0.4	3.3 (5.9) Zero & Span Combined	Air or Inert gases	<b>264</b> 0-5 VDC <b>267</b> 0-10 VDC <b>C264/C267</b> 4-20 mA
 <b>267</b>							

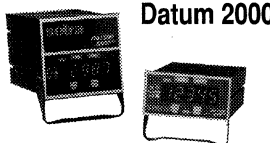


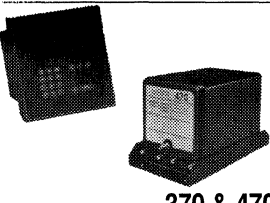
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# Setra Systems, Inc.


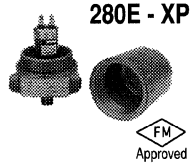

## Product Line Summary Digital Displays and Systems

Model	Description
<b>880 S.I.D. LD330</b> 	The S.I.D. and LD330 are small, low power 3 1/2 digit analog to digital converters with LCD displays. S.I.D. is packaged to be wired in line between a Setra pressure transducer (or transmitter) and the user's application and power supply. The package allows transducer cable entry and strain relief from the opposite side. The LD330 is designed for direct mounting to a transducer or transmitter with a 4 pin bayonet connector. This achieves mechanical mount and electrical contact.


	The DATUM 2000™ meter is a self contained dual channel system for accurately displaying an output from one or two transducers (or transmitters) located at a remote location. Programmed with a selectable menu, the DATUM 2000™ can be calibrated by the user or at the factory. It features an analog to digital converter with an LED display. RS 232 output can be ordered as an option.  The DATUM 2000™ manometer is a Datum meter combined with either a model 204, 204D, 239 or 270 transducer in a versatile 1/4 DIN package. These high accuracy systems can be used as a benchtop reference or panel mounted. The second channel is available for other remote analog instruments. RS 232 output can be ordered as an option.
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Model	Applications	Type of Pressure Measurement	Pressure Ranges	Accuracy (RSS Method) ±% FS	Analog Output
	Altimeter Certification Laser Interferometers Min/Max Tracking Hi/Lo Alarming Pressure Transfer Standard Automatic Weather Systems High Accuracy Altimeter Weather Data Buoy Hydrological (SDI-12) option	Absolute Barometric	600-1100 mbar 800-1100 mbar 0 to 10, 20, 50, 100 psia	±0.02	RS-232

## Specialty Application Products

Model	Applications	Type of Pressure Measurement	Pressure Ranges	Accuracy (RSS Method) ±% FS	Thermal Effect ±% FS/100°F (±% FS/100°C)	Media Compatibility	Output
<b>212FT/214/216/225</b> 	Specialty Gas Handling Systems Semiconductor Process Gas Bottle Filling Equipment Pharmaceutical & Biotechnology HPLC (High Pressure Liquid Chromatography)	Gage Compound Absolute	25 to 3000 psig -14.7 to 3000 psig 25 to 3000 psia	0.20 (M-212FT) 0.25 (M-214) 0.25 (M216/225)	2.0 (3.6) max Zero 2.0 (3.6) max Span	Corrosive liquids or gases (Ultra-High Purity Gas & Liquid Compatible)	212FT/214 216/225 0.2-5.2 VDC C212FT/C214 C216/C225 4-20 mA
<b>280E - XP</b> 	Explosionproof/Weatherproof Process Instrument Signals Natural Gas Lines Chemical Processing Off-Shore Drilling	Gage Absolute Compound P/I	15 to 10,000 psig 25 to 5000 psia -14.7 to 100 psig 3 to 15 psig	0.11	0.75(1.4) Typ. Zero 1.5 (2.7) Typ. Span 2.0 (3.6) max Zero 2.0 (3.6) max Span	Gas or liquid compatible with stainless steel	280E 0-5 VDC C280E 4-20 mA
<b>C290</b> 	Sanitary Pressure Lines Food & Beverage Processing Tank Level Measurement Pharmaceutical Processing Sanitary Filtration Systems	Gage	1 to 1000 psig	0.20	2.0 (3.6) max Zero 2.0 (3.6) max Span	Gas or liquid compatible with stainless steel	4-20 mA

## Accelerometer

<b>141</b> 	Transportation Equipment Position Sensing Robotics Shock & Vibration Testing	G Ranges (Full Scale Ranges ±G)	±2, ±4, ±8, ±15, ±30, ±60, ±150, ±600g Response: DC to 200-3000 Hz (depending on range)	1.00	2.0 (4.0) max Zero 2.0 (4.0) max Span	N/A	141A ±500 millivolts (nominal) 141B ±1000 millivolts (nominal)
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1-800-257-3872

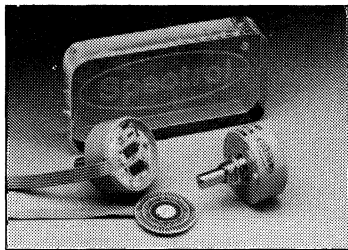
# Turn to Spectrol for Sensors and Digital Encoders.

Spectrol has been an industry leading edge sensor manufacturer for more than 40 years.

Our extensive experience in producing and packaging a wide range of analog resistive and encoder position sensors uniquely qualifies us to produce the highest quality at lowest costs. Custom designed sensors can be developed to meet almost any position, fuel level or control application.

Our resistive inks have been cycled to one billion dithers and operated at 100°F. Their proprietary formulas are being used in the most rigorous military and industrial applications.

An innovative, patented "Silver-In-Glass" encoder sensing technology offers high accuracy, long life and is ideal for rugged and dirty environments that are unsuitable for optical devices.

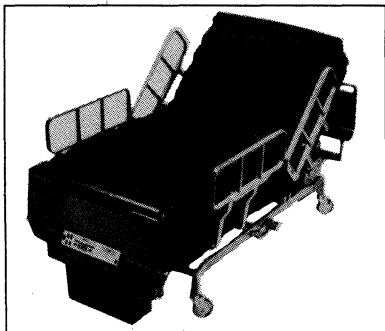


2-channel incremental encoder features Spectrol's "Silver-In-Glass" technology

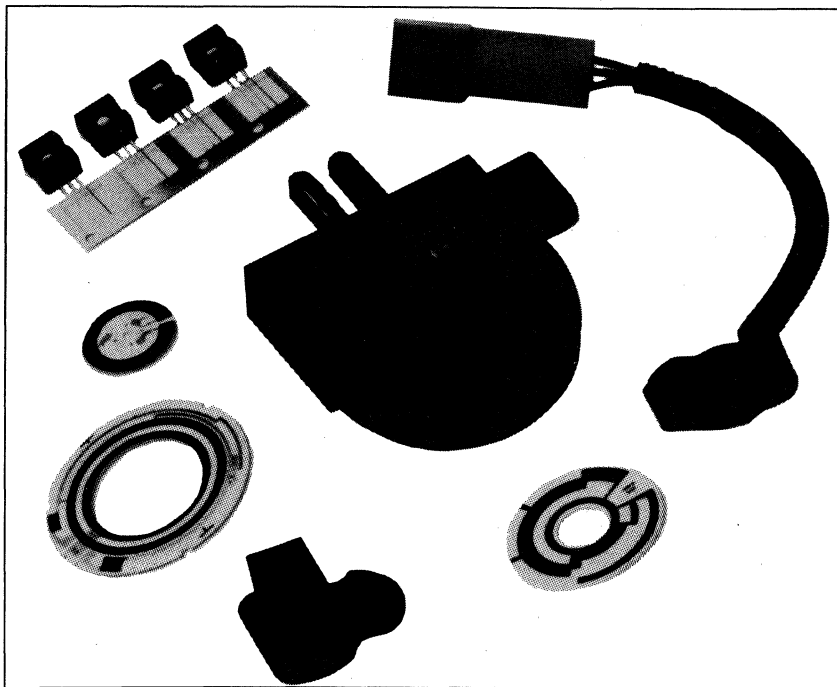
Among them is the prestigious Q1 Quality Award presented by Ford Motor Company.

We excel in producing components that meet or exceed your specifications for accuracy, linearity, temperature, life and reliability.

Whether you require one or one million sensors, let



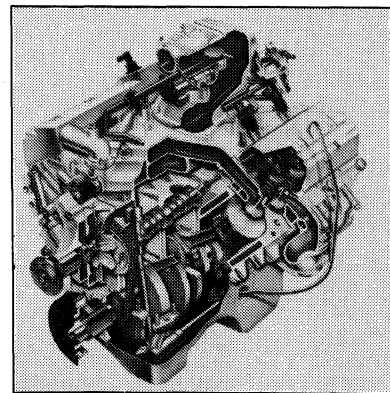
Flexicair low airloss therapy unit courtesy of Support Systems International Inc. 1993



Ideal for digital panel control or position sensing applications. Spectrol's new digital encoder converts rotary motion into electrical signals which can be readily used by microprocessors. Exceptionally sturdy construction makes the encoder highly resistant to shock, vibration, humidity and temperatures (to 125°C). Operating life exceeds two million revolutions.

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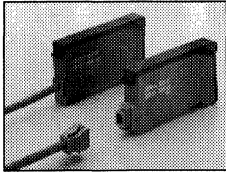


# PHOTOELECTRIC SENSORS & CONTROLS

The SUNX Beam Sensor is designed to handle all of your sensing requirements. Automate your lines in machining, cutting, counting, sorting, monitoring, inspecting, packaging, storing ...

## FIBER OPTIC AMPLIFIERS / CABLES

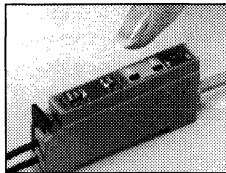
### FX3/10 SERIES



- Input: 12 to 24 VDC
- Output: NPN (Optional PNP)

- 4 different styles of amplifiers
- Response times down to 0.015ms
- Over 300 types of fiber optic cables
- 8 turn adjustment potentiometer

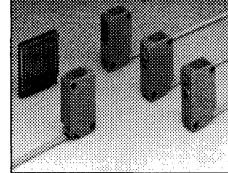
### FX7 Push button settable type



- Just push the "on" button while sensing the object, then push the "off" button when the object is not present. The 10 bit analog to digital converter locks in your setting. Perfect for color mark sensing.

## MULTI-VOLTAGE TYPE RELAY OUTPUT

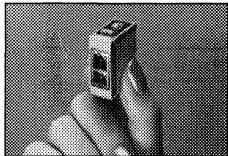
### NX5 SERIES



- Input: 24-240 VAC or 12-240 VDC
- Output: SPDT relay
- IP67 enclosure
- Pre-wired cable
- Thru-beam sense to 30 meter distance
- Retro type to 5 meter distance
- Diffuse mode will sense 700mm

## TOTALLY ENCAPSULATED SENSOR D.C. TYPE AMPLIFIER BUILT-IN

### CX SERIES

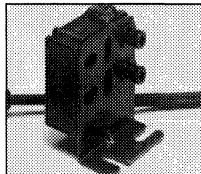


- Input: 12 to 24 VDC
- Output: NPN (Optional PNP)

- Only 20 x 31 x 12mm in size with an enclosure rating of IP67
- Thru-beam (10m) retro (3m) & diffuse (800mm) types • Available in infrared light source for reliable sensing.

## BACKGROUND SUPPRESSANT TYPE

### RSLX200

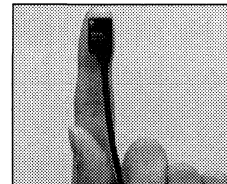


- Sense any color object regardless of back-ground. Even if the background is reflective or the same color as the object being sensed.

Sensing range adjustable from 50mm to 200mm. 12 to 24 VDC input, NPN or PNP output is available.

## SUB-MINIATURE AMPLIFIER BUILT-IN

### EX-10 SERIES

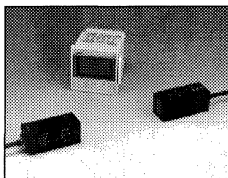


- EX10 thru-beam will sense up to 500mm distance and detect down

to 1mm dia. objects. Diffuse sensor has a sensing range up to 25mm. NPN output included.

## LASER SENSOR (Class I)

### LA511 SERIES

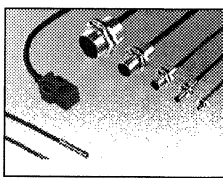


- Sensing beam 15mm x 1mm.
- Sensing distance up to 500mm

- Minimum detectable target .1mm. 10 micro meter accuracy!
- 1-5v analog (thru-time 4v/.5ms) and NPN setpoint out.

## INDUCTIVE PROXIMITY SENSORS

### GX-GXL SERIES

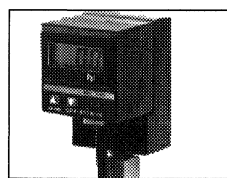


- Input: 10 to 30 VDC
- Output: NPN

- Over 17 different tubular units from 3.8mm to 30mm in dia.
- Max 10mm sensing distance
- 2 wire D.C. type also available

## PRESSURE, VACUUM SENSORS

### DP/DPX SERIES



- Input: 12 to 24 VDC
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- Self contained sensors display pressure or vacuum. Has digital setting for solid state output: analog option available. • LCD & LED display.

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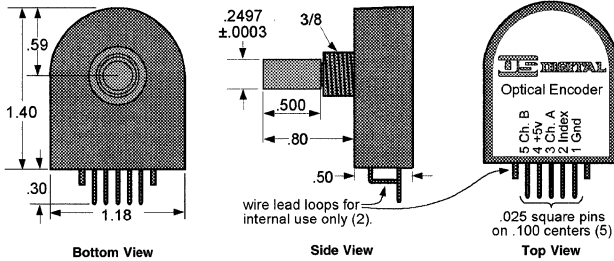


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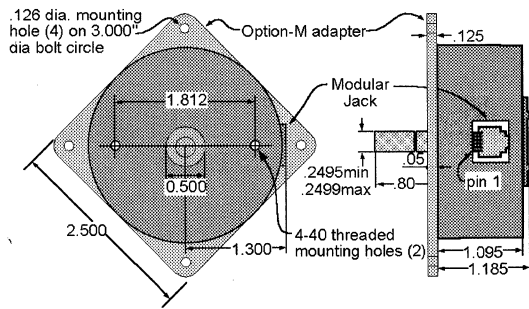
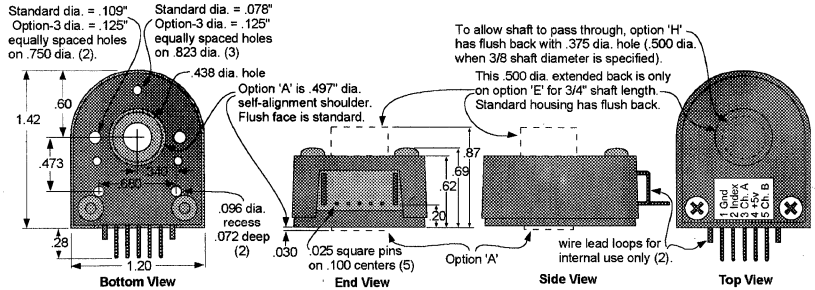


### S1 Encoder Features

- Small size
- Low cost
- Ball bearing version (high speed)
- Sleeve bushing version (feels like potentiometer)
- 2-channel quadrature, TTL square wave outputs
- Optional index (3rd channel)
- Tracks from 0 to 100,000 cycles/sec
- 96 to 2500 cycles/rev.
- 384 to 10,000 codes per revolution
- Single +5 volt supply
- -40 to +100°C operating temperature
- \$39 is typical 100 piece price for standard S1

### E2 Quick Assembly Encoder Features

- Quick and simple assembly & dis-assembly
- Rugged screw-together housing
- Accepts ±.010" axial shaft play
- Fits shaft diameters to 2mm to 3/8"
- 2-channel quadrature, TTL square wave outputs
- Optional index (3rd channel)
- Tracks from 0 to 100,000 cycles/sec
- 96 to 2500 cycles/rev.
- 384 to 10,000 codes per revolution
- Single +5 volt supply
- -40 to +100°C operating temperature
- Compatible with HP HEDS-5500
- \$29 is typical 100 piece price for standard E2
- Also, our E3 fits shaft diameters up to 1" with 2 times the resolution!

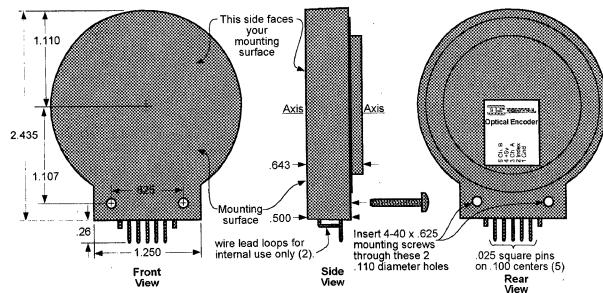


### A2 Absolute Encoder Features

- Up to 15 devices on a single 6-pin telephone-type cable
- Cable length up to 1000 feet
- Field programmable resolution 2-65536 CPR
- Field programmable zero position
- Single or multi-turn configuration
- 12-bit analog output option
- Ball bearing version
- Sleeve bushing version
- Quick assembly kit version
- Through-shaft version
- Absolute / Incremental Hybrid version
- Inclinometer version
- Utility & configuration PC software with source code is available
- \$175 is typical 100 piece price for standard A2

### T2 Inclinometer Features

- Low cost
- Fast response
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- 360 degree range
- 0.05°, 0.1°, or 0.25° resolution
- 2-channel quadrature, TTL square wave outputs
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- \$60 is typical 100 piece price for standard T2



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## ENCODERS

### GENERAL SPECIFICATIONS:



#### Optical, Incremental

<b>ELECTRICAL</b>	
Voltage .....	5 VDC to 15 VDC
Frequency response ..	100 kHz standard
Pulses/revolutions .....	Consult factory
Code .....	Dual channel in quadrature with index
Multi/Comp .....	Available
Output .....	PS- Photo Sensor (sine wave), PU- Pull-Up, OC- Open Collector, LD- Line Drivers
<b>Accuracy</b>	
Pulse-to-pulse .....	± 1 %
Pulse-to-pulse-any-pulse ..	± 3 arc minutes
<b>MECHANICAL</b>	
Sizes .....	5, 11, 15, 23, 25, 30, 35
Mounting .....	Flange, servo, face
Shaft seals/Connectors	Available
Leads .....	Pigtail standard

<b>Optical, Absolute</b>	
<b>ELECTRICAL</b>	
Voltage .....	5 VDC to 15 VDC
Counts/revolutions .....	Up to 12 bits
Multiturn .....	Up to 19 bits
Code .....	Gray, Binary, BCD (increase count cw or ccw)
Accuracy .....	± 1/2 bit
<b>MECHANICAL</b>	
Sizes .....	23, 25, 30,
Mounting .....	Flange, servo, face
Shaft seals/Connectors	Available
Leads .....	Pigtail standard

<b>Contact, Absolute</b>	
<b>ELECTRICAL</b>	
Voltage .....	5 VDC to 28 VDC
Counting speed .....	Up to 200 RPM
Counts/revolutions .....	Up to 10 bits
Multiturn .....	Up to 19 bits (total count)
Code .....	Gray, Binary, BCD (increase count cw or ccw)
Accuracy .....	± 1/2 bit
<b>MECHANICAL</b>	
Sizes .....	11, 18, 23, 31,
Mounting .....	Flange, servo, face
Shaft seals/Connectors	Available
Leads .....	Pigtail standard

## PRESSURE TRANSDUCERS

### GENERAL SPECIFICATIONS:

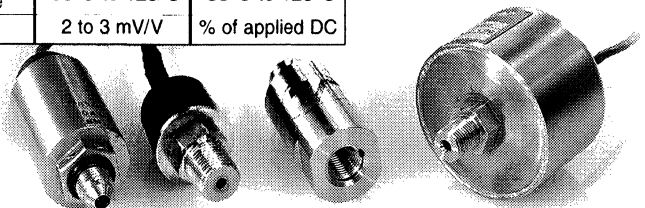
TRANSDUCER TECHNOLOGIES	milliVolt/volt	Voltage	Current Loop	Potentiometric	Digital
<b>BONDED SILICON</b>					
Pressure Range (psi)	FROM 0-100 TO 0-5,000	FROM 0-100 TO 0-5,000		FROM 0-100 TO 0-5,000	FROM 0-100 TO 0-5,000
Reference*	A,G,S	A,G,S		A,G,S	A,G,S
Accuracy	TO ± 0.5%	TO ± 0.5%		TO ± 0.5%	TO ± 0.5%
Overpressure	TO 100%	TO 100%		TO 100%	TO 100%
<b>BONDED FOIL</b>					
Pressure Range (psi)	FROM 0-100 TO 0-10,000	FROM 0-100 TO 0-10,000	FROM 0-100 TO 0-10,000		FROM 0-100 TO 0-10,000
Reference*	A,G,S	A,G,S	A,G,S		A,G,S
Accuracy	± TO 0.5%	± TO 0.5%	± TO 0.5%		± TO 0.5%
Overpressure	50%	50%	50%		50%
<b>DIFFUSED SILICON</b>					
Pressure Range (psi)	FROM 0-2, 0-350	FROM 0-2, 3,000			FROM 0-2, 0-3,000
Reference*	A,G,S	A,G,S			A,G,S
Accuracy	TO ± 0.5%	TO ± 0.5%			TO ± 0.5%
Overpressure	100%	100%			100%
<b>POTENTIOMETRIC</b>					
Pressure Range (psi)		FROM 0-50 TO 0-5,000	FROM 0-50 TO 0-5,000	FROM 0-2 TO 0-10,000	0-10,000
Reference*		G	A,G	A,D,G,S	G
Accuracy		TO ± 0.8%	TO ± 0.5%	TO ± 0.5%	TO ± 0.5%
Overpressure		RANGE ±20%	RANGE +20%	RANGE +20%	RANGE +20%

TYPICAL TRANSDUCER PERFORMANCE CHARACTERISTICS				
	Bonded Silicon	Diffused Silicon	Bonded Foil	Potentiometric
LINEARITY	to 0.25%	to 0.25%	to 0.5%	to 0.5%
COMPENSATED TEMP. RANGE	any 37°C span within -40°C +125°C operating Temperature range	any 37°C span within -40°C +125°C operating Temperature range	-55°C to 125°C	-55°C to 125°C
SIGNAL LEVEL	to 20 mV/V	to 10 mV/V	2 to 3 mV/V	% of applied DC

\*A= ABSOLUTE  
G = GAGE  
S = SEALED GAGE  
D = DIFFERENTIAL

Consult Factory for Custom Requirements or Specifications

See Our Other Page In Volume A, Section 4750





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## Bestact™ Magnetic Proximity Switches

Vane Type PSMO • Separate Type PSMS • Memory Type PSMM

**A wide variety of types available to meet Applications/Specifications: General Purpose, High Temperature, Floodtight for Two-Wire Systems featuring a Wide Power Range (1V 1mA to 240VAC 10A inductive)**

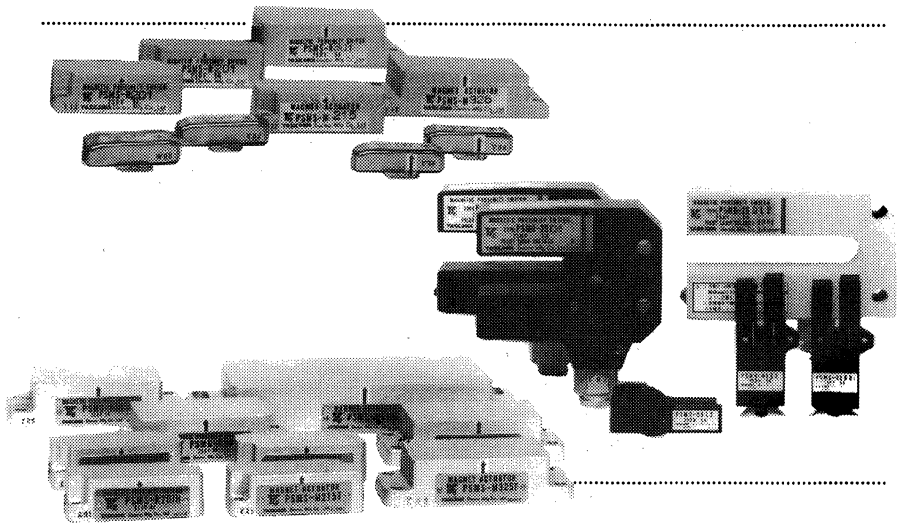
### ■ FEATURES AND BENEFITS

#### Bestact Proximity Switches vs. Other Switches

- 1 No power supply needed. Inductive capacitive, photo-electric & hall effect sensors all need this!
- 2 No maintenance needed. Unaffected by dirt, dust, water (IP 67 or NEMA 6 rating) or incident sunlight. Photo-electric switches need maintenance or shielding when subjected to these conditions.
- 3 Can switch from logic level up to lamp, pilot-duty (360VA) 1/2 HP (240VAC) motor loads directly.
- 4 Eliminate interposing/interfacing or seal-in relays.
- 5 Eliminates the possibility of erroneous operation and breakdown due to noise/voltage surge without protective R-C snubber/surge suppressors.
- 6 Latching (PSMM) capability, SPST (NO or NC) contact configuration available.
- 7 No TTL compatibility issues, short-circuit or overload protection needed, just a simple hard contact for 2-Wire (240VAC/100VDC or greater if needed) switching.
- 8 Operable in temperatures up to 510°F (265°C).
- 9 Sensing ranges up to 4.33" (110mm) or more.
- 10 No demagnetization due to temperature fluctuation or aging (less than 2% over a 10 year period) due to the use of rare earth and anisotropic magnets.
- 11 Barrel, vane, separate or memory/direction sensitive (PSMM) type available.

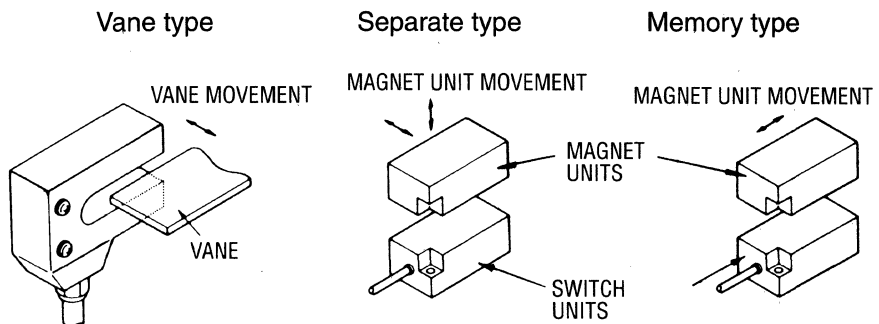
### ■ TYPICAL APPLICATIONS

Steel plant machinery and equipment (for raw material handling, iron making, rolling mills), plating line, large-size material handling machines, automobile manufacturing lines, elevators, cement and related equipment, power station facilities, dam equipment, pollution prevention equipment and devices, mine machinery, chemical industry machinery and equipment, marine product processing machines.



### ■ TYPES AND HOW TO USE

Magnetic proximity switches are usually classified into two types: an integrated type (with magnet) such as vane type and a separate type. Switch operation principle is described below.



#### □ VANE TYPE

- Detection of substance can be made without any physical contact. It enters into or passes by the groove of U-shaped structure. In general, the detected substance is of flat shape and of ferromagnetic material such as iron plate.
- Featuring high detecting accuracy even if the detected substance exhibits play, the switch exhibits less constraint conditions and greater ease-of-handling.

#### □ SEPARATE TYPE

- The switch units are fixed, and the magnet unit is mounted to the moving object to be detected.
- In this type, one magnet unit can energize several switch units. Various detecting methods are available to match your specifications.



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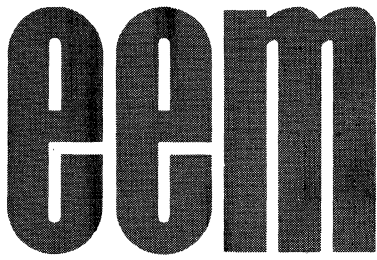
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## MINIGLOSSARY CONNECTORS

**Connector terminology** is often quite confusing. This confusion starts with the very names of connectors. The name of a connector may derive from its shape, application, type of conductor or even method of termination.

**Shape**—Circular, cylindrical, and rectangular.

**Electrical application**—High voltage, RF, microwave, input/output, etc.

**Mechanical application**—Printed circuit, rack & panel, cable, etc.

**Conductor type**—Coaxial, flat cable, ribbon cable, flex circuit, etc.

**Termination method**—Wirewrap, soldercup, solderless, etc.

Hardware such as clamps, hoods, and adapters are frequently used to convert cable connectors to rack and panel types. This adds to the name confusion. A very common telephone connector, for example (the "C" type) got its name from the model number of the original maker.

**Contact:** The part(s) of the connector that actually provides circuit continuity between its two sections—the parts which are normally mated. The back end of the connector should properly be called the *termination*. This is the point where the wires or PC board is attached to the connector.

**Contact alignments:** Often called *contact float*. Describes the amount of allowable contact movement within the connector body. Permits self-alignment.

**Male vs. female:** In the U.S. this describes the contact construction. In Europe this term is more often used to describe the outer shell mating action which may be the reverse of the contacts.

**Closed entry:** A female contact which prevents entry of a male contact larger than a specific size.

**Open entry:** A female contact designed for a specific size of male contact but which will allow entry of larger male contacts by spring action.

**Hermaphrodite:** Contacts or connector bodies which are the same configuration. Male/female designations do not apply. Bodies usually have some mechanical means for maintaining polarity.

**Hermetic seal:** Glass-to-metal seals at terminations. Often used improperly to describe vacuum-tight seals.

**Waterproof seal:** May or may not be truly *waterproof*. May prevent easy entrance of casual water by means of a rubber or other boot.

**Printed circuit connector:** Connectors which are used in conjunction with printed circuit boards. There are two distinctly different styles.

**Edgeboard.** May be called *edge* or *card*. The printed circuit (PC) board edge enters the connector.

**Two-piece:** One part of the connecting pair is physically attached to the PC board itself. The other part is attached to something else such as a cable or a motherboard.

**Readout:** Describes the arrangement at the terminating edge of a PC board.

May be single or double. A double read-out PC board has termination strips on each side not usually interconnected.

**Ribbon connectors:** A type of connector which allows flat "ribbon" cable to be attached to a round or rectangular connector but also used interchangeably for flat connectors to flat cable.

**Ribbon contact connector:** Describes the contacts in a rectangular connector which have a self-wiping mating action. Not the same as ribbon connector.

**Solderless terminal:** Any style of termination which does not require solder for a permanent connection. See *crimp* and *insulation displacement*.

**Crimp termination:** A stripped wire is inserted into a barrel or trough which is then crimped to the conductor with a suitable tool.

**Insulation displacement:** Unstripped insulated wire is fitted into a channel containing metal teeth which are forced through the insulation to make contact with the conductor.

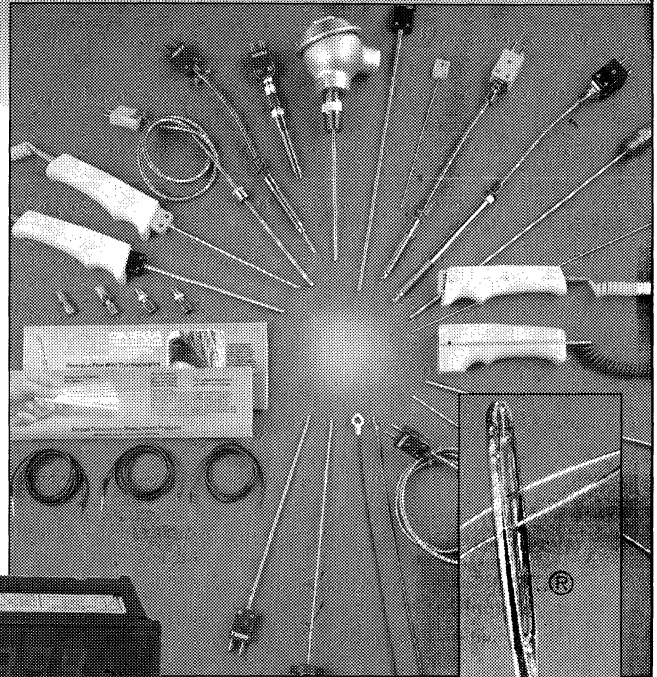
**Service rating:** The maximum rated voltage and/or current which may be applied continuously. May be called *working voltage*. Can be confused with the term used to describe how many times a connector may be mated and separated.

**Withstanding voltage:** Also called *test voltage*. The voltage a connector must withstand for one minute without breakdown. Applied between connectors and between connectors and shell and any grounding devices of the connector.

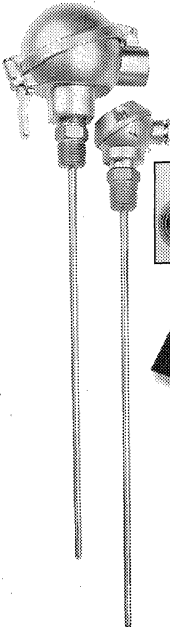
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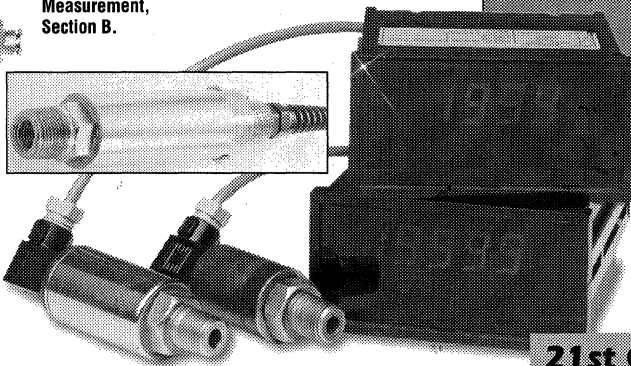
## Temperature



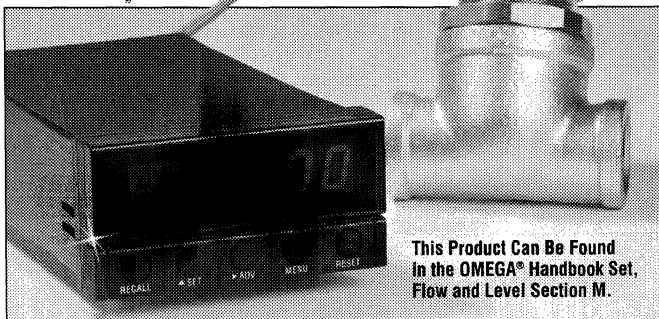
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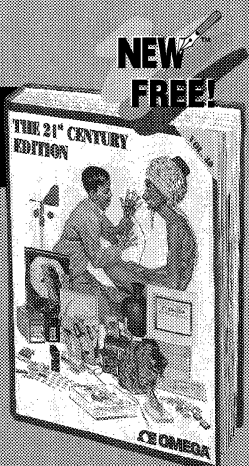


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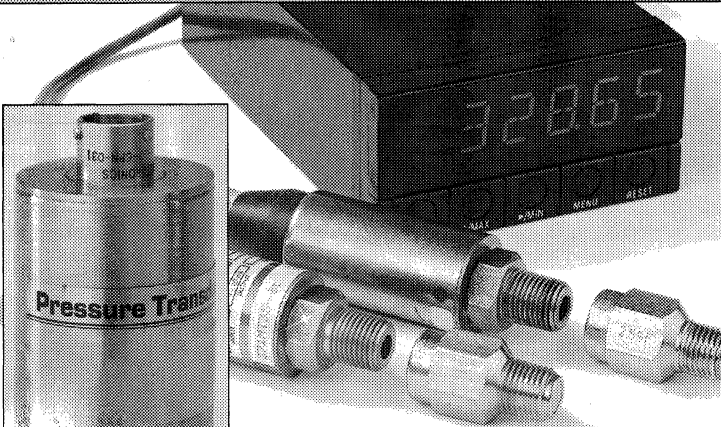
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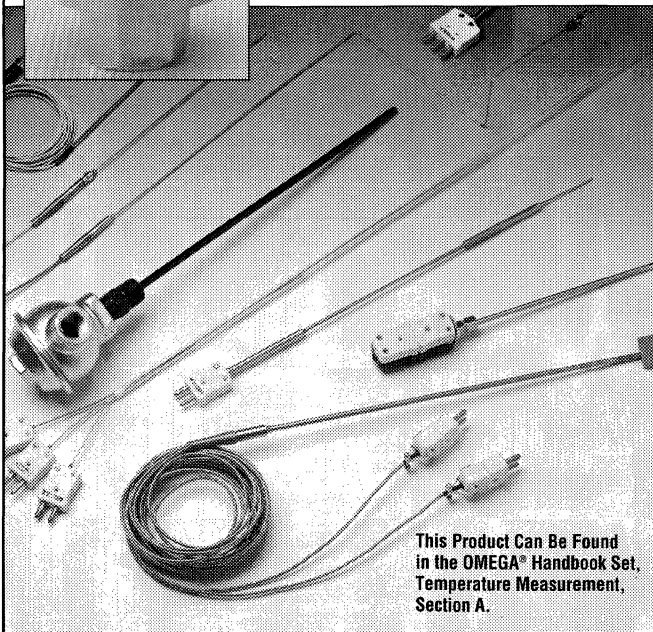
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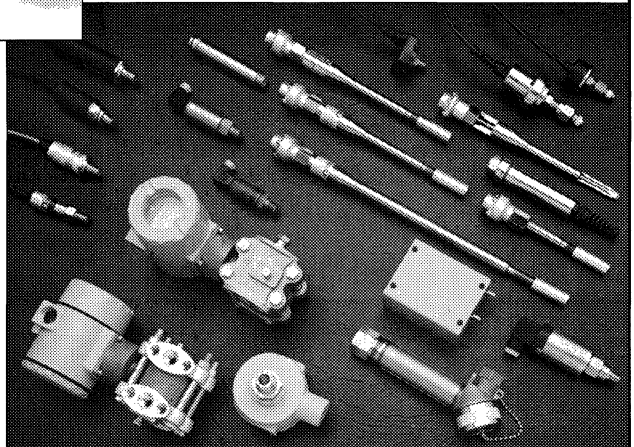
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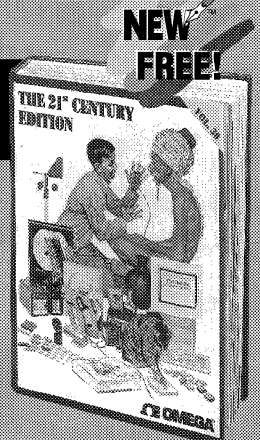
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**Avalanche Photodiode:** A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

**Contrast:** A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

**Chrominance Contrast:** The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

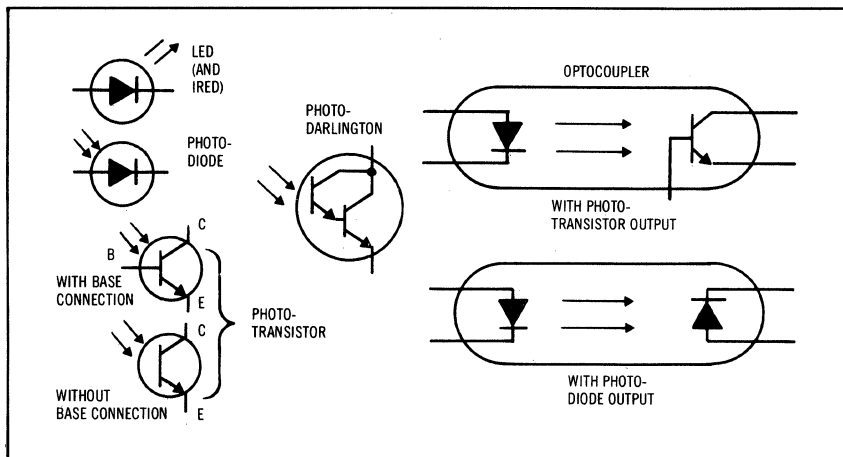
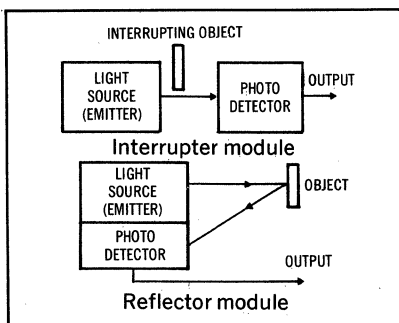
**Current Transfer Ratio:** The ratio of an optocoupler's output current to input current at a specified bias.

**Dark Current:** The leakage current of a photodetector with no incident light.

**Dominant Wavelength:** The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

**Infrared Radiation:** The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

**Interrupter (module):** A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.



**IRED:** An infrared-emitting diode. See light-emitting diode.

**Light Current:** The current that flows through a photodetector when it is exposed to radiant energy.

**Light-Emitting Diode (LED):** A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

**Luminance Contrast:** The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

**Optocoupler:** A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo-Darlington, etc. Sometimes referred to as optoisolator.

**Peak Wavelength:** The wavelength at the peak of the radiated spectrum of an emitter.

**Photo-Darlington:** A light-sensitive Darlington-connected transistor pair. The photo-Darlington has a very high sensitivity to illumination or radiation.

**Photodetector:** A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo-Darlington are the most common type of photodetectors.

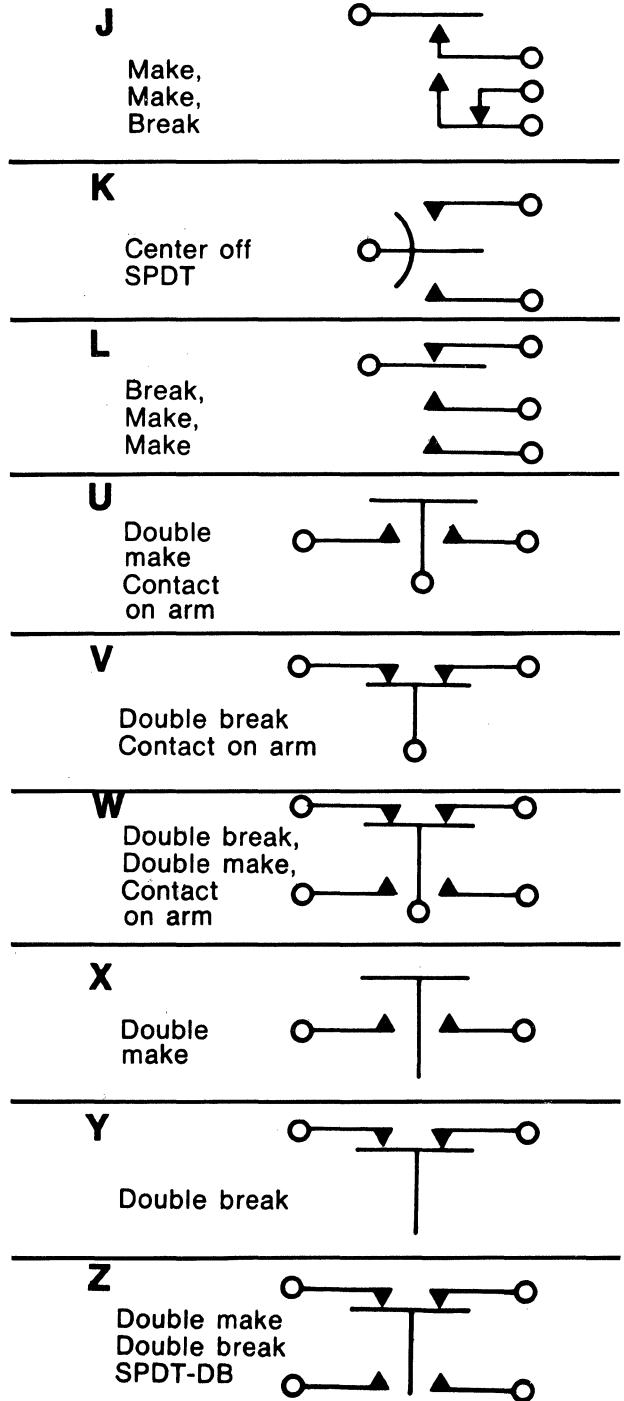
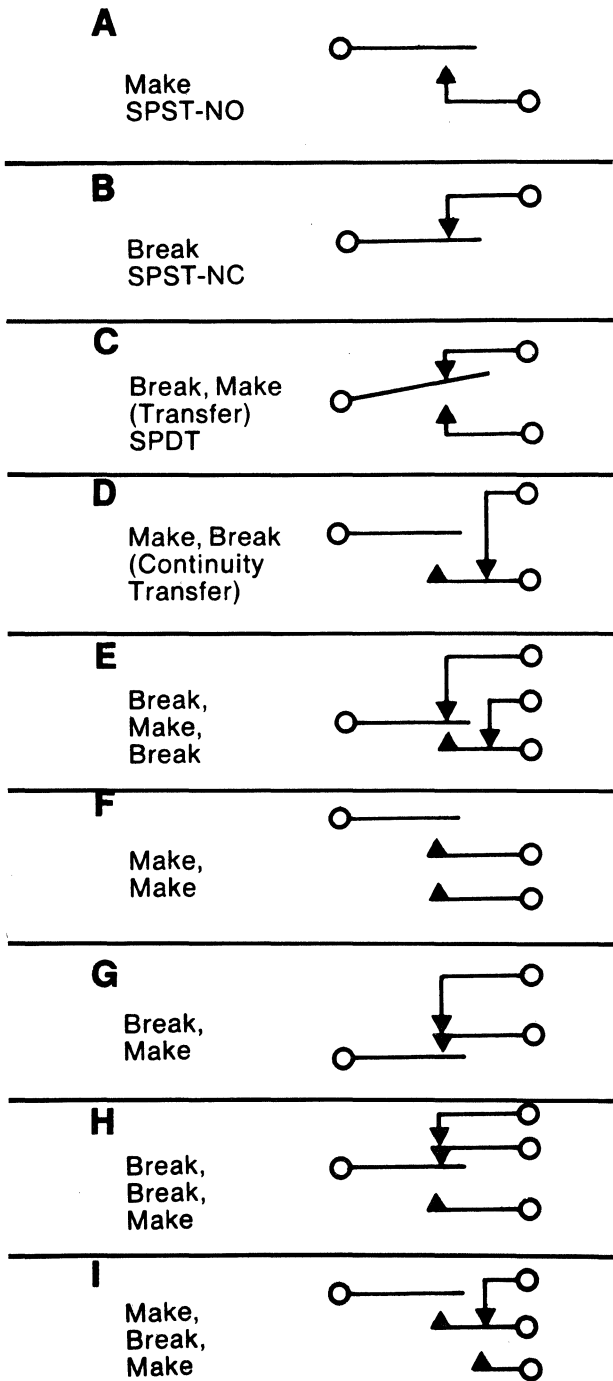
**Photodiode:** A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

**Photothyristor:** A thyristor whose switching action is controlled by light applied to the thyristor gate.

**Phototransistor:** A light-sensitive transistor that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

**Point Source:** A source with a maximum dimension less than one-tenth the distance between sources and detector.

**Reflector (module):** A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.



### RELAYS

**Hybrid:** Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

**Differential:** Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

**Close-differential:** The dropout value is specified close to the pickup value.

**Frequency sensitive:** Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

**Hermetically sealed:** Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

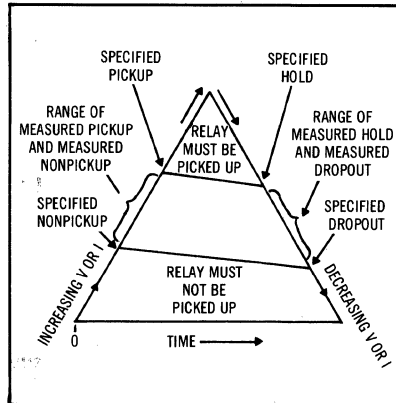
**Encapsulated:** Imbedded in a suitable potting compound.

**Sealed:** Enclosed in a relatively airtight cover. (Not the same as hermetically sealed.)

**Covered:** Unsealed metal or plastic enclosure or housing.

### CONTACTS

**Dry circuit:** contacts that carry current but do not open or close during ener-



gizing of the load circuit. Often wrongly used in reference to low level contacts.

**Low Level:** Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.

### OPERATING CHARACTERISTICS

**Measured dropout:** The value at which all contacts restore to their unoperated position as current or voltage decreases.

**Specified dropout:** The value at or above which all contacts *must* restore to their unoperated position as voltage or current is decreased.

**Specified hold:** The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

**Specified nonpickup:** The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

**Measured pickup:** The value at which all contacts function as voltage or current increases on an unoperated relay.

**Specified pickup:** The value at or below which all contacts *must* function as voltage or current increases on an unoperated relay.

**Sensitivity:** Specified pickup expressed in watts.

**Normal bridging:** The make-before-break action between adjacent contacts on relays designed for this purpose.

**Abnormal bridging:** The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

**Magnetic freezing:** Sticking of the armature to the core as a result of residual magnetism.

### TIME

**Actuation:** The interval from coil energization or de-energization to the functioning of a specified contact.

**Initial actuation:** The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

**Final actuation:** Sum of initial actuation and bounce intervals following an actuation.

**Contact bounce:** The interval from close or opening of a contact to the end of the bounce of "chatter."

**Chatter:** See bounce.

**Operate:** Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

**Release:** Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

**Transfer:** The interval between opening a closed contact and closing an open contact of a break-before-make relay.

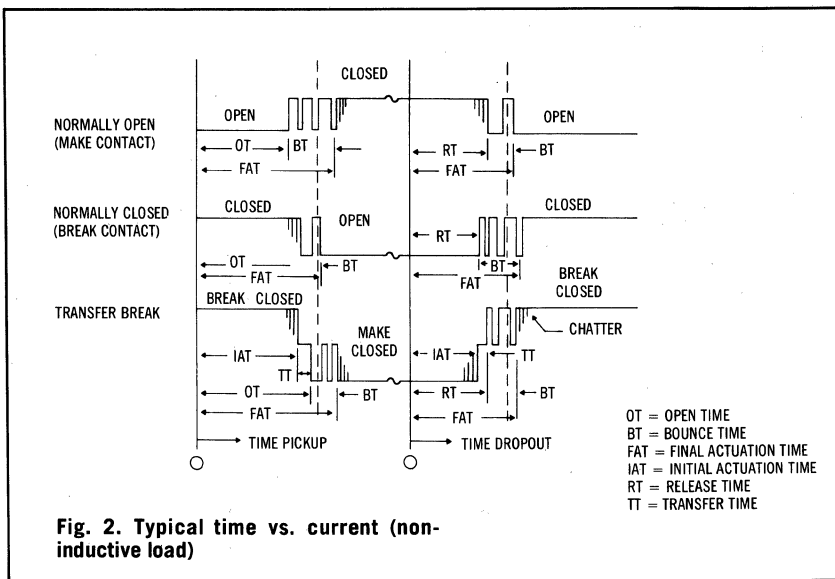


Fig. 2. Typical time vs. current (non-inductive load)

### **Accuracy**

The variation of unit performance, i.e., time delay, voltage trip point, etc., over the specified conditions of ambient temperature, input voltage range, and time between operations.

### **Adjustability**

The changing of a unit set point, within the specified range of unit operation, by means of internal or external adjustment mechanism (i.e., changing time delay with potentiometer).

### **Contact Rating**

The electrical power-handling capability of relay contacts under specified environmental conditions and for a prescribed number of operations.

### **Delayed Interval Timing Function**

Input voltage is applied continuously. The timing cycle is started by momentarily actuating the control circuit. The functions of separate Delay-On-Operate and interval type timers are combined in one package providing a single OFF-ON-OFF output cycles

*Also called:* single shot.

### **Delay-On-Operate Timing Function**

Application of the input voltage starts the time delay. At completion of the time delay, the relay contacts transfer.

*Also called:* Delay-On-Make, On-Delay, Delay Relay, Delay-On-Pickup.

### **Delay-On-Release Timing Function**

Input voltage must be supplied continuously to timer. Actuation of control circuit causes relay contacts to transfer immediately. Time delay starts when control circuit is released. The relay remains energized for the duration of the time delay—then de-energizes.

*Also called:* Delay-On-Break, Off-Delay, Delay-On-Dropout, Delay-On-Energization.

### **Frequency Sensor**

A device that monitors a predetermined overfrequency and/or underfrequency condition, and changes output state when these conditions exist.

### **Hysteresis**

The difference between the response of a unit or system to an increasing and a decreasing signal (example: a voltage sensor).

### **Interval Timer Timing Function**

Application of input voltage causes relay contacts to transfer and time delay to begin. At completion of the time delay, the relay contacts return to de-energized state.

*Also called:* Delay Interval, One Shot.

### **Output Control**

The switching device, either solid-state or electromechanical, used in the unit to control the load connected to the output terminal(s).

### **Phase Sensor**

A device that monitors for proper phase rotation in 3-phase systems.

### **Programmability**

Ability to modify function, time delay or input voltage of a timer.

### **Recovery Timer**

#### **(Delay-On-Operate/Interval Timer)**

The minimum time that input voltage must be interrupted *prior* to time-out to insure a successive timing cycle within the specified limits.

#### **(Delay-On-Release)**

The minimum duration of time that control circuit must be re-actuated to insure a new timing cycle when the control circuit is released.

### **Recycle Time**

#### **(Delay-On-Operate or Interval Timer)**

The minimum time that input voltage must be interrupted after the

timing cycle is completed to assure a successive timing cycle within the repeatability specified.

#### **(Delay-On-Release)**

The minimum duration of time that control circuit must be actuated to insure a successive timing cycle within the repeatability specified when the control circuit is released.

### **Repeat Cycle Timer Timing Function**

Application of power automatically initiates continuous off-on cycling of the output relay.

*Also called:* flasher, intervalometer

### **Reset Time**

The time required for the contacts to return to normal position when power is removed.

### **Reverse Polarity Protection**

Blocking circuitry arrangement within the timer to prevent damage or output actuation if reverse polarity input voltage is applied.

### **Tolerance**

The difference between specified and actual timing or sense point (factory setup tolerance).

### **Transient Protection**

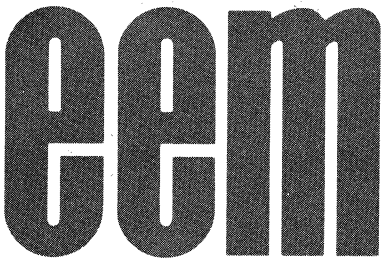
Prevents damage to unit if positive or negative transients are applied to the unit. Insures proper operation of the unit during and after transient occurrence. Max. transients are usually specified as to amplitude and duration, i.e., 1000V for 1 second.

### **Trip Point**

The predetermined point at which a sensing device is set to change the output state.

### **Voltage Sensor**

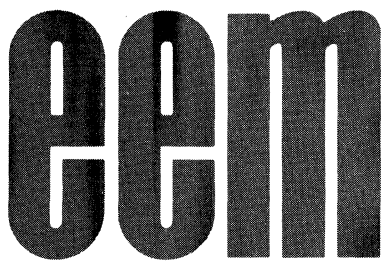
A device that monitors for a predetermined overvoltage and/or undervoltage condition, and changes output state when these conditions exist.



# MAXIMUM CURRENT CAPACITY— CONDUCTORS

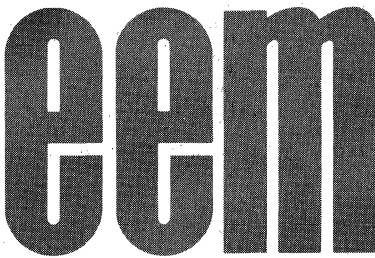
Size, AWG	MIL-W-5088				National Electrical Code	Underwriters Laboratory		American Insurance Association	500 c mils/A
	Copper		Aluminum			60°C	80°C		
	Single- wire	Wire- bundled	Single- wire	Wire- bundled					
30	...	...	...	...	...	0.2	0.4	...	0.20
28	...	...	...	...	...	0.4	0.6	...	0.32
26	...	...	...	...	...	0.6	1.0	...	0.51
24	...	...	...	...	...	1.0	1.6	...	0.81
22	9	5	...	...	...	1.6	2.5	...	1.28
20	11	7.5	...	...	...	2.5	4.0	3	2.04
18	16	10	...	...	6	4.0	6.0	5	3.24
16	22	13	...	...	10	6.0	10.0	7	5.16
14	32	17	...	...	20	10.0	16.0	15	8.22
12	41	23	...	...	30	16.0	26.0	20	13.05
10	55	33	...	...	35	...	...	25	20.8
8	73	46	58	36	50	...	...	35	33.0
6	101	60	86	51	70	...	...	50	52.6
4	135	80	108	64	90	...	...	70	83.4
2	181	100	149	82	125	...	...	90	132.8
1	211	125	177	105	150	...	...	100	167.5
0	245	150	204	125	200	...	...	125	212.0
00	283	175	237	146	225	...	...	150	266.0
000	328	200	...	...	275	...	...	175	336.0
0000	380	225	...	...	325	...	...	225	424.0





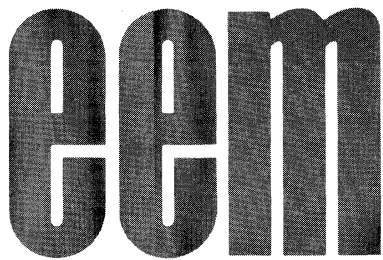
# WIRE GAUGES— DIAMETER, AREA AND COPPER WEIGHT

Size, AWG	Diameter at 20°C (68°F)		Area at 20°C (68°F)			Weight at 20°C (68°F), bare copper wire		
	mils	mm	mils	c mils	mm	lb/1,000 ft.	lb/mile	kg/km
4/0	460.0	11.68	166,200	211,600	107.2	640.5	3,382	953.2
3/0	409.6	10.40	131,800	167,800	85.01	507.8	2,681	755.7
2/0	364.8	9.266	104,500	133,100	67.43	402.8	2,127	599.5
1/0	324.9	8.252	82,891	105,600	53.49	319.5	1,687	477.6
1	289.3	7.348	85,730	83,690	42.41	253.3	1,338	337.0
2	257.6	6.543	52,120	66,360	33.62	200.9	1,061	298.9
3	229.4	5.827	41,330	52,620	26.67	159.3	841.1	237.1
4	204.3	5.189	32,780	41,740	21.15	126.3	667.1	188.0
5	181.9	4.620	25,990	33,090	16.77	100.2	528.8	149.0
6	162.0	4.115	20,610	26,240	13.30	79.44	419.4	118.2
7	144.3	3.665	16,350	20,820	10.55	63.03	332.8	93.80
8	128.5	3.264	12,970	16,510	8.367	49.98	263.9	74.38
9	114.4	2.906	10,280	13,090	6.631	39.61	209.2	58.95
10	101.9	2.588	8,155	10,380	5.261	31.43	166.0	46.77
11	90.7	2.304	6,460	8,230	4.17	24.90	131	37.1
12	80	2.05	5,130	6,530	3.310	19.8	104	29.4
13	72.0	1.83	4,070	5,180	2.63	15.7	82.9	23.4
14	64.1	1.63	3,230	4,110	2.08	12.4	65.7	18.5
15	57.1	1.45	2,560	3,260	1.650	9.87	52.1	14.7
16	50.8	1.29	2,030	2,580	1.31	7.81	41.2	11.6
17	45.3	1.150	1,610	2,050	1.040	6.21	32.8	9.24
18	40.3	1.02	1,280	1,620	0.823	4.92	26.0	7.32
19	35.9	0.912	1,010	1,290	0.653	3.90	20.6	5.81
20	32.0	0.813	804.0	1,020	0.519	3.10	16.4	4.61
21	28.5	0.724	638.0	812.0	0.412	2.46	13.0	3.66
22	25.3	0.643	503.0	640.0	0.324	1.94	10.2	2.88
23	22.6	0.574	401.0	511.0	0.259	1.55	8.16	2.30
24	20.1	0.511	317.0	404.0	0.205	1.22	6.46	1.82
25	17.9	0.455	252.0	320.0	0.162	0.970	5.12	1.44
26	15.9	0.404	199.0	253.0	0.128	0.765	4.04	1.14
27	14.2	0.361	158.0	202.0	0.102	0.610	3.22	0.908
28	12.6	0.320	125	159.0	0.0804	0.481	2.54	0.715
29	11.3	0.287	100.0	128.0	0.0647	0.387	2.04	0.575
30	10.0	0.254	78.50	100.0	0.0507	0.303	1.60	0.450
31	8.9	0.226	62.20	79.2	0.0401	0.240	1.27	0.357
32	8.0	0.203	50.30	64.0	0.0324	0.194	1.02	0.288
33	7.1	0.180	39.60	50.40	0.0255	0.153	0.806	0.227
34	6.3	0.160	31.20	39.7	0.0201	0.120	0.634	0.179
35	5.6	0.142	24.60	31.4	0.0159	0.0940	0.501	0.141
36	5.0	0.127	19.60	25.00	0.0127	0.0757	0.400	0.113
37	4.50	0.114	15.90	20.20	0.0103	0.0613	0.324	0.0912
38	4.0	0.102	12.60	16.0	0.00811	0.0484	0.256	0.0721
39	3.5	0.0889	9.62	12.2	0.00621	0.0371	0.196	0.0552
40	3.1	0.0787	7.55	9.61	0.00487	0.0291	0.154	0.0433
41	2.8	0.0711	6.16	7.84	0.00397	0.0237	0.125	0.0353
42	2.5	0.0635	4.91	6.25	0.00317	0.0189	0.0999	0.0282
43	2.2	0.0559	3.80	4.84	0.00245	0.0147	0.0774	0.0218
44	2.0	0.0508	3.14	4.00	0.00203	0.0121	0.0639	0.0180
45	1.8	0.0457	2.54	3.24	0.00164	0.00981	0.0519	0.0146
46	1.6	0.0406	2.01	2.56	0.00130	0.00775	0.0409	0.0115
47	1.4	0.0356	1.54	1.96	0.000993	0.00593	0.0313	0.00883
48	1.2	0.0305	1.13	1.44	0.000730	0.00436	0.0230	0.00649
49	1.1	0.0279	0.950	1.21	0.000613	0.00366	0.0193	0.00545
50	1.0	0.0254	0.785	1.00	0.000507	0.00303	0.0160	0.00450



# COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

- A**  
A/D acrylonitrile butadiene-styrene  
A/D analog to digital  
ADC analog to digital converter  
ADP automatic data processing  
AFC audio frequency control  
AFT automatic filter test  
ALGOL algorithmic language  
AM a logical operator  
AQL acceptable quality level  
ASCII American national standard code for information interchange  
ASIC application specific IC  
ATE automatic test equipment  
ATG automatic test generation  
AWG American wire gauge
- B**  
BALUN balanced to unbalanced  
BASIC beginners' all-purpose symbolic instruction  
BCD binary-coded decimal  
BNC baby "N" connector  
BUS basic utility system
- C**  
CAD computer-aided design  
CAE computer-aided engineering  
CAM computer-aided manufacture  
CAMAC computer-automated measurement and control  
CAPP computer-aided process planning  
CAT computer-aided test  
CATV cable television or community antenna television  
CCC (leaded) ceramic chip carriers  
CCD computer-controlled display  
CERMET ceramic metal element  
CIE computer-integrated engineering  
CIM computer-integrated manufacturing  
CLCC ceramic leadless chip carriers  
CMOS complementary metal-oxide semiconductor  
Comm. communications  
CPS characters per second  
CPU central processing unit
- D**  
D/A digital to analog  
DAC digital to analog converter  
DBMS data base management system  
DC direct current  
DFT design for testability  
DIAC bidirectional trigger diode  
DIL dual in-line  
DIN Deutsche Industrie Normenausschuss  
DIP dual in-line package  
DPM digital panel meter  
DRAM dynamic RAM  
DTL diode transistor logic
- E**  
EDA electronic design automation  
EDP electronic data processing  
EBCDIC extended binary coded decimal interchange code  
EEPROM electrically erasable PROM
- F**  
FEP fluorinated ethylene propylene Copolymer, 200' Teflon  
FET field-effect transistor  
FM frequency modulation  
FORTRAN formula translator
- G**  
GaAsFET gallium arsenide FET  
CMIP commn management information protocol  
GPIB general purpose interface bus  
GPS global positioning system
- H**  
HF high frequency (3 to 30 MHz)  
HIPOT test, measurement, and diagnostic equipment  
HLL high level language  
HV high voltage  
Hz Hertz
- I**  
IAB Internet Activities Board  
IC integrated circuit  
IDC insulation displacement contact  
IF intermediate frequency  
IO input/output (devices)  
IR insulation resistance (or) infrared  
ISDN integrated services digital network  
ISO International Standards Organization
- J**  
JEDEC Joint Electronic Device Engineering Council  
JFET junction FET  
JMOS junction MOS
- K**  
kHz kilohertz ( $10^3$  hertz)  
KSR keyboard send/receive
- L**  
LAN local area network  
LC (filters) inductance/capacitance  
LCC leaded chip carrier  
LCD liquid crystal display  
LED light-emitting diode  
LF low frequency (30 to 300 kHz)  
LIF low insertion force  
LNA low noise amplifier  
LNB low noise band  
LSI large scale integration  
LVDT linear velocity displacement transformer
- M**  
MASER microwave amplification by stimulated emission of radiation  
MATV master antenna television
- μF** microfarad  
MHz megahertz  
MIC microwave IC  
MIPS million instructions per second  
MIB microcomputer interface board  
MOS metal oxide semiconductor  
MOSFET metal oxide semiconductor FET  
MOSIGT metal oxide semiconductor insulated-gate transistor  
MOV metal oxide varistor  
MPU microprocessor unit  
MSI medium scale integration
- N**  
NBS National Bureau of Standards  
NEMP nuclear electromagnetic pulse  
NIM national instrumentation module  
NOR not OR  
NTC negative temperature coefficient
- O**  
OCR optical character reader  
OEM original equipment manufacturer  
OR a logical operator  
OSI open systems interconnection
- P**  
PAL programmable array logic  
PC printed circuit  
PCB printed circuit board  
PCM pulse code modulation  
PCS plastic clad silica  
pF picofarad  
PGA pin grid array  
PIN positive-intrinsic-negative (transistor)  
PLA programmable logic array  
PLCC plastic leaded chip carrier  
PLL phased lock loop  
PPI plan position indicator  
PROM programmable ROM  
PTC positive temperature coefficient  
PUT programmable unijunction transistor
- Q**  
QAM quadrature amplitude modulation  
Q (meter) quality-factor meter
- R**  
RAM random access memory  
RC resistance-capacitance  
RFI radio frequency interference  
RMS root mean square  
ROM read only memory  
RF radio frequency  
RFC radio-frequency choke  
RFI radio-frequency interference  
RTD resistance-temperature detector  
RTL resistor transistor logic  
RTV room temperature vulcanizing  
RW read/write
- S**  
SAS silicon asymmetrical switch  
SBC single board (micro) computer
- SBS** silicon bilateral switch  
SCR silicon-controlled rectifier  
SCS silicon-controlled switch  
SDA source & detector assemblies  
SGMP simple gateway monitoring protocol  
SIDAC bidirectional voltage-triggered switch  
SIMM single in-line memory module  
SIP single in-line package  
SMD surface mount device  
SMT surface mount technology  
SNMP simple network management protocol  
SO small outline  
SOIC small outline IC  
SOT small outline transistor  
SSI small scale integration  
SSR solid-state relay  
STL Schottky transistor logic  
SUS silicon unilateral switch
- T**  
TC temperature coefficient  
TCE thermal coefficient of expansion  
TXCO temperature compensated crystal oscillator  
TFE tetrafluoride ethylene propylene Copolymer, 250' Teflon  
TRIAC bidirectional AC switch  
TTL transistor-transistor logic  
TTY teletypewriter
- U**  
UHF ultra high frequency (300 MHz to 3 GHz)  
UJT silicon unijunction transistor  
UL Underwriters Laboratory  
UPS uninterruptible power supply
- V**  
VAC volts (of) alternating current  
VAN value-added network  
VAR volt-ampere reactive  
VCR video cassette recorder  
VDC volts (of) direct current  
VHF very high frequency (30 kHz to 300 MHz)  
VHSIC very high speed integrated circuit  
VLF very low frequency (3 to 30 kHz)  
VLSI very large scale integration  
VME virtual machine environment  
VRM voice recognition module  
VTVM vacuum tube volt meter  
VU volume unit  
VSWR voltage standing wave ratio
- W**  
WPS word processing software
- Y**  
YIG yttrium iron garnet
- Z**  
ZIF zero insertion force



# NOMOGRAPH VOLTAGE DROP

## NOMOGRAPH OF VOLTAGE DROP ACROSS LOAD SUPPLY LEADS (as a function of wire size and load current)

### THIS NOMOGRAPH CAN BE USED TO FIND:

**Maximum current carrying capacity recommended for any standard wire size.\***

- 1) With a straight edge, connect from the wire size on Scale 2 to the point "A" on Scale 3.
- 2) Read  $I_{max}$  on Scale 1.

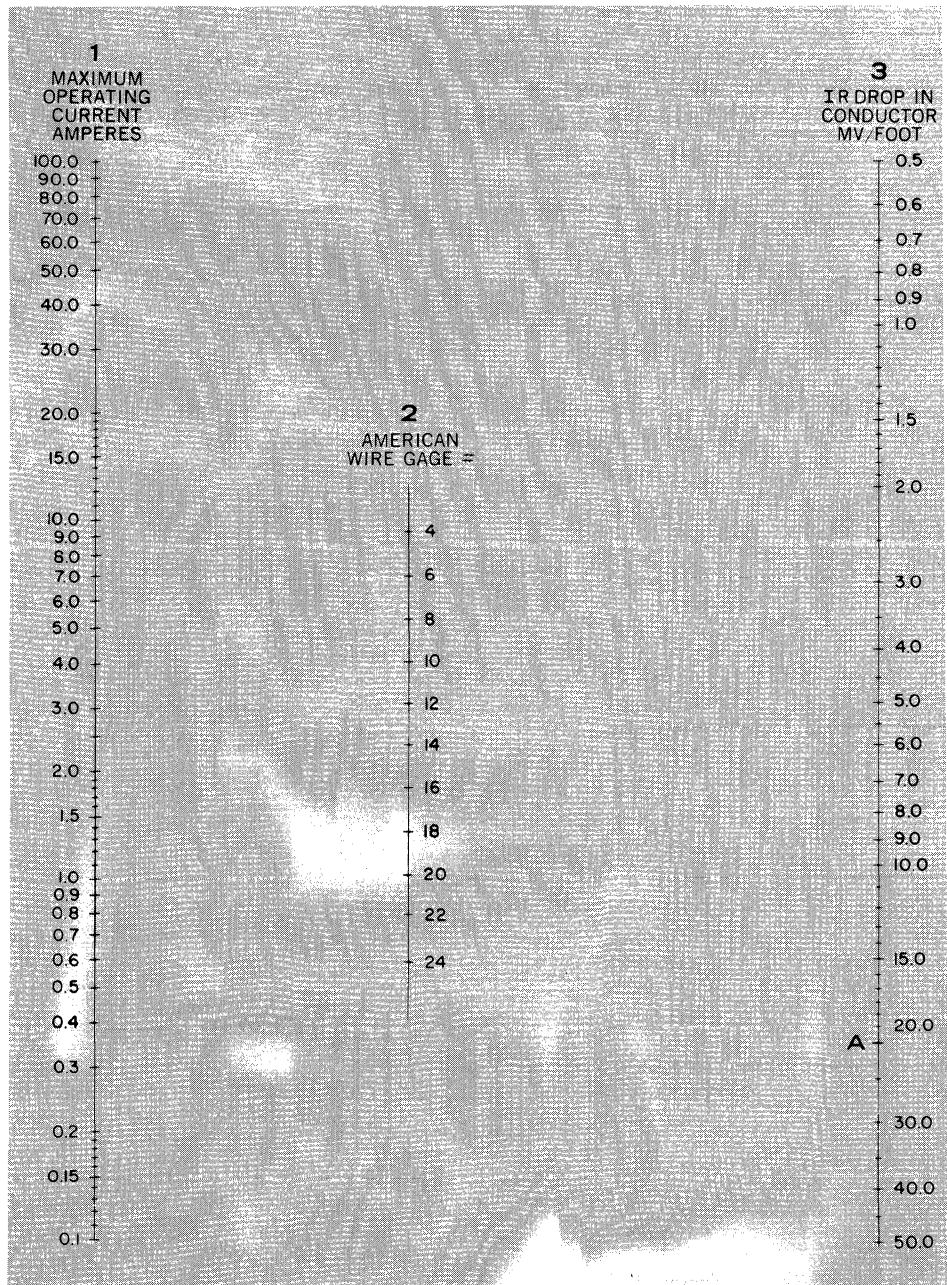
**Voltage drop in millivolts per foot for known wire size and operating current.**

- 1) With a straight edge, connect the known current on Scale 1 and the wire size on Scale 2.
- 2) Read voltage drop on Scale 3.

**Wire size required for known operating current and known maximum tolerable voltage drop across supply leads.**

- 1) Determine maximum tolerable drop in millivolts per foot of lead (sum of positive and negative leads).
- 2) Connect the value on Scale 3 (as determined in step 1) to the known current on Scale 1.
- 3) Read wire size on Scale 2.

\* Based on an arbitrary minimum 500 circular mils per ampere. High-temperature class insulation will safely allow higher currents.



**NOTE:** A voltage stabilized Power Supply controls the voltage across its output terminals. Hence, the wire conductors used to connect the load must be considered as part of the load. At high load currents, the voltage drop across the supply leads may appreciably degrade stabilization at the load. Kepco models equipped with the *remote error sensing* feature can automatically compensate for voltage drops of up to 500 mV across each load supply lead.

### RELATIVE QUANTITY SYMBOLS

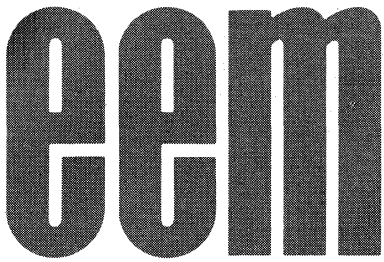
≠	not equal to
≈	approximately equal to
∝	proportional to
<	smaller than
≤	smaller than or equal to
«	much smaller than
>	larger than
≥	larger than or equal to
»	much larger than
≡	identical to or equivalent
↑	increases
↓	decreases

### PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10 <sup>12</sup>	tera	T
10 <sup>9</sup>	giga	G
10 <sup>6</sup>	mega	M
10 <sup>3</sup>	kilo	k
10 <sup>-3</sup>	milli	m
10 <sup>-6</sup>	micro	μ
10 <sup>-9</sup>	nano	n
10 <sup>-12</sup>	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	<i>a</i>	m s <sup>-2</sup>	—	velocity/time
acceleration due to gravity	<i>g</i>	m s <sup>-2</sup>	—	velocity/time
amount of substance	<i>n</i>	mole	mol	mole fraction (n) used
amplification factor	<i>μ</i>	<i>a ratio</i>	—	—
angle	<i>θ</i> <sub>1</sub> , <i>φ</i> <sub>1</sub> , <i>α</i> <sub>1</sub>	—	—	—
angle of incidence	<i>i</i>	degree or radian	°	—
angle of refraction	<i>r</i>	degree or radian	°	—
angle, Bragg	<i>θ</i>	number	—	—
angle, critical	<i>c</i>	degree or radian	°	—
anode slope resistance	<i>R<sub>A</sub></i>	ohm	Ω	$\Delta V_a / \Delta I_a$
area	<i>A</i>	metres squared	m <sup>2</sup>	<i>l</i> × <i>b</i>
atomic number	<i>Z</i>	a number	—	number of protons
Avogadro constant	<i>L</i> , <i>N<sub>A</sub></i>	number	—	—
breadth	<i>b</i>	metre	m	fundamental unit
capacitance	<i>C</i>	farad	F	charge/p.d.
charge, electric	<i>Q</i>	coulomb	C	current × time
charge on electron	<i>e</i>	coulomb	C	1.6 × 10 <sup>-19</sup> C
conductance	<i>G</i>	ohm <sup>-1</sup>	Ω <sup>-1</sup>	reciprocal of resistance
current, electric	<i>I</i>	ampere	A	fundamental unit
decay constant	<i>λ</i>	<i>a ratio</i>	—	—
density	<i>ρ</i>	kg m <sup>-3</sup>	—	<i>m/V</i>
distance along path	<i>s</i>	metre	m	fundamental unit
efficiency	<i>η</i>	<i>a ratio</i>	—	work output/work input
electrochemical equiv.	<i>z</i>	g C <sup>-1</sup>	—	mass/charge
electromotive force	<i>E</i>	volt	V	energy/charge
electron	<i>e</i>	—	—	—
energy	<i>E</i>	joule	J	N m
energy, kinetic	<i>E<sub>k</sub></i>	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	<i>E<sub>p</sub></i>	joule	J	N m. $E_p = mgh$
Faraday constant	<i>F</i>	coulomb mol <sup>-1</sup>	C mol <sup>-1</sup>	96,500 C mol <sup>-1</sup>
field strength, electric	<i>E</i>	V m <sup>-1</sup>	—	potential gradient: p.d./dist.
field-strength magnetic	<i>H</i>	ampere-turns	—	current × no. of turns
flux, magnetic	<i>Φ</i>	weber	Wb	e.m.f./rate of change of flux
flux density	<i>B</i>	tesla	T	flux/area
focal length	<i>f</i>	metre	m	—
force	<i>F</i>	newton	N	kg m s <sup>-2</sup>
free energy	<i>ΔG</i>	joule	J	—
frequency	<i>f</i>	hertz	Hz	oscillations/time
gas constant	<i>r</i>	joule	J	energy
half-life, radioactivity	<i>t</i> <sub>1/2</sub>	second	s	fundamental unit
heat capacity	<i>C</i>	J K <sup>-1</sup>	—	quantity of heat/temp. rise
heat of reaction	<i>ΔH</i>	joule	J	heat energy
heat capacity, specific	<i>c</i>	J K <sup>-1</sup> kg <sup>-1</sup>	—	heat capacity/mass
heat, quantity of	<i>q</i>	joule	J	energy

Quantity	Symbol	SI Unit	Symbol	Derivation
height	$h$	metre	m	fundamental unit
image distance	$v$	metre	m	fundamental unit
inductance, mutual	$M$	henry	H	induced e.m.f./rate of change of current
inductance, self	$L$	henry	H	—
intensity of radiation	$I$	<i>a number</i>	—	—
latent heat	$L$	joule	J	quantity of heat
latent heat, specific	$l$	$\text{J kg}^{-1}$	—	quantity of heat
latent heat, molar	$L_m$	$\text{joule mol}^{-1}$	J	quantity of heat
length	$l$	metre	m	fundamental unit
magnetizing force	$H$	ampere-turns	—	—
magnetic moment	$m$	$\text{Wb m}$	—	torque in unit magnetic field
magnification, linear	$m$	<i>a ratio</i>	—	—
mass	$m$	kilogramme	kg	fundamental unit
mass number	$A$	<i>a number</i>	—	number of neutrons + protons
molar volume	$V_m$	$(\text{dm}^3)$	—	volume of 1 mole
molar solution	$M$	<i>a ratio</i>	—	$\text{moles/dm}^3$
moment of force	—	$\text{N m}$	—	force $\times$ perp. distance
neutron number	$N$	<i>a number</i>	—	number of neutrons
number	$n$	—	—	—
number of molecules	$N$	—	—	—
number turns on coil	$n$	<i>a number</i>	—	—
number order spectrum	$p$	<i>a number</i>	—	—
object distance	$u$	metre	m	fundamental unit
peak current	$I_0$	ampere	A	see current
peak e.m.f.	$E_0$	volt	V	see e.m.f.
period	$T$	second	s	fundamental unit
permeability	$\mu$	$\text{H m}^{-1}$	—	henry/metre
permeability, vacuum	$\mu_0$	$\text{H m}^{-1}$	—	—
permeability, relative	$\mu_r$	<i>a ratio</i>	—	$\mu = \frac{\mu}{\mu_0}$
permittivity	$\epsilon$	$\text{F m}^{-1}$	—	farad/metre
permittivity, vacuum	$\epsilon_0$	$\text{F m}^{-1}$	—	farad/metre
permittivity, relative	$\epsilon_r$	<i>a ratio</i>	—	$\epsilon_r = \frac{\epsilon}{\epsilon_0}$
potential, electric	$V$	volt	V	energy/charge
potential difference	$V$	volt	V	energy/charge
power	$P$	watt	W	$\text{J s}^{-1}$
pressure	$p$	pascal	Pa	$\text{N m}^{-2}$ : force/area
radius	$r$	metre	m	fundamental unit
reactance	$X$	ohm	$\Omega$	$E_0/I_0$
refractive index	$n$	<i>a ratio</i>	—	—
resistance	$R$	ohm	$\Omega$	p.d./current
resistivity, electrical	$\rho$	ohm-metre	—	resistance $\times$ length
relative density	$d$	<i>a ratio</i>	—	$\rho_{\text{sub}}/\rho_{\text{water}}$
r.m.s. current	$I_{\text{r.m.s}}$	ampere	A	see current
r.m.s. voltage	$V_{\text{r.m.s}}$	volt	V	see e.m.f.
slit separation	$s$	metre	m	fundamental unit
tension	$T$	newton	N	see force
temperature, Celsius	$\theta$	degree C	$^{\circ}\text{C}$	from kelvin
temp. interval	$\theta$	degree	$^{\circ}$ or K	—
temp. absolute	$T$	kelvin	K	fundamental unit
thickness	$d$	metre	m	fundamental unit
time	$t$	second	s	fundamental unit
torque	$T$	$\text{Nm}$	—	see moment
turns ratio	$T$	<i>a ratio</i>	—	$n_{\text{sec}}/n_{\text{prim}}$
(unit of electricity)	—	$\text{kW h}$	—	kilowatt $\times$ hour
velocity	$u, v$	$\text{ms}^{-1}$	—	distance/time
velocity, angular	$\omega$	$\text{second}^{-1}$	$\text{s}^{-1}$	angle/time
velocity, e.m.waves	$c$	$\text{m s}^{-1}$	—	—
velocity of sound	$v$	$\text{m s}^{-1}$	—	—
volume	$V$	metre cubed	$\text{m}^3$	$l \times b \times h$
wavelength	$\lambda$	metre	m	fundamental unit
work	$w$	joule	J	force $\times$ distance (Nm)
weight	$W$	newton	N	$\text{kg m s}^{-2}$ or $mg$



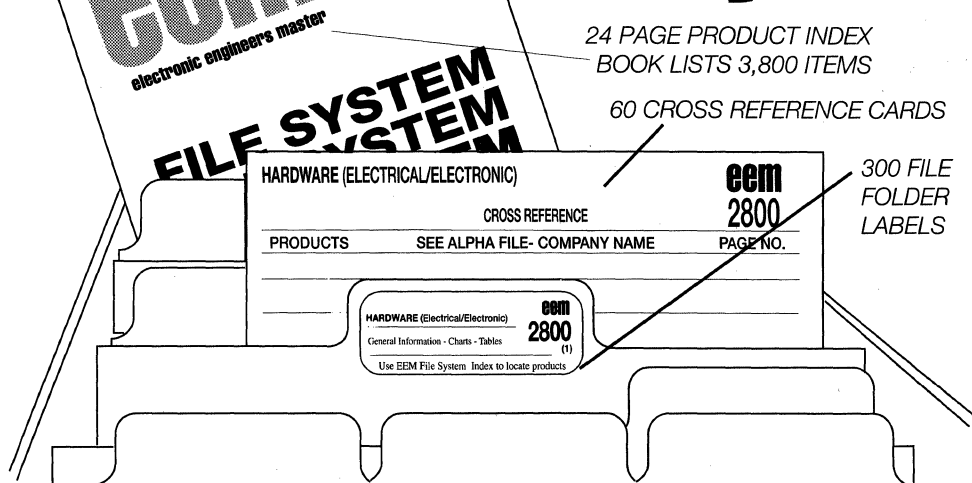
# THERMAL CONDUCTIVITY OF DIELECTRICS AT ROOM TEMPERATURE

Material	Thermal Conductivity, J/ (m.K)
Diamond	658
BeO	167
Graphite	117-200
Bonded SiC	42
MgO	42
Al <sub>2</sub> O <sub>3</sub>	33
TiC	33
BN	28
Mullite	6.3
Titania	3.3-4.2
Porcelain	1.7
Fused silica glass	1.5
Soda-lime glass	0.8
Cast epoxies	0.17-1.3
Wood	0.5-2.5
Melamines	0.3-0.7
Mica	0.3-0.7
Phenolics (molded)	0.17-0.67
Polyethylenes	0.33
Nylons	0.17-0.25
TFE fluorocarbons	0.25
Elastomers	0.08-0.17
Foams	0.003-0.04

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

	<b>Argentina (IRAM)</b> Instituto Argentino de Racionalization de Materiales		<b>Hong Kong</b> Hong Kong Standards & Testing Centre		<b>Poland</b> Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)
	<b>Australia (SAA)</b> Standards Association of Australia		<b>Hungary (MSZH)</b> Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)		<b>Portugal (CEP)</b> Comissão Electrotécnica Portuguesa
	<b>Austria (ÖVE)</b> Österreichischer Verband für Elektrotechnik		<b>India (ISI)</b> Indian Standards Institute "Manak Bhavan"		<b>Romania</b> Institutul Roman de Standardizare (Romanian Standards Institute)
	<b>Belgium (CEB)</b> Comité Electrotechnique Belge		<b>Indonesia</b> Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)		<b>Singapore</b> Singapore Institute of Standards and Industrial Research
	<b>Brazil (ABNT)</b> Associação Brasileira de Normas Tecnicas		<b>Iran</b> Institute of Standards and Industrial Research of Iran		<b>South Africa (SABS)</b> South African Bureau of Standards
	<b>Canada (CSA)</b> Canadian Standards Association		<b>Ireland (IIRS)</b> Institute for Industrial Research and Standards		<b>Spain (IRANOR)</b> Instituto Nacional de Racionalización y Normalización
	<b>Czechoslovakia</b> Urad pro Normalizaci a Mereni (Office for Standards and Measurements)		<b>Israel (SII)</b> Standards Institution of Israel		<b>Sweden (SEK)</b> Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)
	<b>Denmark (DEK)</b> Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)		<b>Italy (CEI)</b> Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)		<b>Switzerland (SEV)</b> Schweizerischer Elektrotechnischer Verein Postfach
	<b>Egypt (EOS)</b> Egyptian Organization for Standardization and Quality Control		<b>Japan (JISC)</b> Japanese Industrial Standards Committee Agency of Industrial Science and Technology		<b>Turkey (TSE)</b> Turk Standardlari Enstitusu (Turkish Standards Institution)
	<b>Finland (SETI)</b> Electrical Inspectorate		<b>Korea, Republic of (South)</b> Industrial Advance Administration		<b>United Kingdom (BSI)</b> British Standards Institution
	<b>France (UTE)</b> Union Technique de l'Électricité		<b>Mexico (DGN)</b> Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco		<b>United States (NEMA)</b> National Electrical Manufacturers Association
	<b>Germany, Democratic Republic of (East) (ASMW)</b> Amt für Standardisierung Messwesen und Warenprüfung (Office for Standardization, Metrology and Quality Control)		<b>Netherlands (NEC)</b> Nederlands Elektrotechnisch Comité		<b>United States (ANSI)</b> American National Standards Institute
	<b>Germany, Federal Republic of (West) (DKE)</b> Deutsche Elektrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)		<b>New Zealand (SANZ)</b> Standards Association of New Zealand		<b>Venezuela</b> CODELECTRA en Conjunto con COVENIN Avda. Ppal.
	<b>Greece (ELOT)</b> The Hellenic Organization of Standardization		<b>Norway (NEK)</b> Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)		<b>Yugoslavia</b> Federal Institute of Standardization
			<b>Pakistan</b> Pakistan Standards Institution		

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