

IDENTIFICATION

DISPTST

PRODUCT CODE: MAINDEC 12-D6BC-D
PRODUCT NAME: VR14, VR20 DISPLAY TEST
DATE CREATED: AUGUST 1, 1971
MAINTAINER: DIAGNOSTICS GROUP
AUTHOR: RAYMOND JOOP

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1. ABSTRACT

THIS PROGRAM TESTS THE PDP-12 DISPLAY SYSTEM BY GENERATING FOUR (FIVE IF A VR20) DISTINCT PATTERNS ON THE SCOPE, TWO (THREE IF A VR20) WITH THE DIS INSTRUCTION AND TWO WITH THE DSC INSTRUCTION.

2. REQUIREMENTS

2.1 EQUIPMENT

A. PDP-12A OR PDP-12B

2.2 STORAGE

MOST OF LOCATIONS 4000(8) TO 6000(8)

3. LOADING PROCEDURES

3.1 METHOD

LOAD THIS PROGRAM INTO MEMORY BY THE STANDARD LOADING PROCEDURE FOR A BINARY PROGRAM.

4. OPERATOR ACTION

SET THE CHANNEL SELECTOR SWITCH ON THE DISPLAY TO THE 1 & 2 POSITION (IF A VR20, SET THE COLOR SWITCH TO THE REMOTE POSITION AND SET SNS 5). PLACE IN LINC-MODE, DEPRESS START 20. UPON STARTING, THE PROGRAM WILL ALTERNATELY DISPLAY THE FOUR (FIVE IF A VR20) PATTERNS, EACH FOR APPROXIMATELY TEN SECONDS.

A. FREEZE ON CURRENT PATTERN,

SETTING OF SENSE SWITCHES 0-4 WILL CAUSE THE PROGRAM TO LOCK ON THAT PATTERN,

B. ALTERNATE BETWEEN FOUR (FIVE IF A VR20) PATTERNS,
RESETTING OF SENSE SWITCHES 0-4 WILL DIRECT THE PROGRAM TO
ALTERNATE THE DISPLAY BETWEEN THE FOUR(FIVE IF A VR20) PATTERNS. IT
SHOULD BE NOTED THAT REQUESTING A FREEZE ON A PATTERN (IE, 4)
SETTING OF SNS 0=3 WILL CAUSE IT TO EXECUTE THE LEFT MOST SNS
THAT IS SET.

C. RETURN TO DIAL.

TYPE "CTRL D" OF THE CONSOLE TELETYPE TO RETURN TO DIAL.

D. ADJUSTMENT OF THE COLOR DELAYS (SHORT=LONG)

TO SCOPE THE DELAYS START LINC=MODE 400.

5. PROGRAM DESCRIPTION

A. PATTERN 0

THIS PERMITS CALIBRATION OF THE SCOPE.

B. PATTERN 1

THE PATTERN GENERATED BY THE DSC INSTRUCTION TAKES THE
FOLLOWING FORM:

(QUADRANT 2)	CHAN 1	CHAN 2
	HALF SIZE	FULL SIZE (QUADRANT 1)

(QUADRANT 3)	CHAN 1	CHAN 2
	FULL SIZE	HALF SIZE (QUADRANT 4)

THE PATTERN DOES WHAT THE DISPLAY SAYS; ONE HALF OF ONE
CHARACTER IS DISPLAYED IN ONE CORNER OF THE SCOPE THEN
HALF OF ONE CHARACTER IS DISPLAYED IN THE OPPOSITE
CORNER OF THE SCOPE, THE LEFT HALF OF THE CHARACTER IN
QUADRANTS 2 AND 4 ARE DISPLAYED FIRST, THEN THE LEFT
HALF OF THE CHARACTER IN QUADRANTS 1 AND 3 ARE DISPLAYED.
WHEN THE LEFT HALF OF ALL CHARACTERS ON THE SCOPE HAVE BEEN
DISPLAYED THE SEQUENCE IS REPEATED FOR THE RIGHT HALF OF
THE CHARACTERS.

C. PATTERN 2

DISPLAY AN X PATTERN:

THIS PATTERN IS 2 DIAGONAL LINES FROM TOP LEFT CORNER TO BOTTOM RIGHT CORNER, AND FROM BOTTOM LEFT CORNER TO TOP, RIGHT CORNER. THIS PATTERN IS USED TO ADJUST DEFLECTION AMPLIFIERS OF THE VR14.

D. PATTERN 3

TWO COLOR OVERLAY DISPLAY TEST (VR20)

THIS PATTERN IS USED TO ADJUST THE GAIN CONTROLS OF THE RED AND GREEN AMPLIFIERS. THE PATTERN IS A BOX ON THE OUTER EDGE OF THE SCREEN, AN "X" IN THE CENTER AND THE WORDS "RED" AND "GREEN". THE DOTS SHOULD CONVERGE THE RESULT BEING AN ORANGE COLOR DISPLAY. THE WORDS "RED" AND "GREEN" WILL REMAIN UNCHANGED. IF A HALT OCCURS DURING THIS TEST, RUN THE COLOR DELAY ADJUSTMENT ROUTINE.

F. PATTERN 4

POWER SUPPLY REGULATION TEST

THIS PATTERN IS USED TO TEST THE POWER SUPPLY REGULATION OF THE VR20. THE WORD MAINDEC IS DISPLAYED IN THE CORNERS, AND THE MAINDEC NUMBER IS DISPLAYED IN THE CENTER. THE CHARACTERS SHOULD NOT MOVE MORE THAN 1/8 OF AN INCH.

/VR14, VR20 DISPLAY CONTROL AND SCOPE TEST

0456 /COPYRIGHT 1971 DIGITAL EQUIPMENT CORP., MAYNARD, MASS.
SKP=0456

/POINT DISPLAY PATTERN [DISPAT
/CHARACTER DISPLAY PATTERN [DSCPAT
/DISPLAY X PATTERN [DISP
/DISPLAY COLOR [DISCL
/DISPLAY POWER SUPPLY REGULATION [PSREG

	4000	SEGMENT 2		
	4010	*0010		
4010	0000	Q4BETA, 0		
4011	0000	Q3BETA, 0		
4012	0000	Q2BETA, 0		
4013	0000	Q1BETA, 0		
	4020	*20		
4020	0011	CLR		
4021	5430	STC	SWITCH	
4022	0077	SET I	17	
4023	7477	-J00		
4024	6026	JMP	INCB	/TEST INCREMENT THE M.B.
4025	6100	JMP	DISPAT	/OUTPUT THE PATTERNS

4026	1000	INCMB,	LDA		/GET THE RETURN
4027	0000		0000		/ ADDRESS
4030	4066		STC	EXMB	/SAVE IN EXIT
4031	4000		STC	0	/CLEAR LOG, 0
4032	0160		DIS I		/DISPLAY A POINT
4033	1000		LDA		/GET THE VALUE IN
4034	0000		0000		/ LOC, 0000
4035	1460		SAE I		/IS IT EQUAL TO
4036	0001		0001		/ THE EXPECTED
4037	0000		HLT		/NO, INCREMENT THE
					/MB FAILED AFTER
					/A DIS INSTRUCTION
4040	0011		CLR		/CLEAR A,C,
4041	0004		ESF		/CLEAR S,F,R,
4042	4001		STC	1	/CLEAR LOC, 0001
4043	1760		DSC I		/DISPLAY A CHARACTER
4044	4477		4477		
4045	1000		LDA		/LOAD THE A,C. WITH
4046	0001		0001		/ THE VALUE IN LOC, 0001
4047	1460		SAE I		/IS IT EQUAL TO
4050	0004		0004		/ THE EXPECTED VALUE?
4051	0000		HLT		/INCREMENT THE M.B.
					/FAILED AFTER A
					/DSC INSTRUCTION (HALF-SIZE)
4052	1020		LDA I		/LOAD THE A,C.
4053	0200		0200		/ WITH 0200
4054	0004		ESF		/LOAD S,F,R,
4055	0011		CLR		/CLEAR A,C, AND
4056	4001		STC	1	/ LOC, 0001
4057	1760		DSC I		/DISPLAY A CHARACTER
4060	7744		7744		
4061	1000		LDA		/LOAD THE A,C. WITH
4062	0001		0001		/ VALUE IN LOC 1
4063	1460		SAE I		/IS IT EQUAL TO
4064	0010		0010		/ THE EXPECTED?
4065	0000		HLT		/NO, INCREMENT THE
					/MB FAILED AFTER
					/A DSC INSTRUCTION (FULL-SIZE)
4066	6066	EXMB,	JMP		

4100 *100

/THE SUBROUTINE BELOW WILL GENERATE 5
 /LINES ACROSS THE SCREEN, THE POINT
 /SPACING IS 4 UNITS
 /THE FIRST LEFT HAND POINT IS
 /0000, THE LAST RIGHT HAND POINT IN
 /EACH LINE IS 0774.

/A GLITCH IS PLACED AT THE HORIZONTAL
 /POINTS OF 100,300,500 AND 700 ON
 /EACH LINE

```

4100 0077  DISPAT, SET I 17          /LOAD THE CLOCK
4101 7500                7500
4102 6667  TST1A, JMP  CLOCK
4103 6105                JMP  TST1B
4104 6447                JMP  DSCPT
4105 1020  TST1B, LDA I
4106 0010                10
4107 0004                ESF
4110 4136                STC  REL
4111 0062                SET I 2
4112 0000                0

4113 6137  TST1LP, JMP  LP1
4114 1000                LDA
4115 0002                2
4116 1660                BCO I
4117 0100                100
4120 1560                BCL I
4121 7600                7600
4122 0470                AZE I
4123 6210                JMP  T1GL
4124 1000                LDA
4125 0002                2
4126 1120                ADA I
4127 0004                4
4130 1040                STA
4131 0002                2
4132 1460                SAE I
4133 1000                1000
4134 6113                JMP  TST1LP
4135 6234                JMP  TST2

4136 0000  REL, 0000          /VARIABLE

```

/THIS IS THE ROUTINE THAT DISPLAYS
/FIVE POINTS, ONE ON EACH OF THE
/HORIZONTAL LINES

```
4137 1000 LP1, LDA
4140 0000      0
4141 1060      STA I
4142 0000      0
4143 1020      LDA I
4144 0370      370
4145 2136      ADD      REL
4146 0142      DIS      2
4147 1000      LDA
4150 0002      2
4151 0017      COM
4152 4002      STC      2
4153 1020      LDA I
4154 0367      367
4155 2136      ADD      REL
4156 0142      DIS      2
4157 1000      LDA
4160 0002      2
4161 0017      COM
4162 4002      STC      2
4163 1020      LDA I
4164 0570      570
4165 2136      ADD      REL
4166 0142      DIS      2
4167 1000      LDA
4170 0002      2
4171 0017      COM
4172 4002      STC      2
4173 1020      LDA I
4174 0167      167
4175 2136      ADD      REL
4176 0142      DIS      2
4177 1000      LDA
4200 0002      2
4201 0017      COM
4202 4002      STC      2
4203 1020      LDA I
4204 0767      767
4205 2136      ADD      REL
4206 0142      DIS      2
4207 6142      JMP      LP1+3
```



```

4210 1000 T1GL, LDA /GLITCH GENERATOR
4211 0000 0
4212 1060 STA I
4213 0000 0
4214 1020 LDA I
4215 0020 20
4216 4136 STC REL
4217 6137 JMP LP1
4220 0011 CLR
4221 1020 LDA I
4222 7774 7774
4223 1200 LAM
4224 0136 REL
4225 1460 SAE I
4226 7774 7774
4227 6217 JMP T1GL+7
4230 1020 LDA I
4231 0010 10
4232 4136 STC REL
4233 6213 JMP T1GL+3

```

/THIS ROUTINE GENERATES 5 VERTICAL LINES
 /AT HORIZONTAL LOCATIONS 0,177,377,577,777,
 /GLITCHES ARE DISPLAYED AT VERTICAL LOCATIONS
 /177,377,500,700 ON THE LINES.

```

4234 0011 TST2, CLR
4235 4136 STC REL

4236 6271 JMP LP2A /SET UP INDEX REG,
4237 6310 TST2LP, JMP LP2B /GO DISPLAY SOME POINTS
4240 1000 LDA
4241 0136 REL
4242 1660 BCO I
4243 0100 100
4244 1560 BCL I
4245 7600 7600
4246 0470 AZE I
4247 6334 JMP GL2
4250 1020 LDA I
4251 0004 4
4252 1140 ADM
4253 0136 REL
4254 1460 SAE I
4255 1000 1000 /DONE ALL POINTS YET
4256 6237 JMP TST2LP

```

/DISPLAY UPPER LEFT AND LOWER RIGHT DOTS

```

4257 0011 CLR
4260 4010 STC Q4BETA
4261 3426 ADD K377
4262 0150 DIS Q4BETA
4263 0070 SET I Q4BETA
4264 0777 777
4265 1020 LDA I
4266 0400 400
4267 0150 DIS Q4BETA
4270 6102 JMP TST1A

```

```

4271 1000 LP2A, LDA /SET UP INDEX REGISTERS
4272 0000 0
4273 1060 STA I
4274 0000 0000
4275 0062 SET I 2
4276 0000 0
4277 0063 SET I 3
4300 0177 177
4301 0064 SET I 4
4302 0377 377
4303 0065 SET I 5
4304 0577 577
4305 0066 SET I 6
4306 0777 777
4307 6274 JMP LP2A+3

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/ACTUALLY DISPLAY THE 5 POINTS
4310 1000 LP2B, LDA
4311 0000 0
4312 1060 STA I
4313 0000 0
4314 1000 LDA
4315 0136 REL
4316 0142 DIS 2
4317 0017 COM
4320 0146 DIS 6
4321 1000 LDA
4322 0136 REL
4323 1120 ADA I
4324 0200 200
4325 0143 DIS 3
4326 0017 COM
4327 0145 DIS 5
4330 1000 LDA
4331 0136 REL
4332 0144 DIS 4
4333 6313 JMP LP2B+3

```

```

/DISPLAY THE GLITCHES ON THE VERTICAL LINES
4334 1000          GL2,  LDA
4335 0000          0
4336 1060          STA I
4337 0000          0
4340 0075          SET I  15
4341 7772          =5
4342 1020          LDA I
4343 0767          767
4344 4352          STC   GL2V
4345 0067          SET I  7
4346 7772          =5
4347 0070          SET I  10
4350 0001          1
4351 1020          LDA I
4352 0767          GL2V, 767
4353 1170          ADM I  10
4354 0227          XSK I  7
4355 6351          JMP   ,=4
4356 6310          JMP   LP2B
4357 1020          LDA I
4360 0004          4
4361 4352          STC   GL2V
4362 0235          XSK I  15
4363 6345          JMP   GL2V=5
4364 6271          JMP   LP2A
4365 6337          JMP   GL2+3
/RESET HORIZONTAL POSITION
/GO BACK
```

```
      4400      *400
4400 1020 DORED, LDA I
4401 0014      14
4402 0004      ESF
4403 0011      CLR
4404 4015      STC      15
4405 0447      SKPRD
4406 0000      HLT
4407 0467      SKPGR
4410 0456      SKP
4411 0000      HLT
4412 0446      SKPVND
4413 0000      HLT
4414 0466      SKPVRD
4415 0456      SKP
4416 6423      JMP      ,+5
4417 0235      XSK I  15
4420 6414      JMP      ,=4
4421 0000      HLT
4422 6400      JMP      DORED

/CHANGE TO RED
/SKIP ON RED
/SKIP ON RED FAILED
/SKIP ON GREEN
/SHOULD NOT SKIP
/SKIPPED IN ERROR
/SKIP ON COLOR NOT DONE
/SKIP ON COLOR NOT DONE FAILED
/SKIP ON COLOR DONE
/NOT YET
/YES
/DELAY
/
/SKIP ON COLOR DONE FAILED
/TRY AGAIN
```

4423	1020	DOGRN,	LDA I	
4424	0010		10	
4425	0004		ESF	/CHANGE TO GREEN
4426	0011		CLR	
4427	4015		STC	15
4430	0467		SKPGR	/SKIP ON GREEN
4431	0000		HLT	/SKIP ON GREEN FAILED
4432	0447		SKPRD	/SKIP ON RED
4433	0456		SKP	/SHOULD NOT SKIP
4434	0000		HLT	/SKIPPED IN ERROR
4435	0446		SKPVND	/SKIP ON COLOR NOT DONE
4436	0000		HLT	/SHOULD SKIP
4437	0466		SKPVRD	/SKIP ON DONE
4440	0456		SKP	/NOT DONE YET
4441	6446		JMP	,05 /YES
4442	0235		XSK I	15 /DELAY
4443	6437		JMP	,-4 /TRY AGAIN
4444	0000		HLT	/SKIP ON COLOR DONE FAILED
4445	6423		JMP	DOGRN /TRY AGAIN
4446	6400		JMP	DORED

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4447 0077 DSCPT, SET I 17
4450 0000 0
4451 6667 DSCPTA, JMP CLOCK
4452 6454 JMP DSCPAT
4453 7155 JMP DISPX

4454 0075 DSCPAT, SET I 15 /PUT GRID PATTERN ADDR FOR
4455 0740 Q1GRID=1 /EACH QUAD IN 4 REFS
4456 1035 LDA I 15
4457 4013 STC Q1BETA
4460 1035 LDA I 15
4461 4012 STC Q2BETA
4462 1035 LDA I 15
4463 4011 STC Q3BETA
4464 1035 LDA I 15
4465 4010 STC Q4BETA
/HAFFLG=0 WHEN DISPLAYING LEFT HALF OF PATTERN
/=4 WHEN DISPLAYING RIGHT HALF
4466 4733 STC HAFFLG
4467 0067 SET I 7 /INITIALIZE ARGUMENTS
4470 0734 RHCHNG=1
4471 0074 SET I 14 /THERE ARE
4472 7773 -4 /4 QUADRANTS
/IN RIGHT HALF PASS NOP BELOW WILL BE REPLACED BY ADA I 7
/LEFT AND RIGHT HALF SEQUENCES ARE STAGGERED BY A CONSTANT
/20 FOR FULL SIZE CHARACTERS, 10 FOR HALF SIZE
4473 1035 LDA I 15 /PTR FOR HORIZ COORD
4474 0016 RH1, NOP
4475 1075 STA I 15 /HORIZ ARGUMENT
4476 1035 LDA I 15 /PTR FOR VERT COORD
4477 1075 STA I 15 /VERT ARGUMENT
4500 0234 XSK I 14 /DONE ALL QUADRANTS
4501 6473 JMP RH1-1 /NO
4502 4734 STC LNFLG /#0 WHEN DOING LN 2 IN
/E, 0 WHEN DOING LN 1
4503 0075 SET I 15 /THERE ARE 6 CHAR ON LN 1
4504 7771 -6
4505 0004 ESF /ENABLE HALF SIZE CHARS
4506 2752 LOOP1, ADD Q2HOR /SELECT CHAN 0 AND
4507 4001 STC 1 /SET HORIZ COORD
4510 2754 ADD Q2VER /VERT COORD TO AC
4511 1772 DSC I Q2BETA /DSC IN QUAD 2
4512 1020 LDA I /BUMP HORIZ COORD TO

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4513 0010 BHQ2, 10
4514 2001 ADD 1
4515 4752 STC Q2HOR
4516 2762 ADD Q4HOR /SET HORIZ COORD
4517 1620 BSE I
4520 4000 4000
4521 4001 STC 1
4522 2764 ADD Q4VER
4523 1770 DSC I Q4BETA /DSC IN QUAD 4
4524 1020 LDA I /BUMP HORIZ COORD
4525 0010 BHQ4, 10
4526 2001 ADD 1
4527 4762 STC Q4HOR
4530 0235 XSK I 15 /DONE A LN?
4531 6506 JMP LOOP1 /NO
4532 2734 ADD LNFLG
4533 0470 AZE I /DONE 2 LNS?
4534 6560 JMP FULSIZ /YES GO TO FULL SIZE CHARS
4535 0075 SET I 15 /THERE ARE 11
4536 7766 =11 /CHARS IN LN 2
4537 0011 CLR /SET LNFLG
4540 4734 STC LNFLG /TO EXIT ON NEXT CRK
4541 2751 ADD KQ2HOR /RESET HORIZ
4542 2733 ADD HAFFLG /AND VERT
4543 4752 STC Q2HOR /COORD
4544 2753 ADD KQ2VER /FOR LN 2
4545 1120 ADA I
4546 7737 BVQ2, =40
4547 4754 STC Q2VER
4550 2761 ADD KQ4HOR
4551 2733 ADD HAFFLG
4552 4762 STC Q4HOR
4553 2763 ADD KQ4VER
4554 1120 ADA I
4555 7737 BVQ4, =40
4556 4764 STC Q4VER
4557 6506 JMP LOOP1 /DOO LN 2
4560 0075 FULSIZ, SET I 15 /SET CTR
4561 7771 -6 /FOR LN 1

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/DELAY, SIZE CHANGE NEXT
4562 0076      SET I   16
4563 7737      -40
4564 0236      XSK I   16
4565 6564      JMP     -1

4566 1020      LDA I           /ENABLE
4567 0210      210           /FULL SIZE
4570 0004      ESF           /CHAR
4571 4734      STC     LNFLG  /SET FLAG FOR LN 1
4572 2746      LOOP2, ADD     Q1HOR /HORIZ COORD
4573 1620      BSE I
4574 4000      4000
4575 4001      STC 1
4576 2750      ADD     Q1VER
4577 1773      DSC I   Q1BETA  /QUAD 1
4600 1020      LDA I
4601 0020      BHQ1, 20       /BUMP HORIZ
4602 2001      ADD 1
4603 4746      STC     Q1HOR
4604 2756      ADD     Q3HOR  /HORIZ COORD
4605 4001      STC     1      /CHAN 0
4606 2760      ADD     Q3VER
4607 1771      DSC I   Q3BETA  /QUAD 3
4610 1020      LDA I
4611 0020      BHQ3, 20
4612 2001      ADD     1
4613 4756      STC     Q3HOR
4614 0235      XSK I   15     /DONE A LN?
4615 6572      JMP     LOOP2  /NO
4616 2734      ADD     LNFLG
4617 0470      AZE I           /DONE 2 LNS?
4620 6646      JMP     HAFCHK  /YES CHK FOR 2ND HALF OF PATTERN
4621 0075      SET I   15     /NO SET FOR LN 2
4622 7766      -11
4623 0011      CLR
4624 4734      STC     LNFLG  /SET LNFLG FOR
4625 2745      ADD     KQ1HOR  /EXIT TO HAFCHK
4626 2733      ADD     HAFFLG  /RESET COORDINATES
4627 2733      ADD     HAFFLG
4630 4746      STC     Q1HOR
4631 2747      ADD     KQ1VER
4632 1120      ADA I
4633 7737      BVQ1, -40

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4634	4750	STC	Q1VER	
4635	2755	ADD	KQ3HOR	
4636	2733	ADD	HAFFLG	
4637	2733	ADD	HAFFLG	
4640	4756	STC	Q3HOR	
4641	2757	ADD	KQ3VER	
4642	1120	ADA I		
4643	7737	BVQ3, =40		
4644	4760	STC	Q3VER	
4645	6572	JMP	LOOP2	
4646	1000	HAFCHK, LDA		/DO LN 2
4647	0733	HAFFLG		/DONE BOTH
4650	0450	AZE		/LEFT AND RIGHT
4651	6663	JMP	DSCEND	/SEQUENCES?
4652	1020	LDA I		/YES EXIT
4653	0004	4		/NO SET FOR
4654	4733	STC	HAFFLG	/DSC RIGHT SEQ.
4655	1020	LDA I		/SET HAFFLG FOR EXIT
4656	1127	ADA I	7	/ENABLE INST TO ADD A
4657	4474	STC	RH1	/CONSTANT FOR
4660	0075	SET I	15	/RIGHT HALF SEQ.
4661	0744	KQ1HOR=1		
4662	6467	JMP	RH1=5	/DO RIGHT HALF SEQ.
4663	1020	DSCEND, LDA I		/RESTORE NOP
4664	0016	NOP		/FOR NEXT LEFT HALF SEQ.
4665	4474	STC	RH1	
4666	6451	JMP	DSCPTA	

4667	1000	CLOCK,	LDA	
4670	2000		0	
4671	4732		STC	RTNJMP
4672	0415		KST	
4673	6706		JMP	CLOCKA
4674	0500		IOB	
			Pmode	
4675	6036		KRB	
			Lmode	
4676	1460		SAE I	
4677	0204		0204	
4700	6706		JMP	CLOCKA
4701	0076		SET I	16
4702	0701		0701	
4703	0077		SET I	17
4704	7300		7300	
4705	6016		JMP	16
4706	0460	CLOCKA,	SNS I	0
4707	6105		JMP	TST1B
4710	0461		SNS I	1
4711	6454		JMP	DSCPAT
4712	0462		SNS I	2
4713	7162		JMP	GO
4714	0463		SNS I	3
4715	7221		JMP	DRW
4716	0444		SNS	4
4717	6723		JMP	CLOCKB
4720	0077		SET I	17
4721	1770		1770	
4722	7474		JMP	PSREGB
4723	0237	CLOCKB,	XSK I	17
4724	6732		JMP	RTNJMP
4725	1000		LDA	
4726	0732		RTNJMP	
4727	1120		ADA I	
4730	0001		1	
4731	4732		STC	RTNJMP
4732	2000	RTNJMP,	0	
4733	0000	HAFFLG,	0	
4734	0000	LNFLG,	0	

TO 2143

/TICK CLOCK AND
/REFRESH SCOPE

4735	0010	RHCHNG, 10	
4736	0004	4	
4737	0010	10	
4740	0004	4	
4741	0764	Q1GRID, Q4VER	/ADDR =1 OF GRID PATTERNS
4742	1022	Q2GRID, Q4VER+36	
4743	1060	Q3GRID, Q4VER+74	
4744	1116	Q4GRID, Q4VER+132	
4745	0450	KQ1HOR, 450	
4746	0000	Q1HOR, 0	
4747	0340	KQ1VER, 340	
4750	0000	Q1VER, 0	
4751	0010	KQ2HOR, 10	
4752	0020	Q2HOR, 0	
4753	0340	KQ2VER, 340	
4754	0000	Q2VER, 0	
4755	0010	KQ3HOR, 10	
4756	0000	Q3HOR, 0	
4757	7477	KQ3VER, =300	
4760	0000	Q3VER, 0	
4761	0600	KQ4HOR, 600	
4762	0000	Q4HOR, 0	
4763	7477	KQ4VER, =300	
4764	0000	Q4VER, 0	
		/GRID PATTERNS	
		/QUAD 1 LEFT HALF	
4765	4136	4136	/C
4766	1077	1077	/H
4767	4477	4477	/A
4770	3077	3077	/N
4771	0000	0	/SPACE
4772	4523	4523	/2
4773	4477	4477	/F
4774	0177	0177	/U
4775	0177	0177	/L
4776	0177	0177	/L
4777	0000	0	/SPACE
5000	5121	5121	/S
5001	7741	7741	/I
5002	4543	4543	/Z
5003	4577	4577	/E
		/RIGHT HALF	
5004	2241	2241	/C
5005	7710	7710	/H
5006	7744	7744	/A
5007	7706	7706	/N
5010	0000	0	/SPACE
5011	2151	2151	/2
5012	4044	4044	/F
5013	7701	7701	/U
5014	0301	0301	/L
5015	0301	0301	/L
5016	0000	0	/SPACE
5017	4651	4651	/S
5020	0041	0041	/I

5021	6151	6151	/Z
5022	4145	4145	/E
	/QUAD 2	LEFT HALF	
5023	4136	4136	/C
5024	1077	1077	/H
5025	4477	4477	/A
5026	3077	3077	/N
5027	0000	0	/SPACE
5030	2101	2101	/1
5031	1077	1077	/H
5032	4477	4477	/A
5033	0177	0177	/L
5034	4477	4477	/F
5035	0000	0	/SPACE
5036	5121	5121	/S
5037	7741	7741	/I
5040	4543	4543	/Z
5041	4577	4577	/E
	/RIGHT	HALF	
5042	2241	2241	/C
5043	7710	7710	/H
5044	7744	7744	/A
5045	7706	7706	/N
5046	0000	0	/SPACE
5047	0177	0177	/1
5050	7710	7710	/H
5051	7744	7744	/A
5052	0301	0301	/L
5053	4044	4044	/F
5054	0000	0	/SPACE
5055	4651	4651	/S
5056	0041	0041	/I
5057	6151	6151	/Z
5060	4145	4145	/E
	/QUAD 3	LEFT HALF	
5061	4136	4136	/C
5062	1077	1077	/H
5063	4477	4477	/A
5064	3077	3077	/N
5065	0000	0	/SPACE
5066	2101	2101	/1
5067	4477	4477	/F
5070	0177	0177	/U
5071	0177	0177	/L
5072	0177	0177	/L
5073	0000	0	/SPACE
5074	5121	5121	/S
5075	7741	7741	/I
5076	4543	4543	/Z
5077	4577	4577	/E

		/RIGHT HALF	
5100	2241	2241	/C
5101	7710	7710	/H
5102	7744	7744	/A
5103	7706	7706	/N
5104	0000	0	/SPACE
5105	0177	0177	/1
5106	4044	4044	
5107	7701	7701	
5110	0301	0301	
5111	0301	0301	
5112	0000	0	
5113	4651	4651	
5114	0041	0041	
5115	6151	6151	
5116	4145	4145	
		/QUAD 4 LEFT HALF	
5117	4136	4136	
5120	1077	1077	
5121	4477	4477	
5122	3077	3077	
5123	0000	0	
5124	4523	4523	
5125	1077	1077	
5126	4477	4477	
5127	0177	0177	
5130	4477	4477	
5131	0000	0	
5132	5121	5121	
5133	7741	7741	
5134	4543	4543	
5135	4577	4577	Q4EL,
		/RIGHT HALF	
5136	2241	2241	
5137	7710	7710	
5140	7744	7744	
5141	7706	7706	
5142	0000	0	
5143	2151	2151	
5144	7710	7710	
5145	7744	7744	/A
5146	0301	0301	/L
5147	4044	4044	/F
5150	0000	0	/SPACE
5151	4651	4651	/S
5152	0041	0041	/I
5153	6151	6151	/Z
5154	4145	4145	Q4ER,

```
      /THIS ROUTINE DISPLAYS X PATTERN
5155  0077  DISPX, SET I  17
5156  1300                1300
5157  6667  GOA,   JMP   CLOCK
5160  7162                JMP   GO
5161  7212                JMP   DISCL
5162  1020  GO,   LDA I
5163  0210                210
5164  0004                ESF
5165  0073                SET I  13
5166  0377                377
5167  0074                SET I  14
5170  7400                =377
5171  0075                SET I  15
5172  7001                7001
5173  0061                SET I  1
5174  0000                0
5175  1020  XPATRN, LDA I
5176  7776                =1
5177  1140                ADM
5200  0013                13
5201  0161                DIS I  1
5202  1020                LDA I
5203  0001                1
5204  1140                ADM
5205  0014                14
5206  0141                DIS   1
5207  0235                XSK I  15
5210  7175                JMP   XPATRN
5211  7157                JMP   GOA
```

/COLOR ROUTINE (VR20)
/ EXECUTE THIS TEST ONLY IF SNS 5=1

0446		SKPVND=0446	/SKIP ON COLOR NOT DONE
0466		SKPVRD=0466	/SKIP ON COLOR DONE
0447		SKPRD=0447	/SKIP ON RED
0467		SKPGR=0467	/SKIP ON GREEN
5212	0445	DISCL, SNS 5	
5213	7467	JMP PSREG	
5214	0077	SET I 17	
5215	0000	0	
5216	6667	DISCLA, JMP CLOCK	
5217	7221	JMP DRW	
5220	7467	JMP PSREG	
/DRAW OUTER BOX			
5221	0011	DRW, CLR	
5222	4010	STC Q4BETA	
5223	3427	ADD K400	
5224	0150	DIS Q4BETA	
5225	0011	CLR	
5226	3425	ADD K10	
5227	2010	ADD Q4BETA	
5230	1460	SAE I	
5231	1000	1000	
5232	7222	JMP DRW+1	
5233	0011	DRWA, CLR	
5234	4010	STC Q4BETA	
5235	3426	ADD K377	
5236	0150	DIS Q4BETA	
5237	0011	CLR	
5240	3425	ADD K10	
5241	2010	ADD Q4BETA	
5242	1460	SAE I	
5243	1000	1000	
5244	7234	JMP DRWA+1	
5245	0070	SET I Q4BETA	
5246	0777	777	
5247	3426	ADD K377	
5250	0150	DIS Q4BETA	

5251	0011	DRWB,	CLR	
5252	4010		STC	Q4BETA
5253	3427		ADD	K400
5254	0146		DIS	6
5255	3425		ADD	K10
5256	1460		SAE I	
5257	1400		1400	
5260	7254		JMP	,=4
5261	0066		SET I	6
5262	0777		777	
5263	0011		CLR	
5264	3427		ADD	K400
5265	0150		DIS	Q4BETA
5266	3425		ADD	K10
5267	1460		SAE I	
5270	1400		1400	
5271	7265		JMP	,=4
5272	0073		SET I	13
5273	0200		200	
5274	0074		SET I	14
5275	0600		600	
5276	0075		SET I	15
5277	7700		7700	
5300	0061		SET I	1
5301	0220		220	
5302	1020	DRWC,	LDA I	
5303	7773		=4	
5304	1140		ADM	
5305	0013		13	
5306	0161		DIS I	1
5307	1020		LDA I	
5310	0004		4	
5311	1140		ADM	
5312	0014		14	
5313	0141		DIS	1
5314	1020		LDA I	
5315	0002		2	
5316	1140		ADM	
5317	0001		1	
5320	0235		XSK I	15
5321	7302		JMP	DRWC

5322	0011	CLR		
5323	3430	ADD	SWITCH	
5324	0450	AZE		/0=RED -0=GREEN
5325	7367	JMP	GREEN	
5326	1020	LDA I		
5327	7070	7070		
5330	5430	STC	SWITCH	
5331	1020	LDA I		
5332	0014	14		
5333	0004	ESF		
5334	0011	CLR		
5335	4015	STC	15	
5336	0447	SKPRD		/SKIP ON RED
5337	0000	HLT		/SKIP ON RED FAILED
5340	0467	SKPGR		/SKIP ON GREEN
5341	0456	SKP		/SHOULD NOT SKIP
5342	0000	HLT		/SKIP ON GREEN IN ERROR
5343	0446	SKPVND		/SKIP ON COLOR NOT DONE
5344	0000	HLT		/SKIP ON COLOR NOT DONE FAILED
5345	0466	SKPVRD		/SKIP ON COLOR DONE
5346	0456	SKP		/NOT YET
5347	7354	JMP	,+5	/YES
5350	0235	XSK I	15	/DELAY
5351	7345	JMP	,+4	/
5352	0000	HLT		/SKIP ON COLOR DONE FAILED
5353	7326	JMP	RED	/TRY AGAIN
5354	0011	CLR		
5355	0061	SET I	1	
5356	0200	200		
5357	0070	SET I	Q4BETA	
5360	1430	TXT1-1		
5361	0071	SET I	Q3BETA	
5362	7765	-12		
5363	1770	DSC I	Q4BETA	
5364	0231	XSK I	Q3BETA	
5365	7363	JMP	,+2	
5366	7216	JMP	DISCLA	

5367	0011	GREEN,	CLR		
5370	5430		STC	SWITCH	
5371	1020		LDA I		
5372	0010		10		
5373	0004		ESF		
5374	0011		CLR		
5375	4015		STC	15	
5376	0467		SKPGR		/SKIP ON GREEN
5377	0000		HLT		/SKIP ON GREEN FAILED
5400	0447		SKPRD		/SKIP ON RED
5401	0456		SKP		/SHOULD NOT SKIP
5402	0000		HLT		/SKIP ON RED SKIPPED IN ERROR
5403	0466		SKPVRD		/SKIP ON COLOR DONE
5404	0456		SKP		/NOT YET
5405	7412		JMP	,+5	/YES
5406	0235		XSK I	15	/DELAY
5407	7403		JMP	,-4	/TRY AGAIN
5410	0000		HLT		/SKIP ON COLOR DONE FAILED
5411	7367		JMP	GREEN	/TRY AGAIN
5412	0011		CLR		
5413	0061		SET I	1	
5414	0470		470		
5415	0070		SET I	Q4BETA	
5416	1444		TXT2=1		
5417	0071		SET I	Q3BETA	
5420	7755		-22		
5421	1770		DSC I	Q4BETA	
5422	0231		XSK I	Q3BETA	
5423	7421		JMP	,=2	
5424	7216		JMP	DISCLA	
5425	0010	K10,	10		
5426	0377	K377,	377		
5427	0400	K400,	400		
5430	0000	SWITCH,	0		

5431	4477	TXT1,	4477
5432	3146		3146
5433	0000		0
5434	0000		0
5435	4577		4577
5436	4145		4145
5437	0000		0
5440	0000		0
5441	4177		4177
5442	3641		3641
5443	0000		0
5444	0000		0
5445	4136	TXT2,	4136
5446	2645		2645
5447	0000		0
5450	0000		0
5451	4477		4477
5452	3146		3146
5453	0000		0
5454	0000		0
5455	4577		4577
5456	4145		4145
5457	0000		0
5460	0000		0
5461	4577		4577
5462	4145		4145
5463	0000		0
5464	0000		0
5465	3077		3077
5466	7706		7706

/POWER SUPPLY REGULATION TEST

```
5467 0077 PSREG, SET I 17
5470 1770      1770
5471 6667 PSREGA, JMP CLOCK
5472 7474      JMP PSREGB
5473 6100      JMP DISPAT

5474 0076 PSREGB, SET I 16
5475 7000      7000
5476 1020      LDA I
5477 0210      210
5500 0004      ESF
5501 0061 PSREGC, SET I 1
5502 0000      0
5503 1020      LDA I
5504 0377      377
5505 7546      JMP OPTIT
5506 0061      SET I 1
5507 0000      0
5510 1020      LDA I
5511 7400      =377
5512 7546      JMP OPTIT
5513 0061      SET I 1
5514 0440      440
5515 1020      LDA I
5516 0377      377
5517 7546      JMP OPTIT
5520 0061      SET I 1
5521 0440      440
5522 1020      LDA I
5523 7400      =377
5524 7546      JMP OPTIT
5525 0236      XSK I 16
5526 7501      JMP PSREGC
5527 0076 PSREGD, SET I 16
5530 0000      0
5531 0061 PSREGE, SET I 1
5532 0200      200
5533 0070      SET I Q4BETA
5534 1611      TXT4-1
5535 0071      SET I Q3BETA
5536 7745      =32
5537 0011      CLR
5540 1770      DSC I Q4BETA
5541 0231      XSK I Q3BETA
5542 7540      JMP ,=2
5543 0236      XSK I 16
5544 7531      JMP PSREGE
5545 7471      JMP PSREGA
```

5546	0046	OPTIT,	SET	6
5547	0000		0	
5550	0070		SET I	Q4BETA
5551	1557		TXT3-1	
5552	0071		SET I	Q3BETA
5553	7745		-32	
5554	1770		DSC I	Q4BETA
5555	0231		XSK I	Q3BETA
5556	7554		JMP	,=2
5557	6006		JMP	6

5560	3077	TXT3,	3077	
5561	7730		7730	
5562	0000		0	
5563	0000		0	
5564	4477		4477	
5565	7744		7744	
5566	0000		0	
5567	0000		0	
5570	7741		7741	
5571	0041		0041	
5572	0000		0	
5573	0000		0	
5574	3077		3077	
5575	7706		7706	
5576	0000		0	
5577	0000		0	
5600	4177		4177	
5601	3641		3641	
5602	0000		0	
5603	0000		0	
5604	4577		4577	
5605	4145		4145	
5606	0000		0	
5607	0000		0	
5610	4136		4136	
5611	2241		2241	

/MAINDEC

5612	2101	TXT4,	2101
5613	0177		0177
5614	0000		0
5615	0000		0
5616	4523		4523
5617	2151		2151
5620	0000		0
5621	0000		0
5622	0404		0404
5623	0404		0404
5624	0000		0
5625	0000		0
5626	4177		4177
5627	3641		3641
5630	0000		0
5631	0000		0
5632	1506		1506
5633	4225		4225
5634	0000		0
5635	0000		0
5636	5177		5177
5637	2651		2651
5640	0000		0
5641	0000		0
5642	4136		4136
5643	2241		2241

/12-D6BC

/END

@

0000
0100

0200
0300

0400
0500

0600
0700

1000
1100

1200
1300

1400
1500

1600
1700

2000
2100

2200
2300

2400
2500

2600
2700

3000
3100

3200
3300

3400
3500

3600
3700

BHQ1	4601	OPTIT	5546
BHQ2	4513	PSREG	5467
BHQ3	4611	PSREGA	5471
BHQ4	4525	PSREGB	5474
BVQ1	4633	PSREGC	5501
BVQ2	4546	PSREGD	5527
BVQ3	4643	PSREGE	5531
BVQ4	4555	Q1BETA	4013
CLOCK	4667	Q1GRID	4741
CLOCKA	4706	Q1HOR	4746
CLOCKB	4723	Q1VER	4750
DISCL	5212	Q2BETA	4012
DISCLA	5216	Q2GRID	4742
DISPAT	4100	Q2HOR	4752
DISPX	5155	Q2VER	4754
DOGRN	4423	Q3BETA	4011
DORED	4400	Q3GRID	4743
DRW	5221	Q3HOR	4756
DRWA	5233	Q3VER	4760
DRWB	5251	Q4BETA	4010
DRWC	5302	Q4EL	5135
DSCEND	4663	Q4ER	5154
DSCPAT	4454	Q4GRID	4744
DSCPT	4447	Q4HOR	4762
DSCPTA	4451	Q4VER	4764
EXMB	4066	RED	5326
FULSIZ	4560	REL	4136
GL2	4334	RH1	4474
GL2V	4352	RHCHNG	4735
GO	5162	RTNJMP	4732
GOA	5157	SKP	0456
GREEN	5367	SKPGR	0467
HAFCHK	4646	SKPRD	0447
HAFFLG	4733	SKPVND	0446
INCMB	4026	SKPVRD	0466
K10	5425	SWITCH	5430
K377	5426	T1GL	4210
K400	5427	TST1A	4102
KQ1HOR	4745	TST1B	4105
KQ1VER	4747	TST1LP	4113
KQ2HOR	4751	TST2	4234
KQ2VER	4753	TST2LP	4237
KQ3HOR	4755	TXT1	5431
KQ3VER	4757	TXT2	5445
KQ4HOR	4761	TXT3	5560
KQ4VER	4763	TXT4	5612
LNFLG	4734	XPATRN	5175
LOOP1	4506		
LOOP2	4572		
LP1	4137		
LP2A	4271		
LP2B	4310		

/VR14, VR20 DISPLAY CONTROL AND SCOPE TEST

DIAL10 V003

16-AUG-71

13130 PAGE 25-4

ERRORS DETECTED: 0

LINKS GENERATED: 0

RUN-TIME: 7 SECONDS

3K CORE USED