

# KEY SYSTEMS SERVICE MANUAL

VOLUME III



## Key System Manual Vol. III

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# **KEY SYSTEMS SERVICE MANUAL VOL III**

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# INTRODUCTION

The Key Systems Service Manual consists of Volumes I, II, and III. Volume I contains three parts: Common Key System Information, General Apparatus, and Telephone Sets. Volume II contains information concerning 1A, 1A1, and 1A2 Key Telephone Systems. Volume III includes those BSPs unique to COM KEY\* services. The sections are compiled in the manual numerically and not in the order they appear in the Table of Contents.

This manual supports plant craft personnel in their daily work operations. The sections contained in the manual provide information necessary for installing and maintaining key systems.

For information not included in this manual, refer to the standard BSP files.

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## 575AM AND 2575AM TELEPHONE SETS

### IDENTIFICATION, INSTALLATION, CONNECTIONS, AND MAINTENANCE

#### 1. GENERAL

1.01 This section contains information on the 575AM and 2575AM telephone sets.

1.02 This section is reissued to add:

- Information on the 683AE transmitter, Table A
- Information on the third intercom line used in COM KEY\* 2152 key telephone system, Fig. 4.

#### 2. IDENTIFICATION

2.01 The 575AM (rotary) and 2575AM (TOUCH-TONE® dial) telephone sets, available in ivory only, are the same in appearance as the standard 6-button desk sets and are arranged for intercom-only in COM KEY\* 718, 734, 1434, and 2152 key telephone systems.

2.02 Each set is equipped with a 636A key, 4228-type network, D20P-87 mounting cord, G15A-50 handset, H4DU-50 handset cord, 616D jack, and either a 9CA-50 rotary dial or a 35Y3A TOUCH-TONE dial. All components are replaceable (except the network) per local instructions.

2.03 The hands-free answer on intercom (HFAI) is an optional feature available in COM KEY 2152 key telephone system installations. This feature consists of a ♦683AE♦ transmitter which is arranged for field installation.

\*Trademark of American Telephone and Telegraph Company

2.04 The key positions from left to right provide a red nonfunctioning button (which may be illuminated for message waiting use), three clear illuminated buttons for intercom (locking and releasing), and two nonfunctioning buttons.

#### 3. INSTALLATION AND CONNECTIONS

3.01 Install telephone sets in desired location making sure that any options are installed before the telephone set is connected.



*The 575AM (Fig. 1) and 2575AM (Fig. 2) telephone sets are factory wired for two intercom lines only, for the third intercom line refer to Fig. 3, Notes 2 and 3 or Fig. 4, Notes 1 and 2.*

3.02 For COM KEY 718 key telephone system connections, terminate the connector cable on the connecting block as shown in Fig. 3. For the third intercom line used in COM KEY 718, 734, and 1434 connect as shown on Fig. 3, Notes 2 and 3. ♦For the third intercom line used in COM KEY 2152 key telephone system connect as shown in Fig. 4, Notes 1 and 2.♦

3.02 For connecting the HFAI feature (COM KEY 2152 key telephone system only) refer to Table A.

#### 4. MAINTENANCE

4.01 Maintenance of the 575AM and 2575AM telephone sets should be limited to checking for loose or broken connections and the replacement of components per local instructions.

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SECTION 503-603-120

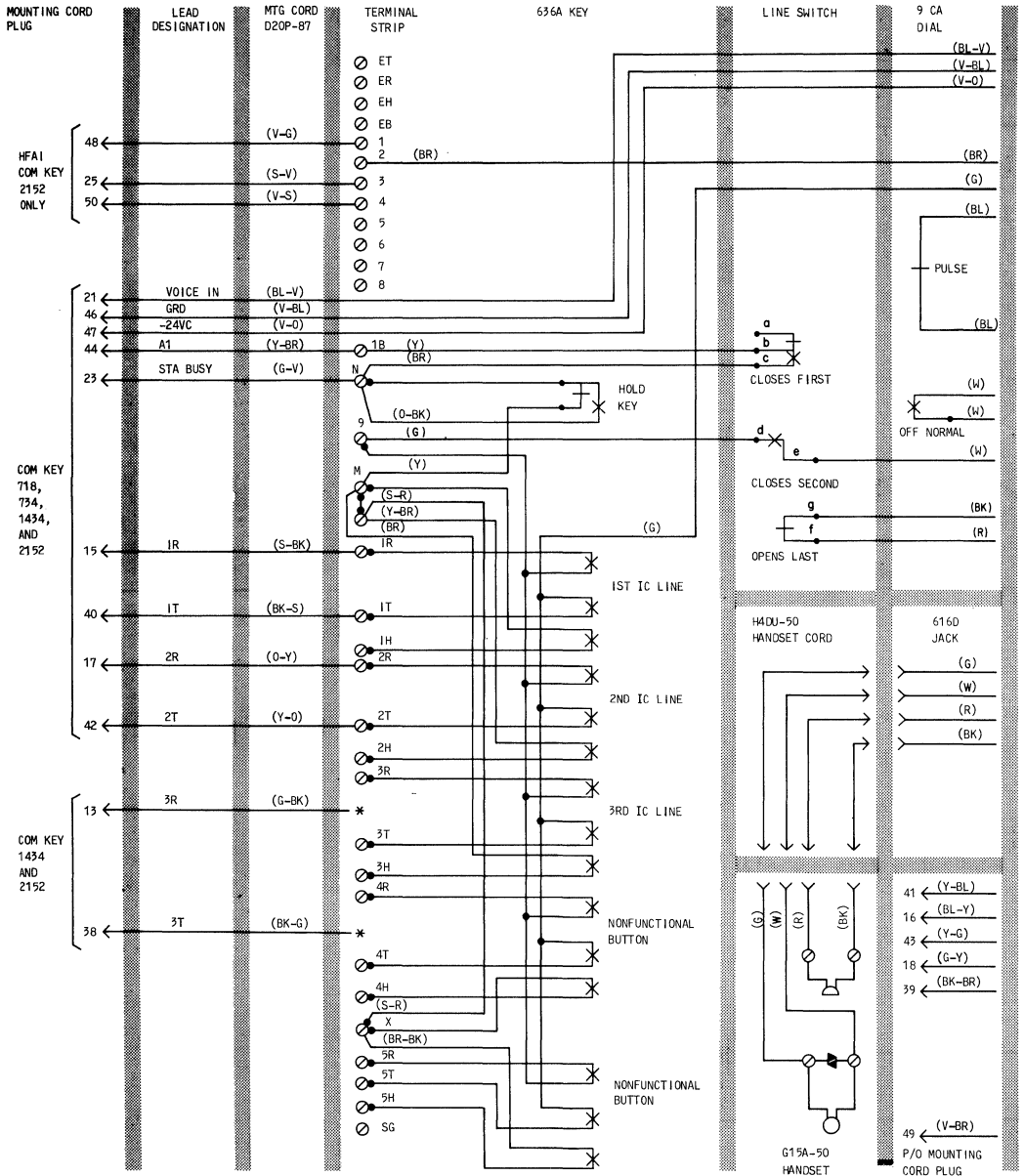


Fig. 1—575AM Telephone Set Connecting Diagram (Sheet 1 of 2)¶



4228-TYPE NETWORK

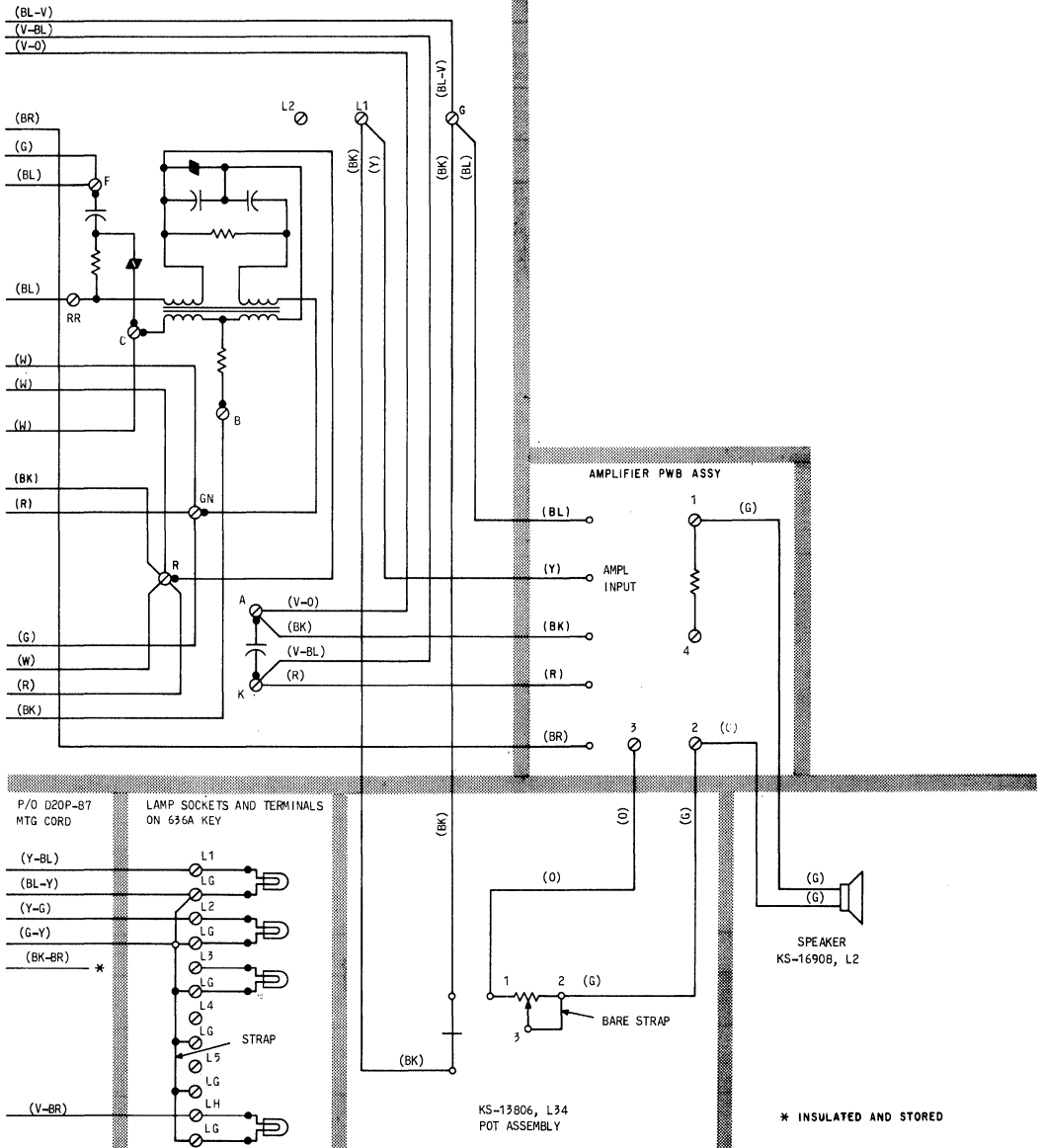


Fig. 1—575AM Telephone Set Connecting Diagram (Sheet 2 of 2)†

SECTION 503-603-120

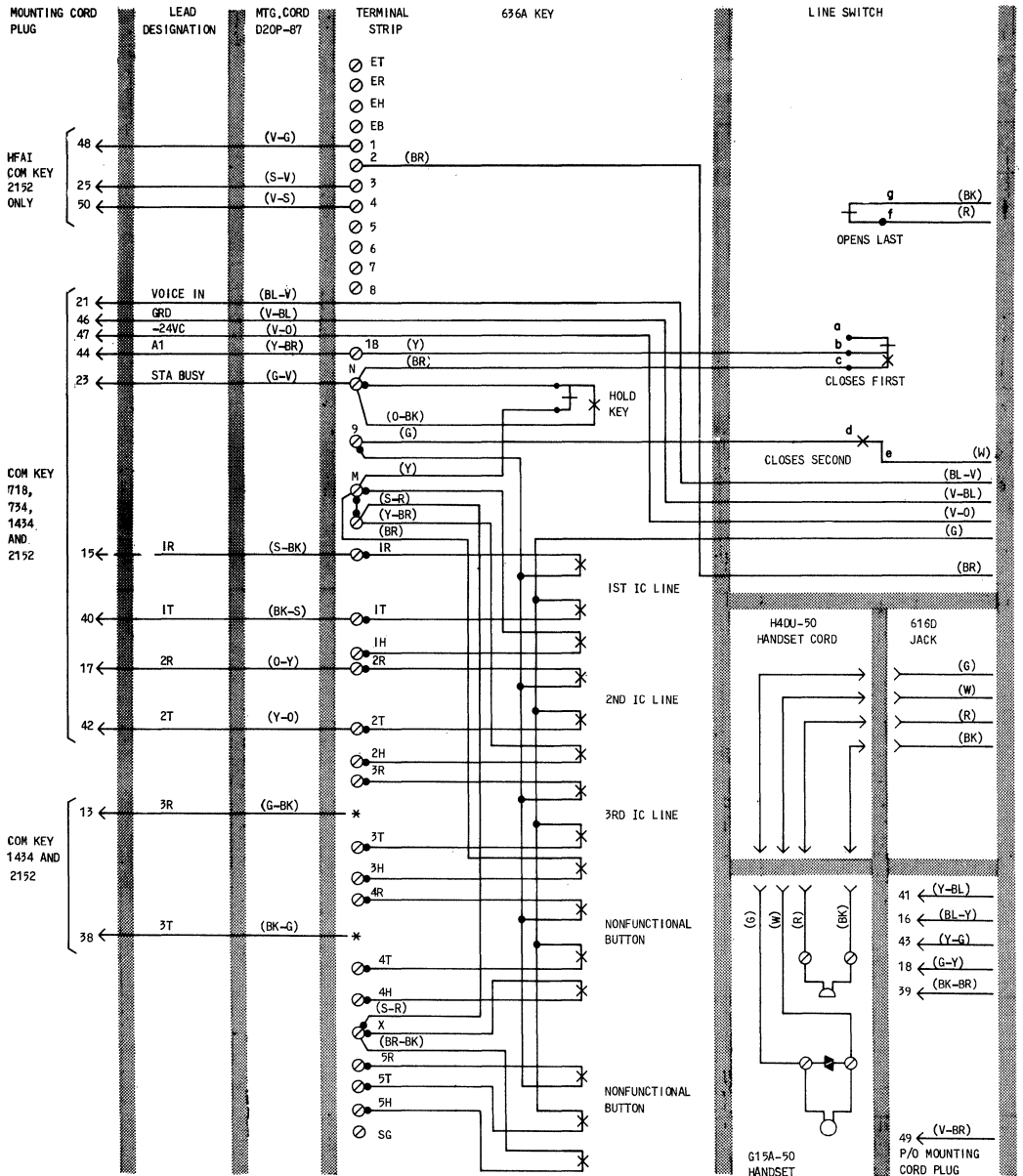


Fig. 2—2575AM Telephone Set Connecting Diagram (Sheet 1 of 2)

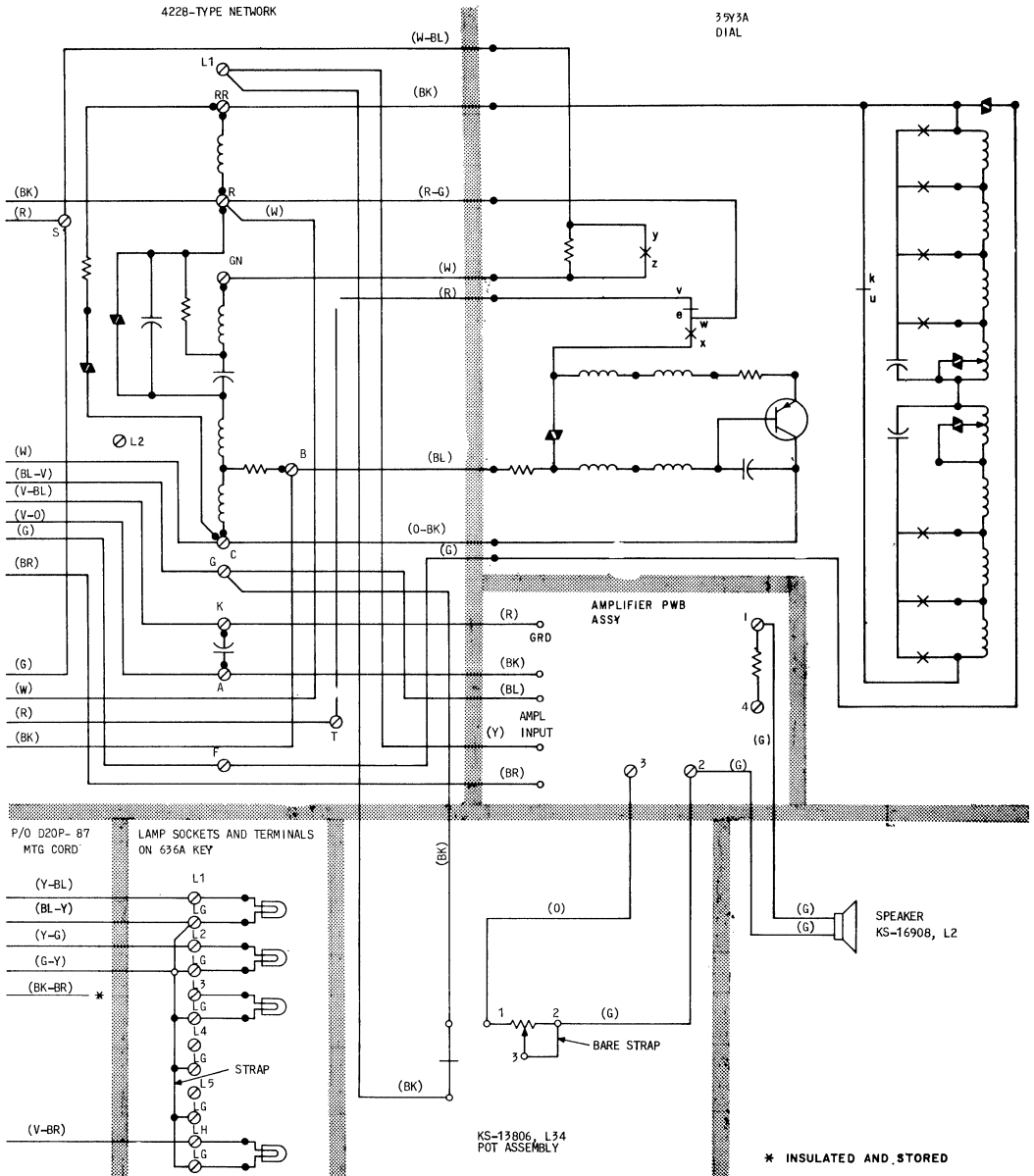
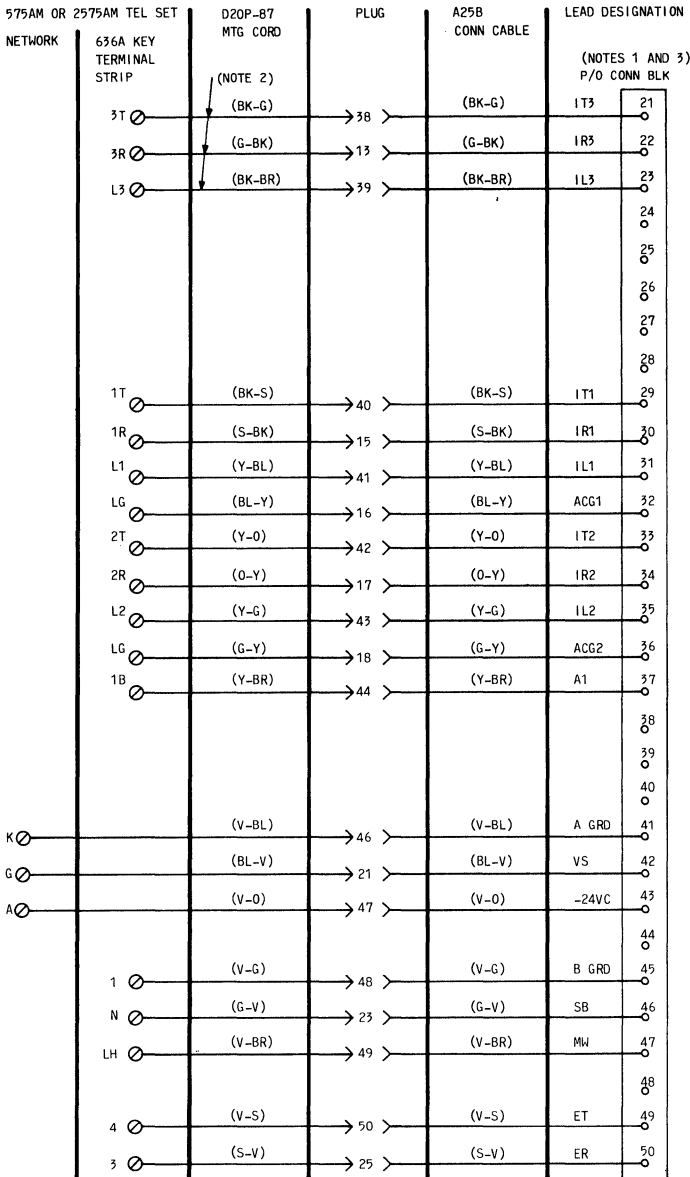


Fig. 2—2575AM Telephone Set Connecting Diagram (Sheet 2 of 2)





- NOTES:
- 3RD INTERCOM PATH APPEARS ON A MULTIPLE PURPOSE BUTTON AND MUST BE CROSS CONNECTED. REFER TO SECTION 518-450-111 FOR ADDITIONAL INFORMATION.
  - THE (BK-G), (G-BK), AND (BK-BR) LEADS ARE INSULATED AND STORED IN THE TELEPHONE SET. IF THE 3RD INTERCOM PATH IS PROVIDED THESE LEADS MUST BE TERMINATED AS SHOWN.
  - TERMINATE CONNECTOR CABLE FOR INTERCOM ONLY STATION ON SAME BLOCK(S) AS ASSIGNED FOR FULL SERVICE STATION.

Fig. 4—575AM and 2575AM Telephone Set Connector Cable Connections In COM KEY 2152 Key Telephone System

◆ TABLE A ◆

## HFAI CONNECTIONS

APPARATUS	LEAD COLOR	REMOVE FROM NET. TERM.	CONNECT TO	
			636A KEY TERM.	NET. TERM.
D20P-87 Mtg. Cord	BL-V	G		L2
683AE TRMTR	W-BL		LG(Lamp Grd)	
	BL-W		1	
	W-O		4	
	O-W		3	
	G-W			L2
	W-G			G
	W-BR			A
BR-W				K

## 832- AND 2832-TYPE TELEPHONE SETS

### IDENTIFICATION, INSTALLATION, CONNECTIONS, AND MAINTENANCE

#### 1. GENERAL

**1.01** This section contains information for the 832- and 2832-type telephone sets. The 832- (rotary) and 2832- (TOUCH-TONE® service) type telephone sets are special plug-ended, 10-, 11-, or 13-button key telephone sets initially designed for use with the 7A Communication System (COM KEY\* 718). These sets also may be used with the 21A Communication System (COM KEY\* 2152). For information on COM KEY Systems, refer to appropriate section in Division 518.

**1.02** This section is reissued to:

- Revise paragraph 2.08
- Replace the 446F diode with the 533K diode for dial restriction and station busy lamp
- Revise Fig. 10
- Add information on the 680AE transmitter.

#### 2. IDENTIFICATION

**2.01** The 832BM (Fig. 1), 2832BM, 832CM, and 2832CM (Fig. 2) are modular type telephone sets and will replace the 832B, 2832B, 832C, and 2832C telephone sets, respectively, which are hereby rated MD. The 832DM, 2832DM, 832EM, and 2832EM are also modular sets and are electrically and functionally equivalent to the 832BM, 2832BM, 832CM, and 2832CM sets, respectively, except that they have been adapted for wall mounting. The modular sets will all be equipped with a G15A-50 handset and H4DU-50 handset cord which will plug into a 616T jack mounted on the left front of the telephone set base (Fig. 3). Current production models of these sets also are equipped with an improved line switch and an improved Automatic

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Button Restoral (ABR) feature. Some early production BM and CM sets were not so equipped.

**2.02** The 832A (MD) and 2832A (MD) are 10-button telephone sets equipped with a 647G5 key consisting of a Hold button, seven line buttons, and two intercom buttons. There is an apparatus blank to the right of the dial which may be removed to mount a 651C key for RING TRANSFER, a 651D key for Privacy Release (PRIV RLS) or a 651F key for RECALL. If required the privacy circuit board can be installed.

**2.03** The 832B (MD), 832BM or 832DM and 2832B (MD), 2832BM, or 2832DM telephone sets are 11-button sets similar to the 832A and 2832A sets, respectively, except that the eleventh button, to the right and below the key assembly is equipped in the factory for RECALL. This key takes the amber key cap provided. PRIV RLS and RING TRANSFER features **cannot** be provided in the 832B, BM, DM and 2832B, BM, DM telephone sets. If required the privacy circuit can be field installed.

**2.04** The 832C (MD), 832CM, or 832EM; 2832C (MD), 2832CM, or 2832EM; and 13-button telephone sets equipped with the 647G5 key and also a 647S5 key with buttons for RECALL, PRIV RLS, and RING TRANSFER. The remainder of the top key space is blocked off by a collar assembly. These sets are also equipped and factory wired with the privacy circuit.

**2.05** The DM and EM (wall type) sets and BM and CM (desk type) sets are not interchangeable due to the mechanical changes in the handset hanger and the new 6C1-50 housing.

**2.06** An adapter (833A-50) will be furnished with each DM and EM telephone set for wall mounting. The switchhook of these sets has been designed to hang vertically to the left of the housing. The sets are equipped with a hard-wired mounting cord which can be coiled up and concealed

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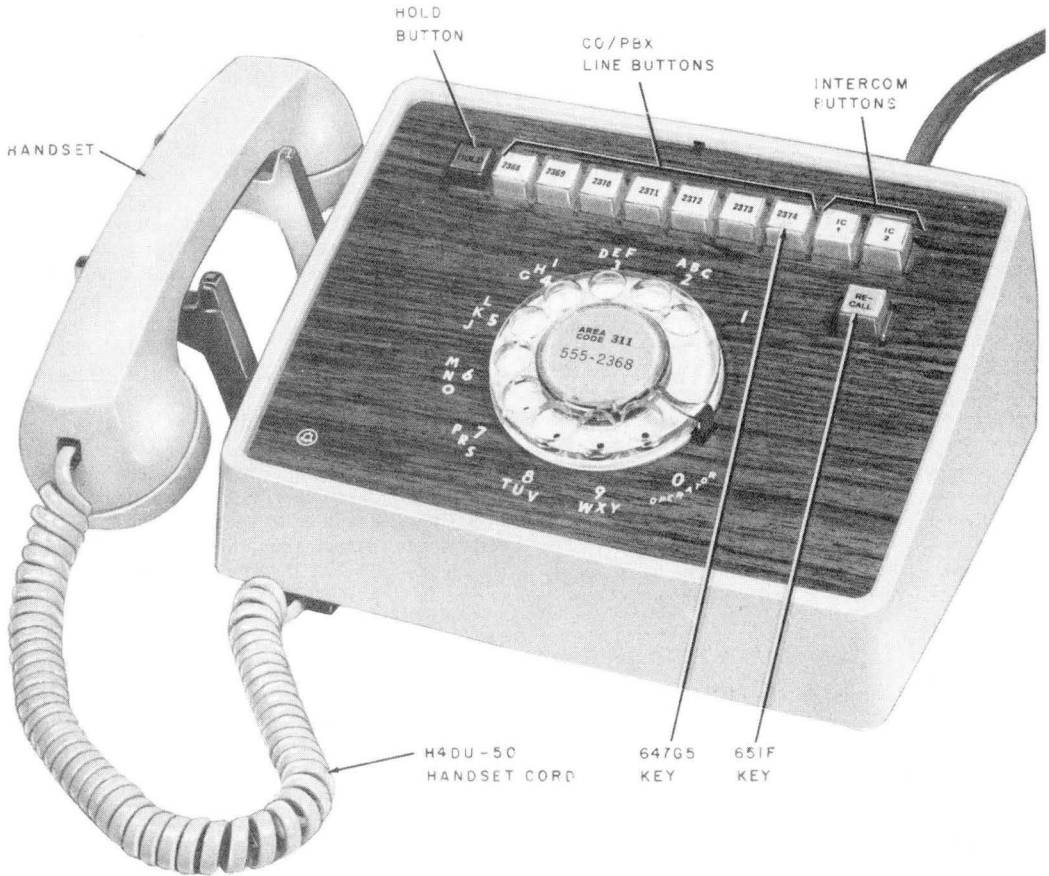


Fig. 1—832BM Telephone Set

in the adapter or the cord can be extended down the wall through a notch in the adapter for termination to appropriate connector-ended cable. All maintenance can be performed on internal components of these sets without removing the set from the wall.

**2.07** All of the 832- and 2832-type sets provide the same basic services such as pickup, hold, button illumination, and intercom. They are equipped with a loudspeaker to provide tone and voice signaling. The level of the tone is adjusted by a volume control knob located under the right side

of housing. Two or more CO/PBX lines may be conferenced by simultaneously depressing the buttons associated with the lines to be conferenced. The two intercom lines may also be conferenced. Intercom and CO/PBX lines cannot be conferenced. Automatic button restoration restores all depressed buttons to the unoperated position when the handset is replaced.

**2.08** This multiline conferencing is a feature of these telephone sets. Since there is no amplification involved, this type conferencing is limited. When lines are conferenced, using this





Fig. 2—2832CM Telephone Set

manner of conferencing, distant stations may have trouble hearing each other, transmission is not guaranteed.

**2.09** The 832- and 2832-type telephone sets may be used with either the 3-type (MD) or 4A speakerphone system.



*The limited number of mounting cord conductors places a restriction on the location of speakerphone components unless it is desired to give up one pickup line. Refer to Section 512-620-487 or 512-740-471 for*

*connection information for the 3-type (MD) or 4A speakerphone system, respectively.*

**2.10** Current 832- and 2832-type telephone sets are available in ivory (-50) only. These sets will be shipped with a disposable faceplate. It will be necessary to order a faceplate separately (Table A).

**2.11** Any station set may be optionally wired to ring on **one** CO/PBX line only, or for common audible ringing.

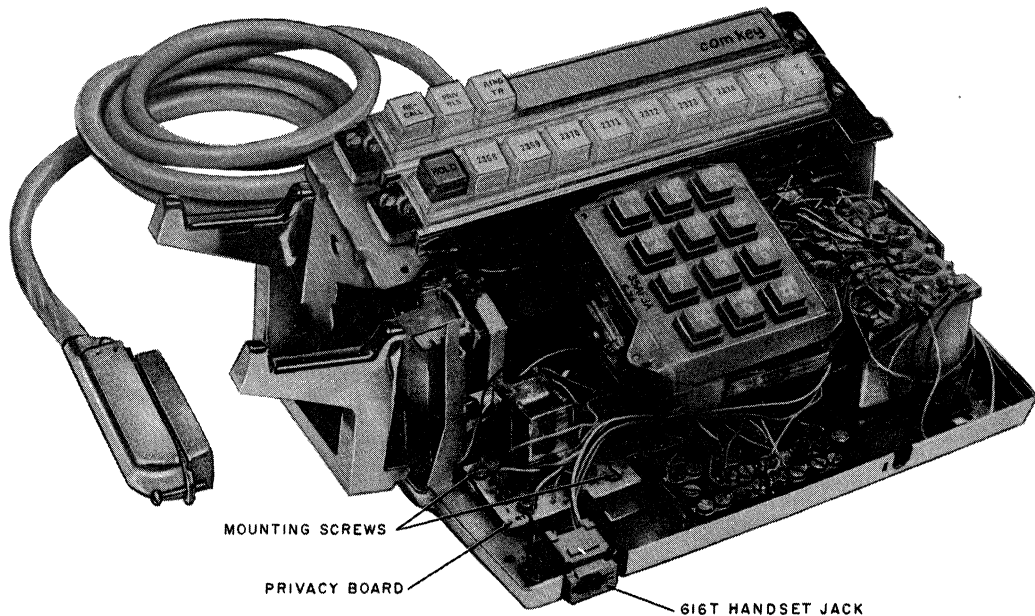


Fig. 3—2832CM Telephone Set Base



*When common audible ringing is wired to a station other than the attendant station (Code 0), that station cannot have the ring transfer option.*

#### Ordering Guide

2.12 For telephone set, faceplate, and replaceable component ordering guide, refer to Table A. See Table B for color ordering information.

2.13 The following optional apparatus may be associated with desk type 832 and 2832 sets (order as required):

- Kit of Parts, D-180656 (to provide a wall shelf mounting arrangement) consists of the following:

1—840362446 shelf  
1—840362479 clamp

1—801812553 screw

- Diode, 533K (order one for each rotary dial station to be restricted)
- 4A Speakerphone (order one each of the following for each station to be equipped with speakerphone). Refer to Section 512-700-100 for color information.

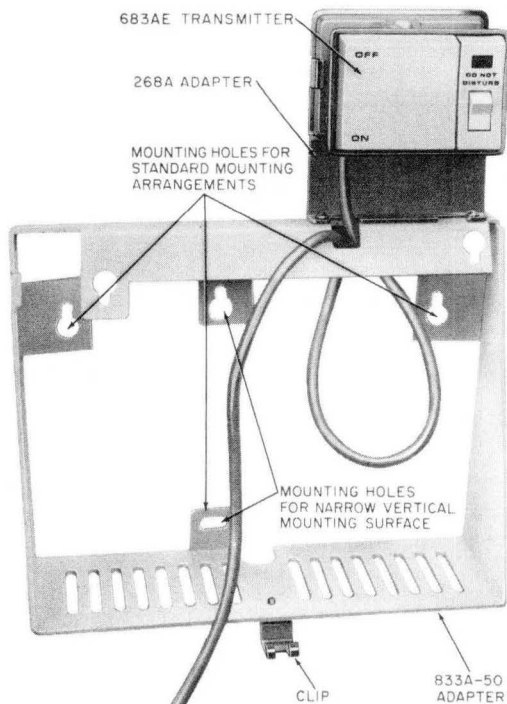
Loudspeaker, 108AA-†‡ (includes 7-foot D20N mounting cord)

Transmitter, 680AE-†‡ (includes 7-foot D8S mounting cord)

Unit, Power, 85B1-49

† Add Color Suffix.

‡ The transmitter and loudspeaker set will be shipped in one of four promoted colors, Black (-03), Green (-51), White (-58), and



**Fig. 4—833A-50 Adapter With 268A Adapter and 683A Transmitter**

Light Beige (-60). For ivory components, it will be necessary to also order a D-180508 Kit of Parts.

- Ringer, E1C (one for each CO/PBX line to be wired for power failure transfer).

**2.14** The following optional apparatus will only be used with the 832A or 2832A telephone sets (except as noted).

- D-180487 (A&M Only) Kit of Parts (RING TRANSFER) order one only per system if the attendant station is to be equipped for ring transfer.
- D-180488 (A&M Only) Kit of Parts (PRIV RLS) order one for each station to be equipped for privacy release.

- D-180591 Kit of Parts (RECALL) order one for each station to be equipped for recall.

**Note:** Only one of the previously listed features can be provided.

- D-180486 Kit of Parts (Privacy Circuit Board), order one for each station to be locked out. Can be added to the 832A, 832B, BM, DM, 2832A, 2832B, BM, or DM telephone set.
- Transmitter, 683A-50 (for HFAI feature of COM KEY 2152)
- Adapter, 268A (for mounting 683A-50 transmitter when using DM or EM type telephone sets).

### 3. INSTALLATION AND CONNECTIONS

**3.01** Install telephone sets at desired locations, making sure that any options are installed before telephone set is connected. See Fig. 6 through 15 for schematics of 832A, 2832A, 832B, BM, DM, 2832B, BM, DM, 832C, CM, EM, 2832C, CM, or EM telephone sets, respectively.

**3.02** All DM and EM (wall type) sets are shipped with an 833A-50 adapter, screw, and clip (Fig. 4) which are used for mounting the telephone set to a vertical surface. Install the 833A-50 adapter and telephone set as follows.

- (1) Mount the adapter to the wall or vertical surface as shown in Fig. 4, using appropriate fasteners (Section 080-720-105). If the mounting cord is to be dressed down the wall, it is necessary to pass the cord through the notch in the adapter before final attachment of the adapter to the wall (Fig. 5). If the cabling enters through the wall, the mounting cord may be contained within the adapter.
- (2) Remove faceplate and housing from telephone set.
- (3) Hang the telephone set on the adapter from the headed rivets that protrude from the base pan (Fig. 5).

**Note:** It may be necessary to slightly bend the top slotted portion of the adapter so the headed rivets of the base pan will align properly.

- (4) Secure the telephone set base with the clip and screws at the bottom of the adapter (Fig. 4).
- (5) Install the telephone set options (see paragraph 3.04).
- (6) Replace housing and faceplate.

**3.03** A D-180656 Kit of Parts may be ordered separately for shelf mounting of all BM or CM sets. The 840362446 shelf should be mounted to a wall or vertical surface and, after placing the telephone set on the shelf, secure set with retainer clamp and screw furnished with the shelf.

**3.04** To install telephone set options, the faceplate and housing must be removed and the dial lifted from its mounting brackets. Use a KS-21107 type releaser or equivalent to release the faceplate catch.

**Caution:** *The ten button key in this set is equipped with special low-friction plastic parts. Special care is required when removing or replacing these keys to avoid cracking or breaking the plastic hooked end of the latchbar projecting from the end of the key. When removing a key, avoid twisting or distorting the hook. When installing a key, make sure the hook is properly engaged over the edge of the pivot arm before tightening the mounting screws of the key.*

**Caution:** *When making wiring changes in this set involving adding or moving spade-tipped leads on the terminal board (e.g., privacy option), extreme care must be taken to prevent shorting between terminal positions. Check for clearance before reinstalling the dial.*



*If telephone set is to be used at attendant station (Code 0) without ring transfer, remove (V-BR) lead from telephone set terminal 28; insulate and store. Otherwise the lamp under HOLD key will be lighted at all times.*

**3.05** Options are installed as follows:

(a) **Station Restriction (832-type telephone set):**

(1) Install 533K diode between network terminals RR and F. Terminate negative lead of diode on terminal F, with positive lead on terminal RR.

(2) On telephone set terminal board, move (G) lead from terminal 22 to 4, and (R) lead from terminal 4 to 22.

(b) **Station Restriction (2832-type telephone set):**

On telephone set terminal board, move (G) lead from terminal 22 to 4, and (R) lead from terminal 4 to 22.

(c) **Privacy Circuit (D-180486 Kit of Parts) 832A, 2832A, 832B, BM, DM, 2832B, BM, or DM telephone set:**

(1) Mount privacy circuit board on the two standoffs located at left front of the telephone set base (Fig. 3).

(2) Fasten circuit board to standoffs using mounting screws furnished with the telephone set.

(3) Connect leads according to Table C.

(4) Refer to paragraph 3.06 for testing the privacy release key.

(d) **Privacy Circuit (D-180486 Kit of Parts) disabling, 832-type telephone sets:**

Remove (O) and (BK) leads of Privacy Circuit from telephone set terminal 8 and 12, respectively, and insulate and store, see Table E.

(e) **PRIV RLS (D-180488 Kit of Parts) 832A or 2832A sets only:**

(1) Pry apparatus blank off locating pins.

(2) Press PRIV RLS key on locating pins.

(3) Connect leads according to Table D.

(4) Refer to paragraph 3.06 for testing the privacy release key.

**Note:** When PRIV RLS is used, RING TRANSFER or RECALL feature cannot be used.

(f) **To Disable PRIV RLS Key:** Move (O-BK) lead of privacy release key from telephone set terminal 10 to 15, see Table F.

(g) **RING TRANSFER (D-180487 Kit of Parts) 832A or 2832A telephone sets attendant station (Code 0) only:**

- (1) Pry apparatus blank off locating pins.
- (2) Press ring transfer key on locating pins.
- (3) Connect leads according to Table H.
- (4) Refer to Section 518-450-100 for KSU strap addition.

**Note:** When RING TRANSFER is used, PRIV RLS or RECALL cannot be used.

(h) **RING TRANSFER (Position 3 of Top Key) 832C, CM and 2832C, CM telephone set.**

- (1) Connect leads per Table I.
- (2) Refer to Section 518-450-100 for KSU strap addition.

(i) **RECALL (D-180591 Kit of Parts) 832A or 2832A telephone sets only:**

- (1) Pry apparatus blank off locating pins.
- (2) Press recall key on locating pins.
- (3) Connect leads according to Table J.

**Note:** When RECALL is used, PRIV RLS or RING TRANSFER cannot be used.

(j) **HANDS-FREE ANSWER INERCOM (HFAI):**

- (1) If feature is to be added to DM- or EM-type set, a 268A adapter must be used as follows:

- (a) Mount 268A adapter onto 833A-50 adapter with two screws as shown on Fig. 3

with the tabs of the 268A adapter facing outward from the vertical surface. The 683AE-50 transmitter is secured by sliding the transmitter downward between the tabs on the adapter. The telephone set end of the transmitter cord enters the telephone set and is attached to the telephone set base at the small notch on the top edge of the base panel. The excess cord is stored in the 833A-50 adapter.

- (2) For B, BM or C, CM (desk type) sets, the transmitter cord will enter at the rear of the set.

- (3) Refer to Table K for connections.

**Note:** It may be necessary to slightly reduce the volume of the 683AE transmitter if distortion or feedback is noticed when the HFAI feature is used.

### 3.06 Privacy Circuit/Privacy Release Test:

(a) Busy out a line using another station (Station X). At the set with the privacy circuit to be tested (Station Y), go off-hook on same line. Station Y should be locked out. Hang up Station Y.

(b) If Station X has a privacy release key, depress it. The lamp under the busy line will indicate it is on-hold. Station Y should now be able to pick up the line on hold. Release the privacy release key, Station X and Y should now be bridged. Hang up Station Y.

(c) If Station X does not have a privacy release key, or a privacy circuit, he can allow Station Y in on the line by just placing the line on-hold by depressing the Hold button (this also releases the line button). Station Y should now be able to pickup the line on hold. Now depress the same button at Station X, the stations should be bridged. Hang up Station Y.

(d) If Station X does not have a privacy release key but does have a privacy circuit, he cannot allow Station Y to bridge onto the call without excluding himself.

(e) With the line still busied out by Station X and Station Y not bridged, depress a different

line on Station Y and go off-hook. While holding that line button depressed bridge onto the line that was busied out by Station X. Station Y should be locked out of both lines.

**3.07** When installing faceplate, insure that the collar is in place on the key. Place the tabs into slots in front of the faceplate opening in the housing and lower slowly over the dial and key collar until almost in place. Use a KS-21107 type releaser or equivalent to release the faceplate catch and seat the faceplate.

**3.08** The 647G5 key uses key designation tabs form E-5837, E-6672, and the 647S5, 651-type keys use key designation tabs form E-6672. To install, squeeze sides of the cap and remove from key. Insert designation tabs and replace cap with locking tabs along the horizontal axis of the key.

**3.09** For telephone set station number cards, use form E-4203-G or E-4204-G for rotary dial sets (nonmodular) and form E-5002-A or E-5002-B for TOUCH-TONE dial sets (nonmodular). Use Forms E-4203-G-(M) or E-6417 for rotary dial sets (modular) and forms E-5002-A-(M) or E-6418 for TOUCH-TONE dial sets (modular).

**3.10** Refer to Fig. 6 through 15 for telephone set schematics.

**3.11** Refer to Section 512-620-487 or 512-740-471 for connections to 3-type (MD) or 4A speakerphone systems, respectively.

**3.12** Early version of 832- and 2832-type telephone sets were equipped with a D50AL mounting cord which require contact strips to be installed in

the back of the keys. Current production 832- and 2832-type telephone sets are equipped with a D50AP mounting cord. The D50AP mounting cord is a direct replacement for the D50AL mounting cord but does not require that contact strips be installed in the back of the keys.



***Do not install contact strips in the back of the key when telephone sets are equipped with a D50AP mounting cord. Wires are factory provided in this cord from the key terminal plugs to the set terminal board. Use of contact strips may damage terminal plugs.***

**3.13** If Power Failure Transfer feature is to be provided, use an external ringer (E1C) and connect as shown in Table G.

#### **4. MAINTENANCE**

**4.01** Maintenance of the 832- and 2832-type telephone sets should be limited to checking for loose or broken connections and replacement of items listed under Ordering Guide table as replaceable components.



***Telephone set should not be carried by the switchhook since this applies excessive strain to the line switch and could cause a trouble condition.***

**4.02** The current production 647-type key has been modified for easy lamp replacement by merely removing the lamp cap and inserting a 553-type tool through the hole in the top of the button. In early production keys, it is necessary to remove faceplate, key collar, and button for lamp replacement.

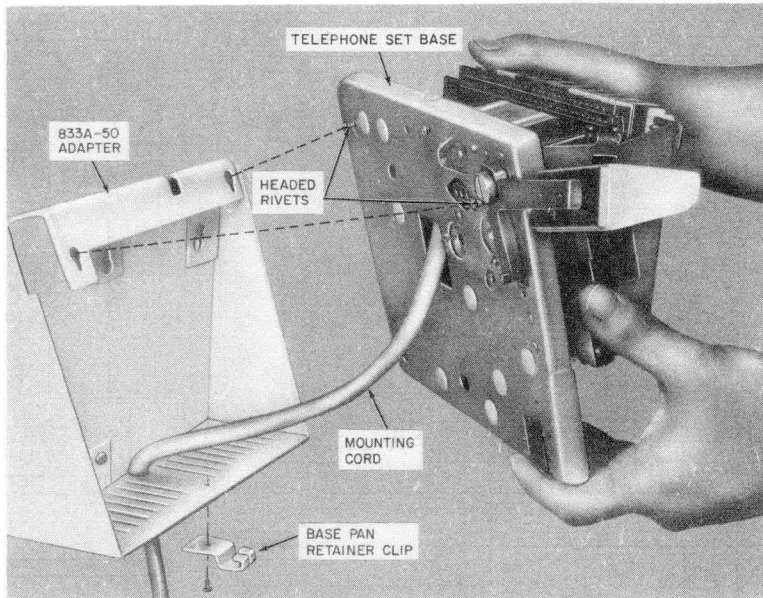


Fig. 5—Mounting Telephone Set Base onto 833A-50 Adapter

TABLE A

TELEPHONE SETS AND REPLACEABLE COMPONENTS—ORDERING GUIDE

TEL SET	BASE	HOUSING	DIAL	KEY	FACE-PLATE*	HAND-SET	HANDSET CORD	LAMP
832BM	832BM	832A-50	8CA	647G5 651F	832B-	G15A-50	H4DU-50	51A
832CM	832CM	832A-50	8CA	647G5 647S5	833A-			
832DM	840998710	6C1-50	8CA	647G5 651F	832B-			
832EM	840998736	6C1-50	8CA	647G5 647S5	833A-			
2832BM	2832BM	832A-50	35AF3A	647G5 651F	2832B-			
2832CM	2832CM	832A-50	35AF3A	647G5 647S5	2833A-			
2832DM	840998728	6C1-50	35AF3A	647G5 651F	2832B-			
2832EM	840998744	6C1-50	35AF3A	647G5 647S5	2833A-			

\* See Table B for color suffix.

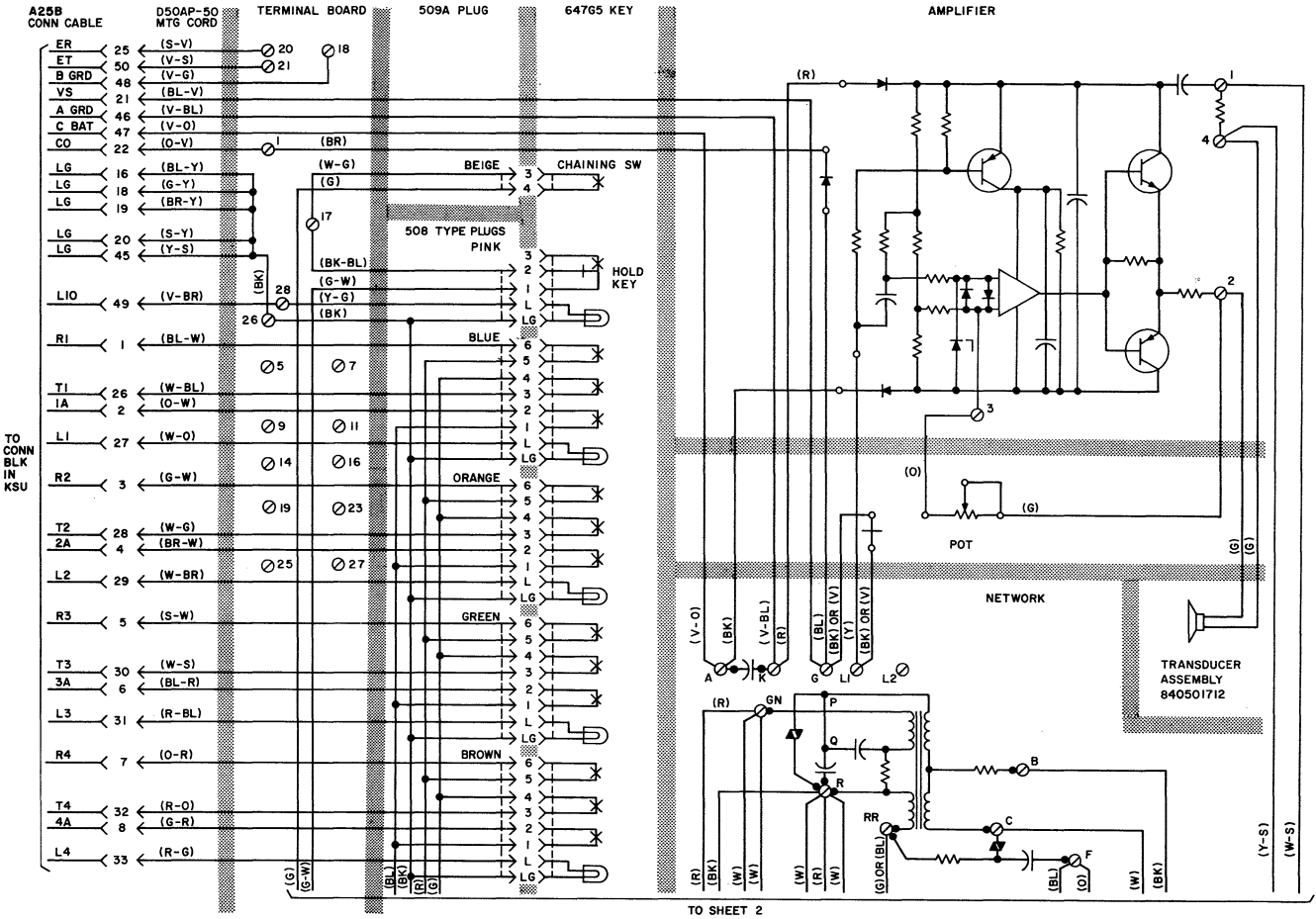


Fig. 6—832A (MD) Telephone Set, Connections (Sheet 1 of 2)





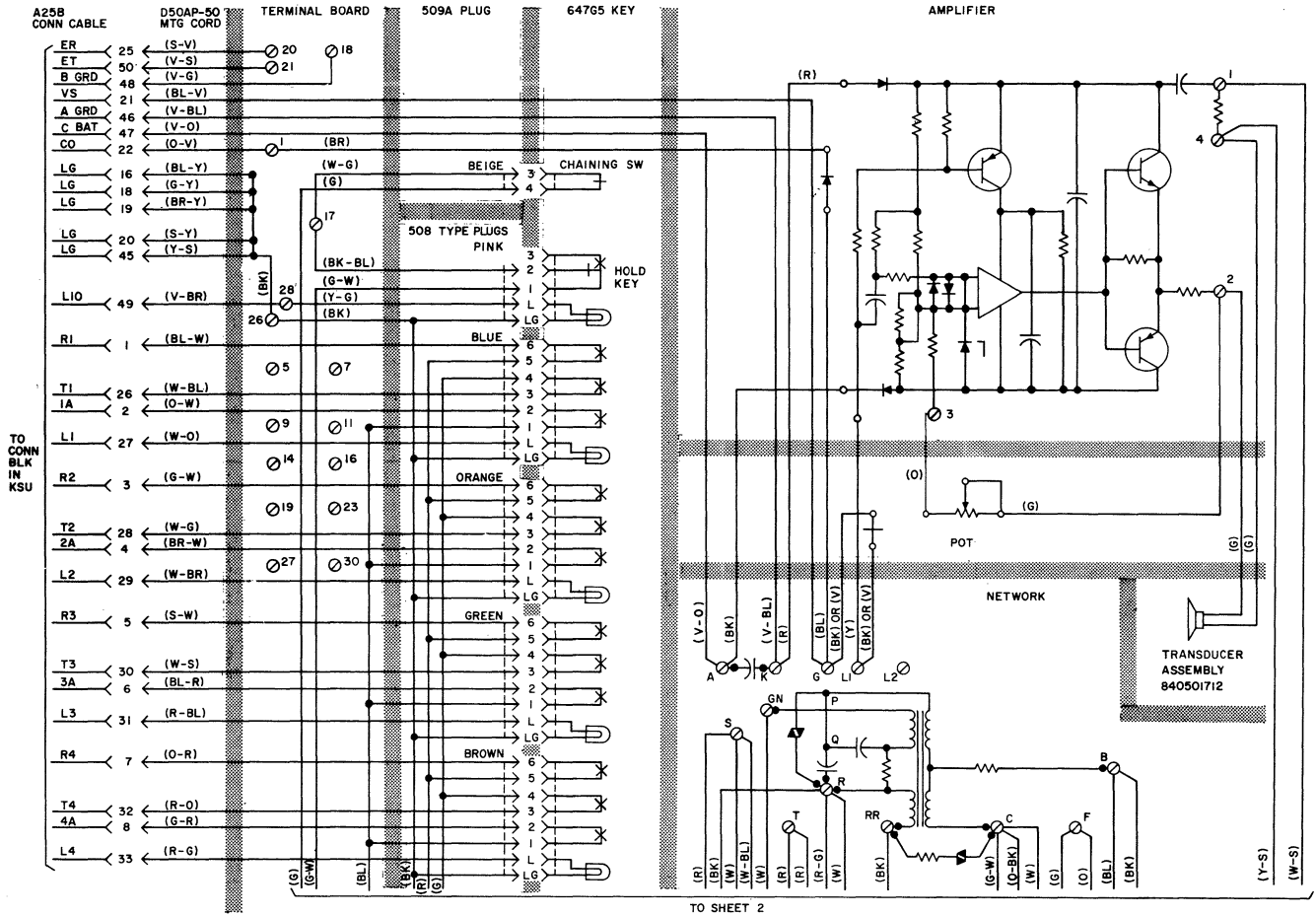


Fig. 7—2832A (MD) Telephone Set, Connections (Sheet 1 of 2)

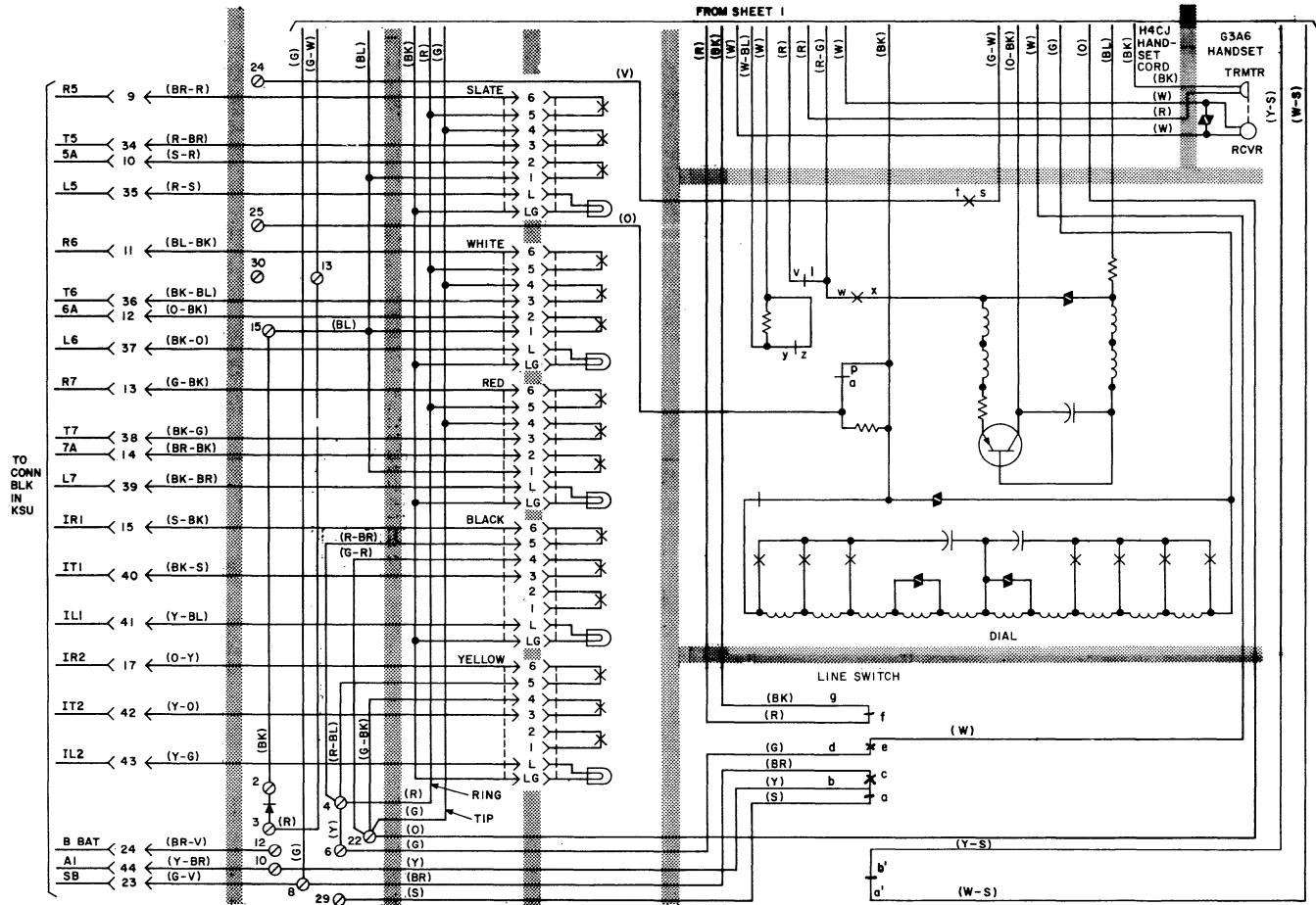
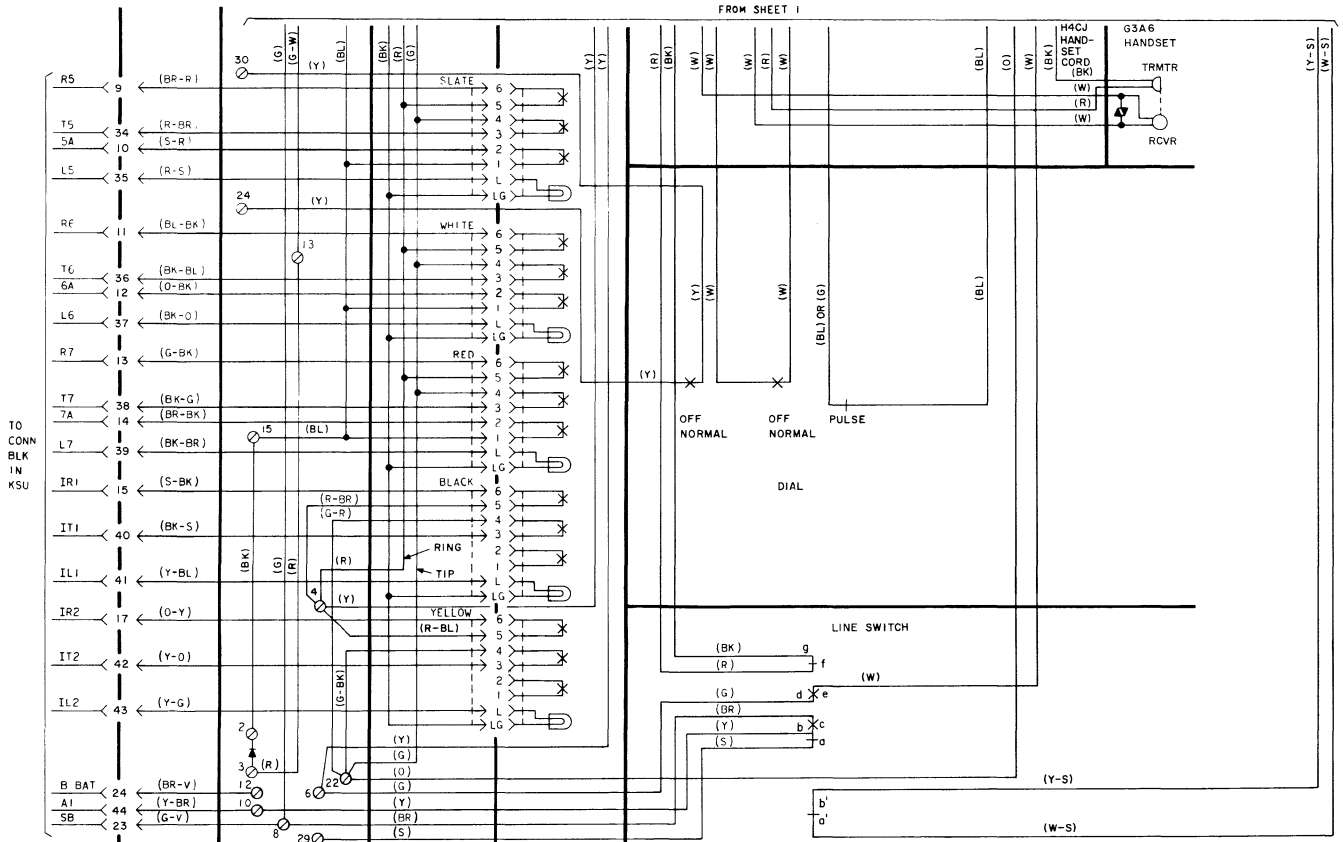


Fig. 7—2832A (MD) Telephone Set, Connections (Sheet 2 of 2)



Fig. 8—832B (MD) Telephone Set, Connections (Sheet 2 of 2)



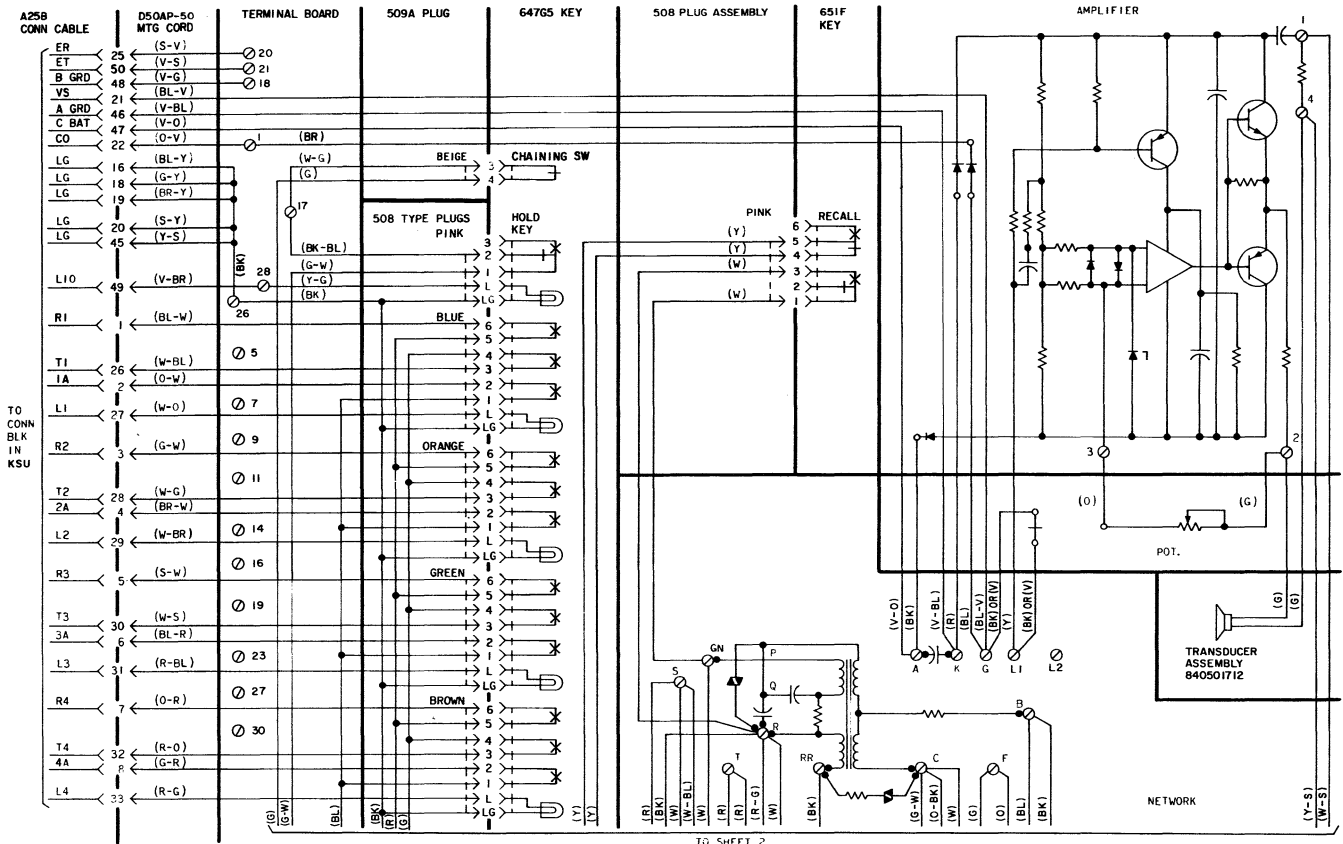


Fig. 9—2832B (MD) Telephone Set, Connections (Sheet 1 of 2)

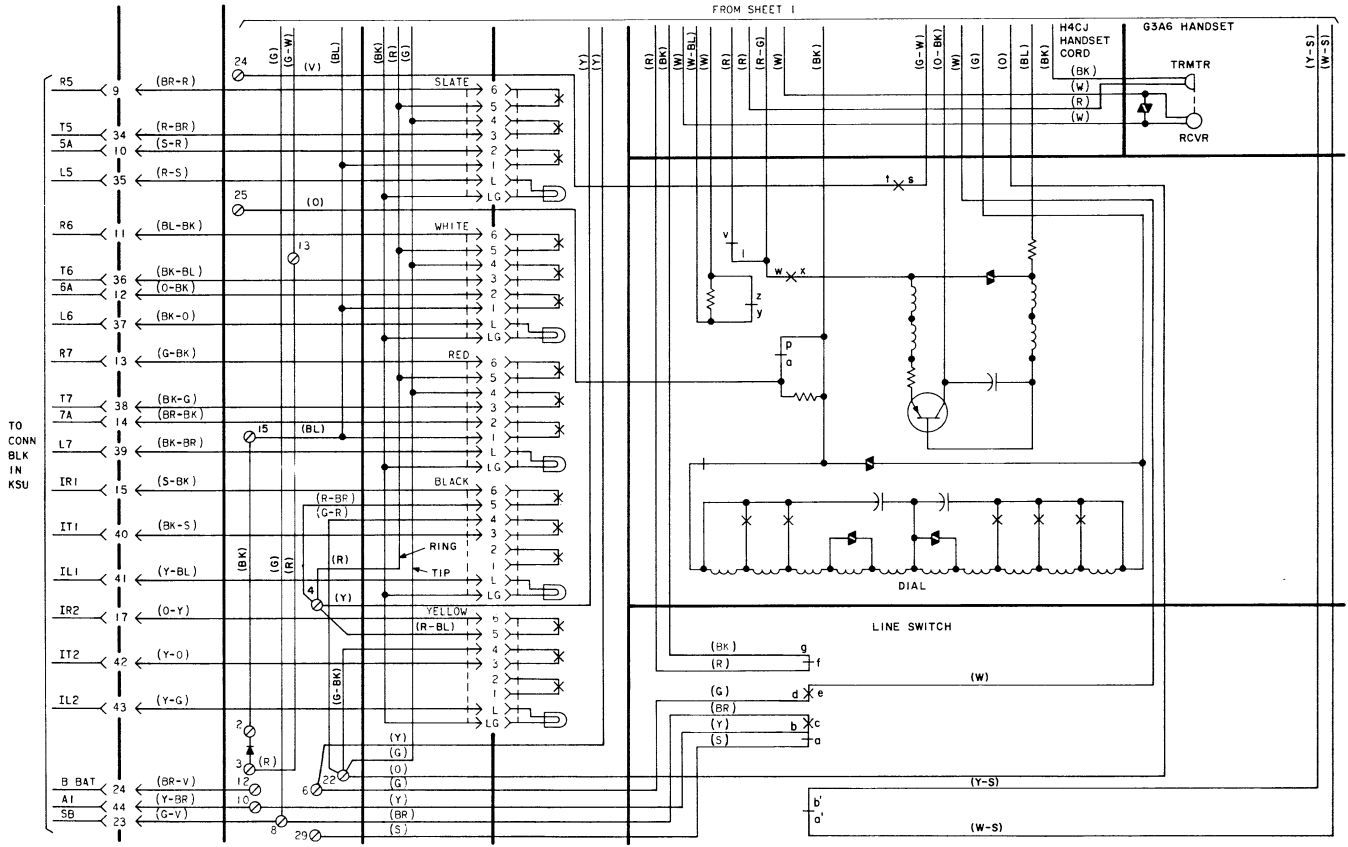


Fig. 9—2832B (MD) Telephone Set, Connections (Sheet 2 of 2)

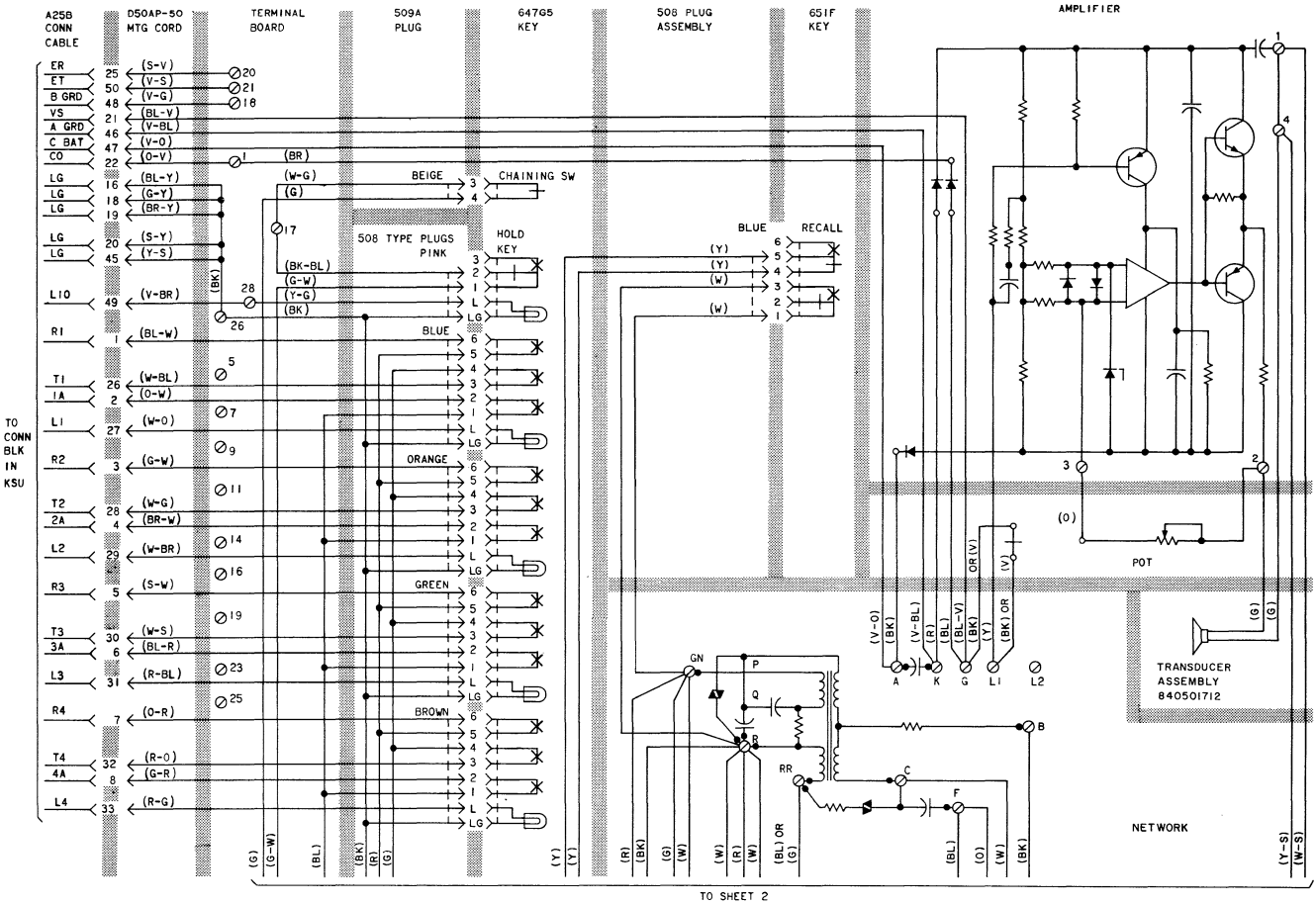


Fig. 10—832BM or 832DM Telephone Set, Connections (Sheet 1 of 2)







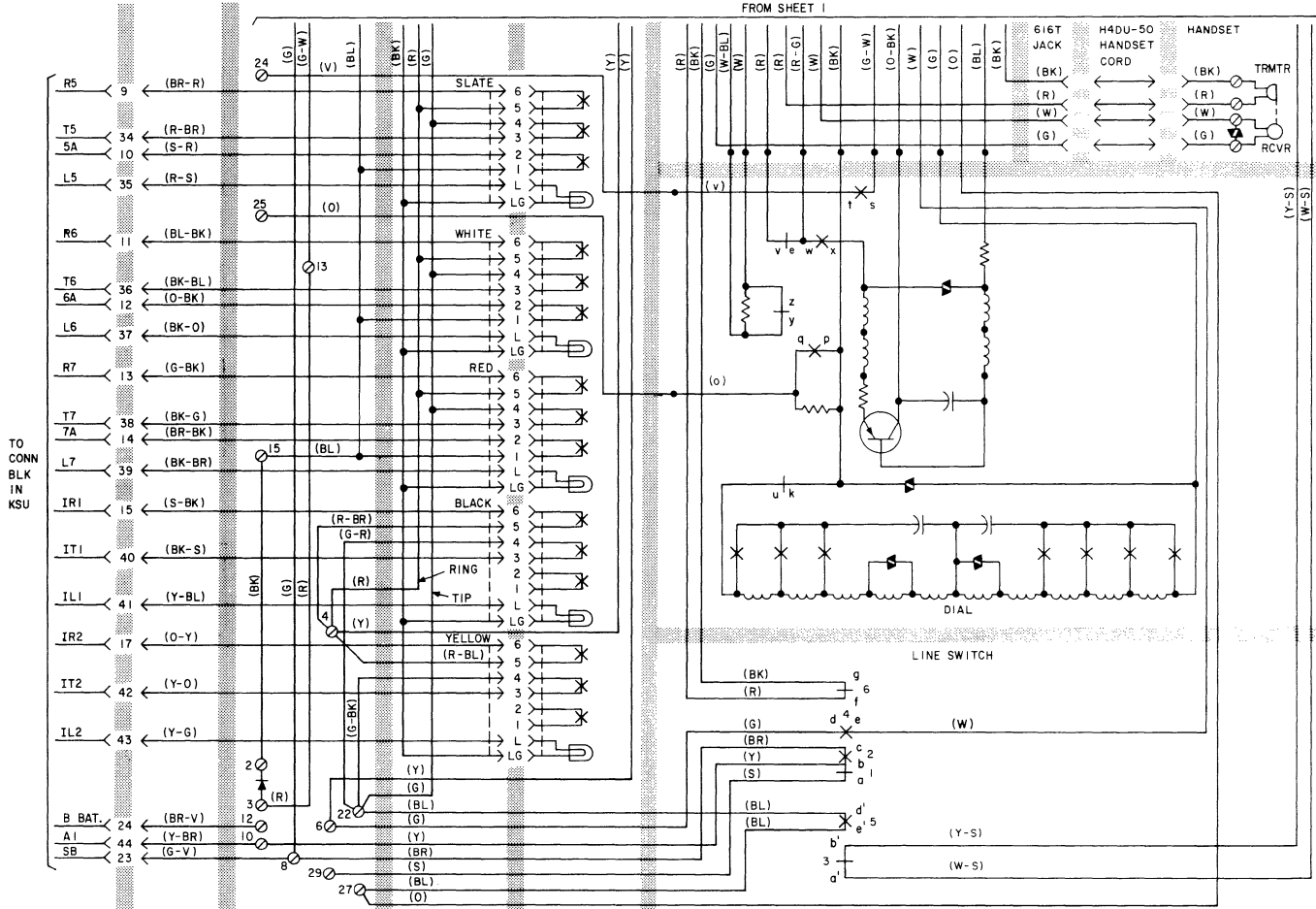


Fig. 11—2832BM or 2832DM Telephone Set, Connections (Sheet 2 of 2)

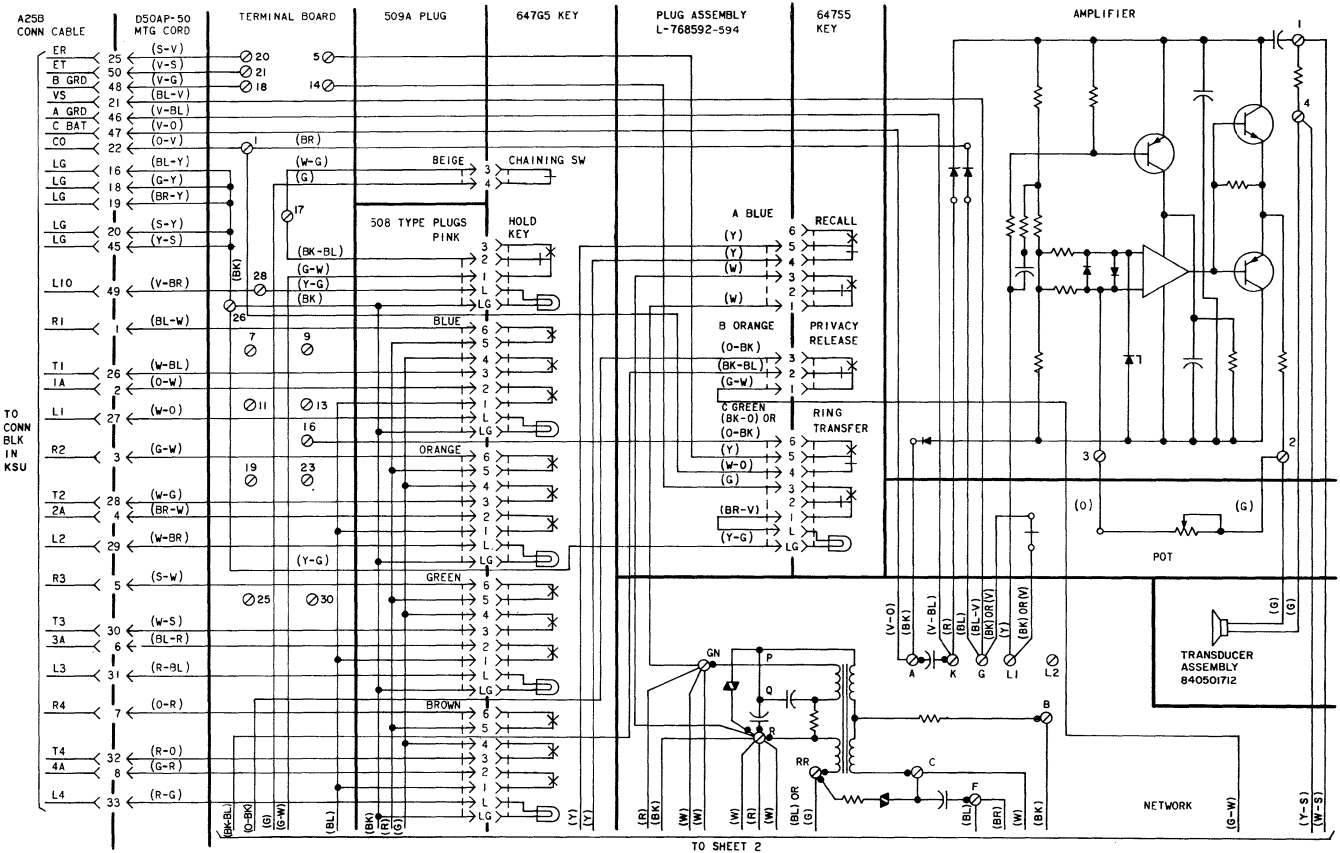


Fig. 12—832C (MD) Telephone Set, Connections (Sheet 1 of 2)

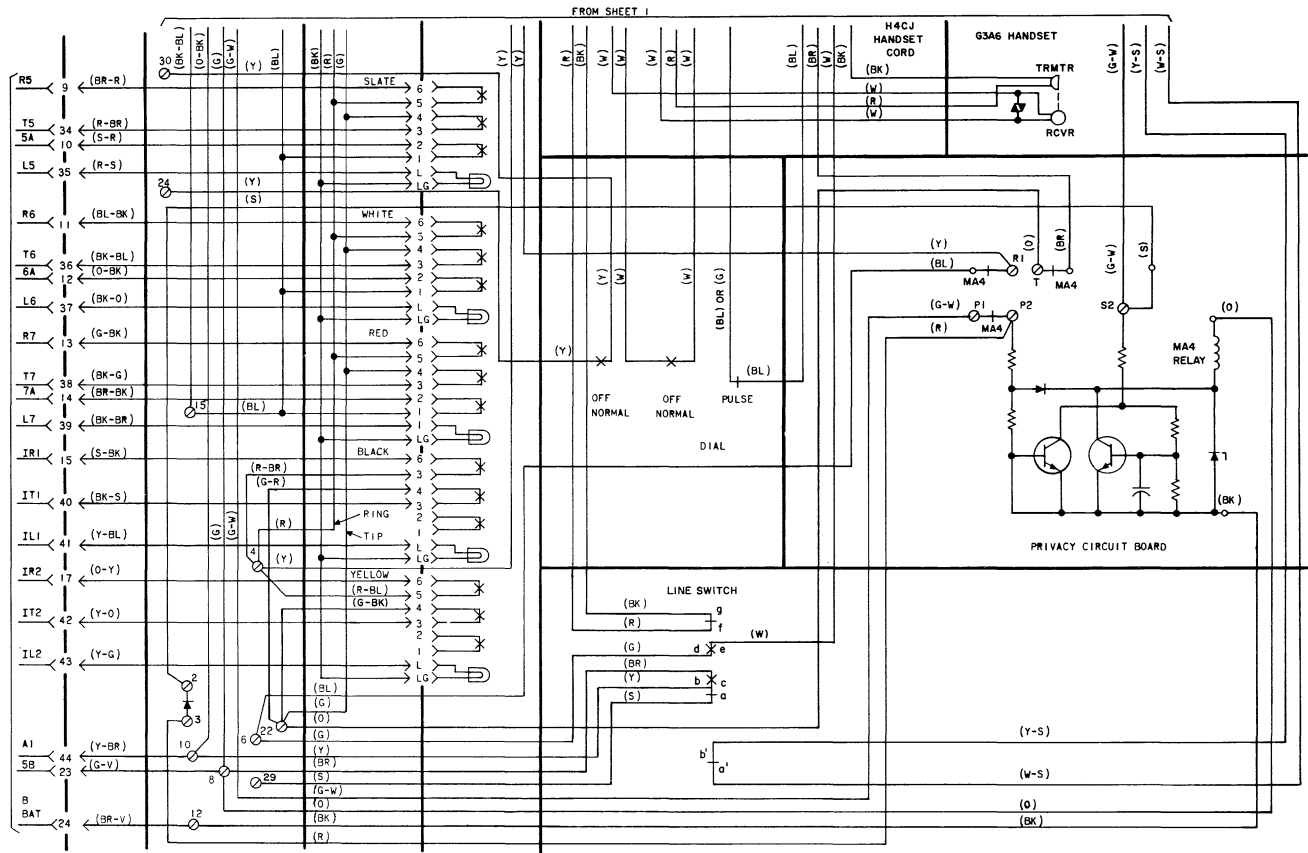


Fig. 12—832C (MD) Telephone Set, Connections (Sheet 2 of 2)

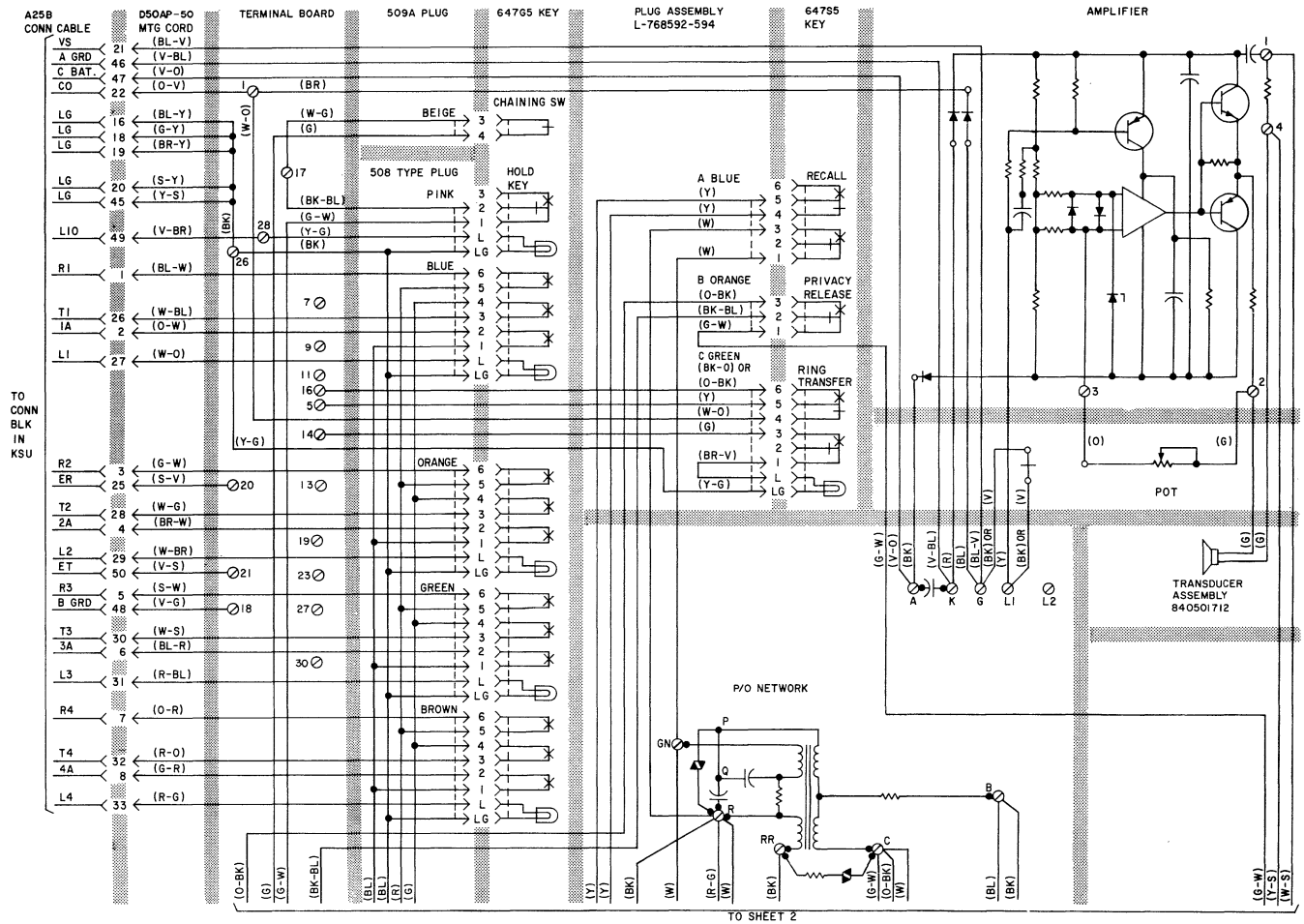


Fig. 13—2832C (MD) Telephone Set, Connections (Sheet 1 of 2)



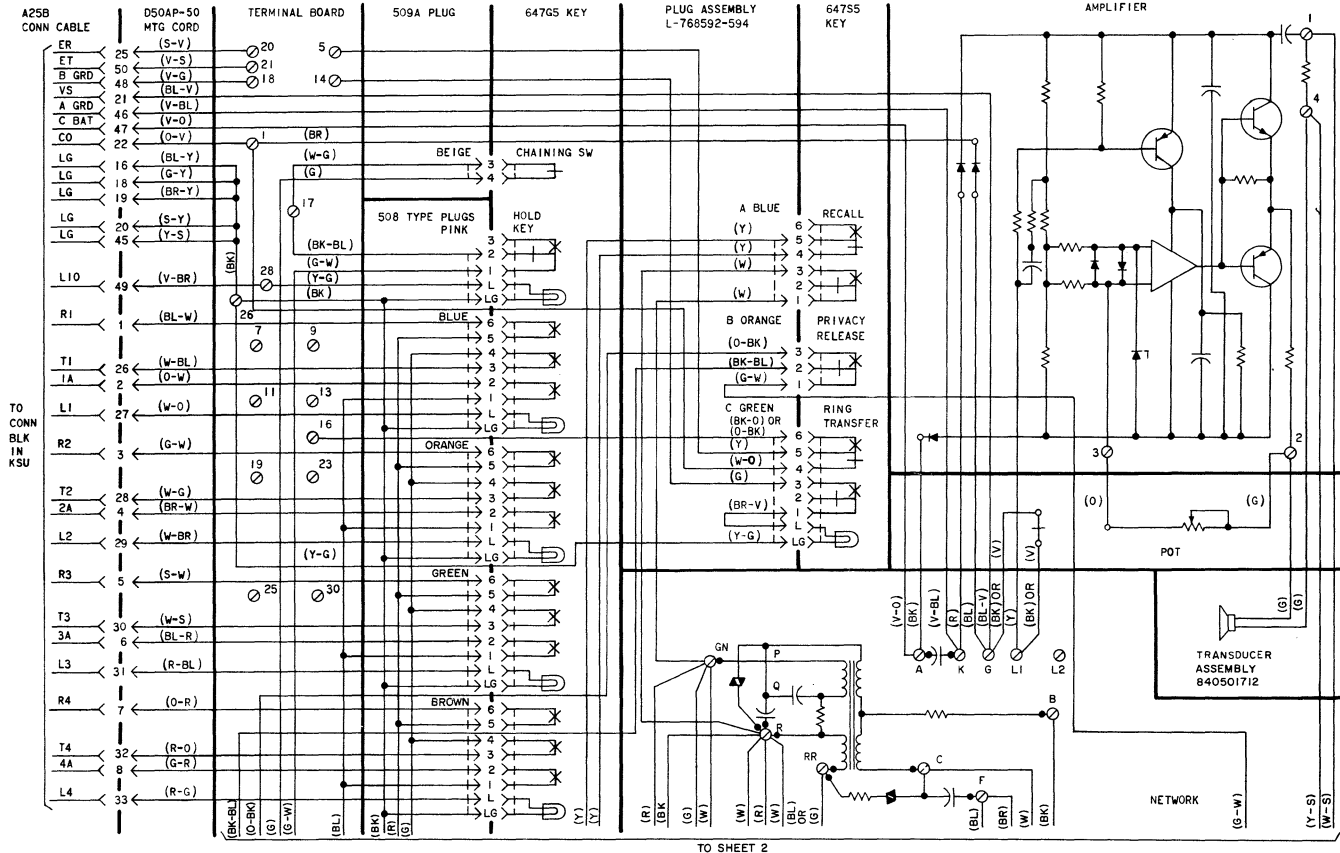


Fig. 14—832CM or 832EM Telephone Set, Connections (Sheet 1 of 2)



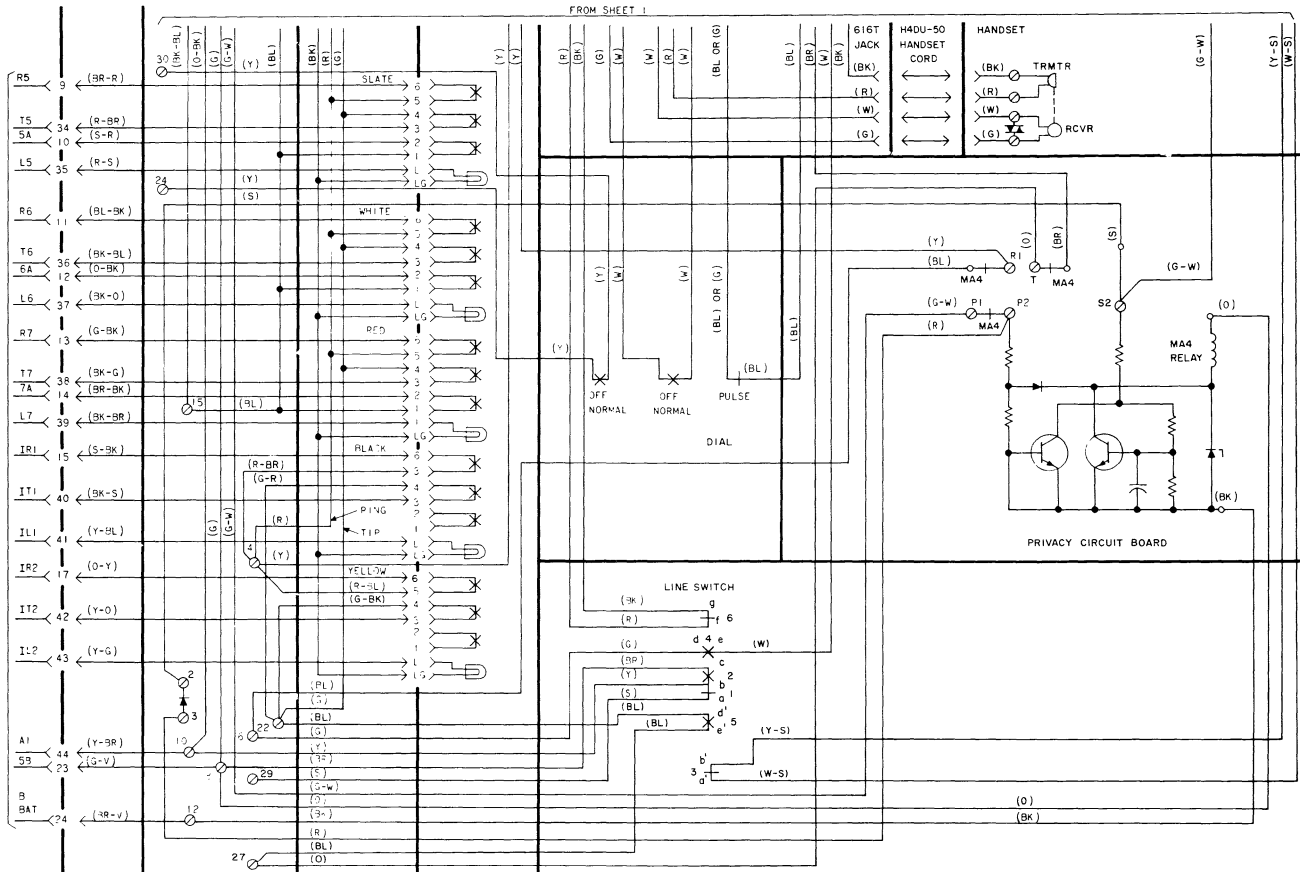


Fig. 14—832CM or 832EM Telephone Set, Connections (Sheet 2 of 2)

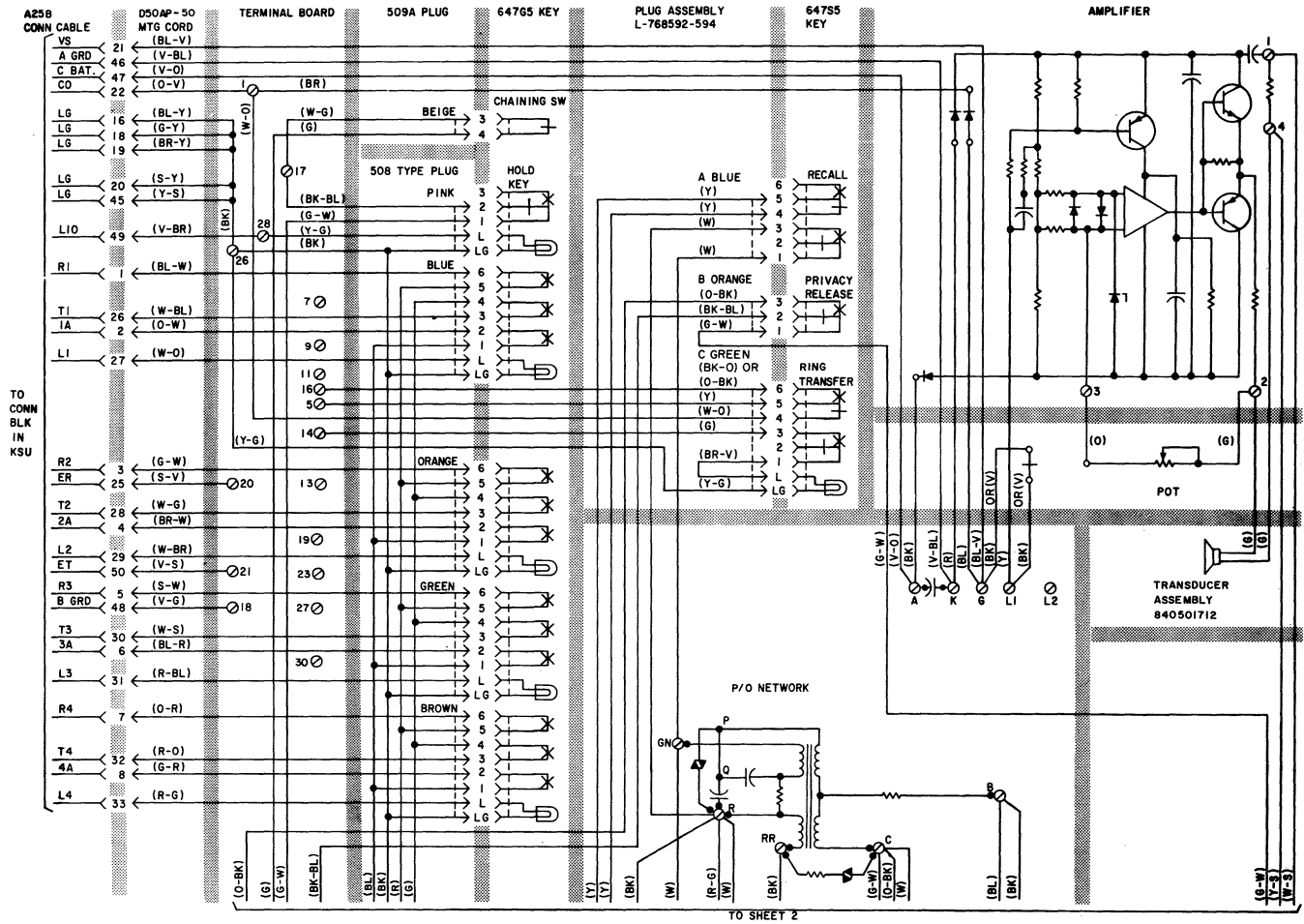


Fig. 15—2832CM or 2832EM Telephone Set, Connections (Sheet 1 of 2)¶

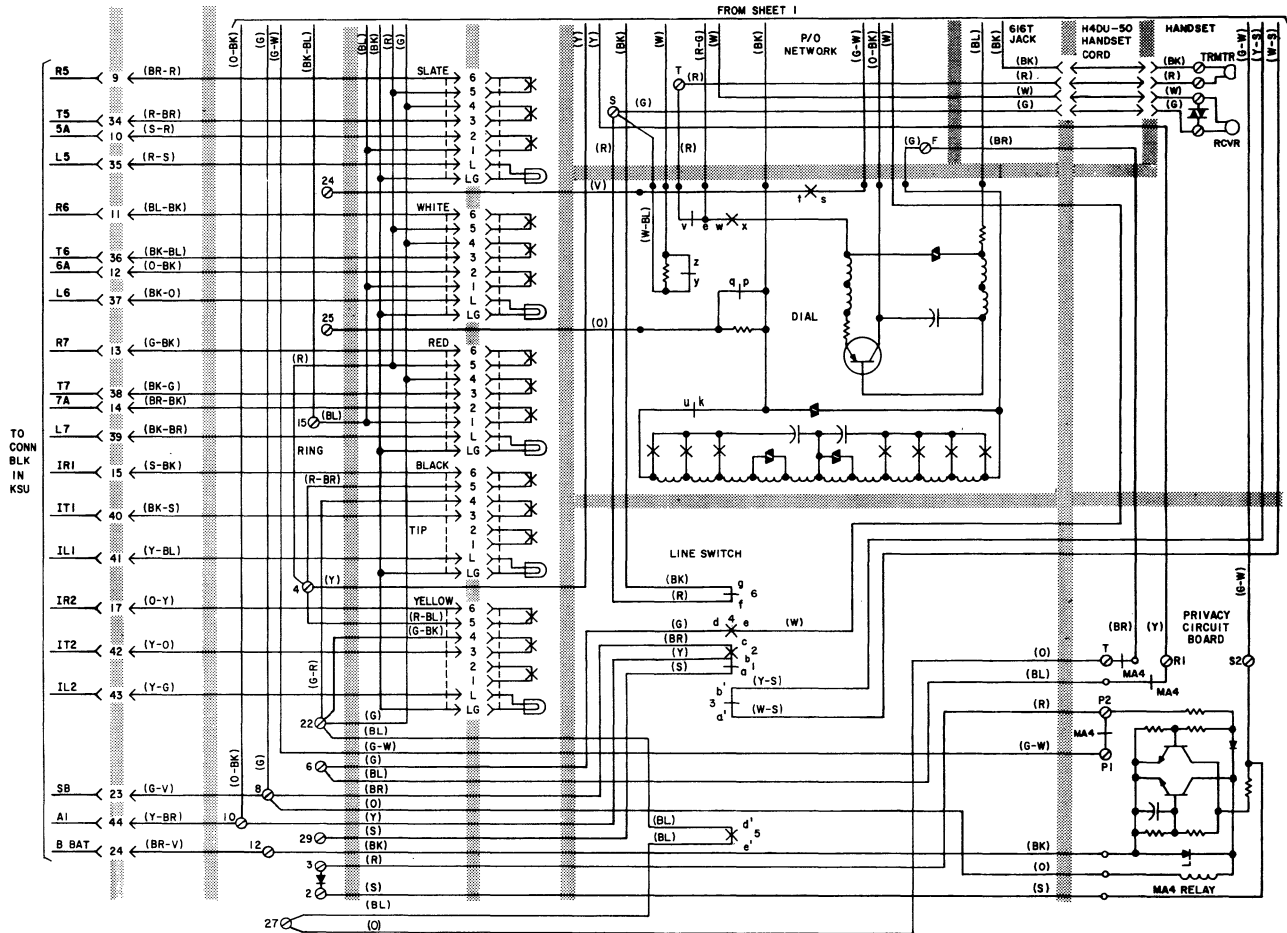


Fig. 15—2832CM or 2832EM Telephone Set, Connections (Sheet 2 of 2)

TABLE B

## COLOR ORDERING GUIDE

TEL SET	HOUSINGS, HANDSETS, AND HANDSET CORDS		FACEPLATES*	
	SUFFIX	COLOR	SUFFIX	COLOR
832BM, 2832BM, 832CM, 2832CM, 832DM, 2832DM, 832EM, 2832EM	-50	Ivory	-100	Avocado
			-108	Teak
			-109	Walnut
			-111	Gold
			-112	Orange
			-113	Brown
			-114	Red
			-115	Blue
		-118	Black	

\* Faceplates must be ordered separately (Table A).

**TABLE C**  
**832B, BM, DM, EM, 2832B, BM, DM, AND EM TELEPHONE SET CONNECTIONS FOR PRIVACY CIRCUIT**  
**(D-180486 KIT OF PARTS)**

TEL SET LEAD COLOR	PRIVACY BOARD LEAD COLOR	CONNECT TO TEL SET TERM.	MOVE LEAD	
			FROM TEL SET TERM.	TO PRIVACY BOARD TERM.
R			13	P2
G-W			13	P1
Y			6	R1
O			F on net.	T
	O	8		
	BR	F on net.		
	S	15		
	BK	12		
	BL	6		

TABLE D

**832A AND 2832A TELEPHONE SET CONNECTIONS  
FOR PRIVACY RELEASE KEY (D-180488 KIT OF PARTS)**

TEL SET LEAD COLOR	PRIVACY BOARD LEAD COLOR	PRIVACY RELEASE KEY LEAD COLOR	CONNECT TO TEL SET TERM.	MOVE LEADS	
				FROM TEL SET TERM.	TO PRIVACY BOARD TERM.
BK			2*	15	S2
	S†			15	S2
		O-BK	10		
		BK-BL	15		
		G-Y	27		
		Y-G	27		
		G-W	2*		S2

\* If telephone set does not have privacy circuit.

† If telephone set has privacy circuit and privacy release is now being added.

TABLE E

## TO DISABLE PRIVACY CIRCUIT

COLOR	MOVE LEAD IN TEL SET	
	FROM TERM.	TO TERM.
O	8	*
BK	12	*

\* Insulate and store.

TABLE G

RINGER (E1C) CONNECTIONS FOR POWER FAILURE  
TRANSFER FEATURE

CONNECT LEADS*	
FROM TEL SET TERM.	TO RINGER TERM.
20	5
21	6

\* Use inside wire.

TABLE F

## TO DISABLE PRIVACY RELEASE KEY

COLOR	MOVE LEAD IN TEL SET	
	FROM TERM.	TO TERM.
O-BK	10	15

TABLE H

832A OR 2832A TELEPHONE SET CONNECTIONS  
FOR RING TRANSFER (D-180487 KIT OF PARTS)

RING TRANSFER KEY LEADS	TEL SET TERM. BOARD		
	COLOR	REMOVE LEAD FROM	CONNECT LEAD TO
COLOR			
G			14
V-BR			27
O-BK or BK-O			16
W-O			1
Y			5
Y-G			26
BR-V			9
G-Y			
	O-V	1	5
	V-BR	28	14
	G-V	8	16

TABLE I

832C, CM, EM, 2832C, CM, OR EM TELEPHONE  
SET CONNECTIONS FOR RING TRANSFER

TEL SET TERM. BOARD		
COLOR	REMOVE LEAD FROM	CONNECT LEAD TO
O-V	1	5
V-BR	28	14
G-V	8	16

TABLE J

832A AND 2832A TELEPHONE SET  
CONNECTIONS FOR RECALL

651F KEY LEADS	CONNECT TO	
	NET TERM.	TEL SET TERM. BOARD
COLOR		
W	GN	
W	R	
Y		4
Y		6

**Note:** Remove (Y) strap from terminals 4 and 6 of telephone terminal board.

♦TABLE K♦  
 683AE TRANSMITTER CONNECTIONS FOR HFAI (SEE  
 NOTE)

FROM 683AE TRANSMITTER	CONNECT TO TELEPHONE SET	
	TERM. BOARD	NET. TERM.
W-BL	26	
BL-W	18	
W-O	21	
O-W	20	
W-G		G
G-W		L2*
W-BR		A
BR-W		K

\*Remove (BL-V) from G of network and connect to L2 of network.

*Note:* HFAI feature initially available with COM KEY 2152 only.



## 833- AND 2833-TYPE TELEPHONE SETS

### IDENTIFICATION, INSTALLATION, CONNECTIONS, AND MAINTENANCE

#### 1. GENERAL

**1.01** This section contains information for the 833- and 2833-type telephone sets. The 833- (rotary dial) and 2833- (TOUCH-TONE® dial) type key telephone sets are special plug-ended 20-button key telephone sets, initially designed for use with the 14A Communication System, (COM KEY\* 1434). May also be used with 21A Communication System (COM KEY 2152). For information on COM KEY Systems, refer to the appropriate section in Division 518.

**1.02** This section is reissued to:

- Revise Fig. 5 through 12 to add lead colors and detached contacts for keys
- Add 840501712 transducer assembly
- Show 533K diode replaces 446F diode, station restriction (833-type telephone set)
- Revise Table D.

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

#### 2. IDENTIFICATION

**2.01** The 833BM, 2833BM, 833CM, and 2833CM (Fig. 1) are modular type telephone sets and will replace the 833B, 2833B, 833C, and 2833C telephone sets, respectively, which are hereby rated MD. The 833DM, 2833DM, 833EM, and 2833EM are also modular sets and are electrically and functionally equivalent to the 833BM, 2833BM, 833CM, and 2833CM sets, respectively, except that

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they have been adapted for wall mounting. The modular sets will all be equipped with a G15A-50 handset and H4DU-50 handset cord which will plug into a 616T jack mounted on the left front of the telephone set base (Fig. 2). Current production models of these sets also are equipped with an improved line switch and an automatic button restoral (ABR) feature. Some early production BM and CM sets were not so equipped.

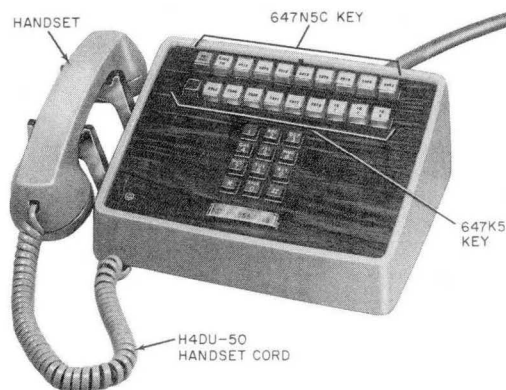


Fig. 1—2833CM Telephone Set

**2.02** The 833B (MD), or 833BM, 833DM and 2833B (MD), or 2833BM, 2833DM telephone sets are equipped with a 647K5 key in the lower key position consisting of a hold button, six line buttons, and three intercom buttons. A 647P5C key is located in the upper key position consisting of a RECALL button, a Privacy Release (PRIV RLS) button, and eight line buttons. The privacy circuit board is factory installed and wired (Fig. 2).

#### NOTICE

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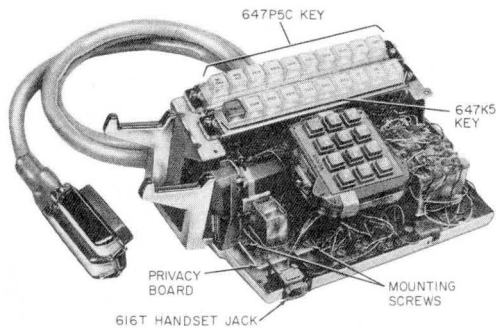


Fig. 2—2833BM Telephone Set Base

**2.03** The 833C (MD) or 833CM, 833EM and 2833C (MD) or 2833CM, 2833EM telephone sets are similar to the above sets except a 647N5C key is located in the upper key position consisting of a RECALL button, a RING TRANSFER button (not connected), and eight line buttons. The RING TRANSFER button must be wired in the field when ring transfer option is provided (Table E).

**Note:** In early production 833C and 2833C telephone sets the RING TRANSFER key was factory wired.

**2.04** The DM and EM (wall type) sets and BM and CM (desk type) sets are not interchangeable due to the mechanical changes in the handset hanger and the new 6C1-50 housing.

**2.05** An adapter (833A-50) will be furnished with each DM and EM telephone set for wall mounting. The switchhook of these sets has been designed to hang vertically to the left of the housing. The sets are equipped with a hard-wired mounting cord which can be coiled up and concealed in the adapter or the cord can be extended down the wall through a notch in the adapter for termination to appropriate connector-ended cable. All maintenance can be performed on internal components of these sets without removing the set from the wall.

**2.06** All of the 833- and 2833-type sets provide the same basic services such as pickup, hold and illumination, and intercom. They are equipped with a loudspeaker to provide tone and voice

signaling. The level of the tone is adjusted by a volume control knob located under the right side of housing. Two or more CO/PBX lines may be conferenced by simultaneously depressing the buttons associated with the lines to be conferenced. The three intercom lines may also be conferenced. Intercom and CO/PBX lines cannot be conferenced. Automatic button restoration restores all depressed buttons to the unoperated positions when the handset is replaced.

**2.07** Multiline conferencing is a feature of these telephone sets. Since there is no amplification involved, this type conferencing is limited. When lines are conferenced, using this manner of conferencing, distant stations may have trouble hearing each other and transmission is not guaranteed.

**2.08** The 833- and 2833-type telephone sets may be used with either the 3-type (MD) or 4A speakerphone system.



*The limited number of mounting cord conductors places a restriction on the location of 3-type (MD) speakerphone components unless it is desired to give up one pickup line. Refer to Section 512-620-487 or 512-740-471 for connection information for the 3-type (MD) or 4A speakerphone system.*

**2.09** The 833- and 2833-type telephone sets are available in Ivory (-50) only. These sets will be shipped with a disposable faceplate, so it is necessary to order the proper 833A or 2833A faceplate separately (Table B).

**2.10** Any station set may be optionally wired to ring on one CO/PBX line only or for common audible ringing.



*When common audible ringing is wired to a station other than the attendant station (Code 0), that station cannot have the ring transfer option.*

#### Ordering Guide

**2.11** For telephone set and replaceable component ordering guide, refer to Table A. See Table B for color and faceplate ordering information.

TABLE A

TELEPHONE SETS AND REPLACEABLE COMPONENTS  
ORDERING GUIDE

TEL SET	BASE	HOUSING	DIAL	KEY	FACE-PLATE*	HANDSET	HANDSET CORD	LAMP			
833BM-50	833BM	832A-50	8C or 8CA	647P5C 647K5	833A-	G15A-50	H4DU-50	51A			
833CM-50	833CM			647N5C 647K5							
833DM-50	840998678	6C1-50		647P5C 647K5							
833EM-50	840998694			647N5C 647K5							
2833BM-50	2833BM	832A-50	35AF3A	647P5C 647K5	2833A-				G15A-50	H4DU-50	51A
2833CM-50	2833CM			647N5C 647K5							
2833DM-50	840998686	6C1-50		647P5C 647K5							
2833EM-50	840998702			647N5C 647K5							

\* See Table B for color suffix.

**2.12** The following optional apparatus may be associated with desk type 833 and 2833 sets (order as required):

- D-180656 Kit of Parts [to provide a wall shelf mounting arrangement] consists of the following:

1—840362446 shelf

1—840362479 clamp

1—801812553 screw

- Diode 533K or equivalent (order one for each rotary dial station to be restricted)
- 870A1 or 2870A1 TOUCH-A-MATIC® adjunct, for connections refer to Section 501-164-201
- 4A Speakerphone (order one each of the following for each station to be equipped with speakerphone). For additional information on 4A components, refer to Section 512-700-100.

Loudspeaker, 108AA-†† (includes 7 foot D20N mounting cord)

Transmitter, 680AE-†† (includes 7 foot D8S mounting cord)

Adapter, 223D (includes 7 foot M16H and 25 foot M2FG cord)

Unit, Power, 85B1-49

- Ringer, E1CM (one for each CO/PBX line to be wired for power failure transfer)
- D-180486 Kit of Parts (privacy circuit board), order one for each station to be locked out. Can be added to the 833C, CM, EM, 2833C, CM, or EM telephone set.
- Transmitter, 683AE-50 (for HFAI feature of COM KEY 2152)
- Adapter, 268A (for mounting 683AE-50 transmitter when using DM or EM type telephone sets).

† Add color suffix.

‡ The transmitter and loudspeaker set will be shipped in one of four promoted colors, Black (-03), Green (-51), White (-58), and Light Beige (-60). For ivory components, it will be necessary to also order a D-180508 Kit of Parts.

### 3. INSTALLATION AND CONNECTIONS

**3.01** Install telephone sets at desired locations, making sure that any options are installed before telephone set is connected. See Fig. 5 through 12 for schematics of 833B, 833BM, 833DM, 2833B, 2833BM, 2833DM; 833C, 833CM, 833EM, and 2833C, 2833CM, 2833EM telephone sets, respectively.

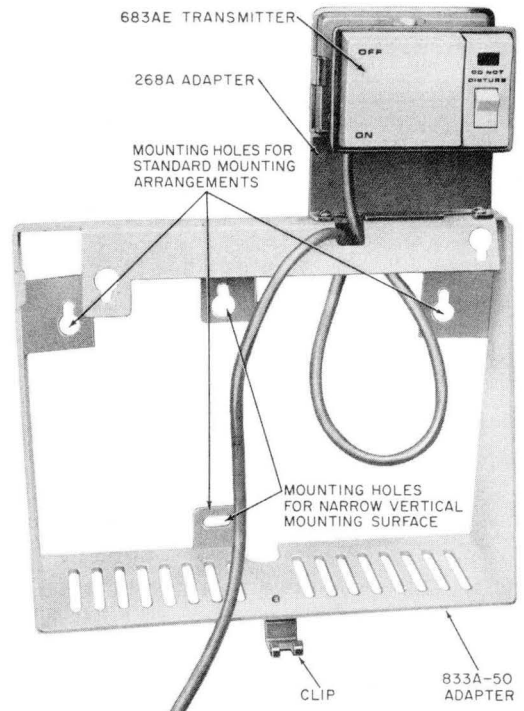
**3.02** All DM and EM (wall type) sets are shipped with an 833A-50 adapter, screw, and clip (Fig. 3) which are used for mounting the telephone set to a vertical surface. Install the 833A-50 adapter and telephone set as follows.

- (1) Mount the adapter to the wall or vertical surface as shown in Fig. 3, using appropriate fasteners (Section 080-720-105). If the mounting cord is to be dressed down the wall, it is necessary to pass the cord through the notch in the adapter before final attachment of the adapter to the wall (Fig. 4). If the cabling enters through the wall, the mounting cord may be contained within the adapter.
- (2) Remove faceplate and housing from telephone set.
- (3) Hang the telephone set on the adapter from the headed rivets that protrude from the base pan (Fig. 4).

**Note:** It may be necessary to slightly bend the top slotted portion of the adapter so the headed rivets of the base pan will align properly.

- (4) Secure the telephone set base with the clip, and screw at the bottom of the adapter (Fig. 3).
- (5) Install telephone set options (see paragraph 3.05).
- (6) Replace housing and faceplate.

**3.03** A D-180656 Kit of Parts may be ordered separately for shelf mounting of all B, BM, C, or CM sets. The 840362446 shelf should be mounted to a wall or vertical surface and, after placing the telephone set on the shelf, secure set with retainer clamp and screw furnished with the shelf.



**Fig. 3—833A-50 Adapter with 268A Adapter and 683AE Transmitter**

**3.04** To install telephone set options the faceplate and housing must be removed and the dial lifted from its mounting brackets. Use a KS-21107L1 releaser or equivalent to release the faceplate catch.

**Caution:** The ten button key(s) in this set is equipped with special low-friction plastic parts. Special care is required when removing or replacing these keys to avoid cracking or breaking the plastic hooked end of the latchbar projecting from the end of the key. When removing a key, avoid twisting or distorting the hook. When installing a key, make sure the hook is properly engaged over the edge of the pivot arm before tightening the mounting screws of the key.

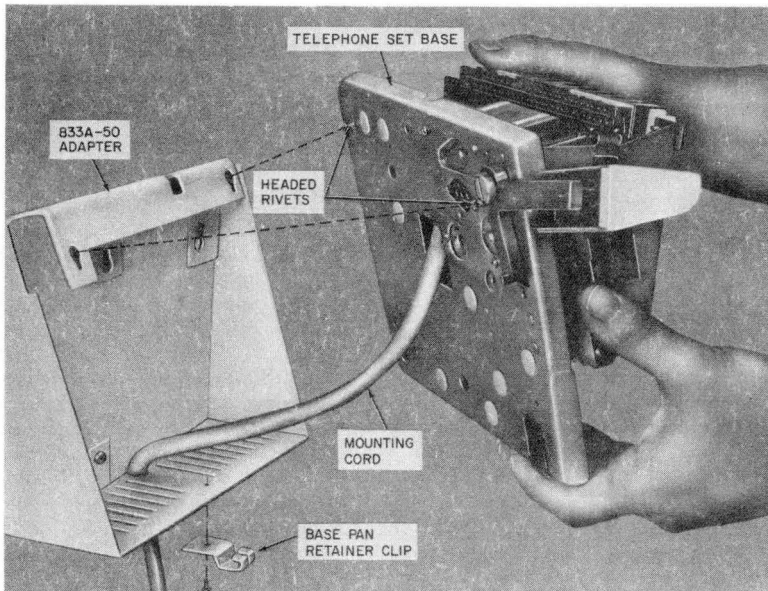


Fig. 4—Mounting Telephone Set Base onto 833A-50 Adapter

**Caution:** When making wiring changes in this set involving adding or moving spade tipped leads on the terminal board (e.g., privacy option), extreme care must be taken to prevent shorting between terminal positions. Check for clearance before reinstalling the dial.

3.05 Options are installed as follows:

(a) **Station Restriction (833-type telephone set):**

(1) Install 533K or equivalent diode between network terminals RR and F. Terminate negative lead of diode on terminal F (arrow on diode pointing toward F), with positive lead on terminal RR.

(2) On telephone set terminal board, move two (G) leads from terminal 22 to 4 and move two (R) leads from terminal 4 to 22.

(b) **Station Restriction (2833-type telephone set):** On telephone set terminal board, move two (G) leads from terminal 22 to 4 and move two (R) leads from terminal 4 to 22.

(c) **Privacy Circuit 833C, 833CM, 833EM, or 2833C, 2833CM, 2833EM (D-180486 Kit of Parts):**

- (1) Mount privacy circuit board on the two standoffs located at the left front of the telephone set base (Fig. 2) using mounting screws furnished with the telephone set.
- (2) Refer to Table C for connections.
- (3) To test privacy circuit refer to 3.06.

(d) **Disable Privacy Circuit (D-180486 Kit of Parts) 833-type telephone sets:** Remove (O) and (BR) leads of privacy circuit from the telephone set terminal 8 and 12, respectively, and insulate and store.

- (e) **To Disable PRIV RLS (part of top key) 833B, 833BM, 833DM or 2833B, 2833BM, 2833DM telephone sets:** Move (O-BK) lead of privacy release key from telephone set terminal 10 to 15, see Table G.
- (f) **RING TRANSFER (833C, 833CM, 833EM or 2833C, 2833CM, 2833EM telephone set only):**

- (1) Refer to Table E for connections.
- (2) Refer to Section 518-450-102 for KSU strap addition.

**Note:** Early version of the 833C and 2833C telephone sets had the RING TRANSFER feature factory wired. Current 833C, 833CM, 833EM and 2833C, 2833CM, 2833EM telephone sets are not factory wired for RING TRANSFER.

- (g) **HANDS-FREE ANSWER INTERCOM (HFAI):**

- (1) If feature is to be added to DM- or EM-type set, a 268A adapter must be used as follows:
  - (a) Mount 268A adapter onto 833A-50 adapter with two screws as shown in Fig. 3 with the tabs of the 268A adapter facing outward from the vertical surface. The 683AE-50 transmitter is secured by sliding the transmitter downward between the tabs on the adapter. The telephone set end of the transmitter cord enters the telephone set and is attached to the telephone set base at the small notch on the top edge of the base panel. The excess cord is stored in the 833A-50 adapter.
  - (2) For B/BM or C/CM (desk type) sets, the transmitter cord will enter at the rear of the set.
  - (3) Refer to Table D for connections.

**Note:** It may be necessary to slightly reduce the volume of the 683AE transmitter if distortion or feedback is noticed when the HFAI feature is used.

### 3.06 Privacy Circuit/Privacy Release Test:

- (a) Busy out a line using another station (Station X). At the set with the privacy circuit to be tested (Station Y) go off-hook on that line. Station Y should be locked out. Hang up Station Y.
- (b) If Station X has a privacy release key, depress it. The lamp under the busy line will indicate it is on-hold. Station Y should now be able to pickup the line on hold. Release the privacy release button, Station X and Y should now be bridged. Hang up Station Y.
- (c) If Station X does not have a privacy release key or a privacy circuit he can allow Station Y in on the line by just placing the line on-hold ie, depressing the hold button (this also releases the line button). Station Y should now be able to pick up the line on hold. Now depress the same button at Station X; the stations should be bridged. Hang up Station Y.
- (d) If Station X does not have a privacy release key but does have a privacy circuit he cannot allow Station Y to bridge onto the call without excluding himself.
- (e) With the line still busied out by Station X and Station Y not bridged, depress a different line on Station Y and go off-hook. While holding that line button depressed bridge onto the line that was busied out by Station X. Station Y should be locked out of both lines.

**3.07** When installing faceplate, insure that the collar is in place on the key. Place the tabs into slots in front of the faceplate opening in the housing and lower slowly over the dial and key collar until almost in place. Use a KS-21107L1 releaser or equivalent to release the faceplate catch and seat the faceplate.

**3.08** The 647K5 and 647P5C keys use designation tabs, forms E-5837 and E-6672 (new preprinted designation tabs for feature designations). The forms are shipped with the telephone sets. To install, squeeze sides of the cap and remove. Insert designation tabs and replace cap with locking tabs along the horizontal axis of the key.

**3.09** For telephone set number designation, use form E-4203-G or E-4204-G on nonmodular

rotary dial sets and form E-5002-A or E-5002-B for station number card on nonmodular TOUCH-TONE dial sets. Use forms E-4203-G-(M) or E-6417 for modular rotary dial sets and forms E-5002-A-(M) or E-6418 for modular TOUCH-TONE dial sets.

**3.10** Refer to Fig. 7 through 14 for telephone set schematics.

**3.11** Refer to Section 512-620-487 or 512-740-471 for connections to 3-type (MD) or 4A speakerphone system, respectively.

**3.12** If Power Failure Transfer feature is to be provided, use an external ringer (E1CM) and connect as shown in Table H.

**4. MAINTENANCE**

**4.01** Maintenance of the 833- and 2833-type telephone sets should be limited to checking

for loose or broken connections and replacement of items listed under Ordering Guide table as replaceable components.



**Telephone set should not be carried by the switchhook since this applies excessive strain to the line switch and could cause a trouble condition.**

**4.02** The current production 647-type key has been modified for easy lamp replacement by merely removing the lamp cap and inserting a 553-type tool through the hole in the top of the button. In early production keys, it was necessary to remove faceplate, key collar, and button for lamp replacement.

**TABLE B**

**COLOR ORDERING GUIDE**

TEL SET	HOUSINGS, HANDSETS, AND HANDSET CORDS		FACEPLATES*	
	SUFFIX	COLOR	SUFFIX	COLOR
833BM, 2833BM, 833CM, 2833CM, 833DM, 2833DM, 833EM, 2833EM,	-50	Ivory	-100	Avocado
			-108	Teak
			-109	Walnut
			-111	Gold
			-112	Orange
			-113	Brown
			-114	Red
			-115	Blue
		-118	Black	

\* Faceplates must be ordered separately (Table A).

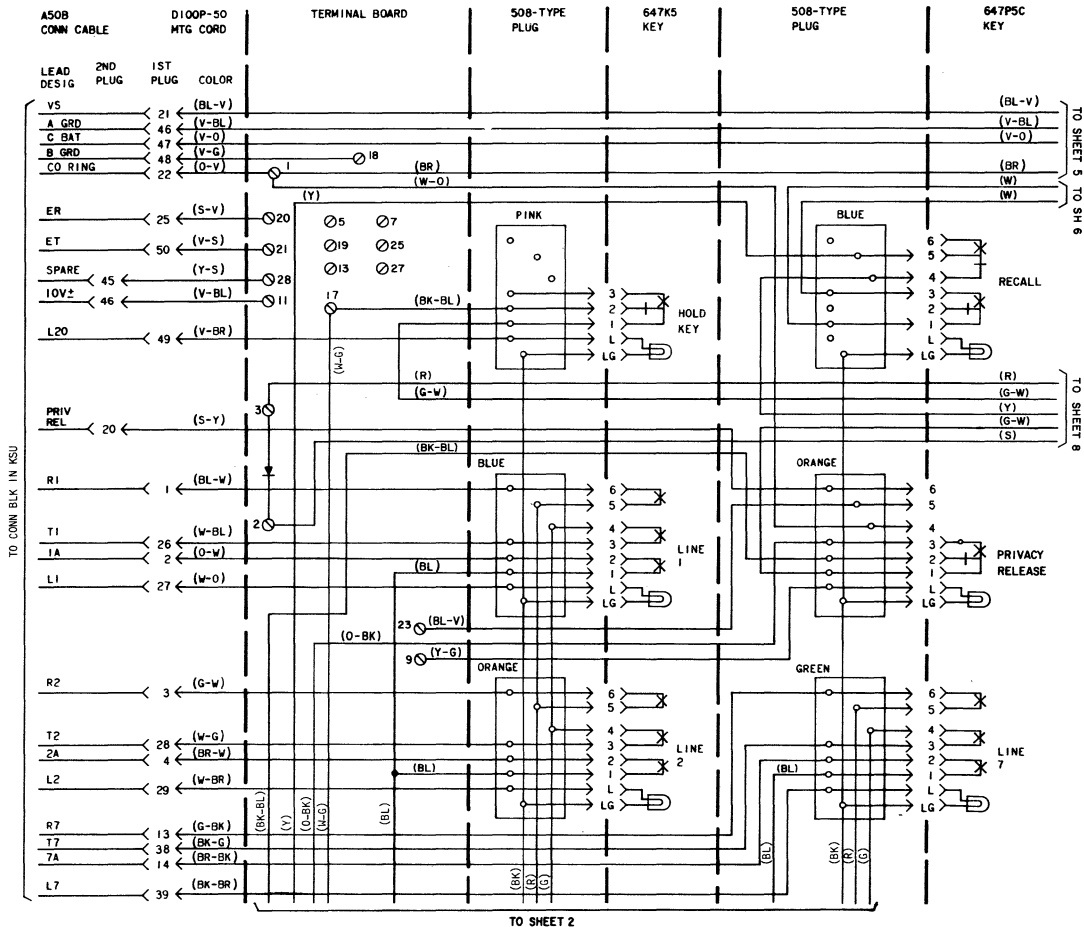


Fig. 5—833B (MD) Telephone Set, Connections (Sheet 1 of 8)



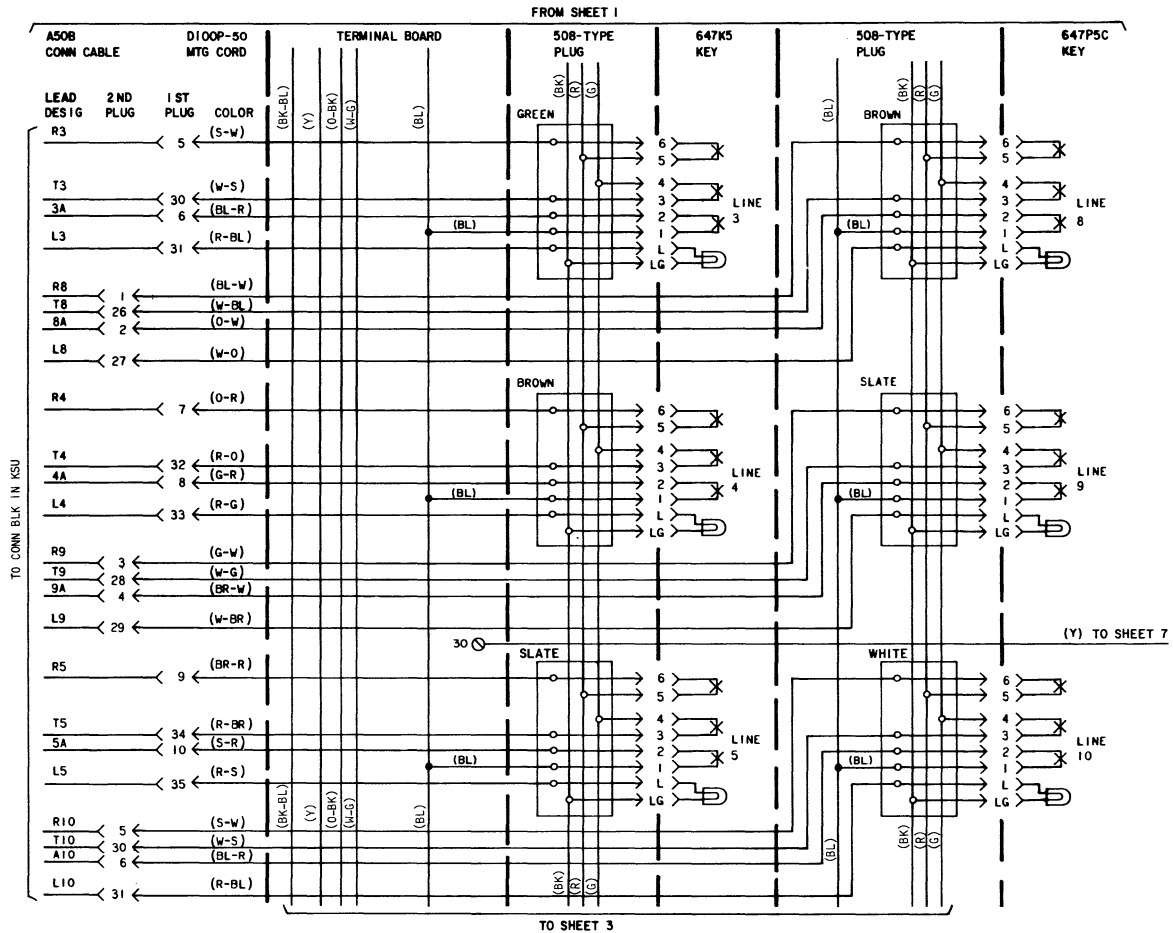


Fig. 5—833B (MD) Telephone Set, Connections (Sheet 2 of 8)

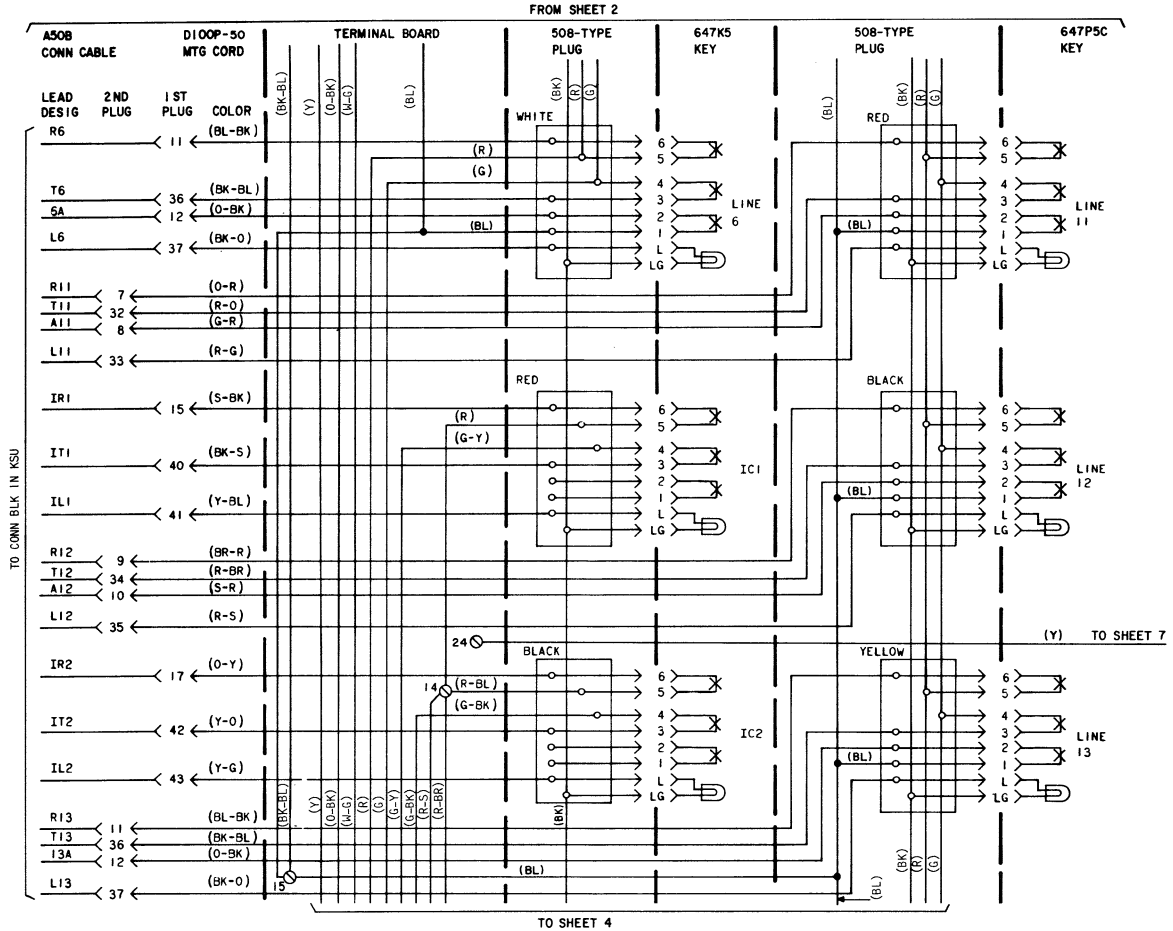


Fig. 5—833B (MD) Telephone Set, Connections (Sheet 3 of 8)

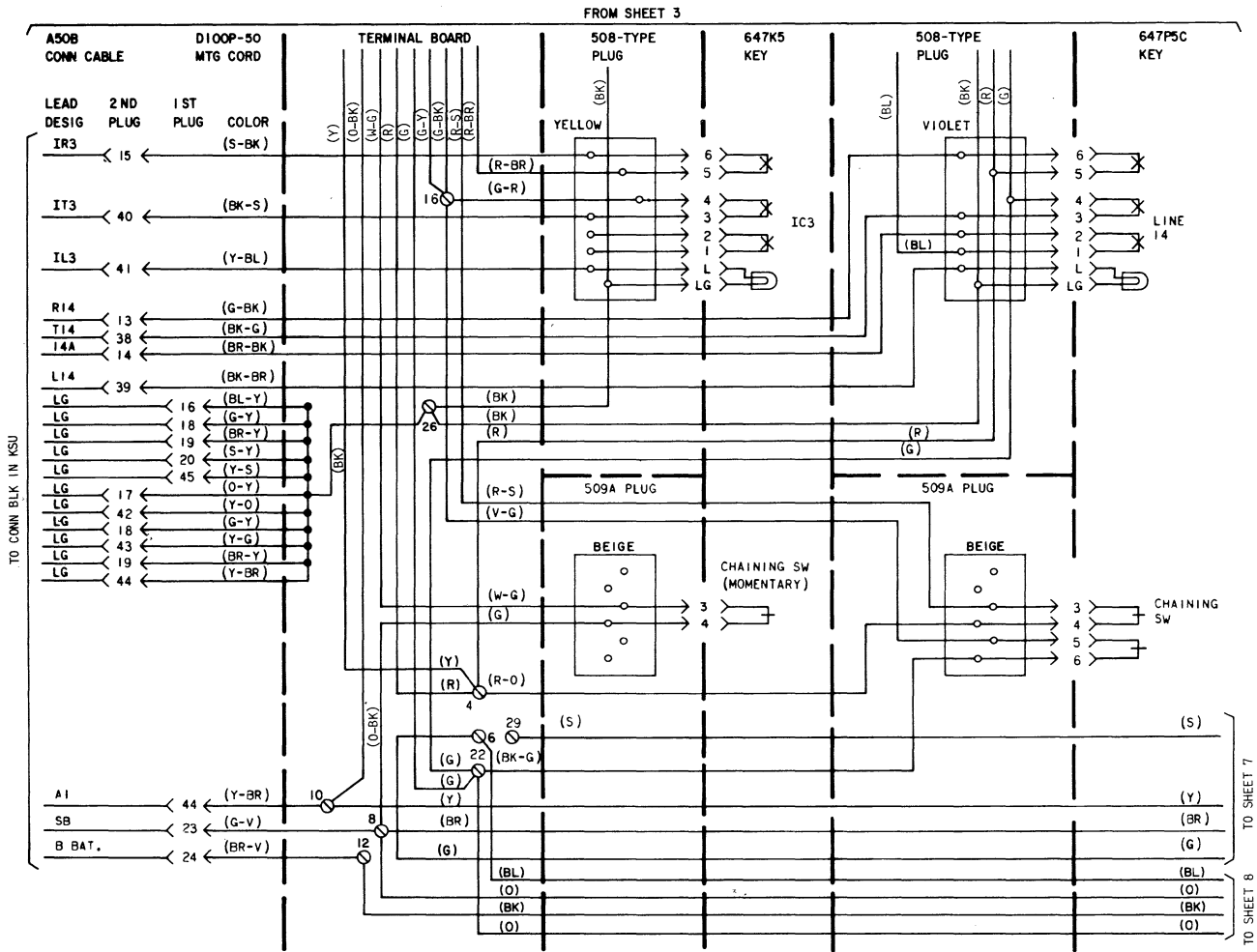


Fig. 5—833B (MD) Telephone Set, Connections (Sheet 4 of 8)

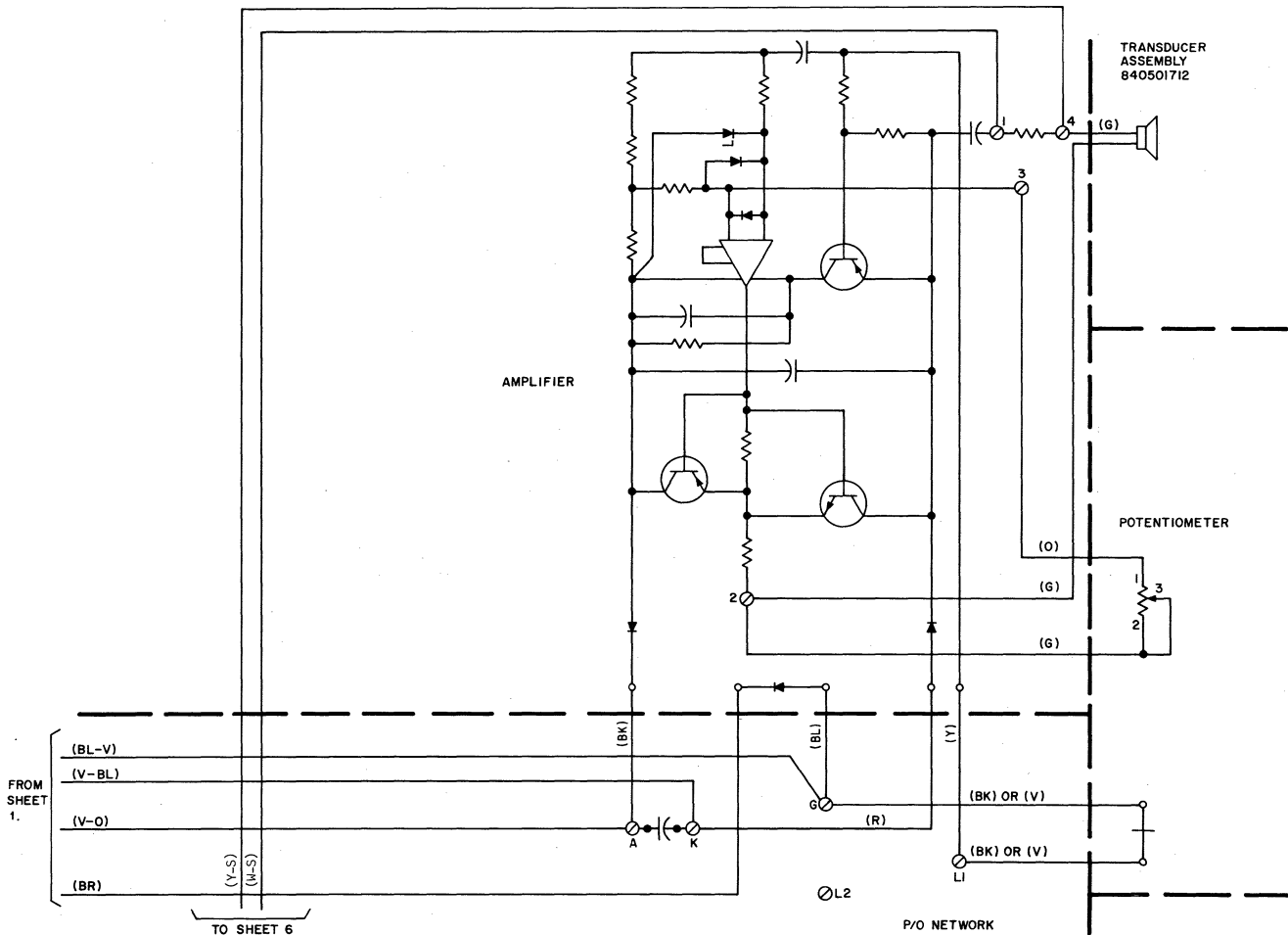


Fig. 5—833B (MD) Telephone Set, Connections (Sheet 5 of 8)

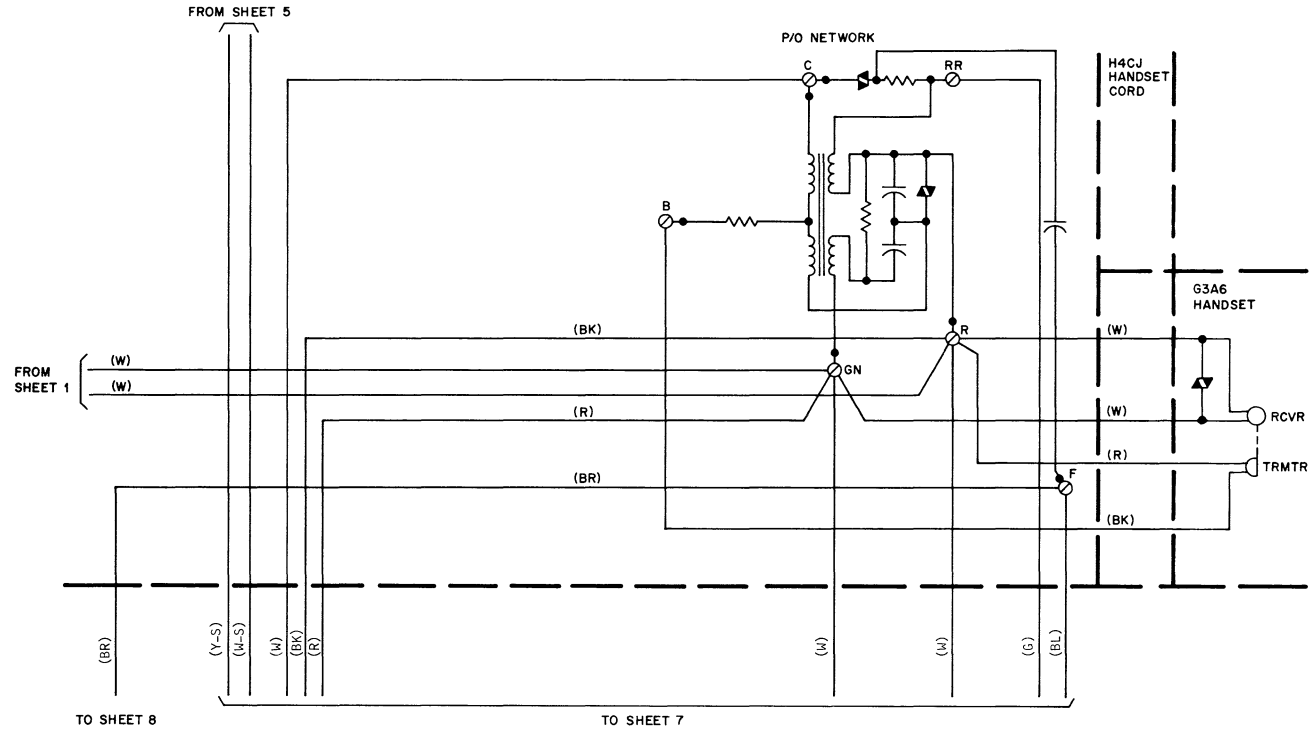


Fig. 5—833B (MD) Telephone Set, Connections (Sheet 6 of 8)

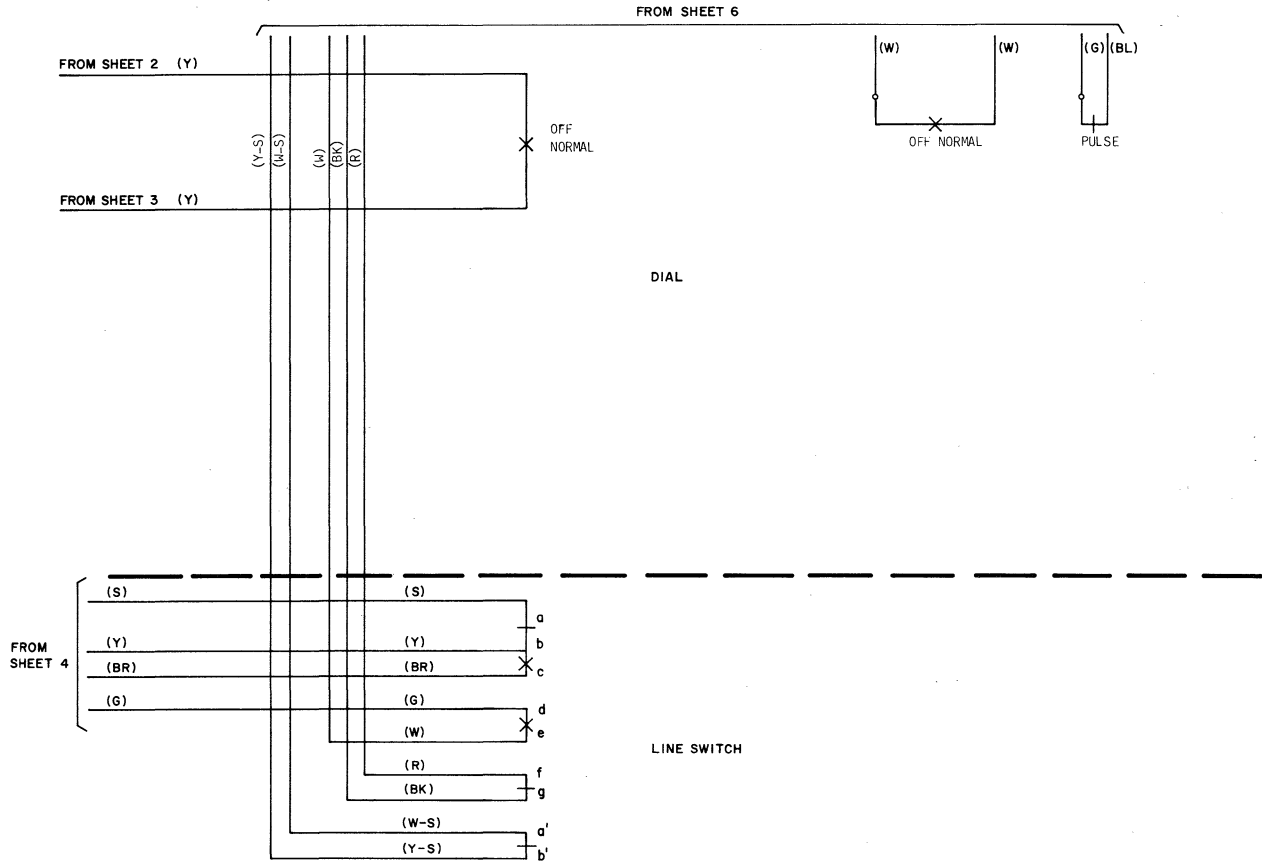


Fig. 5—833B (MD) Telephone Set, Connections (Sheet 7 of 8)

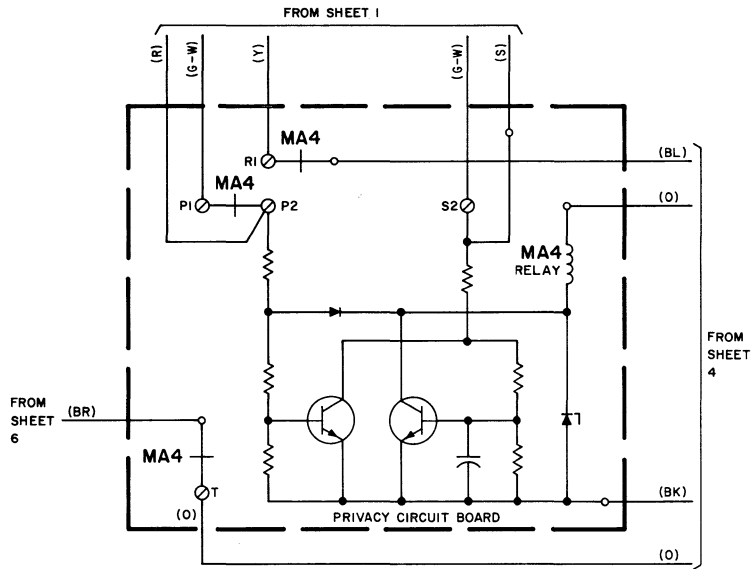


Fig. 5—833B (MD) Telephone Set, Connectors (Sheet 8 of 8)

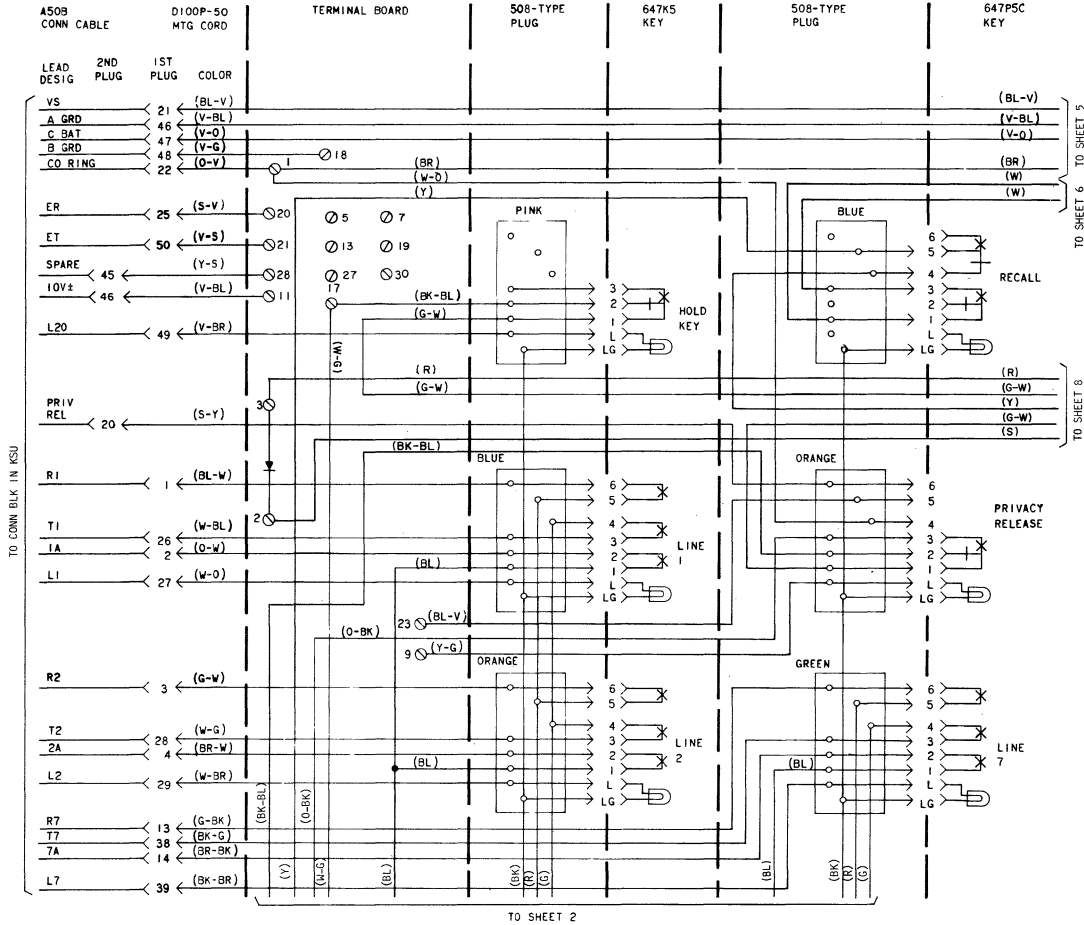


Fig. 6—2833B (MD) Telephone Set, Connections (Sheet 1 of 8)



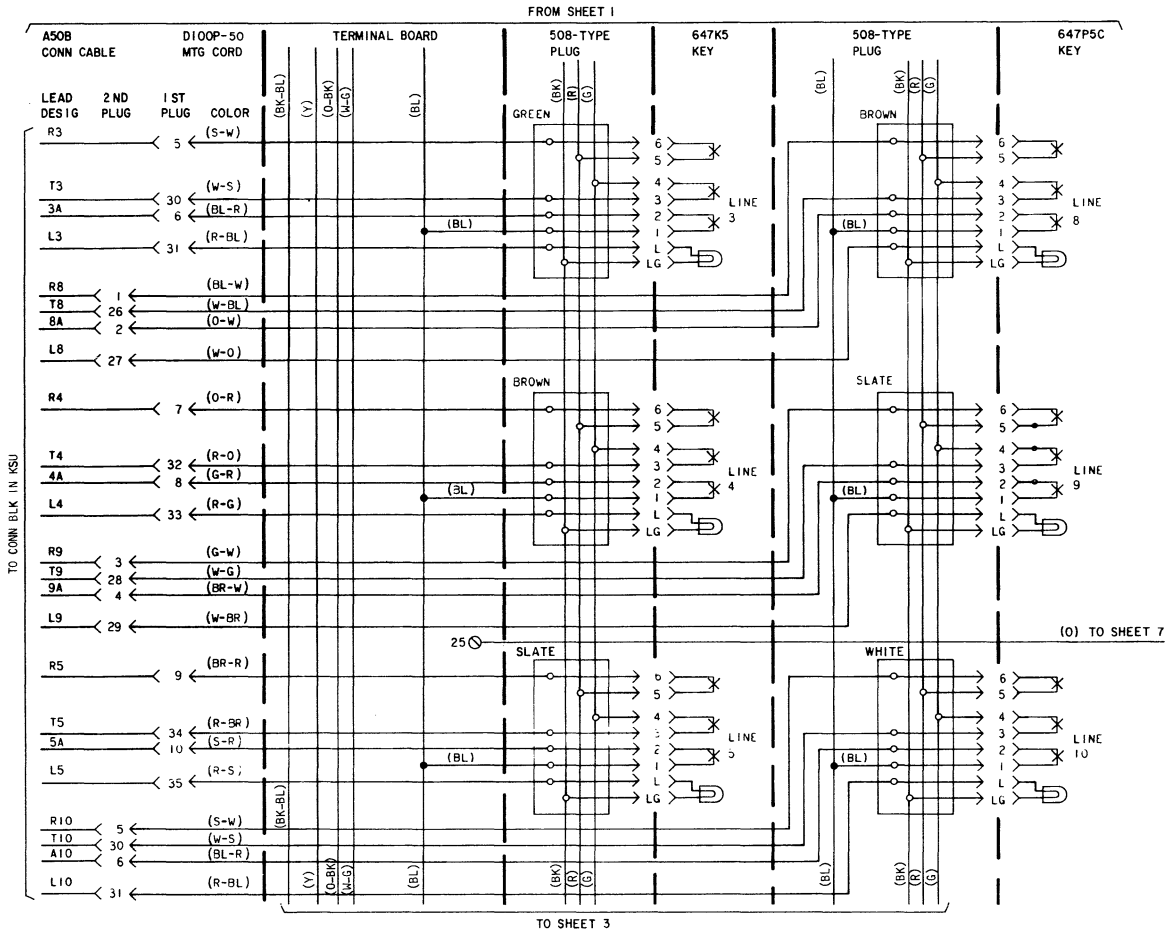


Fig. 6—2833B (MD) Telephone Set, Connections (Sheet 2 of 8)



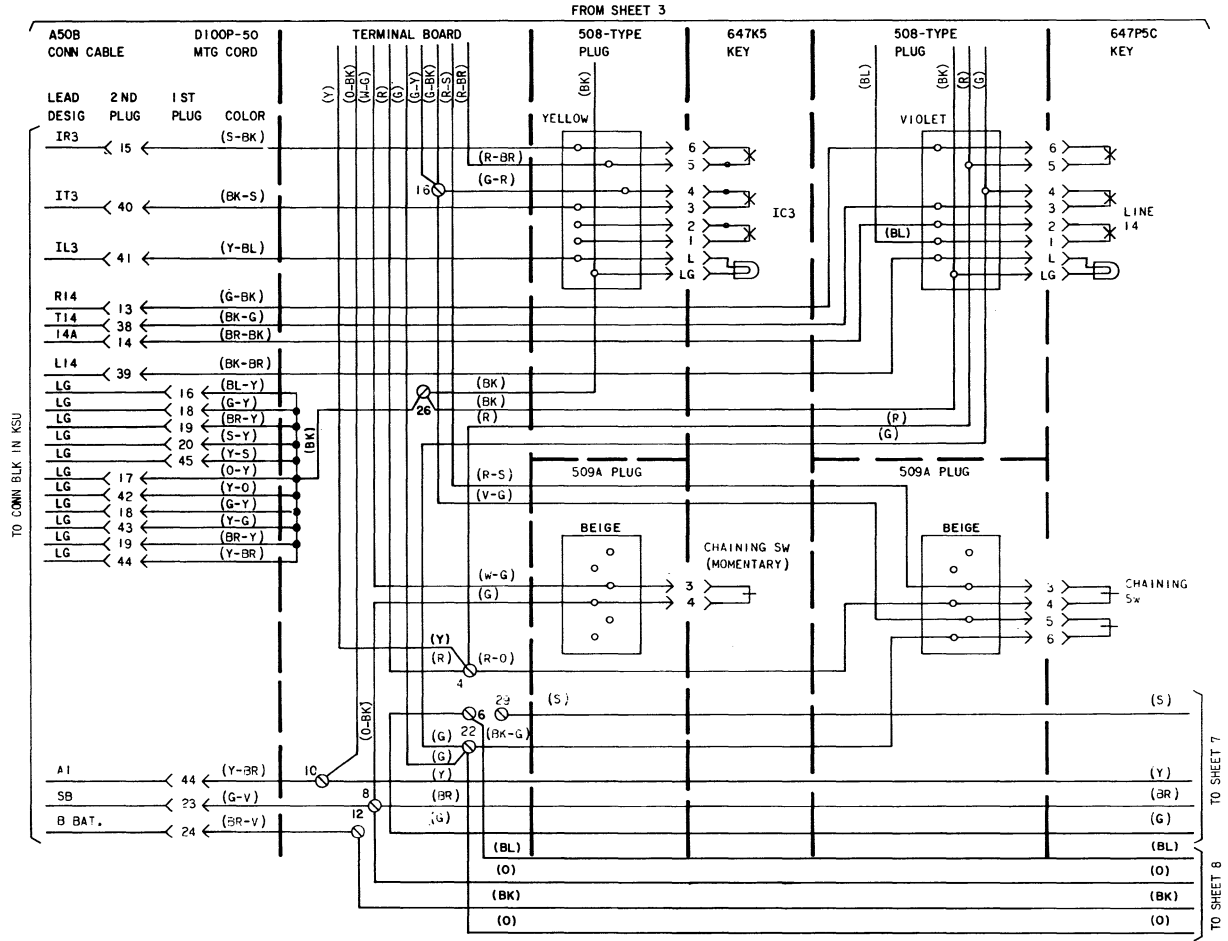


Fig. 6—2833B (MD) Telephone Set, Connections (Sheet 4 of 8)

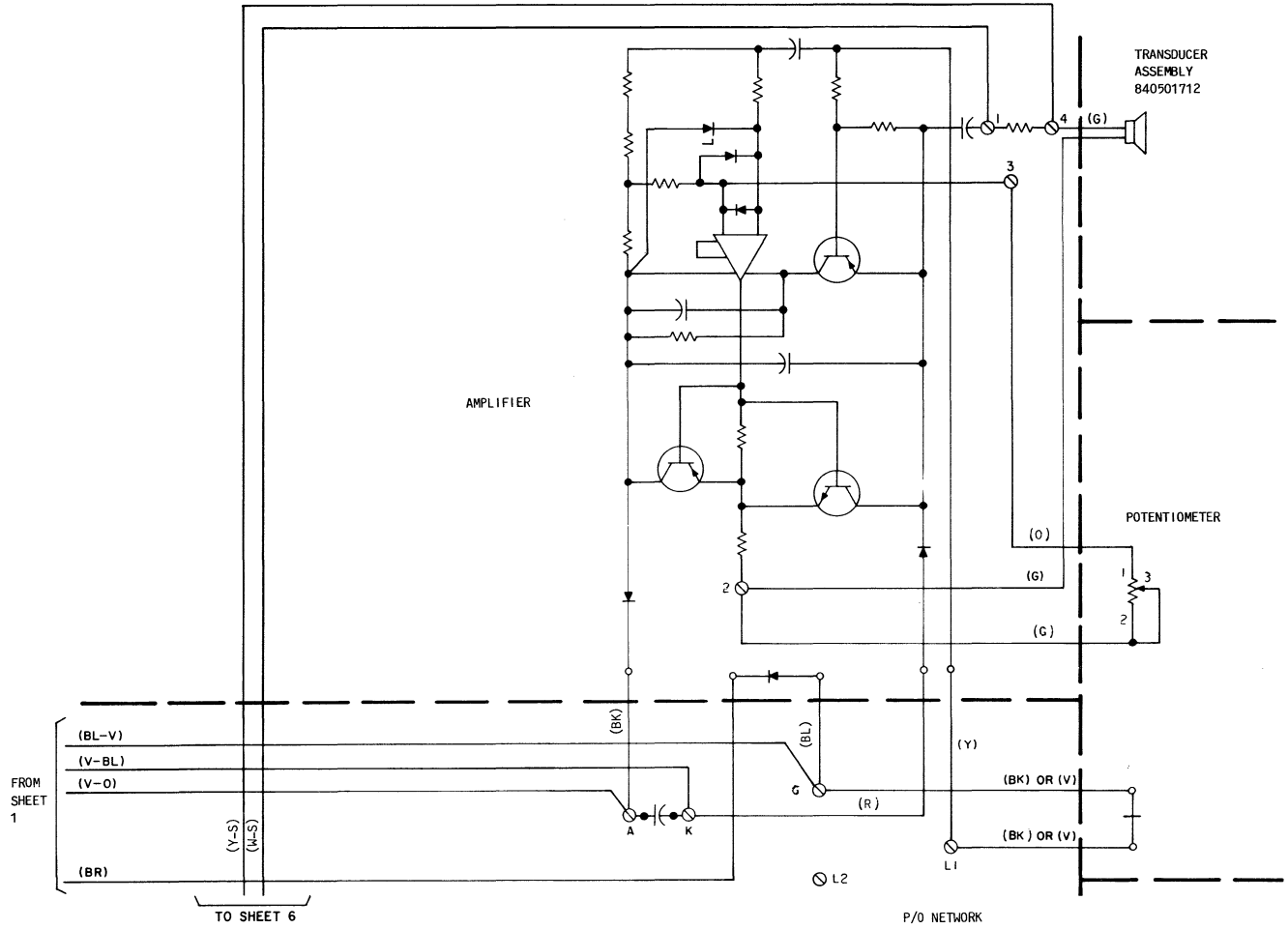


Fig. 6—2833B (MD) Telephone Set, Connections (Sheet 5 of 8)

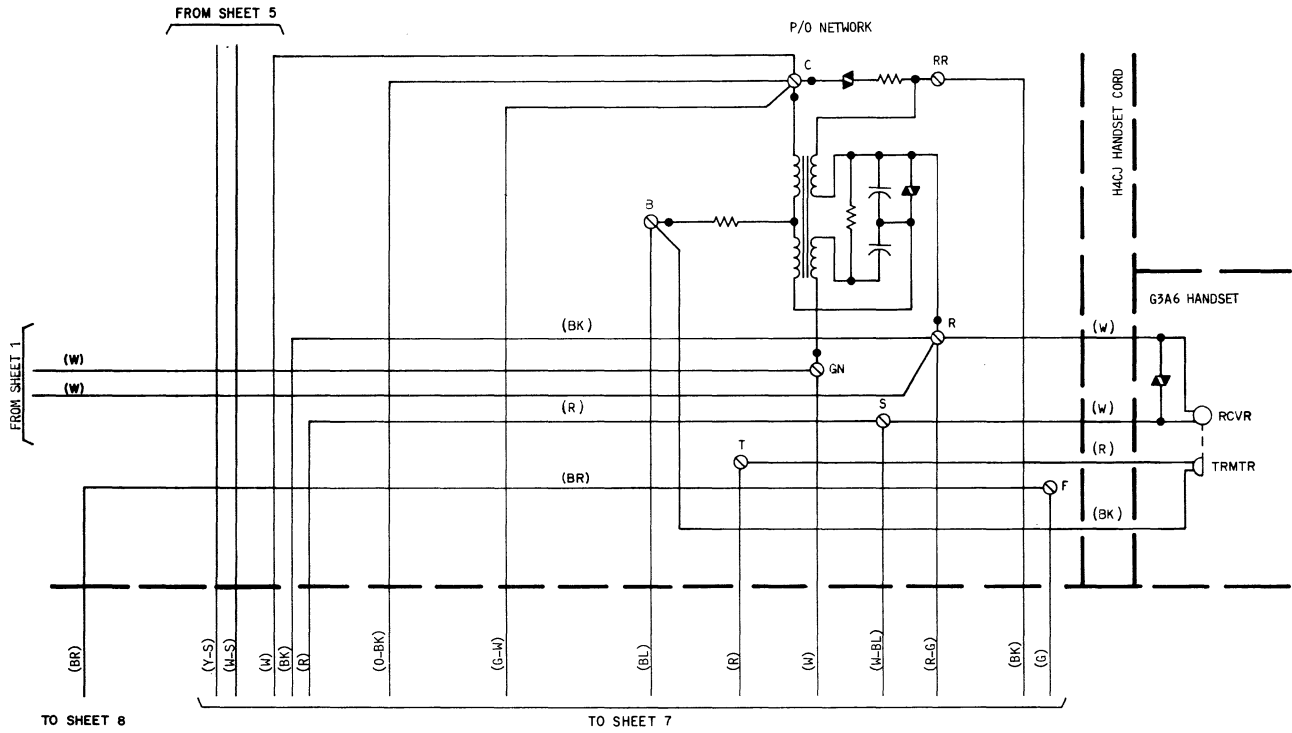


Fig. 6—2833B (MD) Telephone Set, Connections (Sheet 6 of 8)

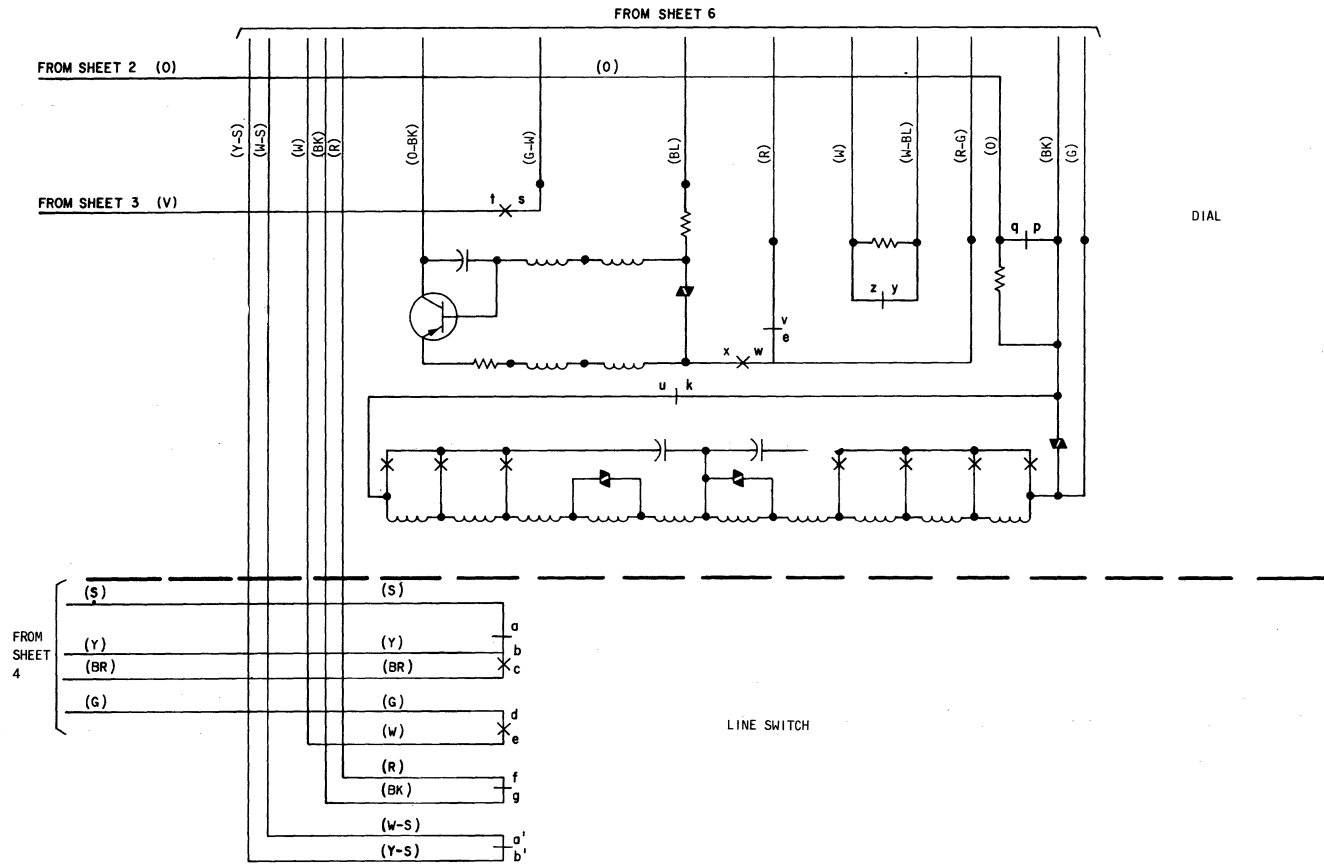


Fig. 6—2833B (MD) Telephone Set, Connections (Sheet 7 of 8)

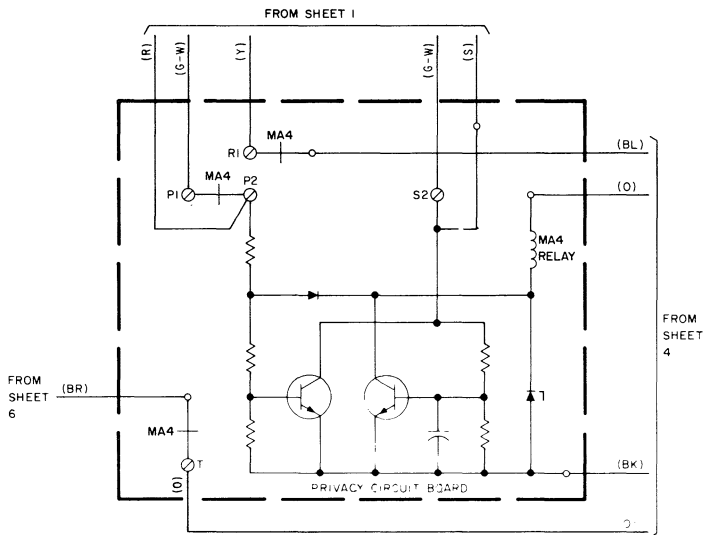


Fig. 6—2833B (MD) Telephone Set, Connections (Sheet 8 of 8)





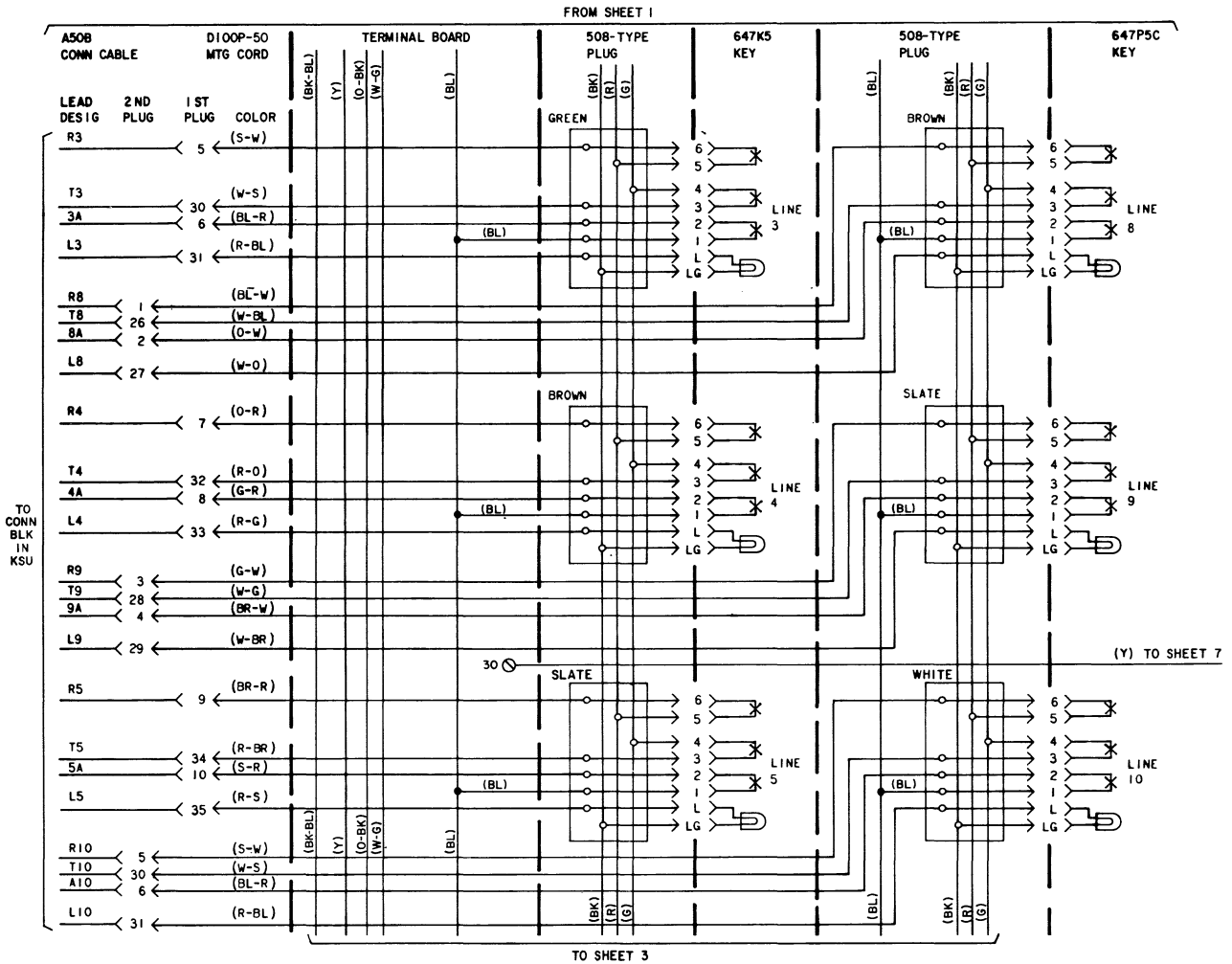


Fig. 7—833BM or 833DM Telephone Set, Connections (Sheet 2 of 8)

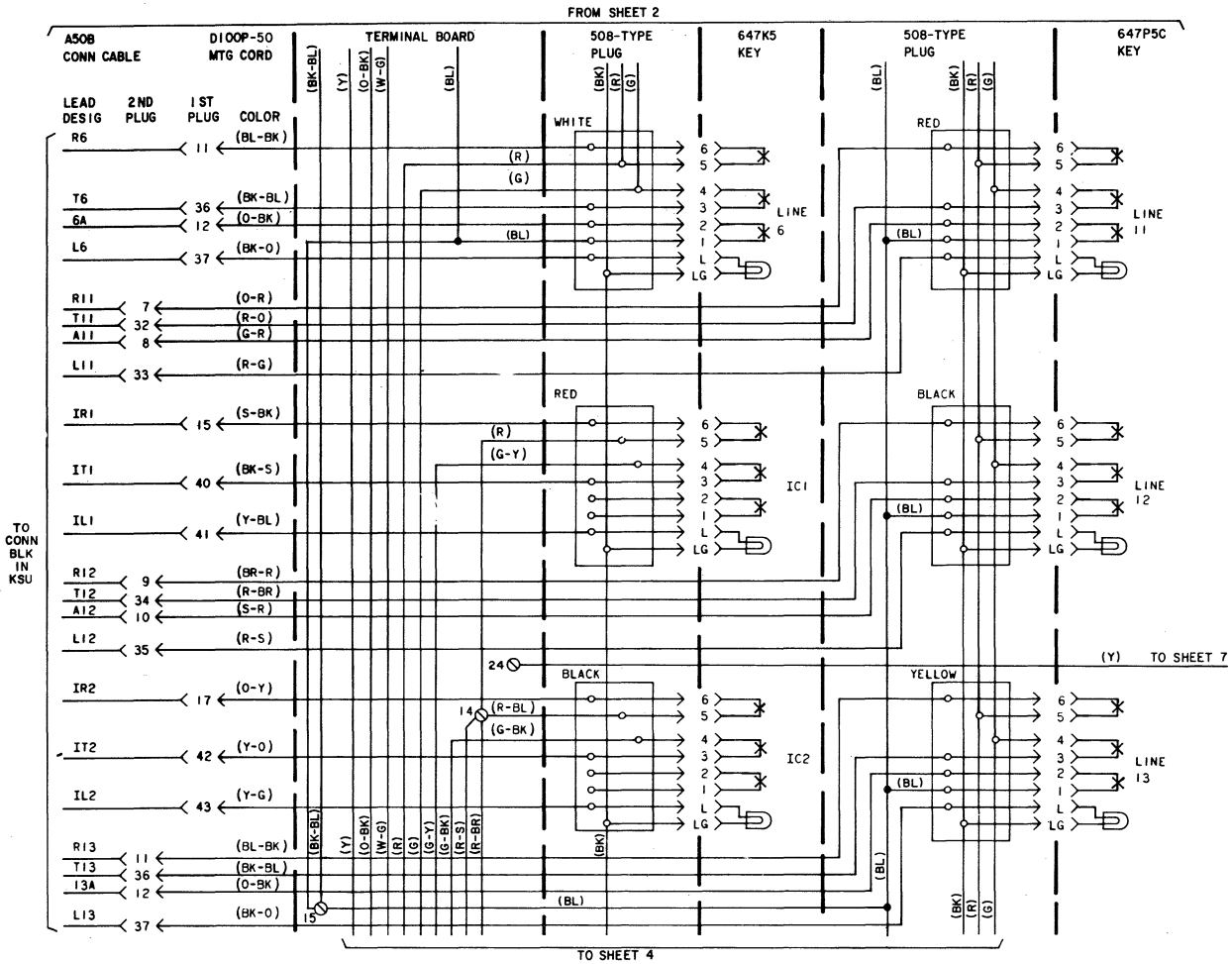


Fig. 7—833BM or 833DM Telephone Set, Connections (Sheet 3 of 8)

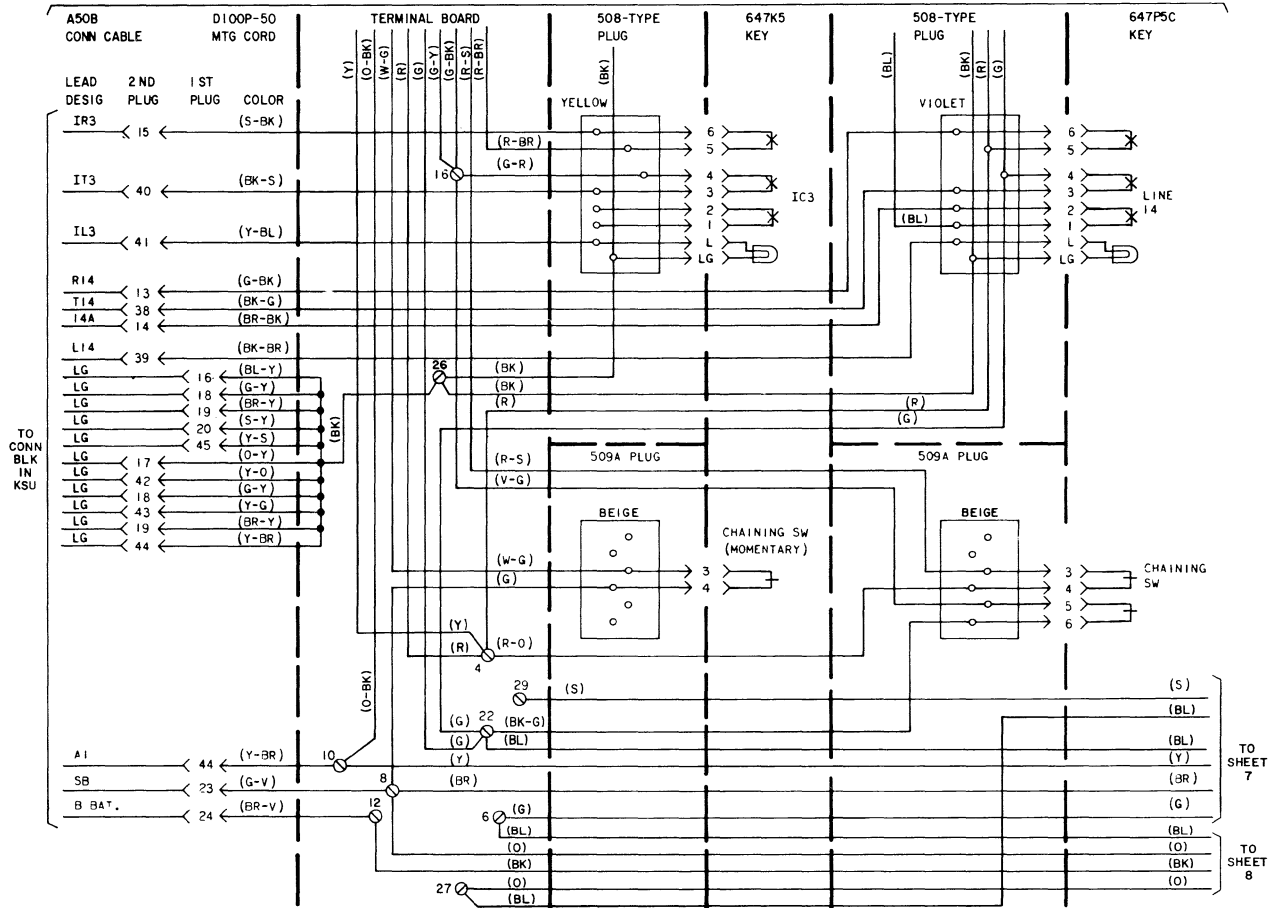


Fig. 7—833BM or 833DM Telephone Set, Connections (Sheet 4 of 8)

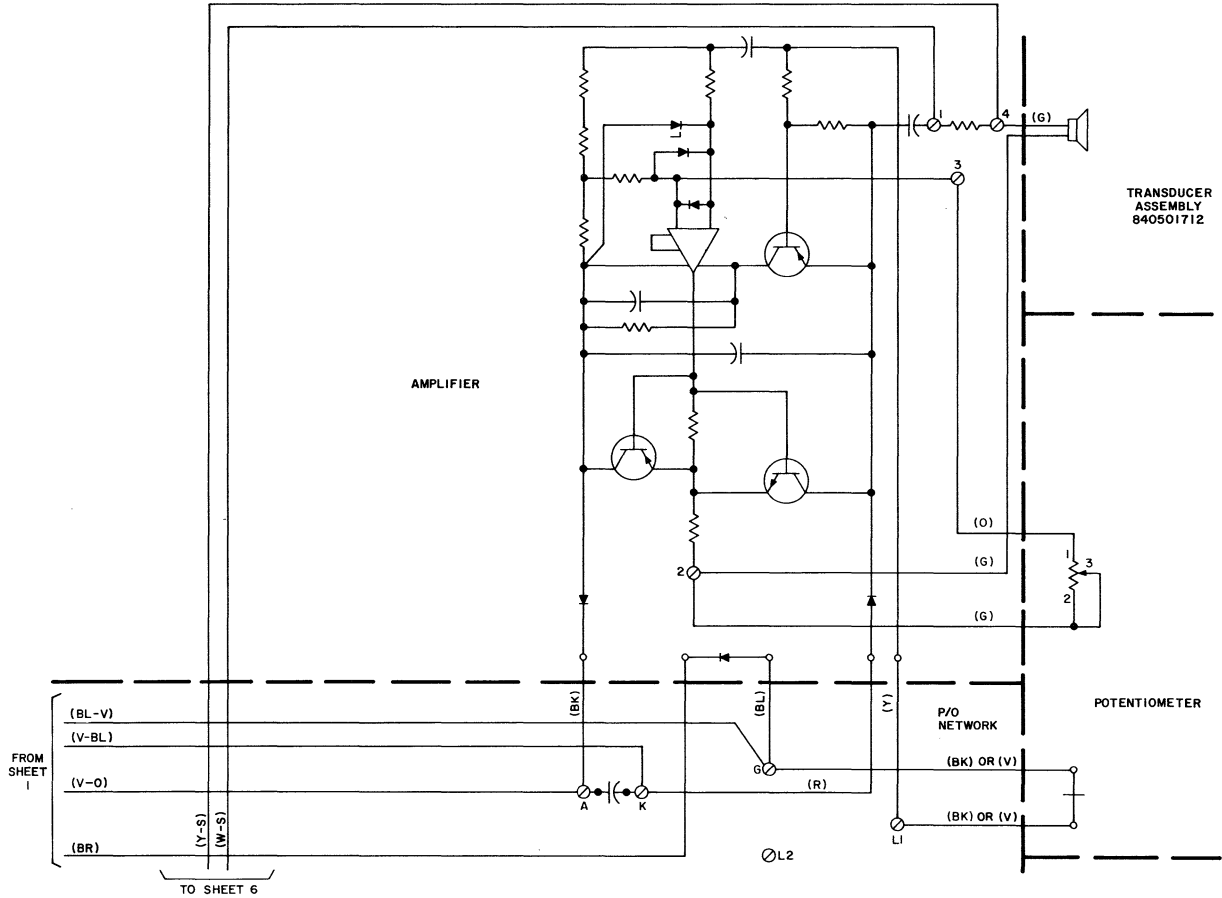


Fig. 7—833BM or 833DM Telephone Set, Connections (Sheet 5 of 8)

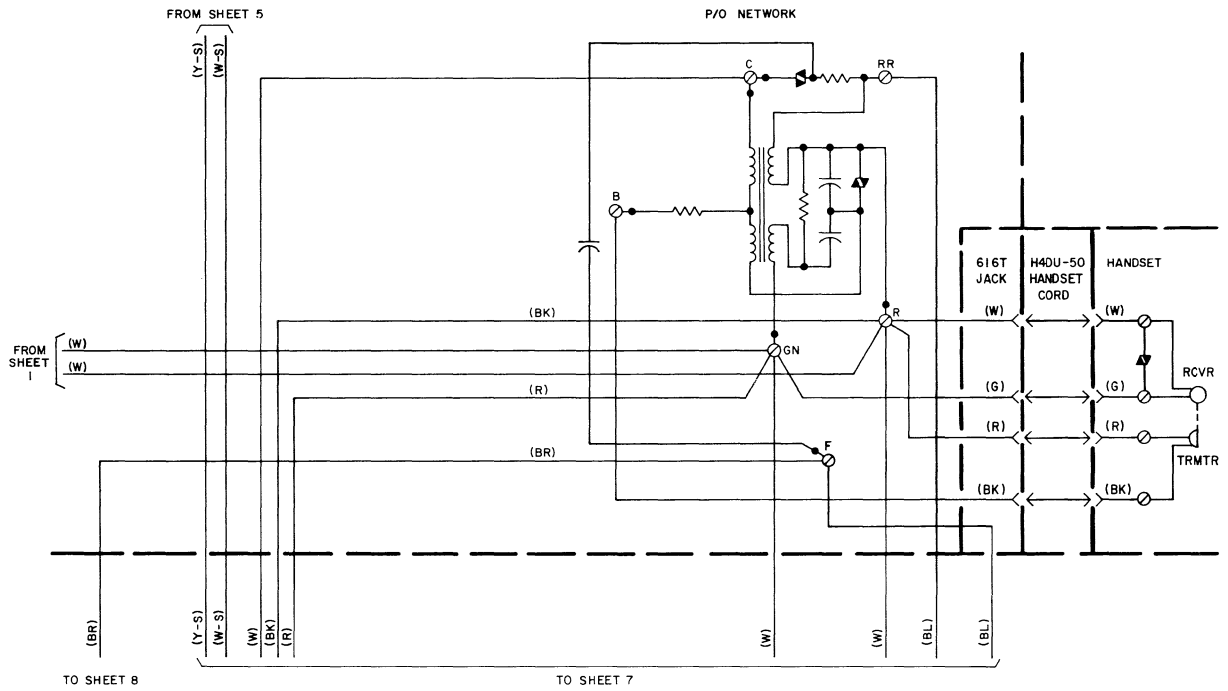


Fig. 7—833BM or 833DM Telephone Set, Connections (Sheet 6 of 8)

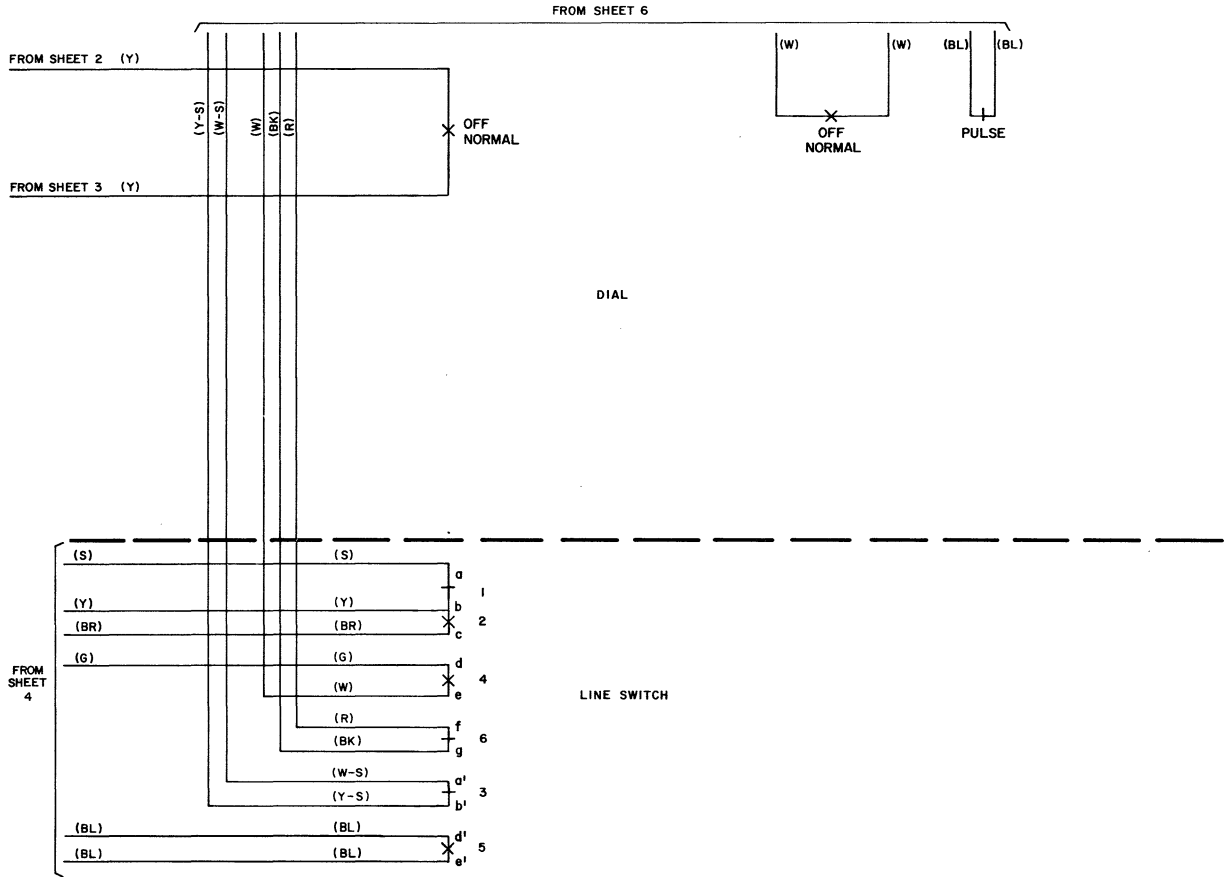


Fig. 7—833BM or 833DM Telephone Set, Connections (Sheet 7 of 8)

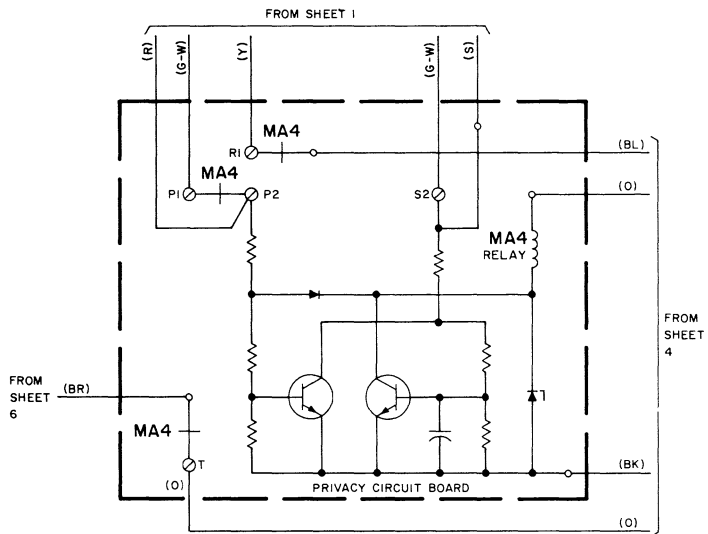


Fig. 7—833BM or 833DM Telephone Set, Connections (Sheet 8 of 8)

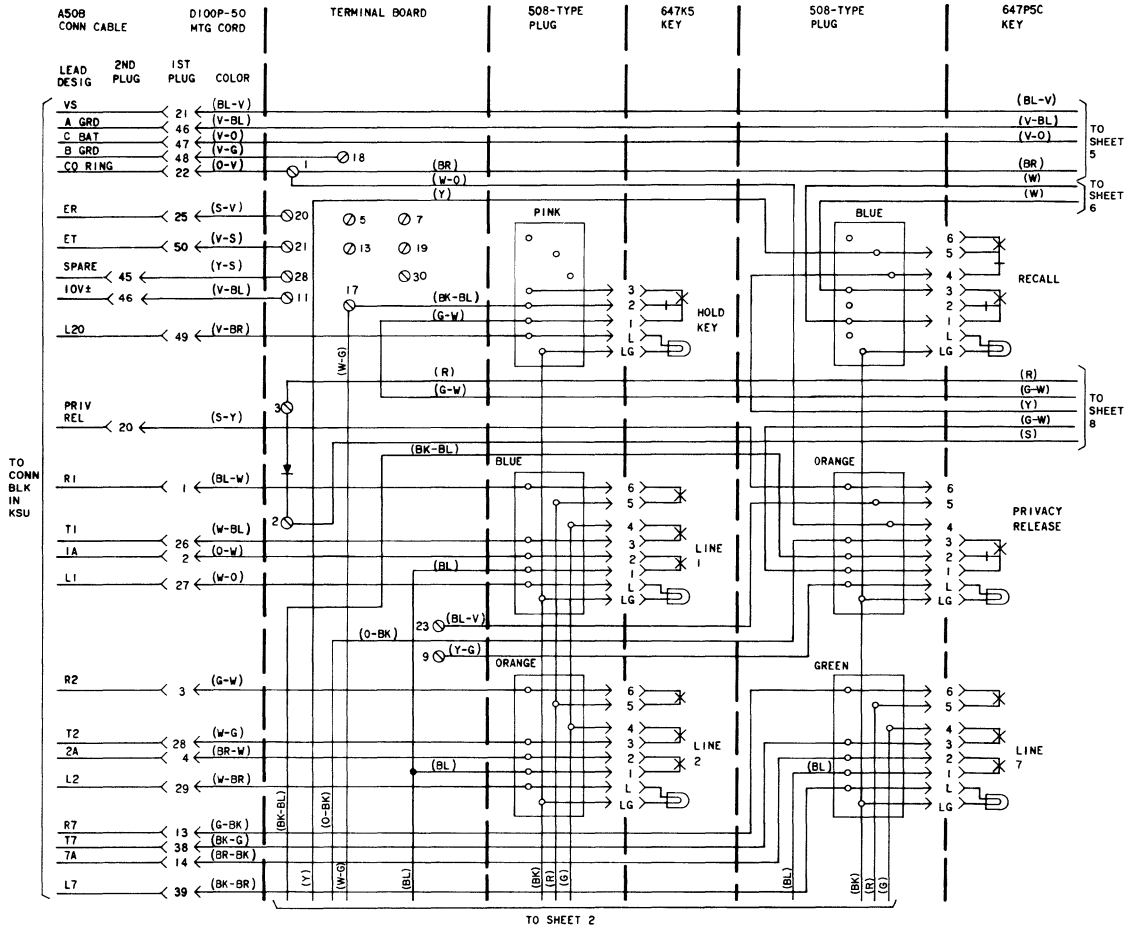


Fig. 8—2833BM or 2833DM Telephone Set, Connections (Sheet 1 of 8)



FROM SHEET 1

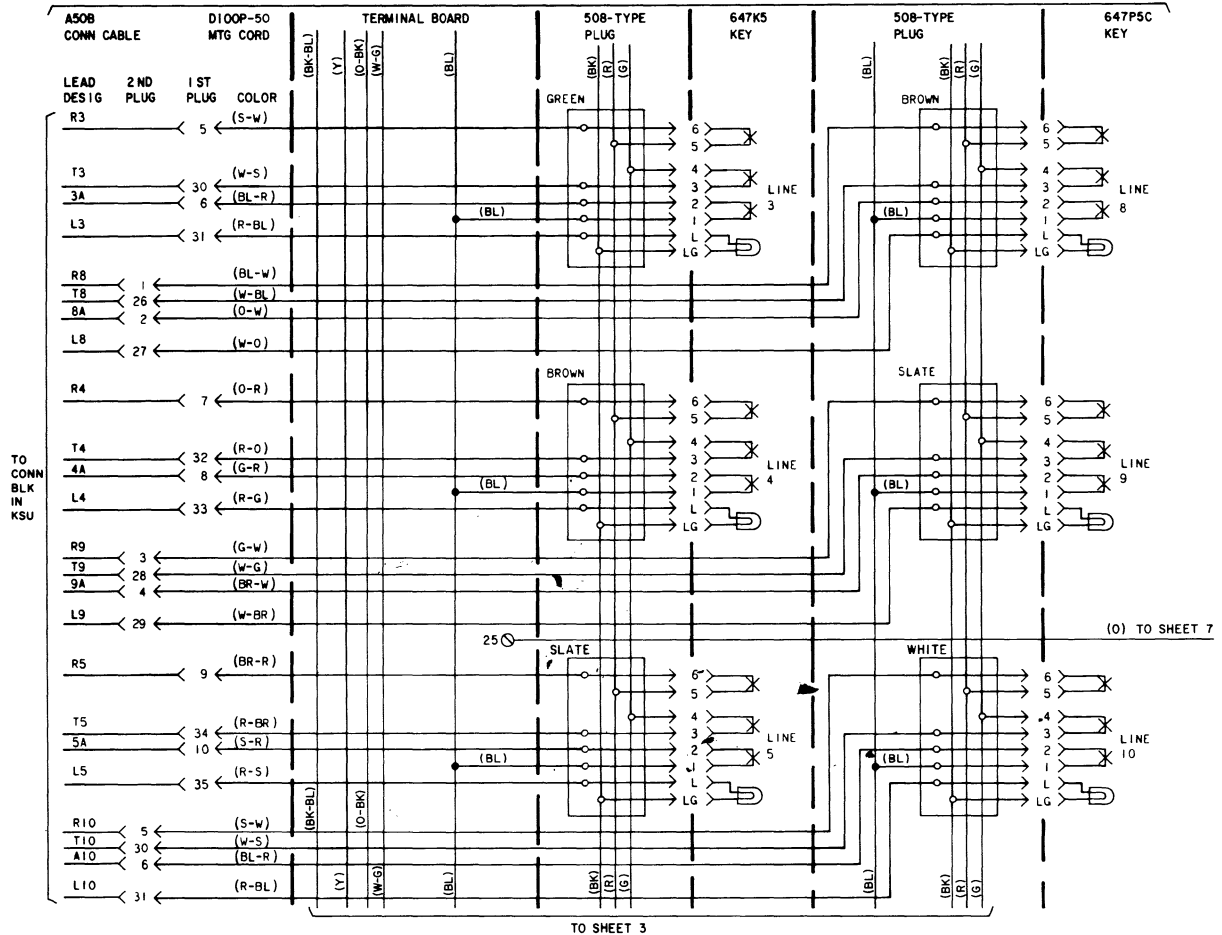


Fig. 8—2833BM or 2833DM Telephone Set, Connections (Sheet 2 of 8)

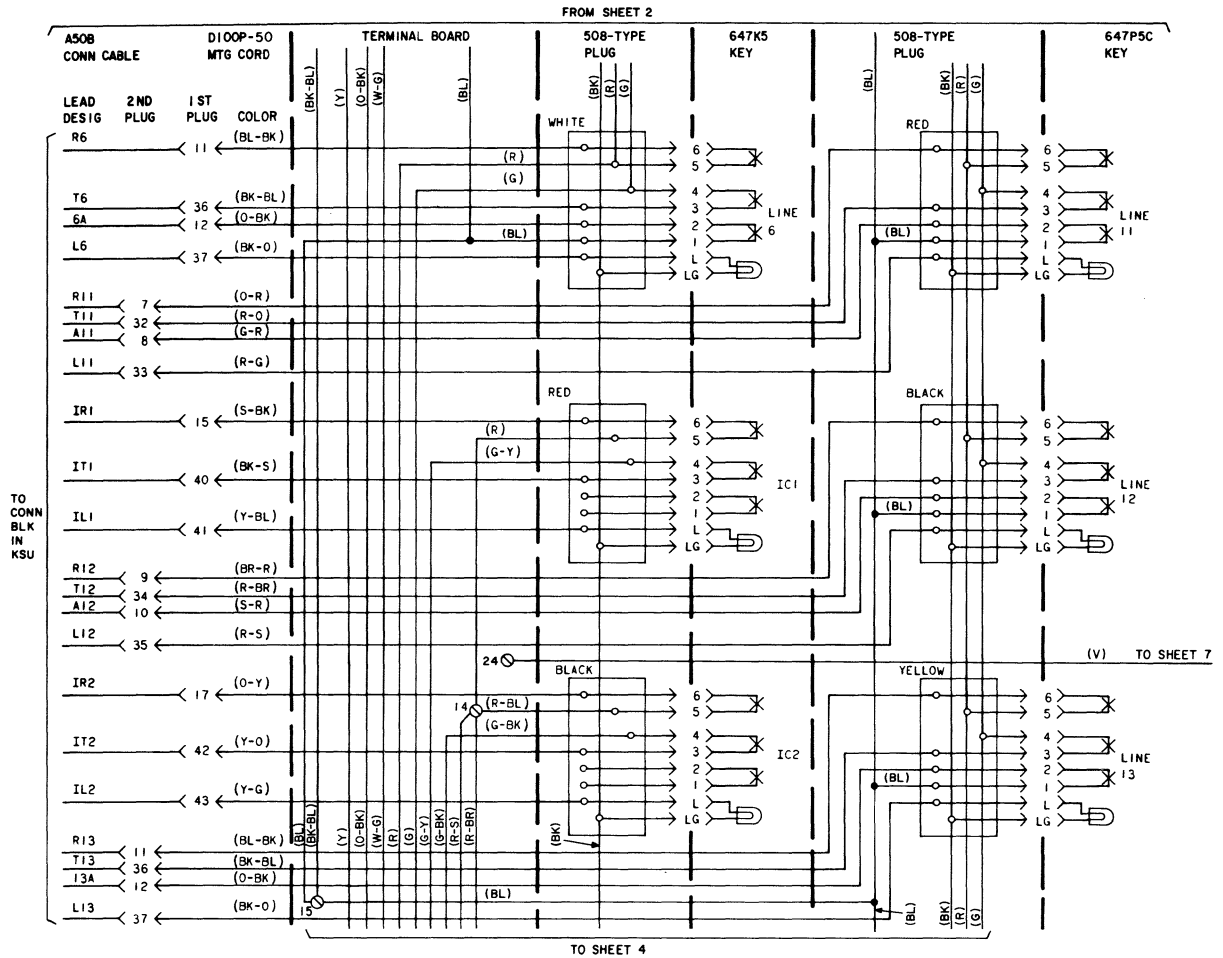


Fig. 8—2833BM or 2833DM Telephone Set, Connections (Sheet 3 of 8)

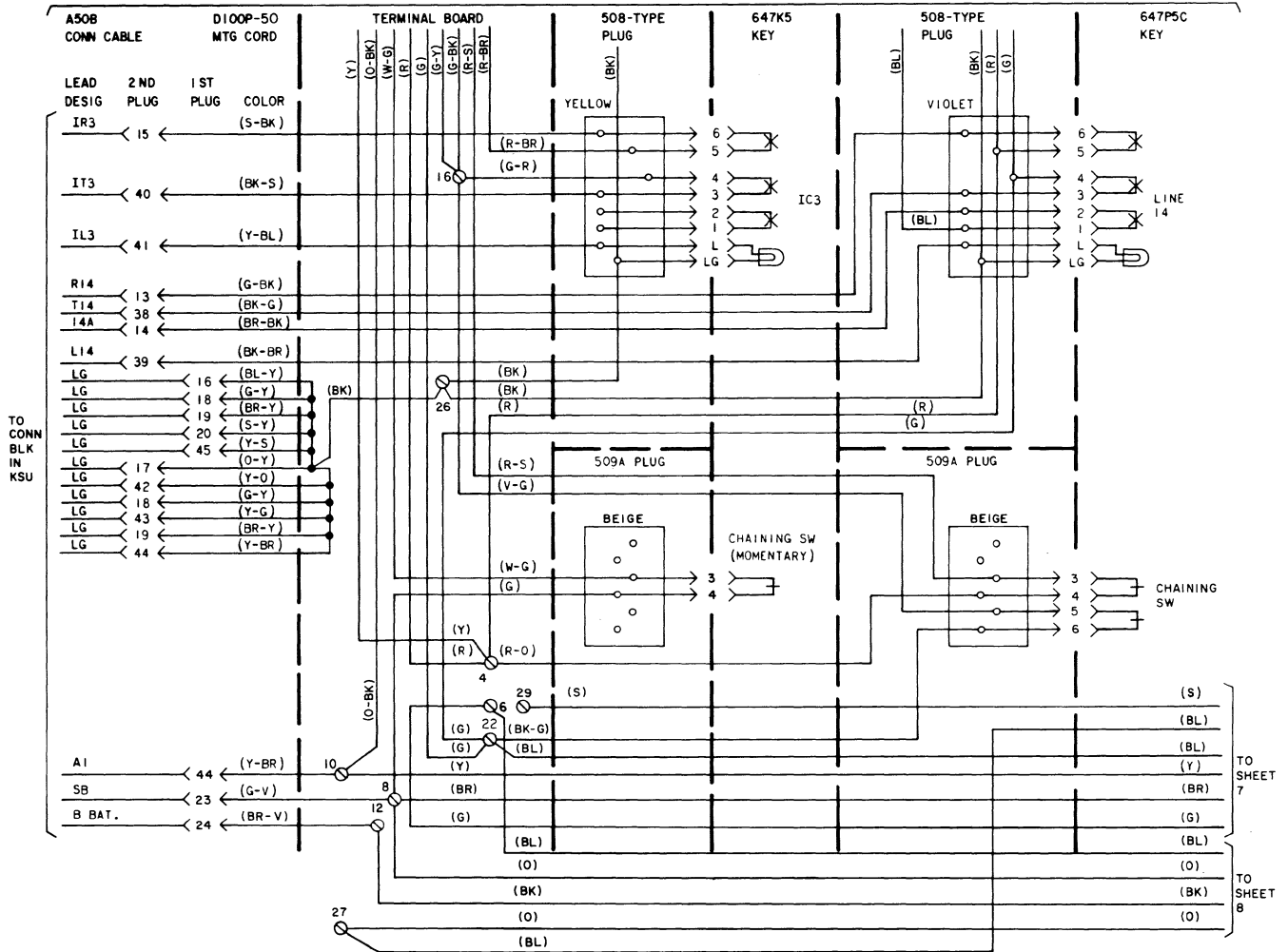


Fig. 8—2833BM or 2833DM Telephone Set, Connections (Sheet 4 of 8)

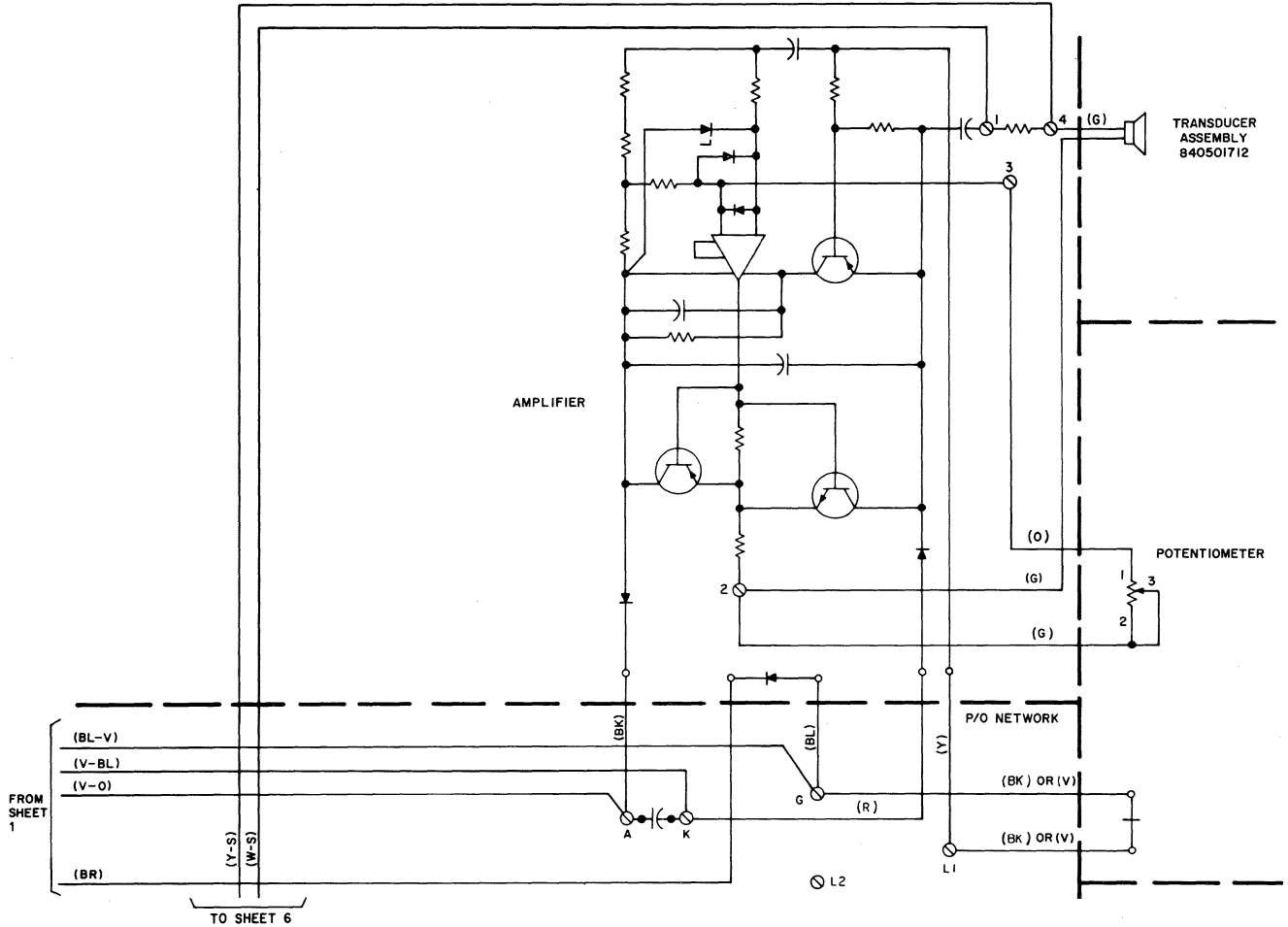


Fig. 8—2833BM or 2833DM Telephone Set, Connections (Sheet 5 of 8)

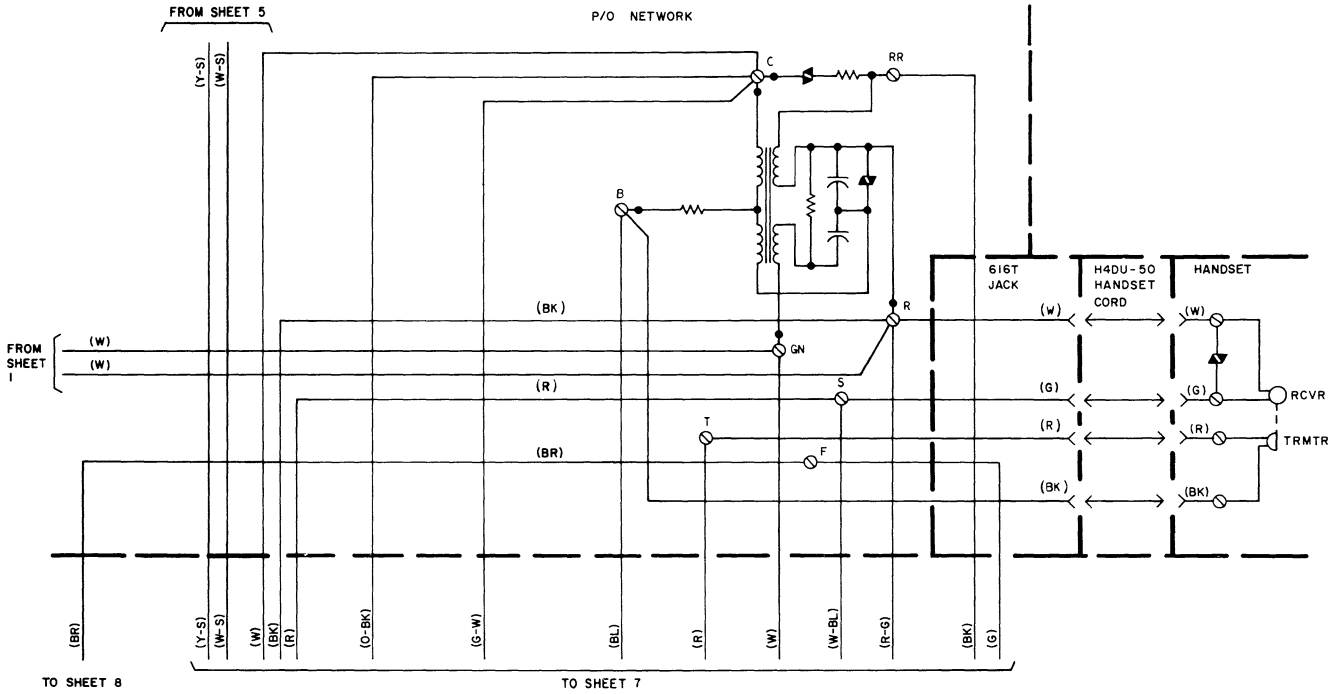


Fig. 8—2833BM or 2833DM Telephone Set, Connections (Sheet 6 of 8)

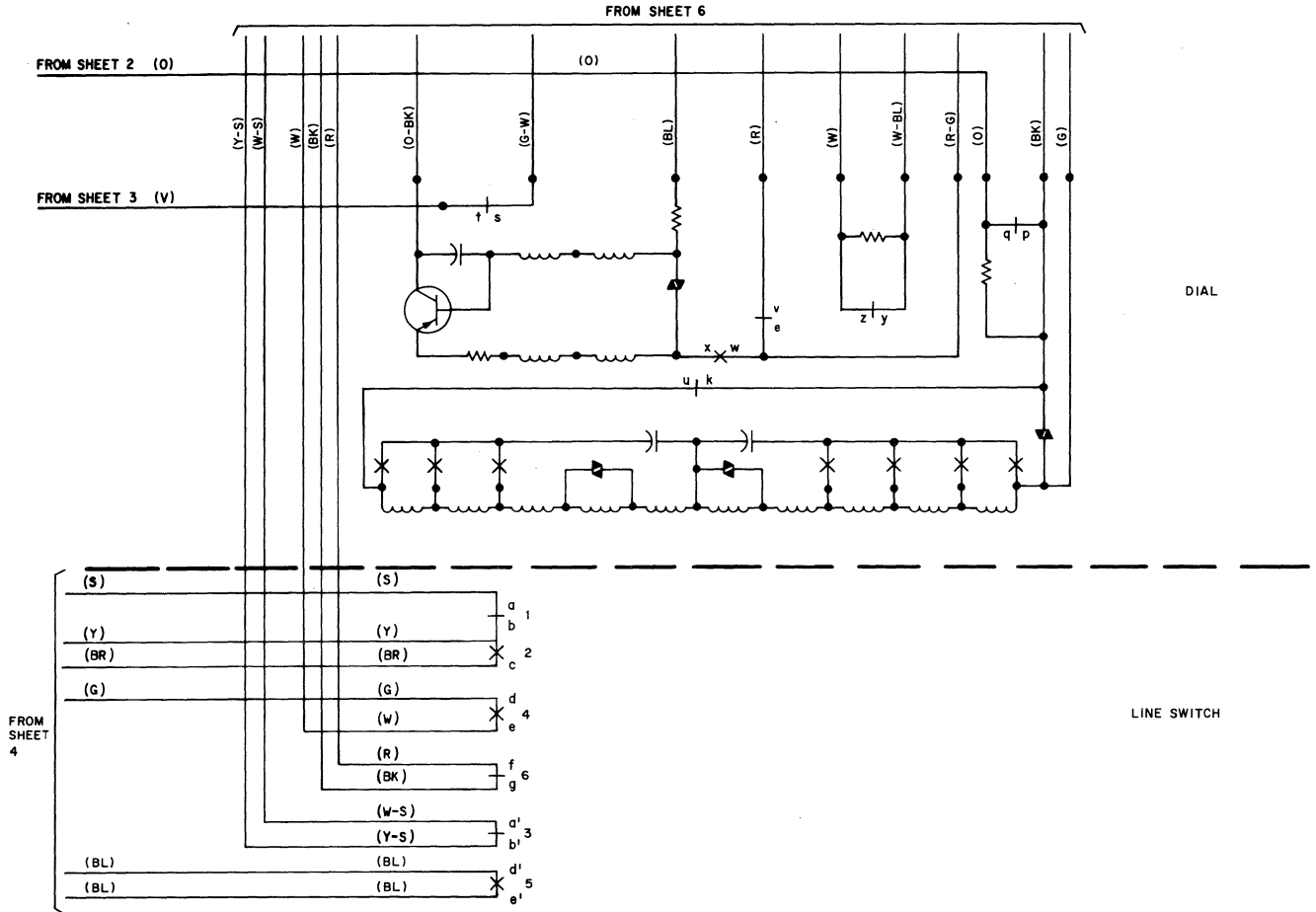


Fig. 8—2833BM or 2833DM Telephone Set, Connections (Sheet 7 of 8)

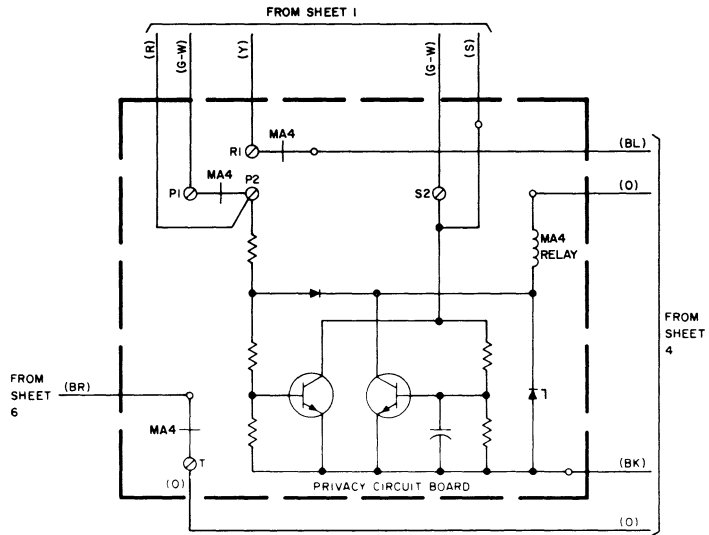


Fig. 8—2833BM or 2833DM Telephone Set, Connections (Sheet 8 of 8)

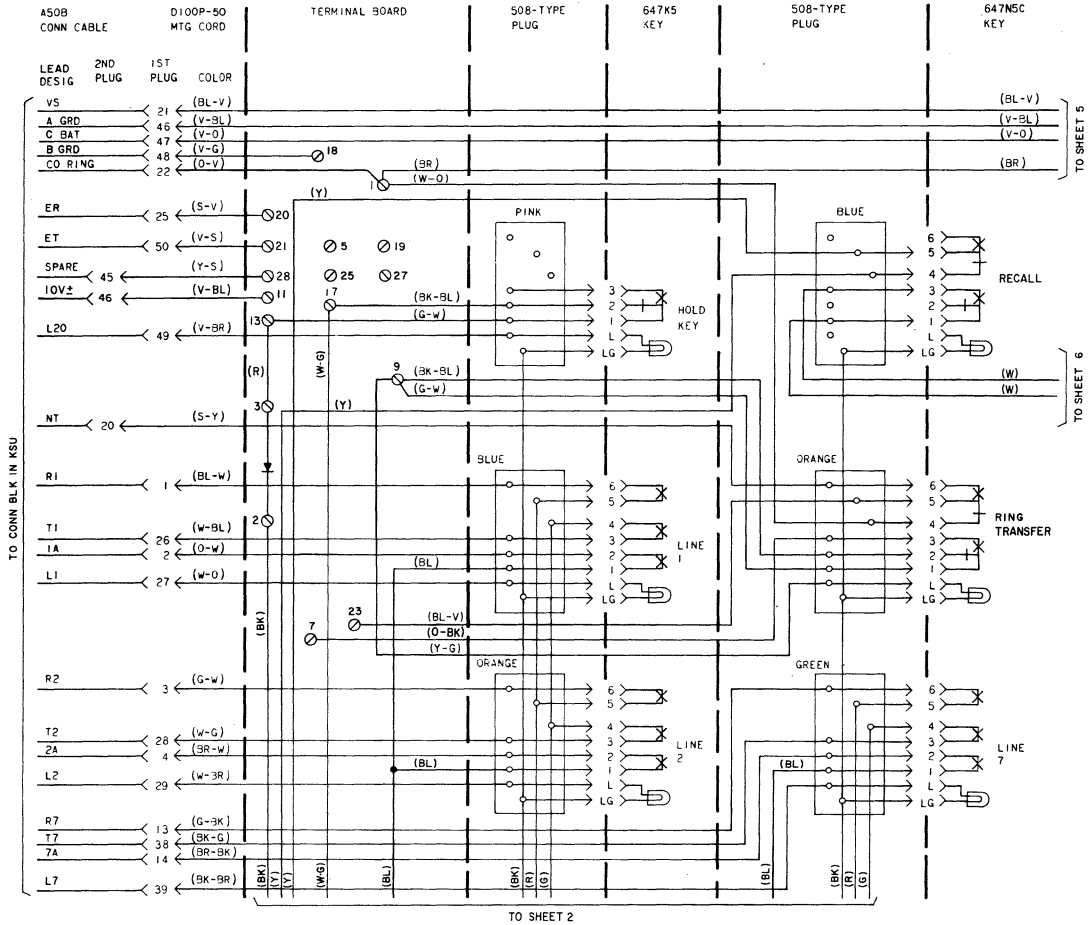


Fig. 9—833C (MD) Telephone Set, Connections (Sheet 1 of 7)







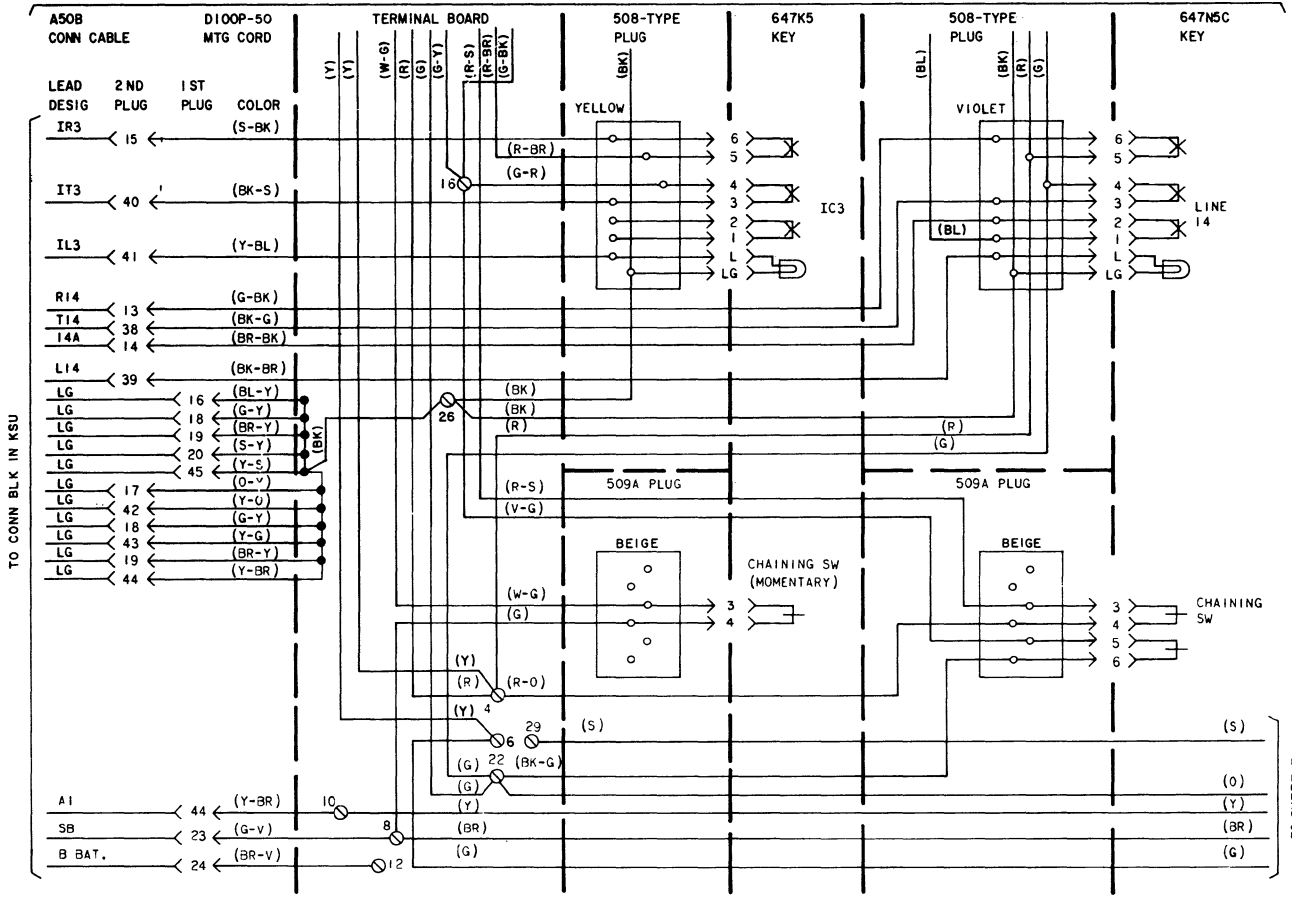


Fig. 9—833C (MD) Telephone Set, Connections (Sheet 4 of 7)

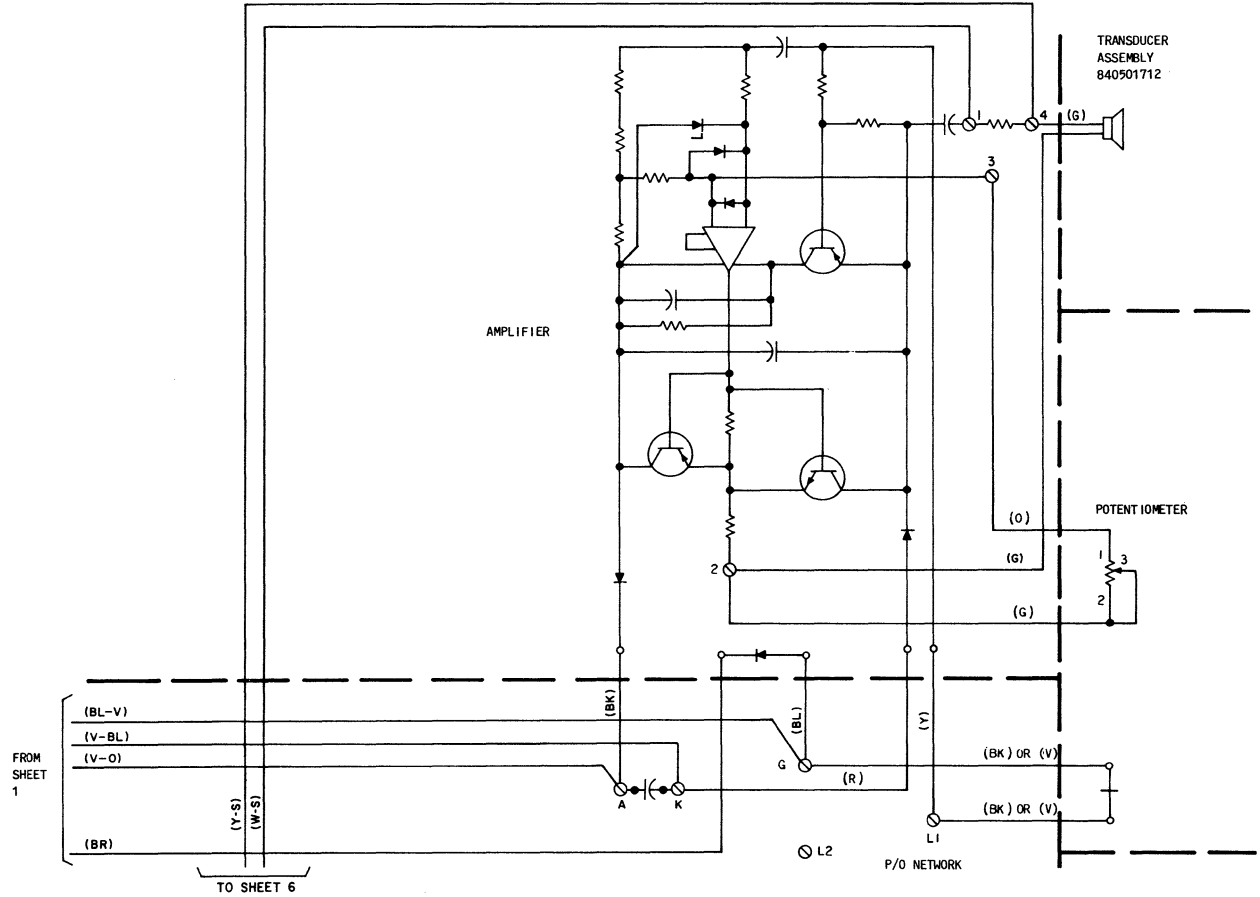


Fig. 9—833C (MD) Telephone Set, Connections (Sheet 5 of 7)

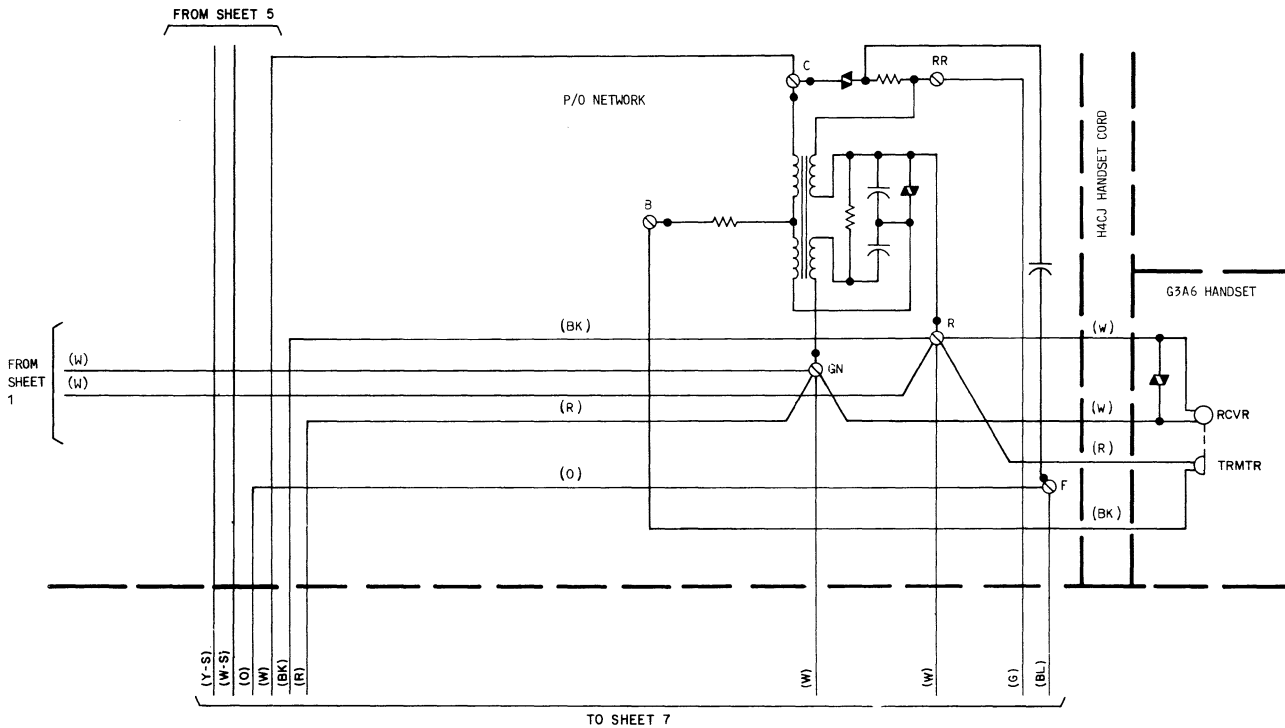


Fig. 9—833C (MD) Telephone Set, Connections (Sheet 6 of 7)

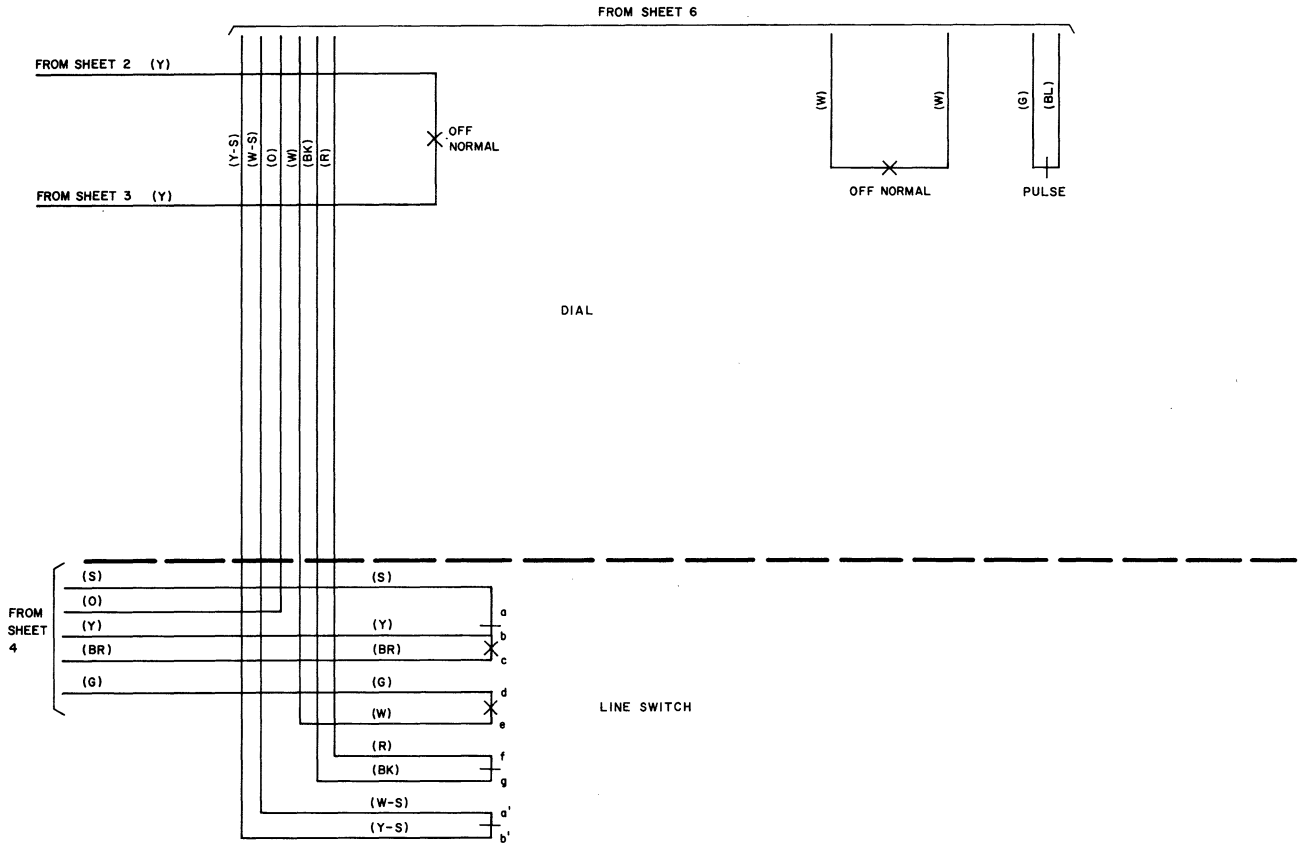


Fig. 9—833C (MD) Telephone Set, Connections (Sheet 7 of 7)

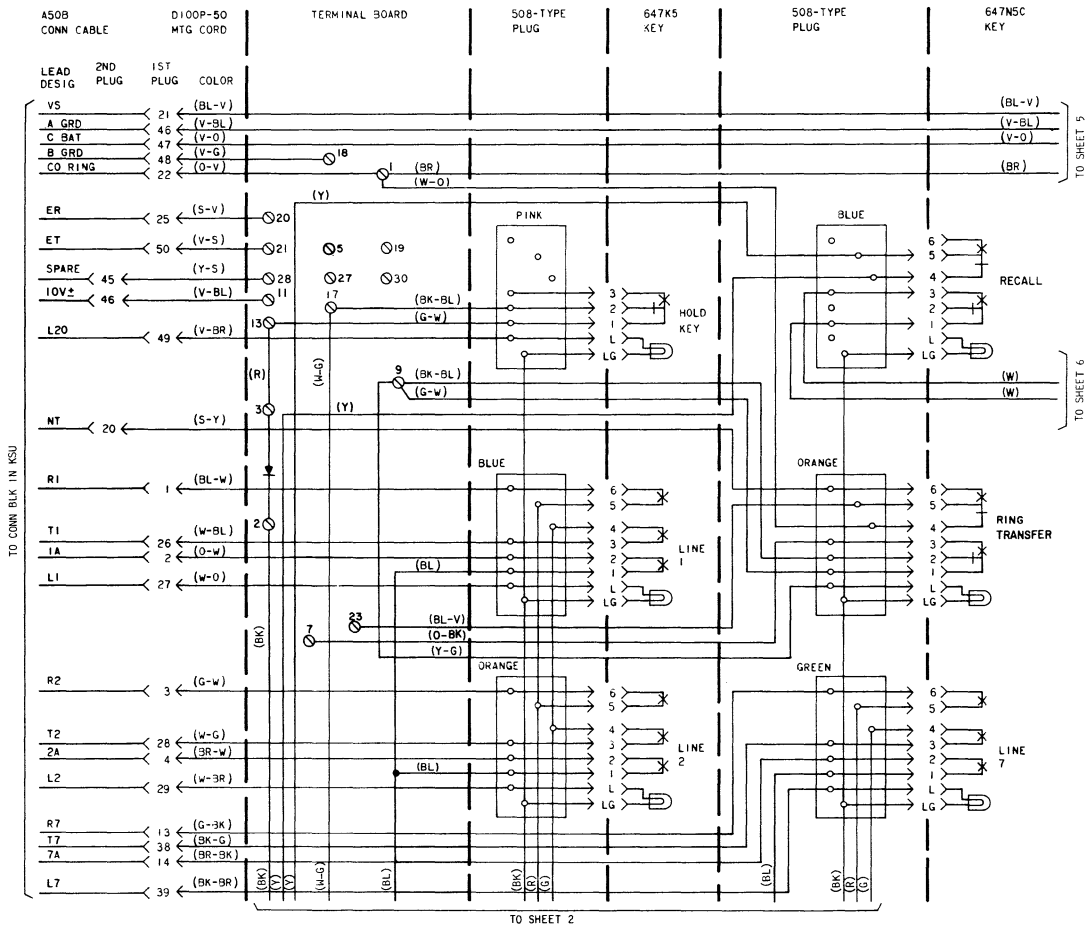


Fig. 10—2833C (MD) Telephone Set, Connections (Sheet 1 of 7)

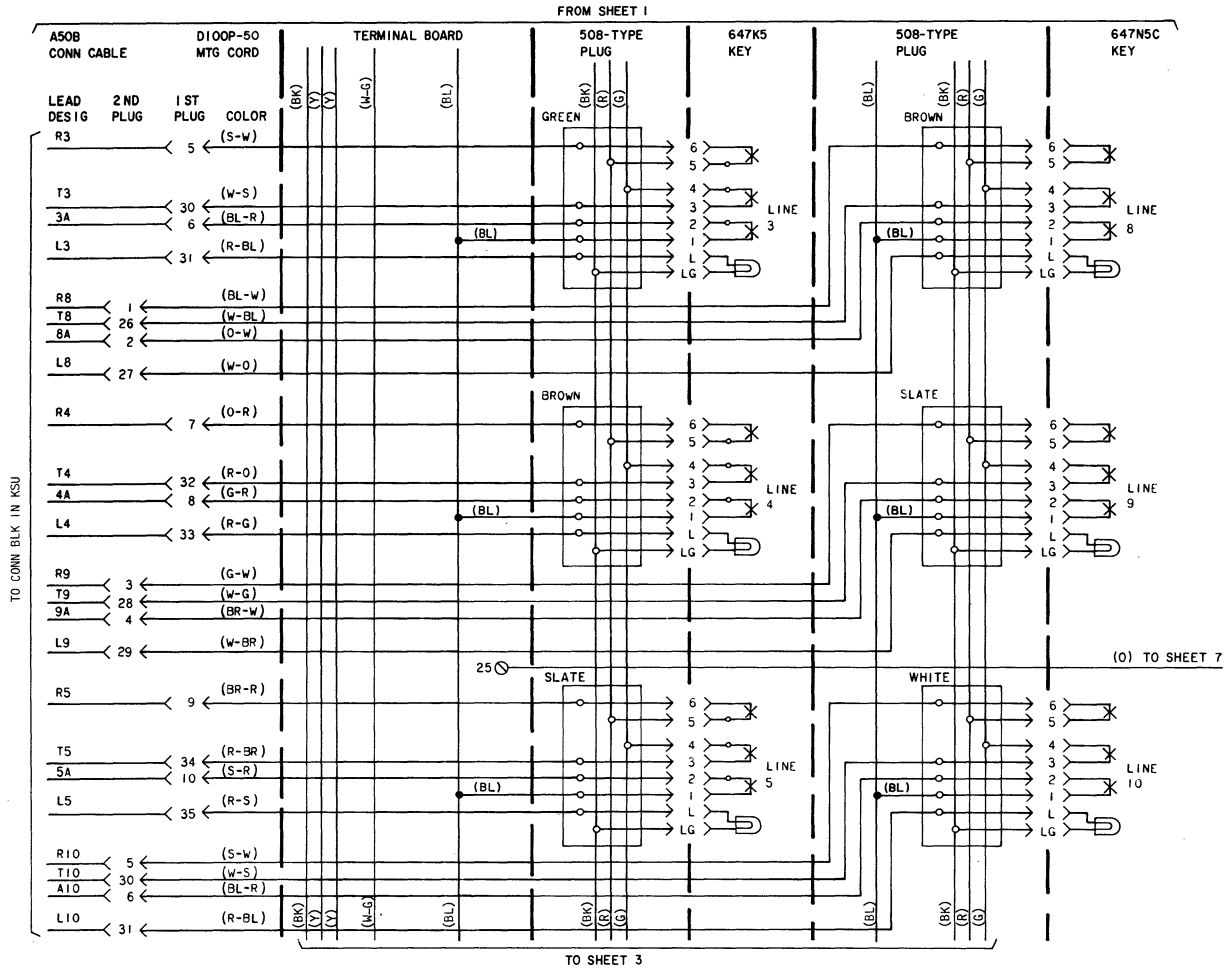


Fig. 10—2833C (MD) Telephone Set, Connections (Sheet 2 of 7)





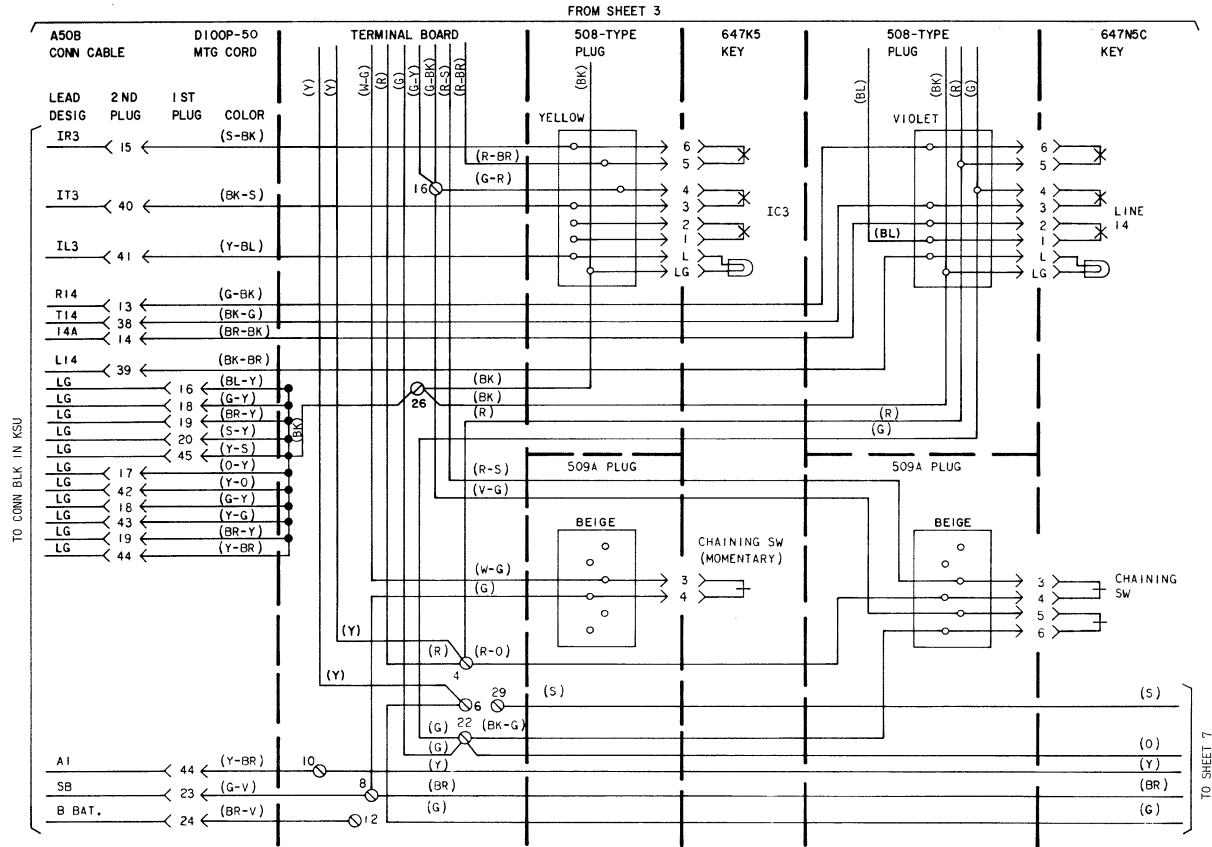


Fig. 10—2833C (MD) Telephone Set, Connections (Sheet 4 of 7)



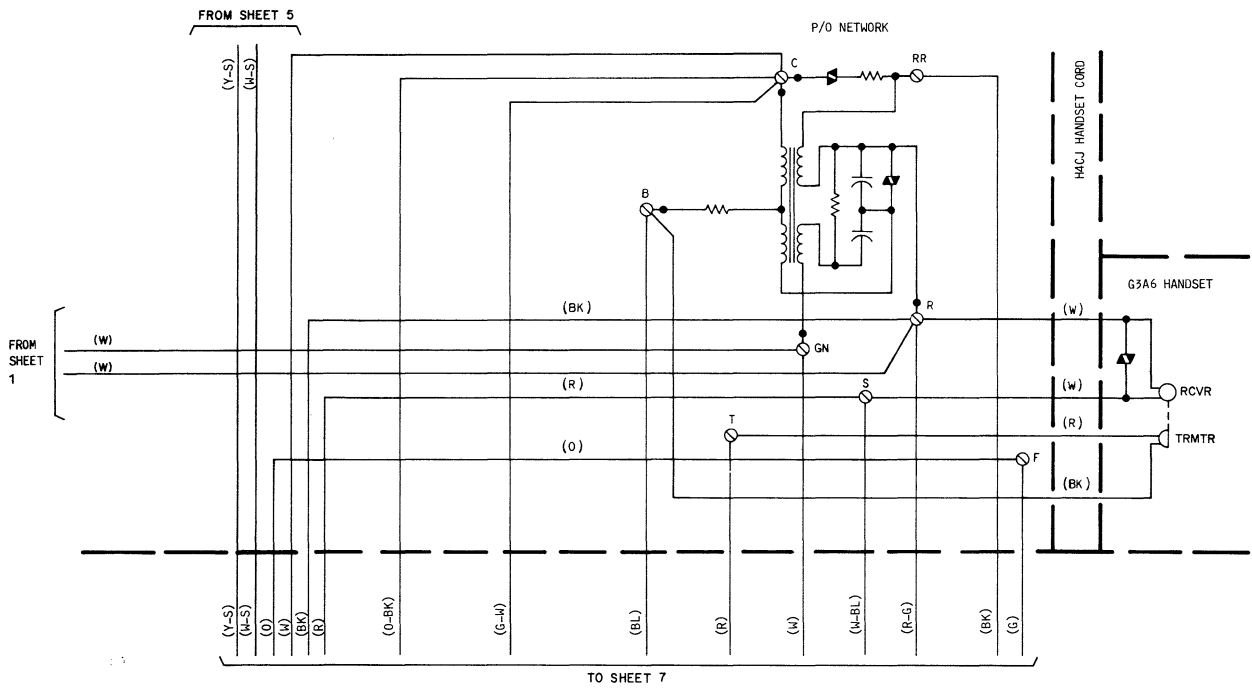


Fig. 10—2833C (MD) Telephone Set, Connections (Sheet 6 of 7)

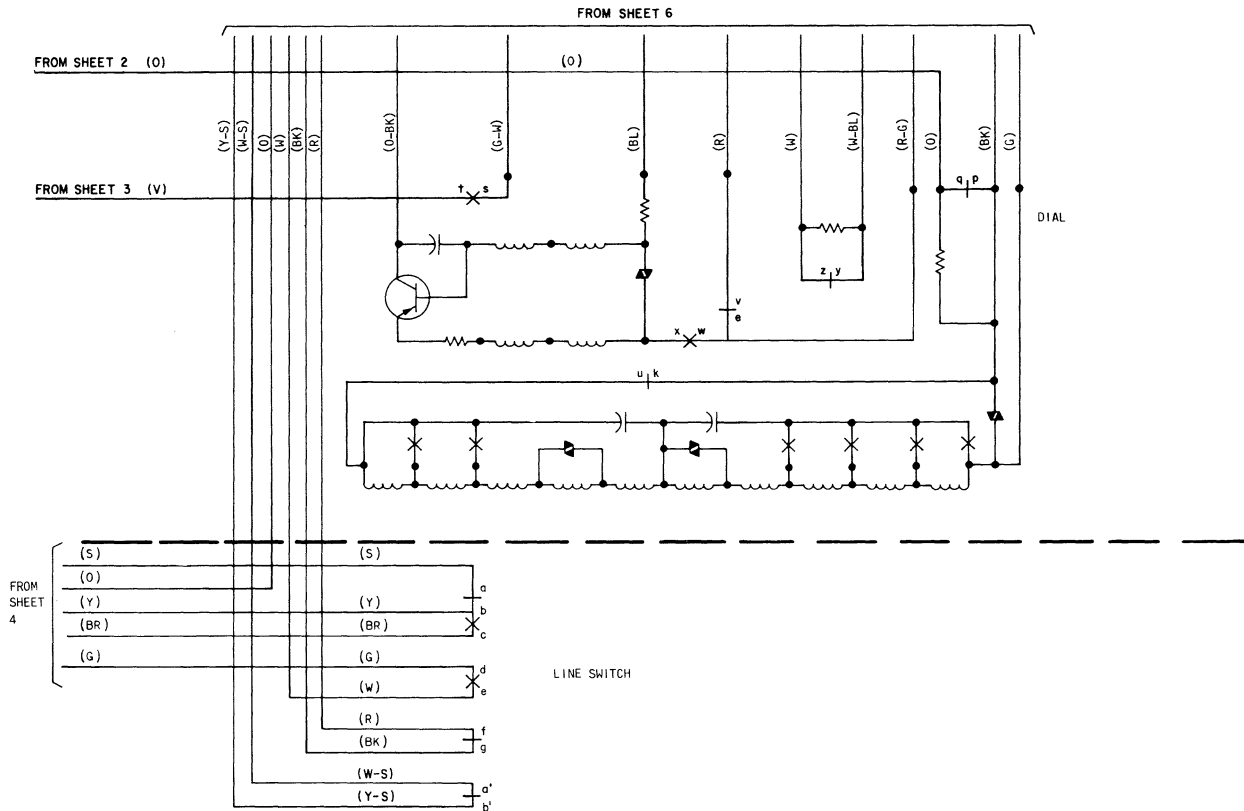


Fig. 10—2833C (MD) Telephone Set, Connections (Sheet 7 of 7)

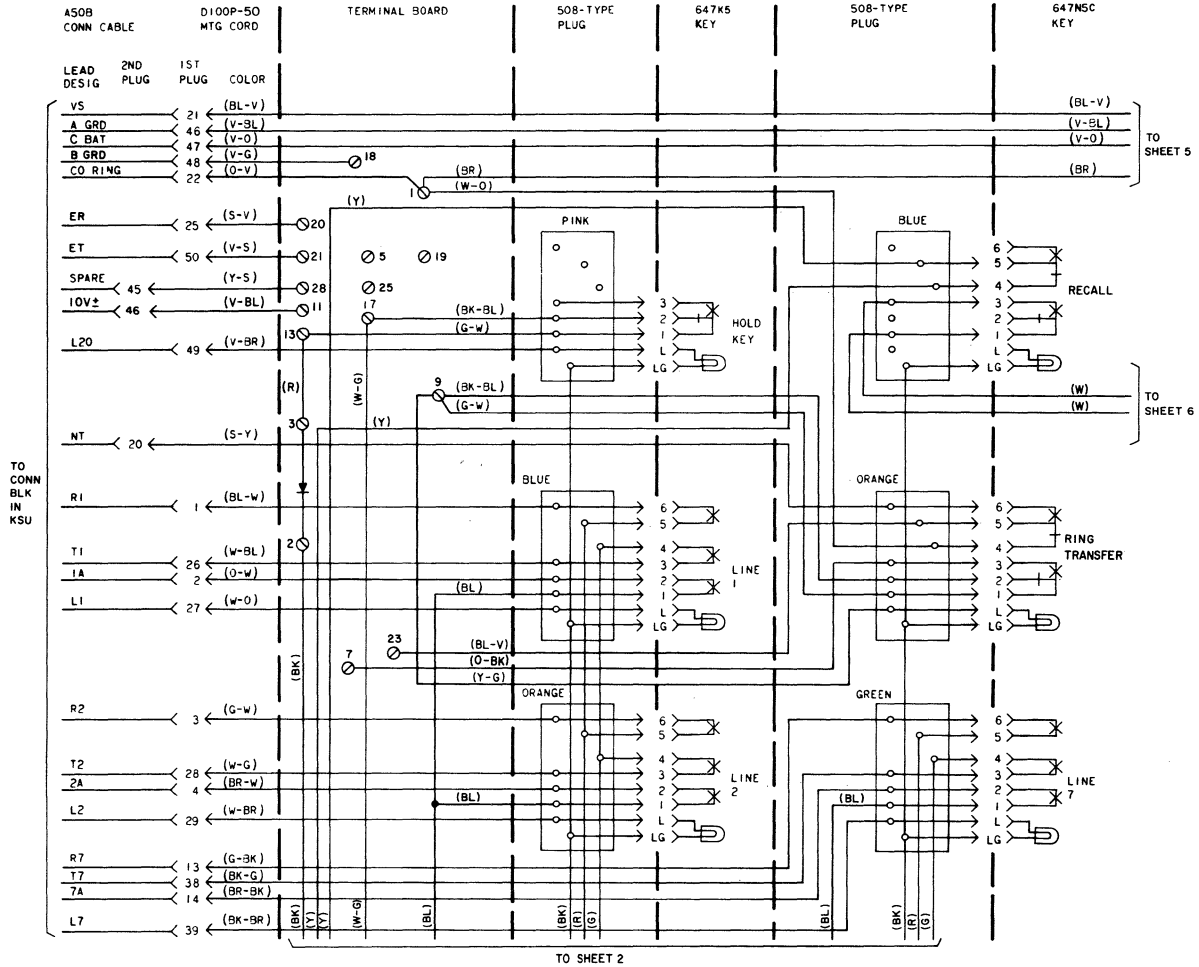


Fig. 11—833CM or 833EM Telephone Set, Connections (Sheet 1 of 7)

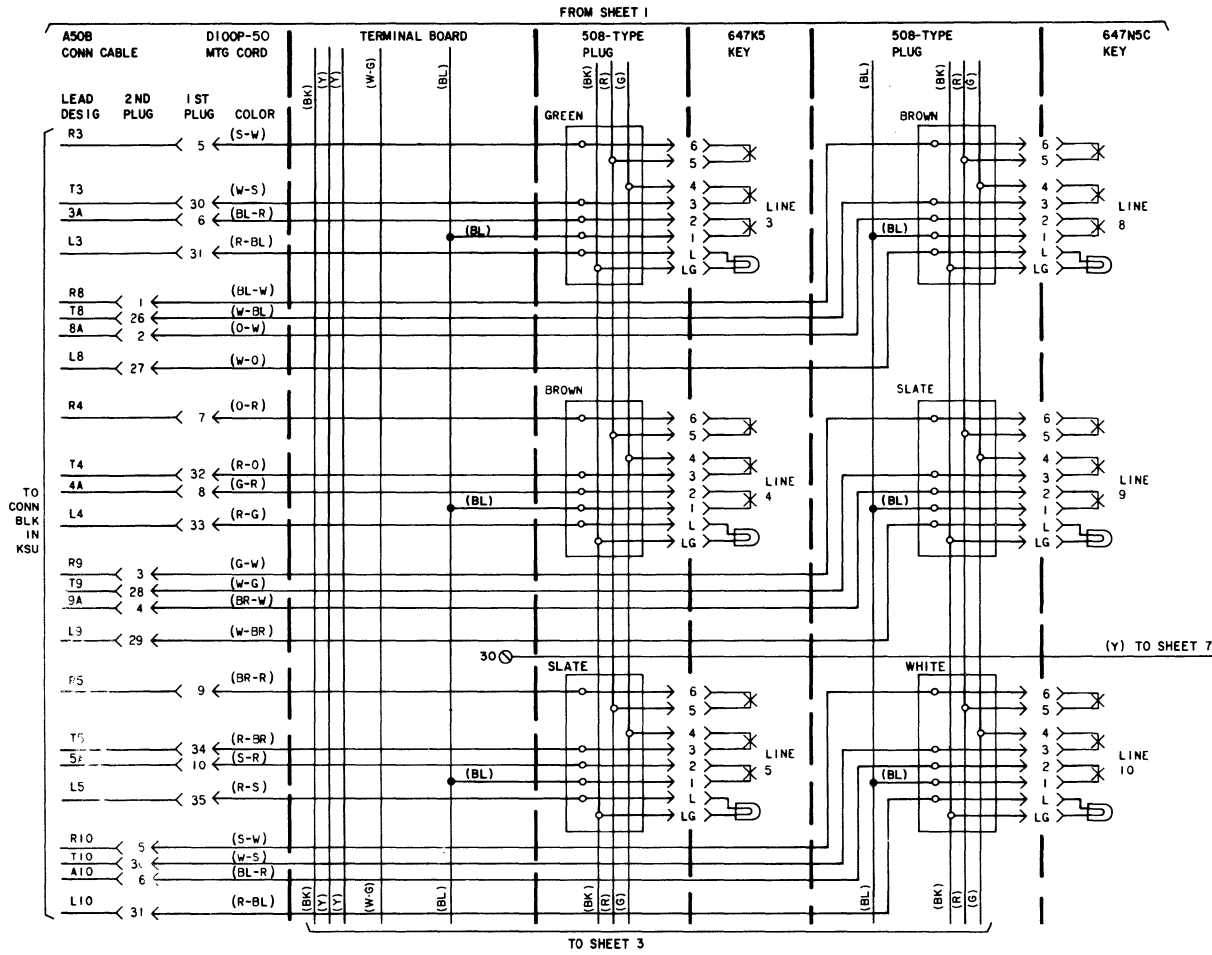


Fig. 11—833CM or 833EM Telephone Set, Connections (Sheet 2 of 7)

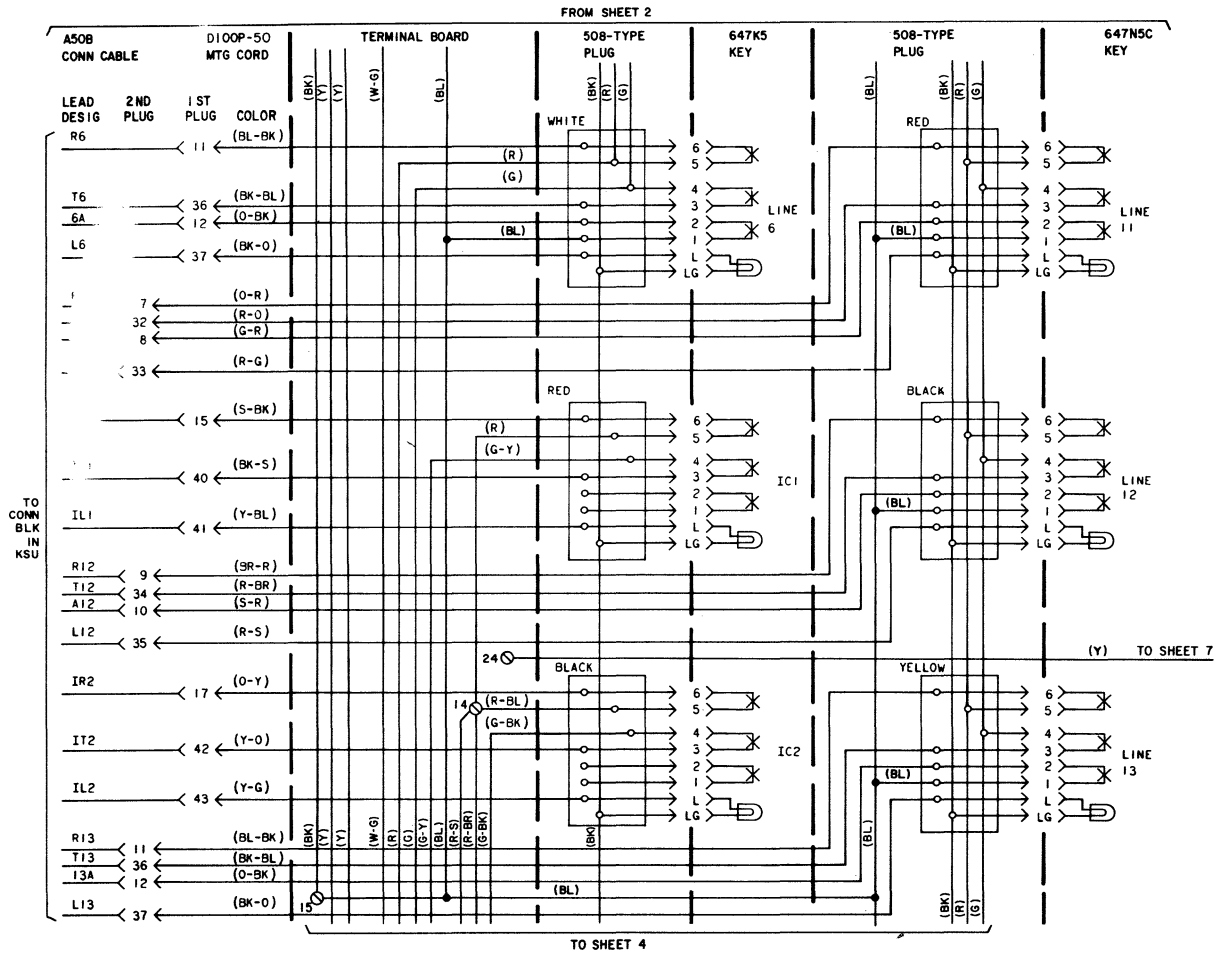


Fig. 11—833CM or 833EM Telephone Set, Connections (Sheet 3 of 7)





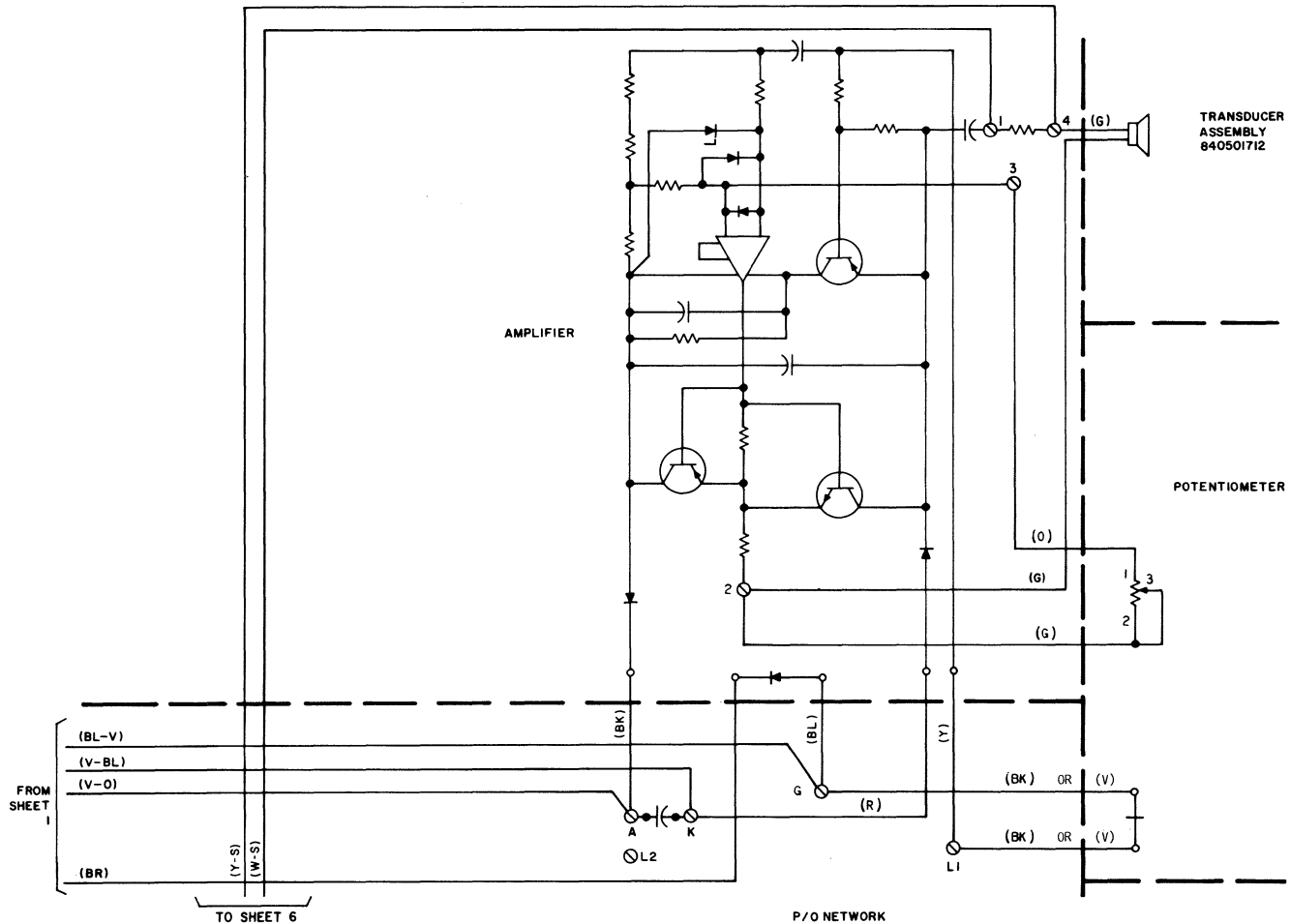


Fig. 11—833CM or 833EM Telephone Set, Connections (Sheet 5 of 7)

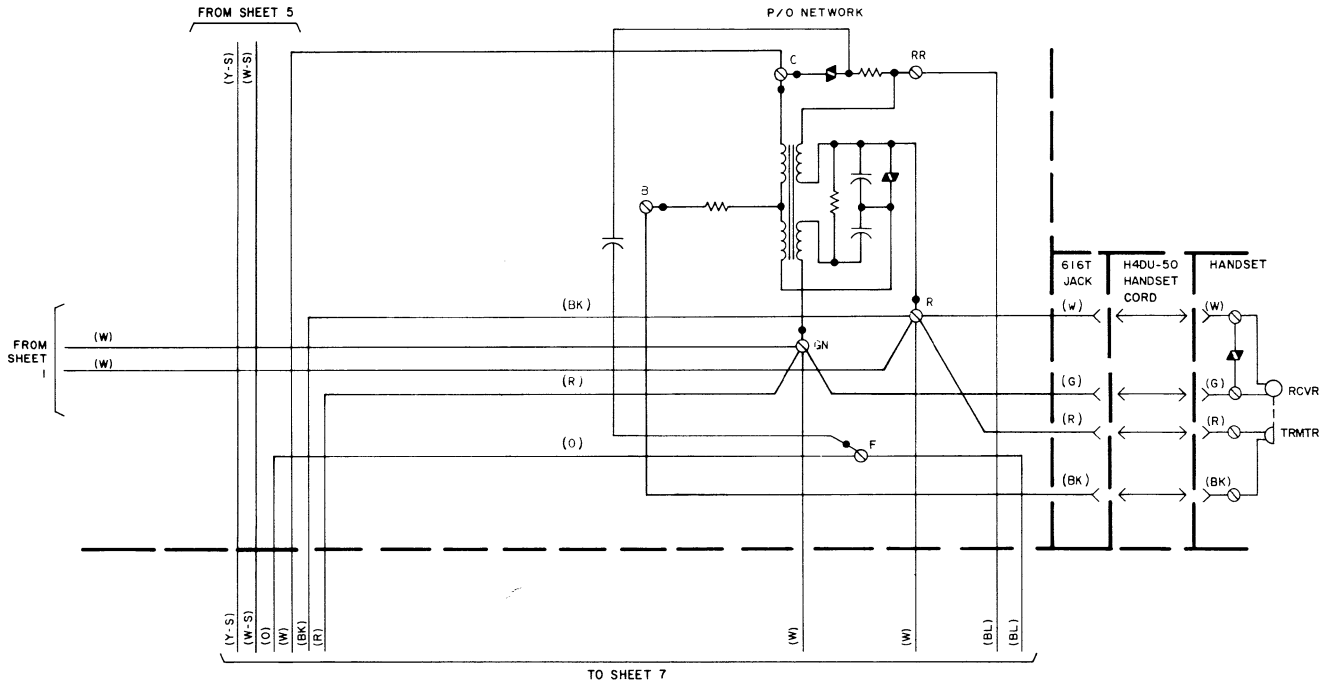


Fig. 11—833CM or 833EM Telephone Set, Connections (Sheet 6 of 7)

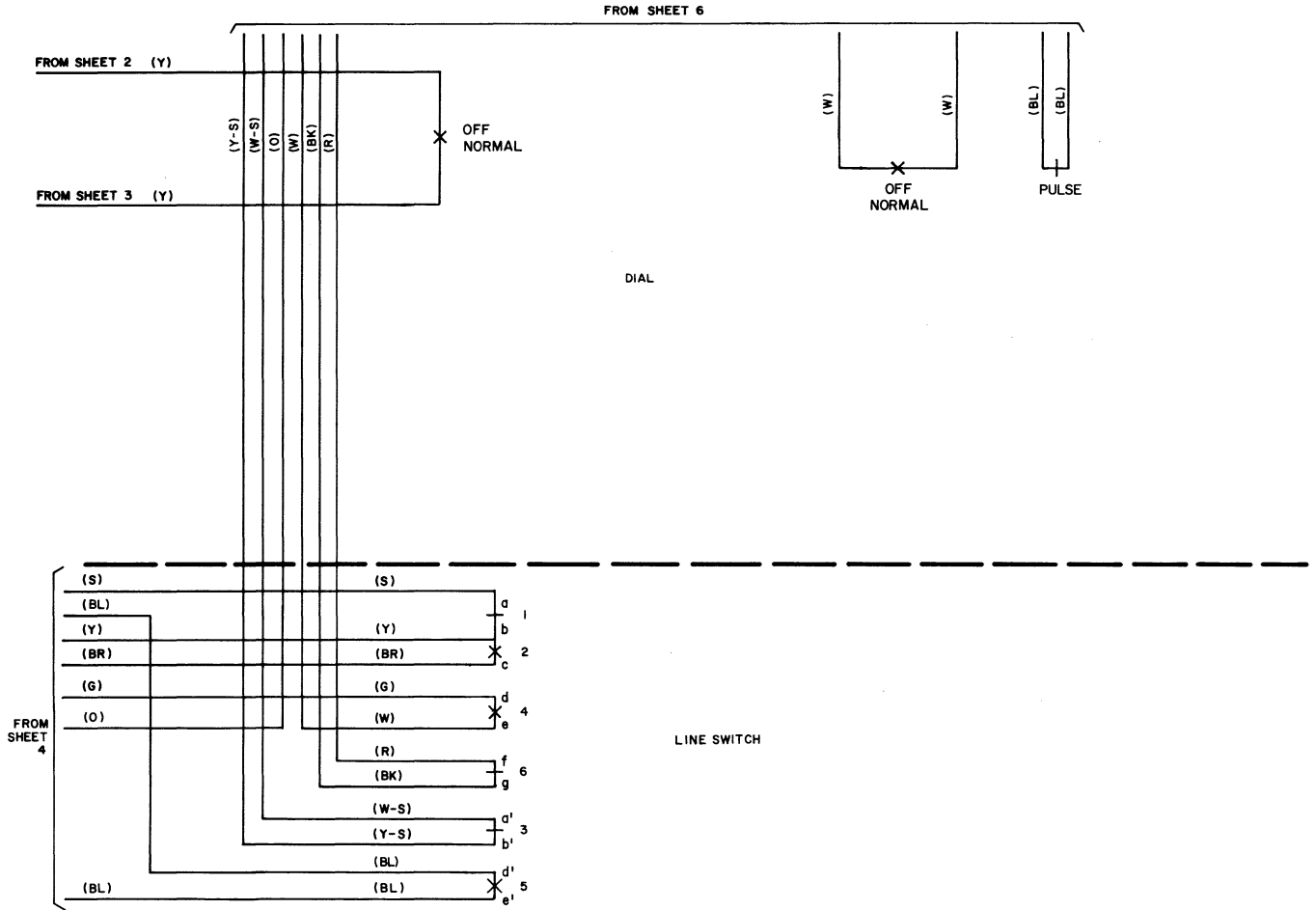


Fig. 11—833CM or 833EM Telephone Set, Connections (Sheet 7 of 7)

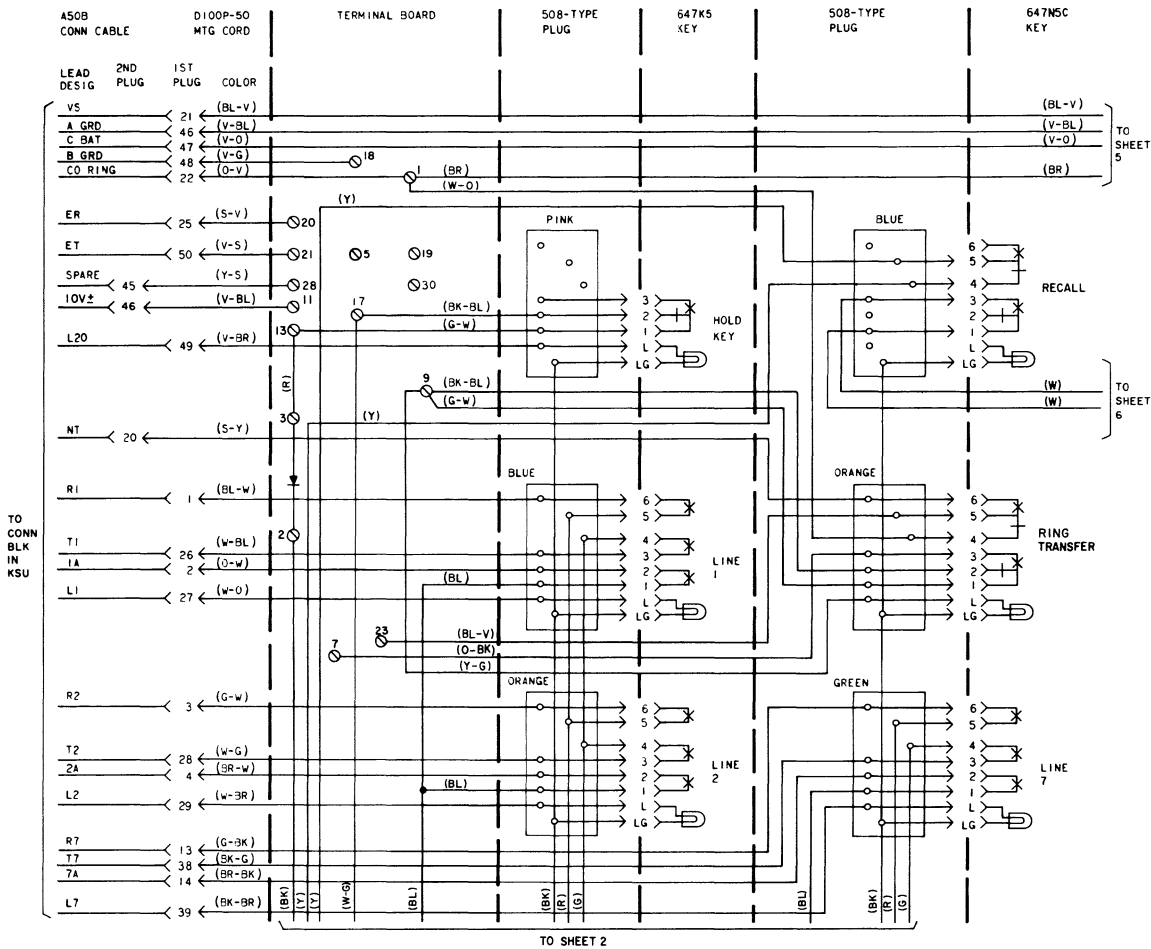


Fig. 12—2833CM or 2833EM Telephone Set, Connections (Sheet 1 of 7)









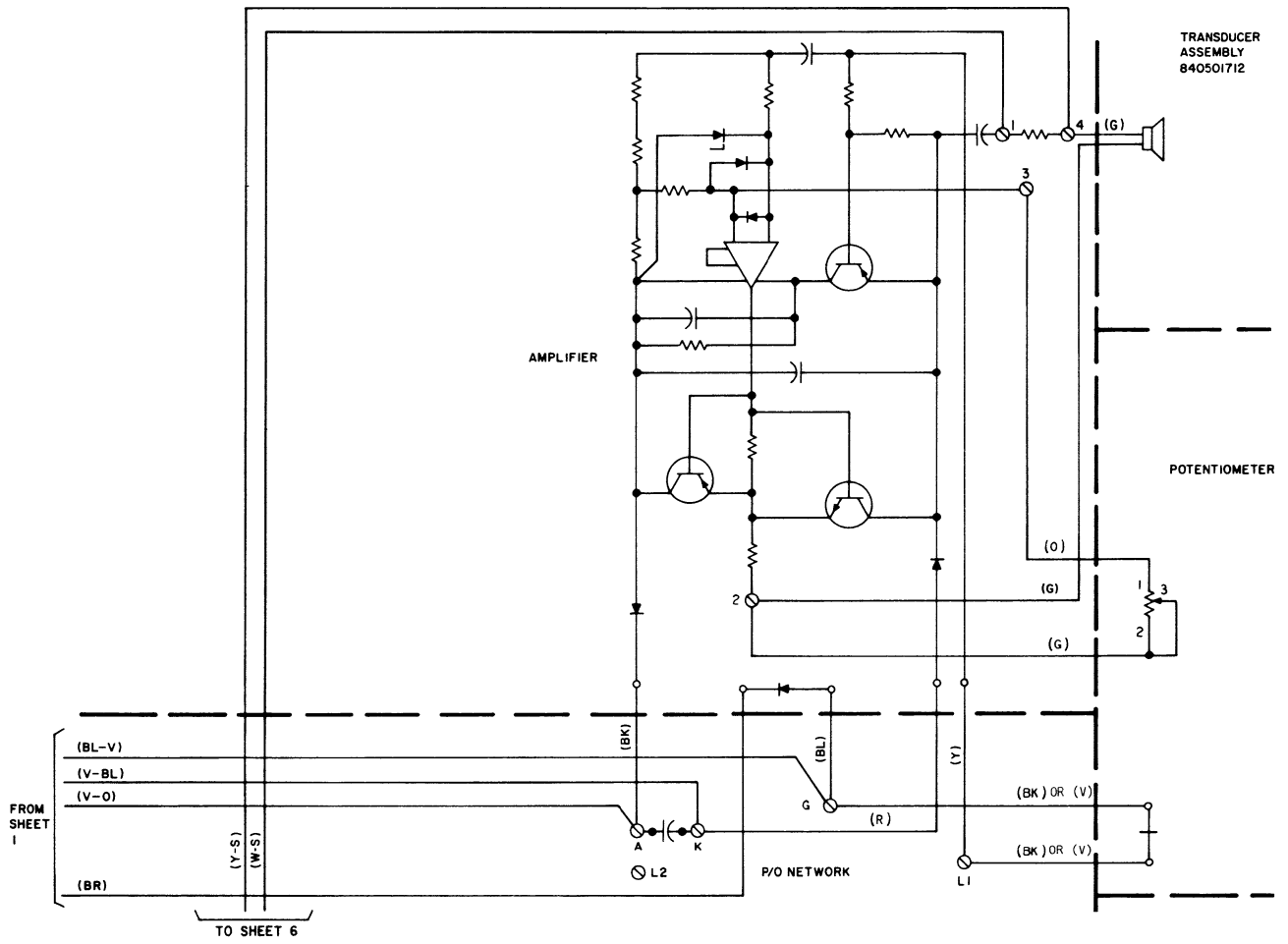


Fig. 12—2833CM or 2833EM Telephone set, Connections (Sheet 5 of 7)

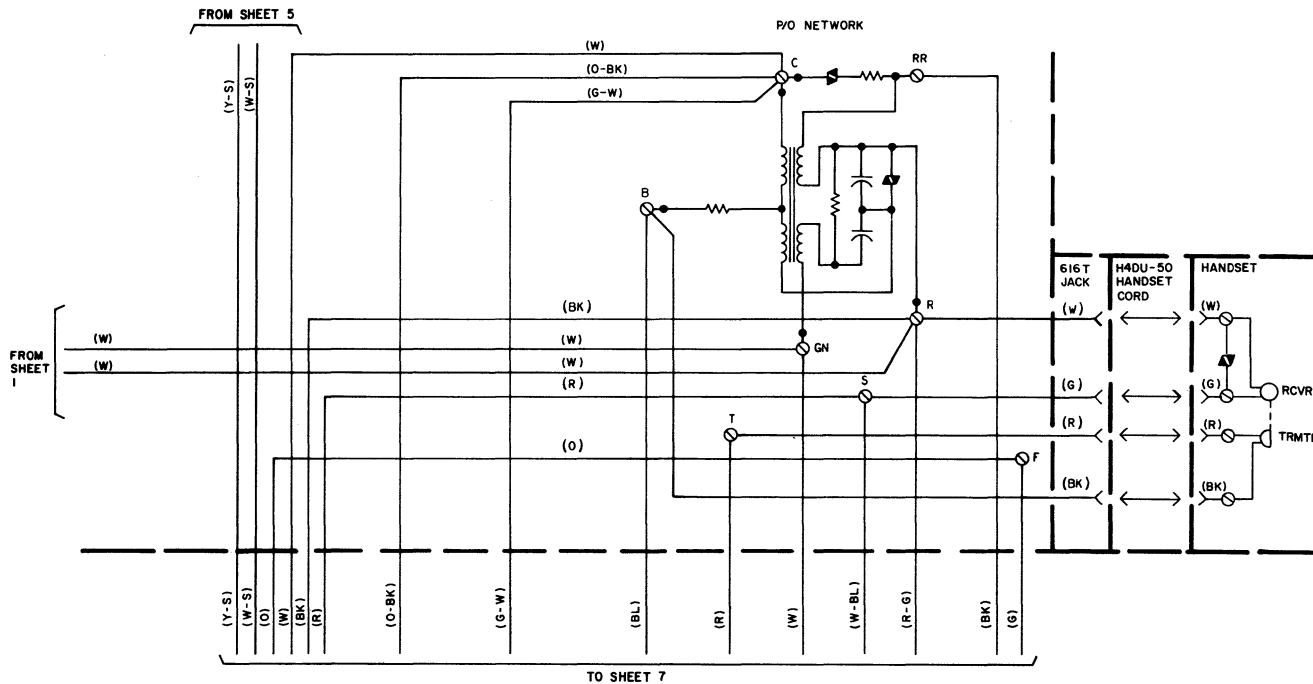


Fig. 12—2833CM or 2833EM Telephone Set, Connections (Sheet 6 of 7)

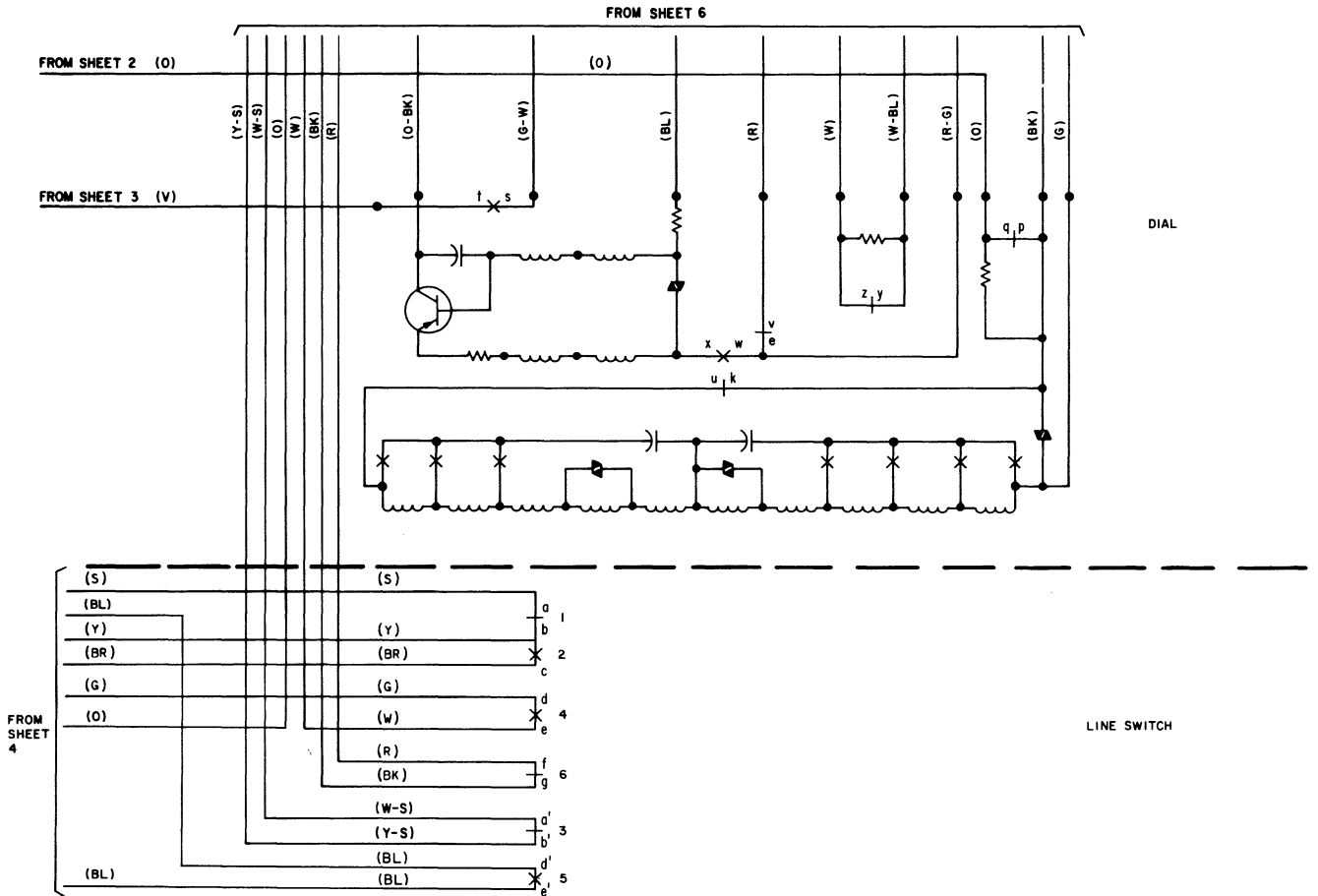


Fig. 12—2833CM or 2833EM Telephone Set, Connections (Sheet 7 of 7)

TABLE C

**833C(MD), CM, EM AND 2833C(MD), CM, EM TELEPHONE  
SET CONNECTIONS FOR PRIVACY CIRCUIT  
(D-180486 KIT OF PARTS)**

TEL SET LEAD COLOR	PRIVACY BOARD LEAD COLOR	CONNECT TO TEL SET TERM.	MOVE LEAD	
			FROM TEL SET TERM.	TO PRIVACY BOARD TERM.
	O	8		
	BR	F on net.		
	S	15		
	BK	12		
	BL	6		
R			13	P2
G-W			13	P1
Y			6	R1
O			F on net.	T

**TABLE D**

**683AE TRANSMITTER CONNECTIONS FOR HFAI (SEE NOTE)**

FROM 683AE TRANSMITTER	CONNECT TO TELEPHONE SET	
	TERM. BOARD	NET. TERM.
W-BL	26	
BL-W	18	
W-O	21	
O-W	20	
W-G		G
G-W		L2 *
W-BR		A
BR-W		K

\*Remove (BL-V) from G of network and connect to L2 of network.

*Note:* HFAI feature initially available with COM KEY 2152 only.

**TABLE E**

**833C(MD),CM, EM OR 2833C(MD), CM, EM TELEPHONE SET CONNECTIONS FOR RING TRANSFER**

COLOR	MOVE LEAD IN TEL SET	
	FROM TERM.	TO TERM.
O-BK	7	11
O-V	1	23

**TABLE F**

**TO DISABLE PRIVACY CIRCUIT**

COLOR	MOVE LEAD IN TEL SET	
	FROM TERM.	TO TERM.
O	8	*
BK	12	*

\* Insulate and store.

**TABLE G**

**TO DISABLE PRIVACY RELEASE KEY**

COLOR	MOVE LEAD IN TEL SET	
	FROM TERM.	TO TERM.
O-BK	10	15

**TABLE H**

**CONNECTIONS FOR POWER FAILURE TRANSFER RINGER (E1CM) 1434 "COMKEY" ONLY**

CONNECT LEADS*	
FROM TEL SET TERM.	TO RINGER TERM.
20	5
21	6

\* Use inside wire.

**7A COMMUNICATION SYSTEM—(COM KEY\* 718)  
IDENTIFICATION, INSTALLATION, CONNECTION,  
OPERATION, AND MAINTENANCE**

**1. GENERAL**

**1.001** This addendum supplements Section 518-450-100, Issue 4. Place this pink sheet ahead of Page 1 of the section.

**1.002** This addendum is issued to provide information relating to the Federal Communications Commission's (FCC) Registration Program.

**2. CHANGES TO SECTION**

**2.001** On Page 2, following paragraph 1.03, add the following:

**1.04** After January 1, 1980, connection of customer-provided equipment (CPE) or telephone company-provided equipment to the 7A

Communication System requires the use of a 33B voice coupler when providing music-on-hold. Also after January 1, 1980, the 415B, 460C, 471C, and 479C key telephone units (KTUs) must be used when providing their related services. Previously connected or Class C system components may be used for additions and maintenance at grandfathered installations for the life of the equipment, provided they are not modified. Class C stock may also be used in new installations after January 1, 1980.

**1.05** Incoming central office (CO) lines to be installed in compliance with the FCC Registration Program must be routed through a standard network interface. Information on approved interfaces is contained in Sections 463-400-100 through 463-400-150.

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**NOTICE**

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**7A COMMUNICATION SYSTEM—(COM KEY\* 718)**  
**IDENTIFICATION, INSTALLATION, CONNECTION, OPERATION, AND MAINTENANCE**

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**1. GENERAL**

**1.01** This section contains information for the 7A Communication System.

**1.02** This section is reissued to:

- Add information on the 570B key service unit (KSU) and show the 570A rated MD
- Add satelliting information using a nomograph or 14A1-100 terminal block
- Indicate that the telephone sets and consoles used with COM KEY 718 are now supplied with ivory (-50) mounting cords instead of satin-silver (-87)
- Change code of the K8 loudspeaker to KS-21880L1 and add information on the KS-21939L2 loudspeaker
- Add information on use of 415A KTU—Automatic Private Line Circuit (570B only)
- Add 77C apparatus mounting for floor mounting of 570-type KSU

- Add information on D-180720 Kit of Parts—used in 570A KSUs having a serial number of 16390 or lower and using a 478B KTU for TOUCH-TONE dialing
- Remove 19C3 power unit—570A KSUs were never supplied with the 19C3
- Change the rating of the 832A/2832A telephone sets from A&M Only to MD.

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

**1.03** This issue is based on:

- Section 463-341-102—Voice Connecting Arrangement FTP (33A Voice Coupler)
- Section 503-701-110—832- and 2832-Type Telephone Sets; Identification, Installation, Connections, and Maintenance
- Section 512-620-487—Speakerphone System—3-Type; 832-, 833-, 2832-, and 2833-Type Telephone Sets, Connections
- Section 512-740-471—Speakerphone System 4A, 832-, 833-, 2832-, and 2833-Type Telephone sets
- Section 518-010-105—KTS, Grounding and Special Protection Requirements
- CD- and SD-69652-01, Issue 4—7A Communication System Circuit
- CD- and SD-69654-01, Issue 3—832A and 2832A Telephone Circuit for Use With 7A Communication System
- CD- and SD-69656-01, Issue 2—6A1 and 6B1 Selector Console Circuit to Use With 7A Communication System.

If this section is to be used with equipment or apparatus reflecting a later issue of the drawing(s), reference should be made to the CDs and SDs to determine the extent of the changes and the manner in which the section may be affected.



## 2. DESCRIPTION OF APPARATUS

**2.01** The 7A Communication System will accommodate a maximum of 7 CO/PBX lines and 18 stations. It is equipped with a 2-path intercom. A 570-type KSU houses a power supply and KTU mountings. Telephone sets (832- and 2832-type) are special 10-button, 11-button, and 13-button sets providing basic services such as pickup, hold and illumination, voice and tone signaling, multiline conferencing, and automatic button restoration (ABR). Optional features are privacy (lockout), privacy release, station restriction, paging [with or without customer-provided (CP) background music], power failure transfer, ring transfer, music-on-hold (utilizing CP music source), intercom preset conference, station busy console with direct station selection (DSS), station busy console with message waiting (MW), intercom-only telephone sets, TOUCH-TONE dialing, speakerphone, external signaling circuit, and connection to customer paging.

**2.02** In the 7A Communication System, each station has access to all CO/PBX lines and both intercom paths. One station, selected as the attendant station (station code 0), is the only station factory-wired in the KSU for CO/PBX ringing. Incoming calls are answered at the attendant station. The attendant ascertains the station or party being called and places the incoming call on hold. The attendant may then page the called party or dial the called station or party over an intercom path and inform them of the incoming call. The attendant may reenter the call by depressing the associated line button. The attendant station (station code 0) is the only station that can divert its common audible ringing via the optional ring transfer feature. Any station may be optionally wired for CO/PBX ringing on a single line or for common audible ringing. Stations cannot be wired for both common audible and CO/PBX ringing. In the 7A Communication System, as many as ten stations may be wired for common audible ringing. Intercom station codes are 0 (attendant station code) and 3 through 19. Code 1 is a transfer digit for 2-digit codes and code 2 is for paging.

## 570-TYPE KSU

**2.03** The 570A KSU (MD) (Fig. 1) has the following mechanical design features:

- Contains an internally mounted 19C2A power unit (19C2 in some earlier models) and a KS-19175L1 interrupter
- Contains five internally mounted 66-type connecting blocks for option, console, and station connections
- Has fuse panel (Table A) which provides power distribution to connectors and station blocks for lamp and fusing functions
- Has status lamps to indicate status of CO/PBX and intercom lines (Table B)
- Has designation strip holder and tab assembly serving as a retainer to lock KTUs in the connectors
- Mounts twelve 4-inch and three 8-inch KTUs
- Has 424C, 455A, 456B, and 460B KTUs shipped with KSU
- Is 25-1/2 inches wide, 17 inches high, 11 inches deep, and requires 9-1/2 inches of wall space on either side of the backboard to permit full opening of the carrier assemblies
- Is arranged for wall mounting or may be floor-mounted (using the 77-type apparatus mounting)
- Has a removable fiberglass cover.

**2.04** The 570B KSU is the same as the 570A except:

- No KTUs are shipped with the KSU—the 424C, 455A, 456B, and 460B KTUs must be ordered separately

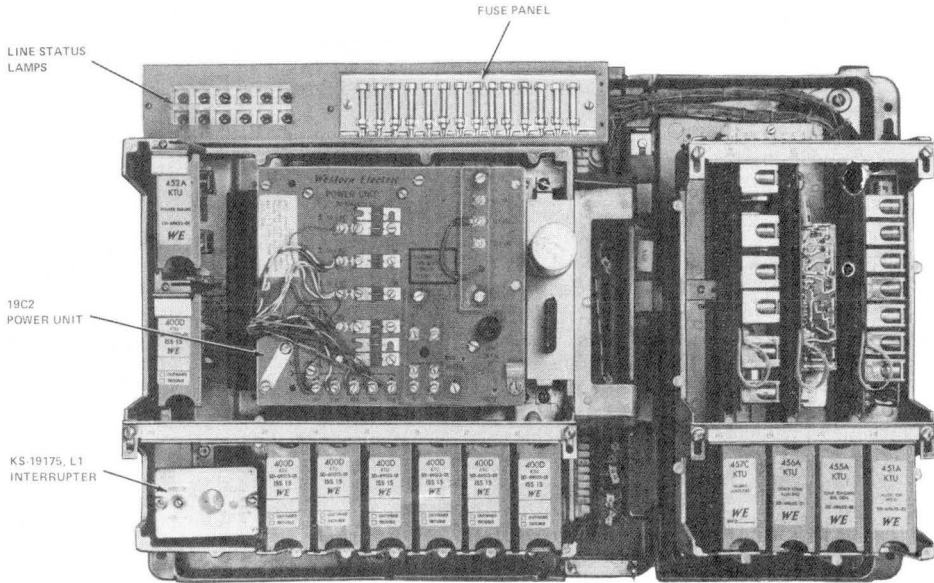


Fig. 1—570-Type KSU (Cover Removed)

- Wired for use of a 498A KTU equipped with a 116A1 circuit module when music-on-hold is furnished—**the 451-type KTU is not compatible with the 570B KSU**
- Redesigned fuse panel using fuse clips instead of fuse holders (Fig. 6)
- J2 through J8 wired to A battery and A ground to permit use of 415A KTU (Automatic Private Line Circuit) when music-on-hold is not provided.

**2.05** All wiring connections are made on connecting blocks located in the KSU (Fig. 2). Since all stations pick up all lines on the same button at each telephone set, all equipment connections are factory-wired to the connecting blocks.



**All station connections are made on the station connection field blocks using standard color-code cutdown. This eliminates the need for an external cross-connection field except when using satellite wiring plan.**

**2.06** The block and column on which a station is cut down determines the intercom code assigned to that station. Intercom codes available are codes 0 and 3 through 19.

(a) Connecting block 1 (Fig. 3) contains the diode arrangement for preset conference and common audible signaling. Terminals are provided for strapping the power failure transfer, CO ringing, preset conference, paging, and ring transfer.

TABLE A

## FUSE ARRANGEMENT—570-TYPE KSU

<i>FUSE PANEL (SEE FIG. 6)</i>			
FUSE DESIG (NOTE 1)	FUSE AMP (TYPE)	POTENTIAL	FUNCTION
F1	1-1/3(70A)	10V ac	First CO/PBX Line Lamps
F2			Second CO/PBX Line Lamps
F3			Third CO/PBX Line Lamps
F4			Fourth CO/PBX Line Lamps
F5			Fifth CO/PBX Line Lamps
F6			Sixth CO/PBX Line Lamps
F7			Seventh CO/PBX Line Lamps
F8	1/2(70G)		Interrupter Motor
F9	1-1/3(70A)	-24V dc(SIG)	System Privacy and DSS Console Paging Amplifier (Note 2)
F10		10V ac	Ring Transfer and MW Console
F11	1/2(70G)	-24V dc(SIG)	
F12	3/4(70H)		C Battery
F13	1-1/3(70A)	10V ac	First Intercom Path Lamp
F14			Second Intercom Path Lamp
<i>POWER UNITS—19C2/19C2A</i>			
FUSE DESIG	FUSE AMP (TYPE)	FUNCTION	
Line F1	2(MDL-2)	AC Input Power	
±18V ac	2(24C)	Console Lamp Supply	
±10V ac	5(24F)	Lamp and Lamp Flash	
±10V ac		Lamp Wink	
24V dc B SIG	3(24B)	B (Signal) Battery	
24V dc A TLK	2(24C)	A (Talk) Battery	
<i>VOLTAGE RANGES</i>			
	-24A	18-26 (19C2, 19C2A)	
	-24B	20-26 (19C2, 19C2A)	

*Note 1:* Early production models of the 570A KSUs were equipped with 16 fuses. Fuses 15 and 16 were used for music-on-hold.

*Note 2:* In the 570A KSU the paging amplifier is fed from fuse 11.

TABLE B

## LINE STATUS LAMPS—570-TYPE KSU

LAMP DESIG	LAMP CODE	FUNCTION
L1	51A	FIRST CO/PBX LINE LAMP
L2	51A	SECOND CO/PBX LINE LAMP
L3	51A	THIRD CO/PBX LINE LAMP
L4	51A	FOURTH CO/PBX LINE LAMP
L5	51A	FIFTH CO/PBX LINE LAMP
L6	51A	SIXTH CO/PBX LINE LAMP
L7	51A	SEVENTH CO/PBX LINE LAMP
L11	51A	FIRST INTERCOM PATH LAMP
L12	51A	SECOND INTERCOM PATH LAMP

(b) Connecting block 2 (Fig. 4) contains the polarity guard diodes for the CO/PBX lines.

(c) Connecting block 3 (Fig. 5) provides terminals for connecting station code 0 (attendant station), station code 3, the incoming CO/PBX lines, the optional message waiting or DSS consoles, and the 33A voice coupler.

(d) Connecting blocks 4 and 5 (Fig. 5) provide terminals for connecting station codes 4 through 19.

**2.07** The fuse panel in the 570-type KSU utilizes 70-type indicator fuses to give a visual indication of fuse status. The 19-type power units are equipped with 24-type fuses which do not provide a fuse status indication. See Fig. 6 and Table A.

**2.08** The lamp panel in the 570-type KSU provides a status lamp for each CO/PBX line and intercom path. The lamps give the same indication of line status (flash, steady, wink) as the line

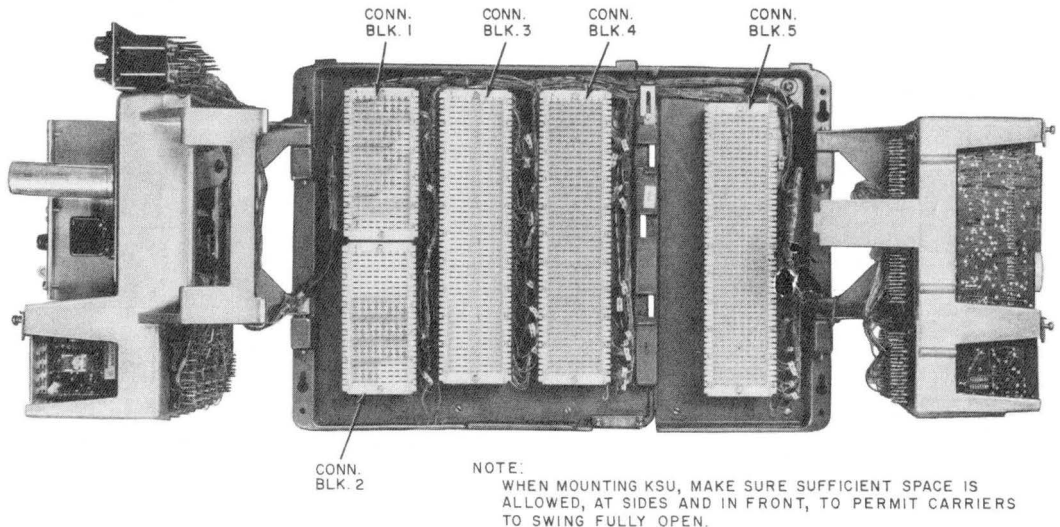


Fig. 2—570-Type KSU (Carriers Open)

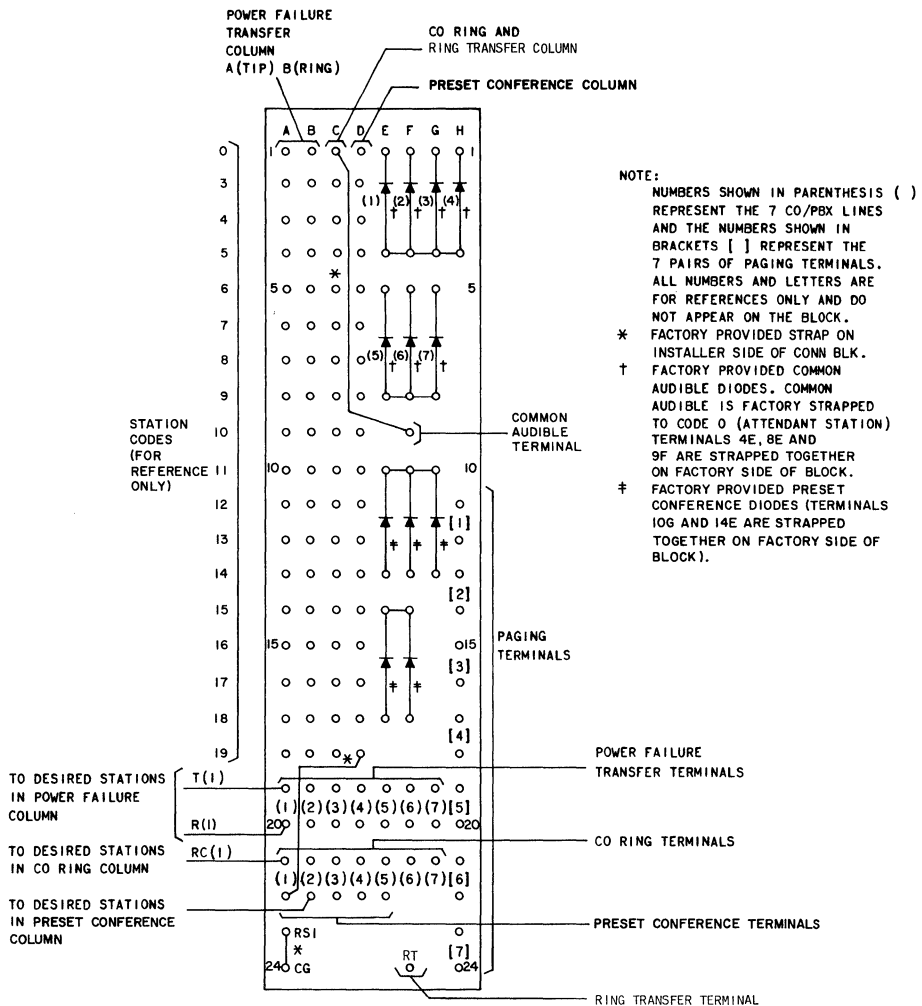


Fig. 3—Terminal Arrangement for Connecting Block 1

lamps in the telephone sets. See Fig. 6 and Table B.

**CONSOLES**

**A. 6A1 Selector Console (Station Busy Console With DSS)**

**2.09** The 6A1 selector console (Fig. 7) is a 20-button console providing a 17-button DSS field with station busy lamps. Of the three remaining buttons, one is used as a paging button, one is used as an

intercom recall button, and one button is spare. Ivory (-50) is the standard console color, and a 6A2-† faceplate must be ordered with each console. Current 6A1 consoles are shipped with an ivory (-50) mounting cord rather than satin-silver (-87). The 6A1 selector console is normally used in addition to the attendant's telephone set to provide DSS on the intercom.

†Refer to Table C for color suffix.

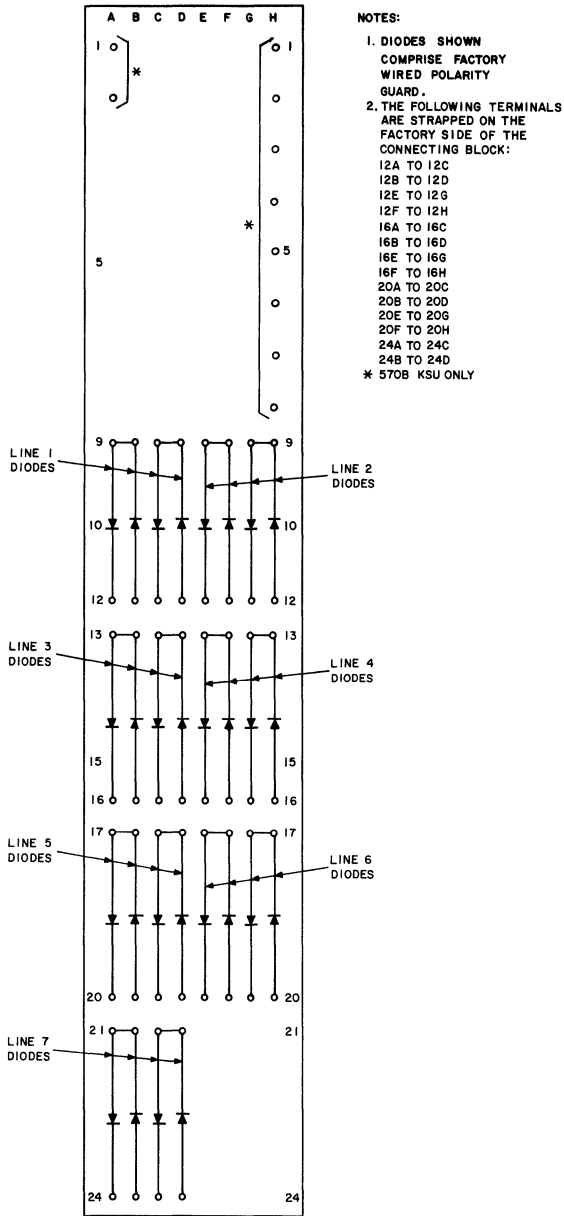


Fig. 4—Terminal Arrangement for Connecting Block 2

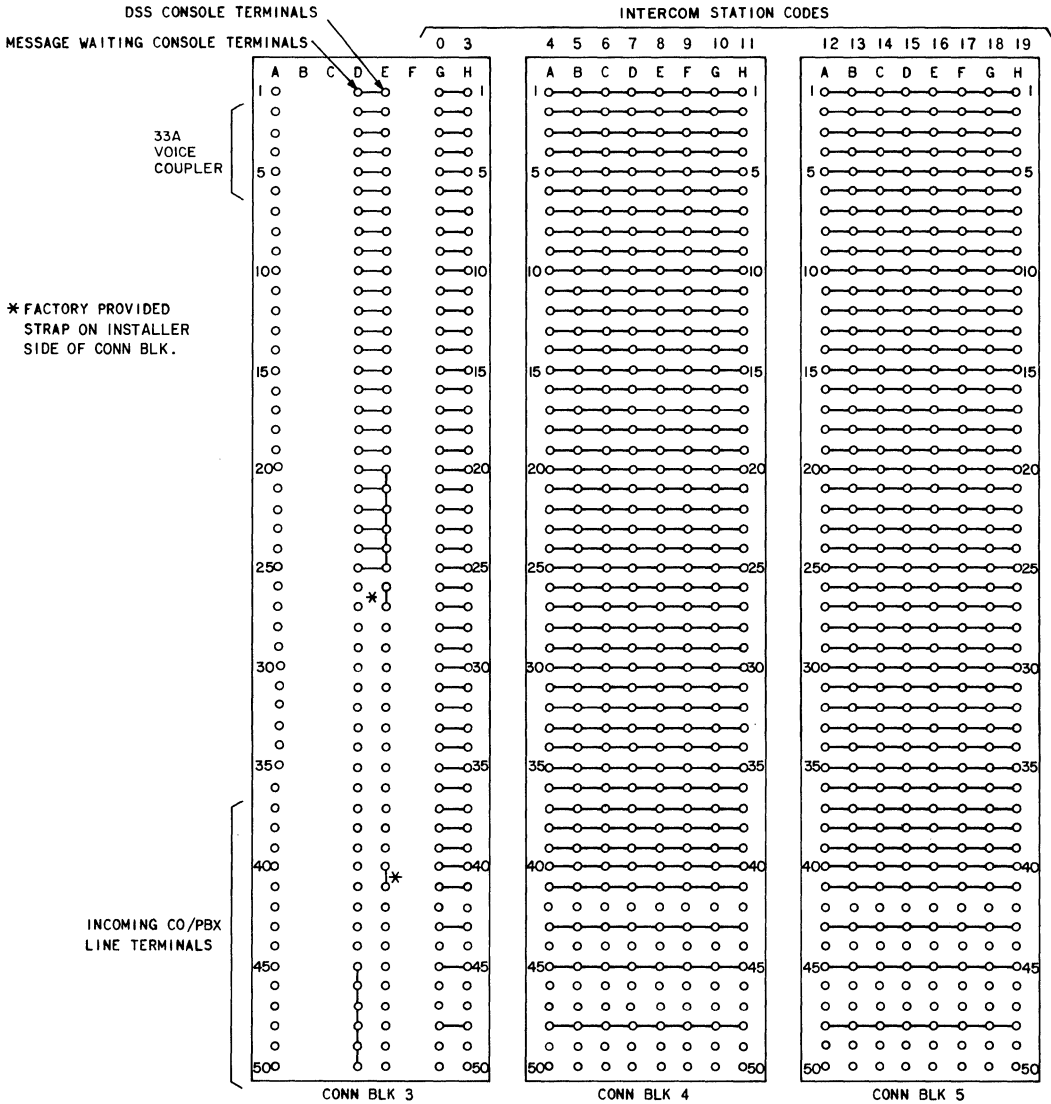


Fig. 5—Terminal Arrangement for Connecting Blocks 3, 4, and 5

**B. 6B1 Selector Console (Station Busy Console With MW)**

**2.10** The 6B1 selector console (Fig. 8) is a 20-button console providing a 17-button message waiting

field. Three buttons are not used. Ivory (-50) is the standard console color, and a 6A2-† faceplate must be ordered with each console. Current 6B1

†Refer to Table C for color suffix.

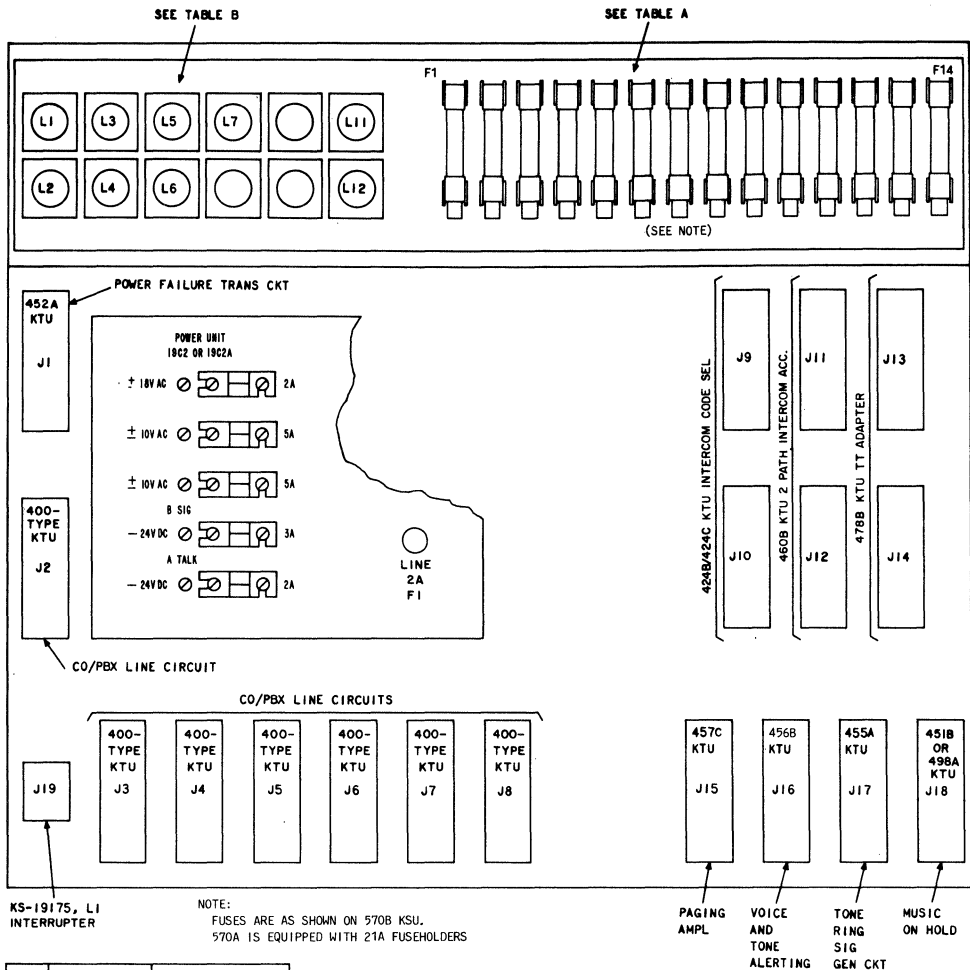


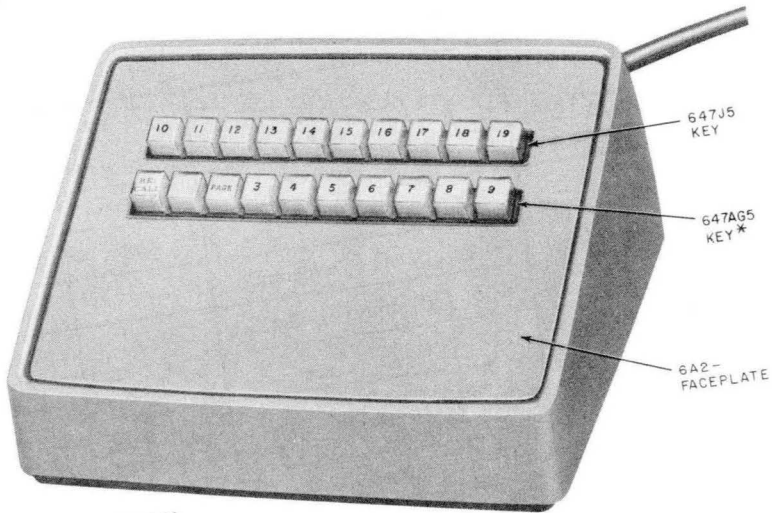
Fig. 6—570-Type KSU, Connector, Fuse, and Lamp Arrangement

consoles are shipped with an ivory (-50) mounting cord rather than satin-silver (-87). The 6B1 selector console is normally used in addition to the attendant telephone set to provide the message waiting feature.

**Note:** Up to three selector consoles in any combination can be used in a 7A Communication System.

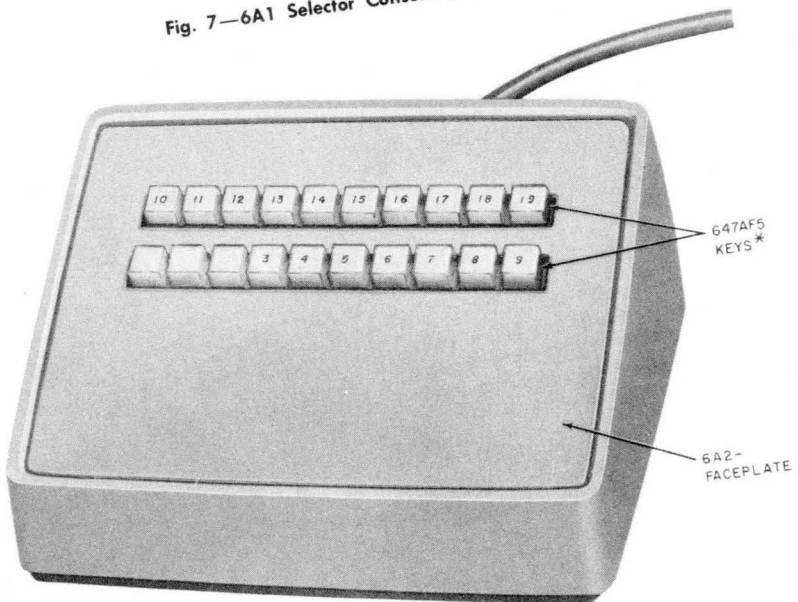
**2.11 Console Power Requirements:** If more than one console is to be used, lamp power ( $\pm 18V$ , 2A) must be provided by a 215C1 power unit installed in the KSU or an equivalent external unit. The 215C1 has three  $\pm 18V$  outputs.





\* OLDER CONSOLES  
EQUIPPED WITH  
647J5C KEY

Fig. 7—6A1 Selector Console (DSS)



\* OLDER CONSOLES  
EQUIPPED WITH  
647C5 KEYS

Fig. 8—6B1 Selector Console (MW)

TABLE C  
COLOR ORDERING GUIDE

832-, 2832-TYPE TELEPHONE SETS AND 6A1, 6B1 SELECTOR CONSOLES		FACEPLATES		SPEAKERPHONE, LOUDSPEAKER, AND TRANSMITTER	
SUFFIX	COLOR	SUFFIX	COLOR	SUFFIX	COLOR
-50	Ivory	-100	Avocado	-03	Black
		-108	Teak (Woodgrain)	-51	Green
		-109	Walnut (Woodgrain)	-58	White
		-111	Gold	-60	Light Beige
		-112	Orange	Kit of Parts D-180508*	Ivory
		-113	Brown		
		-114	Red		
		-115	Blue		
		-118	Black		

\* Order separately.

When it is installed in an earlier model KSU which has a 19C2 for the principal power unit, the  $\pm 18V$  output of the 19C2 is disabled.

## EXTERNALLY MOUNTED APPARATUS

### A. 33A Voice Coupler

**2.12** The 33A voice coupler (Fig. 9) is an interconnecting unit which provides a point of connection for a customer-provided music source used with music-on-hold and background music. It is wall-mounted externally from the KSU. A potentiometer (with screwdriver adjustment slot) controls the level of the background music. The unit contains two fuses for protection against hazardous voltages from the CP music source.

### B. 20A-49 Apparatus Unit

**2.13** The 20A-49 apparatus unit provides a point of connection or interface to a customer-owned and maintained (COAM) paging system. Also, the 20A-49 apparatus unit is used with a large high-power paging system provided by the telephone company.

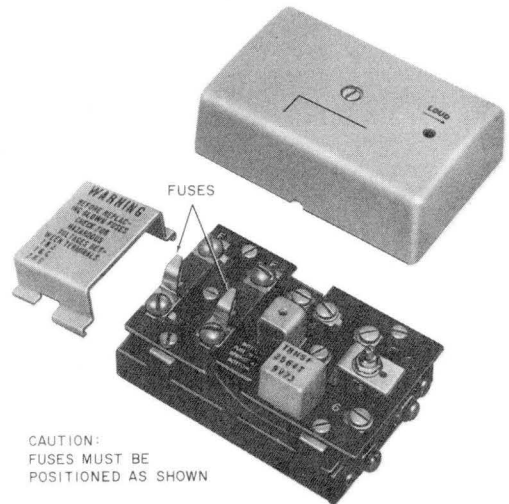


Fig. 9—33A Voice Coupler

The unit is 1-13/16 inches deep by 2-3/4 inches high by 4-3/8 inches long and is wall-mounted externally to the 570-type KSU. It presents a load to the 457C KTU equivalent to one loudspeaker and provides an output impedance to the COAM equipment of approximately 300 ohms. The output is transmitted to the COAM paging equipment through a transformer which is both electrostatically and electromagnetically shielded to minimize the possibility of introducing noise. A potentiometer (with screwdriver adjustment slot) is provided to adjust the signal level. Connections are made on five screw terminals.

### C. 22A-49 Apparatus Unit

2.14 The 22A-49 apparatus unit is an external signaling circuit that activates a signaling device which is external to the telephone sets. The 22A-49 apparatus unit offers a contact closure or opens a contact, as required, to operate KS-16301 type signaling devices (Section 463-110-100) or other external alerting devices. The unit is 1-13/16 inches deep by 2-3/4 inches high by 4-3/8 inches long and is wall-mounted externally to the 570-type KSU. Connections are made on six screw terminals. The 22A-49 apparatus unit may be used to activate an external signaling device for:

- Common audible
- Station codes
- CO/PBX ringing
- Ring transfer.

### D. KS-21880L1 Loudspeaker

2.15 The KS-21880L1 loudspeaker (Fig. 10) is an indoor speaker used for paging. It is 11 inches high, 10 inches wide, and 6-1/2 inches deep. It has a potentiometer (with screwdriver adjustment slot) for volume control. The KS-21880L1 loudspeaker is furnished with a walnut (woodgrain) finish. It was formerly known as the K8 loudspeaker. The speaker and the speaker enclosure are available as a List 2 and List 3, respectively, as repair or replacement parts.

### E. KS-21939L2 Loudspeaker

2.16 The KS-21939L2 loudspeaker (Fig. 11) is a horn-type speaker used for paging at indoor

or outdoor locations. It is 7-1/2 inches in diameter, 7 inches deep, and weighs 3-1/4 pounds. The loudspeaker is equipped with a swivel mounting bracket having three holes in the outer rim for mounting on a flat surface. The loudspeaker will also fasten to a 1/2-inch pipe. Pigtail leads are provided for connections. Nominal frequency response of the loudspeaker is 400 to 13,000 Hz. The KS-21939L2 loudspeaker has a screwdriver adjusted volume control. It was formerly known as the KS-16846L2 loudspeaker. The KS-21939 loudspeaker is also available as a List 1 which is the same as the List 2 except it has no volume control, and as a List 3 which is the same as a List 2 except it is equipped with a rigid conduit mounting adapter.

2.17 The KS-21880 and the KS-21939 loudspeakers are 45-ohm speakers. In the 7A Communication System, do not substitute speakers with other impedances for the two loudspeakers. Existing stocks of K8 or KS-16846L2 loudspeakers may be used.

### KEY TELEPHONE UNITS

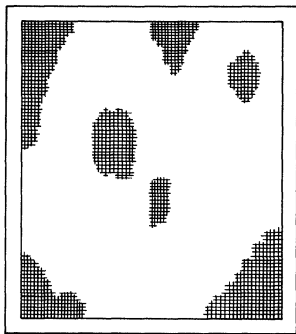
2.18 The circuitry for the 7A Communication System is provided by 400-series KTUs. Functional schematics are located in the rear of the section.

### A. 400-Type KTU (CO or PBX Line Circuit)

2.19 The 400G KTU (Fig. 75) is a 4-inch unit which provides a key telephone set with CO or PBX line service. Additional information on the 400-type KTUs may be found in Section 518-215-400 (Line Services) and CD- and SD-69513-01 or CD- and SD-69942-01.

2.20 The latest version of the line circuit KTU is the 400H (Fig. 76). The 400G is also standard; all earlier 400-type KTUs are rated MD but can be used when available. The 400H can be mounted in any 570-type KSU with the following limitations.

- Do not install a 400H KTU in a 570A KSU (MD) when music-on-hold is required. Only the 451-type music-on-hold KTU can be used with the 570A KSU, and it is *not* compatible with the 400H.



FRONT VIEW

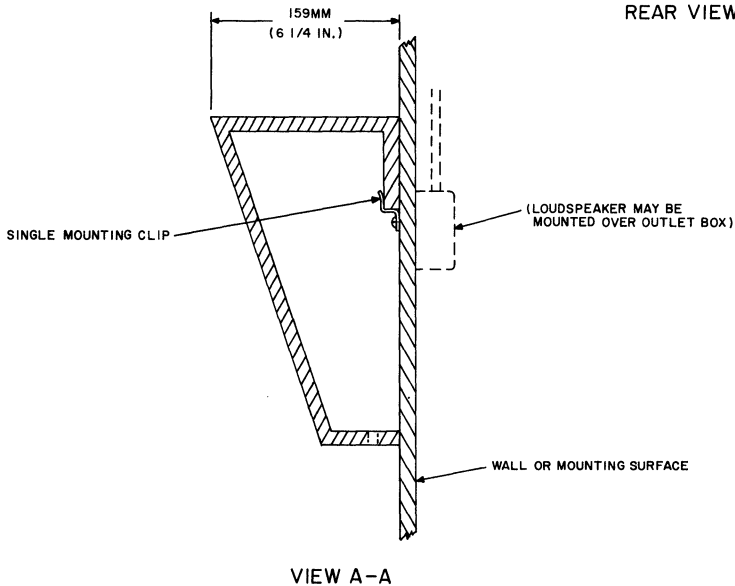
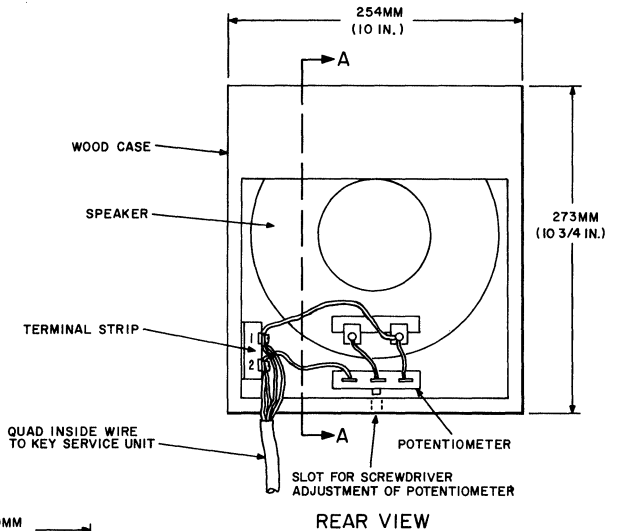


Fig. 10—KS-21880L1 Loudspeaker, Connections, and Mounting

- When a 400H (or any other 400-type line circuit) is installed in a 570B KSU, only the 498A KTU can be used to provide music-on-hold. The 451-type music-on-hold KTU is *not* compatible with the 570B KSU.
  - B. 424A or B and 424C KTU (Dial Intercom, 19-Code Selector Circuit)
- 2.21 The 424A or B KTU is an 8-inch dial selective intercom unit. Additional information may

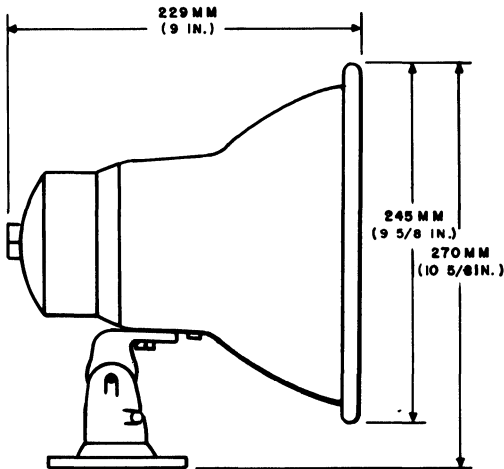


Fig. 11—KS-21939L2 Loudspeaker

be found in CD- and SD-69567-01. The 424C (Fig. 77) is the preferred KTU for replacements and new installations. In the 7A Communication System, the 424B/C KTUs provide the following:

- Rotary dial selection
- Nineteen dial codes (nine single-digit and ten 2-digit codes).

**Note:** In the 7A Communication System, the first digit of the 2-digit code is 1; therefore, 1 is not available as a station code. Code 2 is dedicated to paging which leaves codes 0 (attendant station) and 3 through 19 available for station codes.



**Do not use a 424A KTU in the 7A Communication System.**

#### C. 440A KTU (MD) (TOUCH-TONE Adapter Circuit)

**2.22** The 440A KTU (Fig. 78) is a 8-inch unit that provides TOUCH-TONE dialing when used in conjunction with the 424B or C KTU. Additional information on the 440A KTU may be found in CD- and SD-69906-01.

**Note:** The 440A KTU is superseded by an improved TOUCH-TONE adapter, the 478B KTU, which should be used for replacement and for new installations (see paragraph 2.29).

#### D. 451A or 451B KTU (Music-On-Hold Circuit)

**2.23** The 451-type KTU (Fig. 79) is a 4-inch unit that is used with an externally mounted 33A voice coupler to connect a customer-provided source of music to a maximum of seven CO/PBX lines placed on hold. The 451A KTU was formerly identified as a 123A IU.



**Install the 451-type KTU only in a 570A KSU containing 400G or earlier line circuits. If the KSU is a 570B, the 498A music-on-hold KTU equipped with a 116A1 CM must be used (see paragraph 2.30).**

#### E. 452A KTU (Power Failure Transfer Circuit)

**2.24** The 452A KTU (Fig. 80) is a 4-inch unit that automatically “cuts through” up to seven CO/PBX lines to external line ringers in the event of power failure.

#### F. 455A KTU (Tone Ringing Signal Generator Circuit)

**2.25** The 455A KTU (Fig. 81) is a 4-inch unit that contains the tone ringing generator for CO/PBX signaling.

#### G. 456A or 456B KTU (Voice and Tone Alerting Circuit)

**2.26** The 456-type KTU (Fig. 82) is a 4-inch unit that provides the following features on intercom calls:

- Ringing tone to calling party
- Tone alerting signal to called party
- Voice signaling to called party
- Input signal to paging amplifier.

The 456A will be rated MD but can be used in all installations where paging feedback or radio frequency interference are not problems. Paging feedback is, in general, an installation problem,

and changeout to the 456B will help only in marginal cases.

#### H. 457C KTU (Paging Amplifier Circuit)

**2.27** The 457C KTU (Fig. 83) is a 4-inch unit that contains the amplifier circuitry for paging and customer-provided background music. The customer-provided music source can be connected to the paging speakers when the paging circuit is not in use. The 457C KTU has a peak power output of 3 watts.

**Caution:** *The 457B KTU should not be used in lieu of the 457C KTU due to the likelihood of circuit failures.*

#### I. 460B KTU (2-Path Intercom Access Circuit)

**2.28** The 460B KTU (Fig. 84) is an 8-inch unit that contains two separate intercom paths. Path selection is based on operation of the associated intercom button on the key telephone sets. The unit also provides dial tone, seizes the selector, and provides a flashing lamp signal during selection and a steady lamp during the busy mode. Control circuitry permits only one intercom path to seize the selector at a time.

#### J. 478B KTU (TOUCH-TONE Adapter Circuit)

**2.29** The 478B KTU (Fig. 85) is an 8-inch unit that provides TOUCH-TONE dialing when used in conjunction with the 424B or C KTU. Additional information on the 478B KTU may be found in CD- and SD-69931-01.

#### K. 498A KTU (Music-On-Hold Circuit)

**2.30** The 498A KTU (Fig. 86) is a 4-inch unit which provides music-on-hold for up to four CO/PBX lines when used in a 570B KSU. ***This KTU should always be equipped with a 116A1 CM when used in COM KEY in order to provide music-on-hold for up to seven lines.*** The 498A equipped with a 116A1 CM plugs into J18 on the KSU.



**Do not install a 498A KTU in a 570A KSU. It is not electrically compatible.**

## KITS OF PARTS

**2.31** Privacy (D-180486), Ring Transfer (D-180487), Privacy Release (D-180488), and Recall (D-180591) Kit of Parts can be added to certain type 832 and 2832 telephone sets in the field. Refer to Table D for a summary of the features provided by these kits. Later model telephone sets have these features built in at the factory.

#### A. D-180486 Kit of Parts (Privacy)

**2.32** The D-180486 Kit of Parts provides a privacy or lockout feature. A station equipped with a privacy circuit is prevented from picking up a busy CO/PBX line. Intercom lines have no privacy.

#### B. D-180487 Kit of Parts (Ring Transfer)

**2.33** The D-180487 Kit of Parts provides the feature for transferring incoming CO/PBX ringing from an attendant station to a designated secondary station. The D-180487 Kit of Parts adds an eleventh button (651C key) to the manufacture discontinued 832A or 2832A telephone sets.

#### C. D-180488 Kit of Parts (Privacy Release)

**2.34** The D-180488 Kit of Parts provides the feature of permitting an excluded or locked-out station to enter a conversation on a busy CO/PBX line. The D-180488 Kit of Parts adds an eleventh button (651D key) to the 832A (MD) or 2832A (MD) telephone set.

#### D. D-180591 Kit of Parts (Recall)

**2.35** The D-180591 Kit of Parts provides a station the feature of simulating a switchhook flash or recall. The D-180591 Kit of Parts adds an eleventh button to the 832A or 2832A telephone set. An 832A or 2832A telephone set equipped with the D-180591 Kit of Parts (recall) is electrically equivalent to the 832BM or 2832BM telephone set.

#### E. D-180656 Kit of Parts (Shelf for Wall Mounting Telephone Sets)

**2.36** The D-180656 Kit of Parts provides a method for wall mounting COM KEY telephone sets. This kit of parts consists of a shelf assembly (ivory colored) and a retaining clamp. The shelf will incline the telephone set 15 degrees from the horizontal to facilitate its use. This kit can be

used with any of the 832- or 2832-type telephone sets not already designed for wall mounting.

**Note:** When possible, sets designed for wall mounting should be used in preference to the D-180656 Kit of Parts.

## TELEPHONE SETS

### A. Full Service Telephone Sets (Table D)

**2.37** The 832- and 2832-type telephone sets are 10-, 11-, or 13-button key telephone sets designed for use with the 7A Communication System. The sets are equipped with a loudspeaker for tone and voice signaling. A volume control is provided to control the level of the signal. Conferencing of two or more CO/PBX lines is accomplished by simultaneously depressing the buttons associated with the lines to be conferenced. The CO/PBX lines cannot be conferenced with intercom lines. Automatic button restoration (ABR) restores all depressed buttons when the handset is replaced. The lamp under the HOLD button is provided for use as a message waiting indicator.

**Caution:** *The system may be disabled if multiple buttons are depressed at an idle station.*

**2.38** Full service telephone sets for the 7A Communication System are available in ivory (-50) only and are shipped from the factory with throwaway, protective faceplates. For each set, it is necessary to order a colored faceplate from the complement of nine vinyl-clad metal decorator faceplates that are available (see Table C). Current 832- and 2832-type telephone sets are shipped with an ivory (-50) mounting cord rather than satin-silver (-87).

### 832A/2832A (MD) Telephone Sets

**2.39** The 832A telephone set is a rotary dial 10-button key set. The set has seven CO/PBX line pickup buttons, two intercom pickup buttons, and a HOLD button. The 832A telephone set may be modified in the field to provide a privacy circuit and either a PRIV RLS, RING TR, or RECALL button.

**Note:** Only one button (for privacy release, ring transfer, or recall) can be added to the 832A telephone set.

**2.40** The 2832A set is the same as the 832A except it has a TOUCH-TONE dial.

### 832B/2832B (MD) Telephone Sets

**2.41** The 832B telephone set is a rotary dial 11-button key set. The set has seven CO/PBX line pickup buttons, two intercom buttons, a HOLD button, and a RECALL button. The eleventh button, to the right and below the key assembly, is factory-wired for recall and is designated with an amber cap. A momentary operation of the RECALL button opens the line simulating a switchhook flash. The set may be modified in the field for privacy.

**2.42** The 2832B set is the same as the 832B except it has a TOUCH-TONE dial.

### 832BM/2832BM Telephone Sets (Fig. 12)

**2.43** The 832BM/2832BM 11-button telephone sets are the same as the 832B/2832B (MD) sets except that modular handset components are added.

### 832C/2832C (MD) Telephone Sets

**2.44** The 832C telephone set is a rotary dial 13-button key telephone set. The set has a lower row of ten buttons for seven CO/PBX line pickups, two intercom line pickups, and for hold. The upper row contains three buttons on the left providing recall, privacy release, and (optional) ring transfer. A brushed aluminum finished collar assembly, with the words COM KEY in black letters, is positioned to the right of these buttons. The 832C telephone set is factory-wired with a privacy circuit and with the PRIV RLS button operational. The RING TR button is not factory-connected. An amber button cap is provided for the RECALL button, and an E-6406 designation strip is provided for labeling the RECALL, PRIV RLS, and RING TR buttons.

**2.45** The 2832C set is the same as the 832C except it has a TOUCH-TONE dial.

### 832CM/2832CM Telephone Sets (Fig. 13)

**2.46** The 832CM/2832CM 13-button telephone sets are the same as the 832C/2832C (MD) sets except that modular handset components are added.

TABLE D

## 7A COMMUNICATION SYSTEM TELEPHONE SET FEATURES

FEATURE	STATUS	10-BUTTON SETS	11-BUTTON SETS	13-BUTTON SETS
		832A (MD) 2832A(MD)	832B(MD) 832BM 832DM 2832B(MD) 2832BM 2832DM	832C(MD) 832CM 832EM 2832C(MD) 2832CM 2832EM
RECALL	Factory Provided		•	•
	Factory Connected		•	•
	Field Provided (Note 1)	•*		
	Field Connected	•		
PRIVACY CIRCUIT	Factory Provided			•
	Factory Connected			•
	Field Provided (Note 2)	•	•	
	Field Connected	•	•	
PRIVACY RELEASE	Factory Provided			•
	Factory Connected			•
	Field Provided (Note 3)	•*		
	Field Connected	•		
RING TRANSFER	Factory Provided			•
	Factory Connected			
	Field Provided (Note 4)	•*		
	Field Connected	•		•

*Note 1:* Kit of Parts D-180591

*Note 2:* Kit of Parts D-180486

*Note 3:* Kit of Parts D-180488

*Note 4:* Kit of Parts D-180487

\* Only one of these features can be added to one 832A or 2832A set.



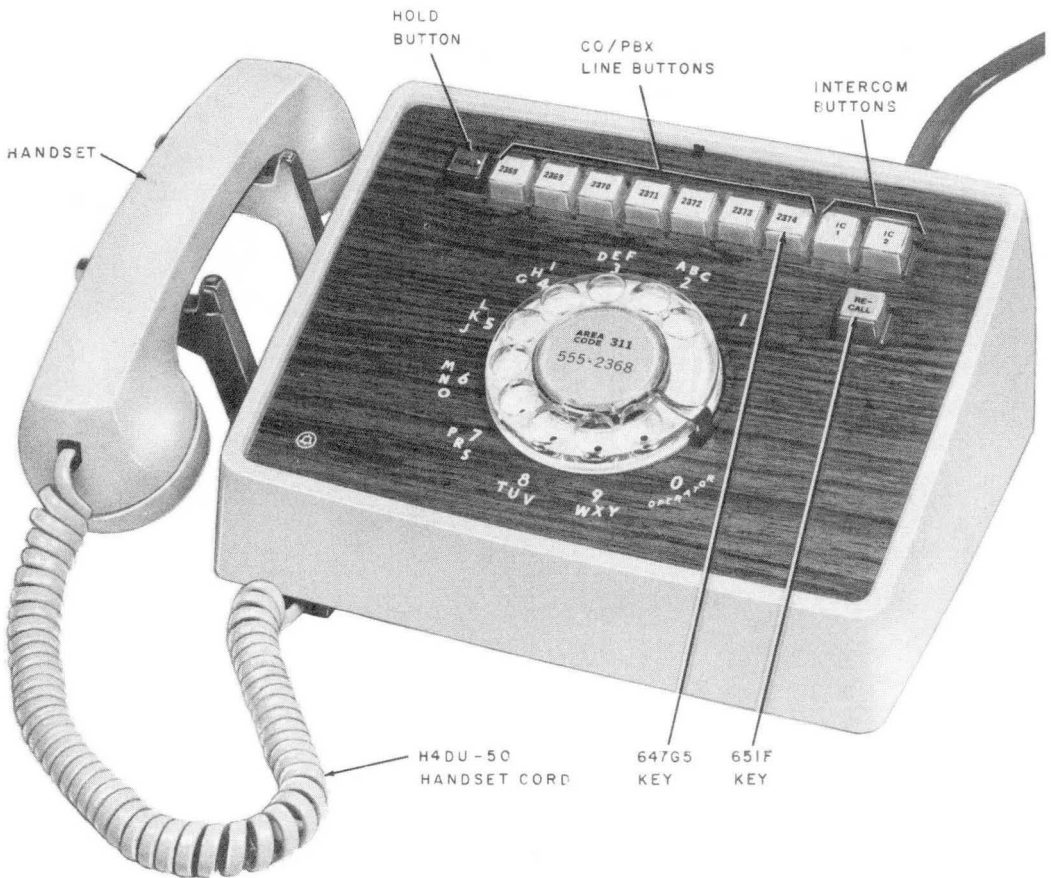


Fig. 12—832BM-50 Telephone Set

### 832DM/2832DM Telephone Sets

2.47 The 832DM/2832DM 11-button telephone sets are the same as the 832BM/2832BM except that they are arranged for wall mounting. The switchhook allows the handset to hang vertically to the left of the housing.

### 832EM/2832EM Telephone Sets (Fig. 14)

2.48 The 832EM/2832EM 13-button telephone sets are the same as the 832CM/2832CM except that they are arranged for wall mounting.

### B. Intercom Only Telephone Sets

#### 575AM Telephone Set

2.49 The 575AM telephone set is a rotary dial, ivory color, 6-button key set **arranged for intercom service only**. It is similar to the 565-type set in physical appearance. The set is equipped with a loudspeaker for tone and voice signaling. A volume control is provided to control the level of the signal. The first button (hold button position) is a red nonfunctional button (blocked nonoperative) which may be illuminated for use as a message



Fig. 13—2832CM-50 Telephone Set

waiting indicator. The second, third, and fourth (not used with 7A Communication System) buttons are illuminated pickup buttons. The fifth and sixth are not illuminated and are blocked nonoperative.

**2.50** As shipped from the factory, only two intercom buttons (buttons two and three) are wired operational as required for use with the 7A Communication System.

**2.51** The intercom pickup buttons on the 575AM telephone set do not automatically restore to the nonoperated position when the handset is placed on-hook.

### 2575AM Telephone Set

**2.52** The 2575AM telephone set is the same as the 575AM telephone set except it is equipped with a TOUCH-TONE dial.

## 3. INSTALLATION

### PLANNING

**3.01** Survey the area to be served by the 7A Communication System. Select a location for the 570-type KSU that:

- Provides a safe working location

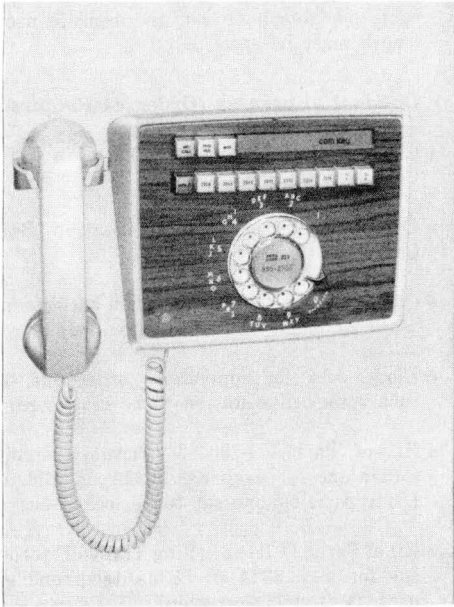


Fig. 14—832EM-50 Telephone Set

- Has customer's approval and is in his best interest
- Has adequate light and is always accessible
- Has a wall providing adequate support and stability, or floor space away from foot traffic and protected from vehicular traffic
- Has sufficient clearance above floor level to avoid damage from water or blows incidental to cleaning
- Is central to station locations to permit shortest cable runs
- Is clean, dry, well-ventilated, and free from corrosive fumes
- Is not subject to extreme temperatures
- Is near a commercial ac power receptacle not controlled by a switch.



**Allow at least 9 inches of space in front of and on each side of KSU to permit gates to swing open.**

**3.02** Arrangements should be made for the customer to provide a commercial ac power receptacle in accordance with the following:

- Not under control of a switch
- Separately fused
- Receptacle should be grounded 3-wire type.

**3.03** Select appropriate apparatus according to job requirements.

**Caution:** *The paging feature of the 7A Communication System can be inadequate for paging in noisy locations. A preinstallation survey should be made of noisy areas where paging is to be provided. The results of the survey may indicate:*

- **Additional speakers located closer together will be required**
- **An auxiliary paging system (telephone company or customer provided) will be required.**

An auxiliary paging system requires the use of a 20A-49 apparatus unit.

#### ORDERING GUIDE

##### (a) *Apparatus for Basic Service:*

- Unit, Service Key, 570B (No KTUs are furnished with the KSU; order required KTUs separately.)

Cord, Power (order required length)

824013288 (P-40J328) (4 feet)

824013296 (P-40J329) (6 feet)

824010995 (P-40J099) (12 feet)

- Mounting, Apparatus, 77C (floor stand for 570-type KSU; order one per installation when KSU is to be floor-mounted)

- Unit, Telephone Key, 400G (CO/PBX line circuit) (order one per line for use in 570A or B KSU)
- Unit, Telephone Key, 400H (CO/PBX line circuit) (order one per line for use in 570B KSU or in 570A KSU when music-on-hold is not required)
- Unit, Telephone Key, 424C (Dial Intercom, 19-Code Selector Circuit)
- Unit, Telephone Key, 455A (Tone Ringing Signal Generator Circuit)
- Unit, Telephone Key, 456A or 456B (Voice and Tone Alerting Circuit)
- Unit, Telephone Key, 460B (2-Path Intercom Access Circuit).

**11-Button Sets:**

- Set, Telephone (desk), 832EM-50 (rotary dial) or 2832BM-50 (TOUCH-TONE dial)
- Set, Telephone (wall), 832DM-50 (rotary dial) or 2832DM-50 (TOUCH-TONE dial)
- Plate, Face, 832B—† (order one for each 832BM or 832DM telephone set)
- Plate, Face, 2832B—† (order one for each 2832BM or 2832DM telephone set).

**13-Button Sets:**

- Set, Telephone (desk), 832CM-50 (rotary dial) or 2832CM-50 (TOUCH-TONE dial)
- Set, Telephone (wall), 832EM-50 (rotary dial) or 2832EM-50 (TOUCH-TONE dial)
- Plate, Face, 833A—† (order one for each 832CM or 832EM telephone set)
- Plate, Face, 2833A—† (order one for each 2832CM or 2832EM telephone set).

**Intercom-Only Sets:**

- Set, Telephone, 575AM (rotary dial)
- Set, Telephone, 2575AM (TOUCH-TONE dial)

- Cable, Connector, A25B (order one single-ended cable per telephone set and console used; length must be specified).

**(b) Optional Apparatus (Order as Required):**

- Console, Selector, 6A1-50 (Station Busy Console with DSS)
- Console, Selector, 6B1-50 (Station Busy Console with MW)
- Coupler, Voice, 33A (order when background music or music-on-hold is provided)
- Diode, 446F, or equivalent (order one for each rotary dial station to be restricted)
- Kit of Parts, D-180486 (Privacy Circuit) (order one for each 832/2832A, B, BM, or DM type telephone set to be locked out)
- Kit of Parts, D-180487 (Ring Transfer) (order one for each 832A or 2832A telephone set used as attendant station)
- Kit of Parts, D-180488 (Privacy Release) (order one for each 832A or 2832A telephone set used for a station equipped with the privacy release feature)
- Kit of Parts, D-180591 (Recall) (order one for each 832A or 2832A telephone set used as a station equipped with the recall feature)
- Kit of Parts, D-180656 (Shelf Assembly) (order one for each 832/2832A, B, C, BM, or CM type telephone set to be wall-mounted)
- Loudspeaker, Horn, KS-21939L2 (order as required for outside paging)
- Loudspeaker, Indoor, KS-21880L1 (order as required for indoor paging)

**Note:** A maximum of seven paging loudspeakers can be connected to the 7A Communication System.

- Ringer, E1C (order one for each line to be wired for power failure ringing)

†Refer to Table C for color suffix.

- Speakerphone, 3B (order one each for each station to be equipped)

Cord, D10R—† (specify length: 1 foot 4 inches, 9, 12, or 25 feet)

Loudspeaker, 760A—†

Transformer, 2012B

Transmitter, 666B—†

Unit, Control, 55B

- Speakerphone, 4A (order one each for each station to be equipped)

Adapter, 223-A-49 (includes M16C and M2FG cords)

Loudspeaker, 108—†

Transmitter, 680A—†

Unit, Power, 85B1-49

†Refer to Table C for color suffix.

- Unit, Apparatus, 20A-49 (order when 7A Communication System is connected to a customer's paging system or connected to a separate paging system provided by the telephone company)
- Unit, Apparatus, 22A-49 (order when signaling devices, external to telephone sets, are required) (Signaling devices, bells, buzzers, gongs, etc, and an external power supply must be ordered as required.)
- Unit, Telephone Key, 440A or 478B (TOUCH-TONE Adapter Circuit)

**Note:** J13/J14 connector on KSU must have A and B ground connected when 478B KTU is used. Do not use 478B KTU in conjunction with any dial intercom selector circuit except 424C.

- Unit, Telephone Key, 451A or 451B (Music-On-Hold Circuit) (order one per system in which 400G or earlier line circuits are used with 570A KSU)

- Unit, Telephone Key, 452A (Power Failure Transfer Circuit)

- Unit, Telephone Key, 457C (Paging Amplifier Circuit)

- Unit, Telephone Key, 498A (Music-On-Hold Circuit) (order one per system in which 400H line circuits are used with 570B KSU; provides music for up to four CO/PBX lines)

- Module, Circuit, 116A1 (Music-On-Hold Circuit daughter board) (order one per 498A KTU).

(c) **Replaceable Components:**

**570-Type KSU:**

- Fuse, 24B (3A)
- Fuse, 24C (2A)
- Fuse, 24F (5A)
- Fuse, 70A (1-1/3A)
- Fuse, 70G (1/2A)
- Fuse, 70H (3/4A)
- Interrupter, KS-19175L1
- Lamp, 51A
- Unit, Power, 19C2A
- Unit, Power, 19C2 (on earlier models of 570A KSU).

**33A Voice Coupler:**

- Fuse, 35P (3/4A).

**832- and 2832-Type Telephone Sets:**

- Refer to Section 503-701-110.

**575AM and 2575AM Telephone Sets:**

- Cord, D20P-87 (mounting cord)
- Cord, H4DU-50 (handset cord)
- Dial, 9CA (rotary dial)

- Dial, 35Y3A (TOUCH-TONE dial)
- Housing, 840996268 (rotary set) or 840997258 (TOUCH-TONE set)
- Key, 636A
- Lamp, 51A
- Plate, Face, 840845502 (required only for TOUCH-TONE set)
- Set, Hand, G15A-50.

#### **6A1 and 6B1 Selector Consoles:**

- Base, 6A1 (for 6A1 Selector Console)
- Base, 6B1 (for 6B1 Selector Console)
- Cord, Mounting, D50AD-50
- Housing, 6A1-50
- Key, 647J5 (for 6A1 Selector Console)
- Key, 647AG5 or 647J5C (for 6A1 Selector Console)
- Key, 647AF5 or 647C5 (for 6B1 Selector Console)
- Lamp, 51A
- Plate, Face, 6A2—†

† Refer to Table C for color suffix.

#### **INSTALLING**

**3.04** Be careful when unpacking to prevent damage to components.

**3.05** Install the 7A Communication System as follows.

##### **A. 570-Type KSU**

- (1) Remove cover from KSU.
- (2) Use the template provided to locate the fastener holes at the selected location.
- (3) Install appropriate fasteners.
- (4) Hang KSU on fasteners.
- (5) Connect the circuit ground to an acceptable ground. For circuit ground, a No. 14 gauge wire should be attached from the LOC GRD terminal of the power unit to an acceptable local ground. If a 3-wire grounded receptacle is not available, a **frame ground** (No. 14 gauge wire) must be connected from the case or frame of the power unit to an acceptable local ground.
 

**Caution: Do not strap the circuit ground to the frame or case of the power unit. The susceptibility of surge damage to semiconductor components used in 400-series KTUs requires that grounding procedures be followed. Properly grounded installations will minimize service failures that can result from surge voltages or differences between dissimilar grounds. Refer to Section 518-010-105 for detailed information on grounding key systems.**
- (6) Unlatch and open carrier assemblies.
- (7) Terminate the incoming CO/PBX lines on connecting block 3 as shown in Fig. 15.
- (8) Terminate the station cables. Cut down the A25B connector cables on connecting blocks 3, 4, and 5 as shown in Fig. 16. Intercom station code 0 (attendant station) is terminated on column G of connecting block 3. Intercom station code 3 is terminated on column H of connecting block 3, and station codes 4 through 19 are terminated on columns A through H on connecting blocks 4 and 5 as shown in Fig. 16. **A direct cable run to any station may not exceed 667 feet of 24-gauge cable.**
- (9) Place or remove option straps.
- (10) Install power cord. Do not connect to ac source at this time.
- (11) Close and latch carrier assembly.
- (12) Install KTUs necessary to provide required services. See Fig. 6 for KTU connector arrangement.

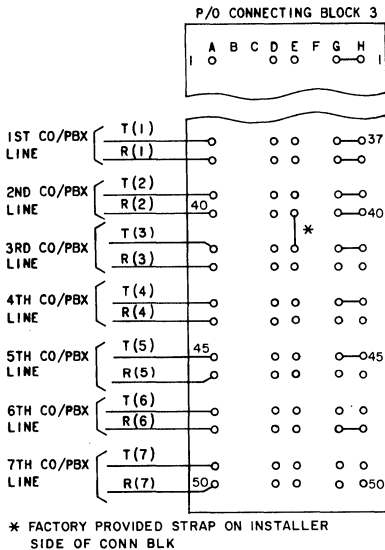


Fig. 15—Connections for Incoming CO/PBX Lines

**B. Satellite Wiring Plan**

**3.06** The 7A Communication System is designed for Home-Run cabling (direct cabling) from each telephone set to the KSU. Where it is more practical to serve a group of stations from a secondary location, a satellite wiring plan can be used. The satellite wiring plan is a connecting block arrangement for station terminations. It is served by a connecting cable or cables from the KSU.

**3.07** Cabling is required between the KSU and the satellite location to provide the following leads:

- Those leads common to all stations, such as T, R, and A of the CO/PBX lines, T and R of the intercoms, etc. Only one appearance of these leads is required at the satellite.
- Six leads for *each* station code working from the satellite location. These are the VS, CO, SB, ±10V, ET, and ER leads.
- Additional leads required to cover A1, lamp, and lamp ground restrictions. These

restrictions limit the voltage drop in the lamp loop to less than 2 volts and require a low resistance A to A1 lead.

**3.08** Two methods are covered for providing the proper amounts of terminations and leads at a satellite location. One method employs a prewired 14A1-100 terminal block. The second uses standard 66-type connecting blocks and a nomograph which help to determine the number of extra lamp and lamp ground leads required.

**3.09** All satellite wiring arrangements should limit the total distance from the KSU to the satellite *plus* from the satellite to the station to 667 feet.

**C. Satellite Plan Using a 14A1-100 Terminal Block**

**3.10** The 14A1-100 terminal block consists of a 66-type connecting block factory-wired to four microribbon connectors. One 14A1-100 terminal block will accommodate eight 25-pair station cables. Station cables are terminated on the 66-type connecting block columns following the even-count color code.

**3.11** Connections between the terminal block and the KSU are made using connector cables plugged into the connectors on the block. The other end of the cables are terminated in the KSU, as shown in Fig. 17, on the rows and columns of the KSU that would normally contain the station cables.

**3.12** For the purpose of illustration, assume a satellite installation made up of station codes 4, 6, 8, 10, 12, and 14. Since one 14A1-100 terminal block will accommodate eight satellite stations, space is available for growth of two stations. In this case, the cables from stations 4, 6, 8, 10, and 12 are terminated on columns A through E, respectively, of the terminal block. Station 14 is terminated on column H, leaving columns F and G as spares.

**Note:** One of the station codes involved in the satellite installation must always be terminated on column H since this column contains the leads common to all the satellite stations, such as the tips and rings.

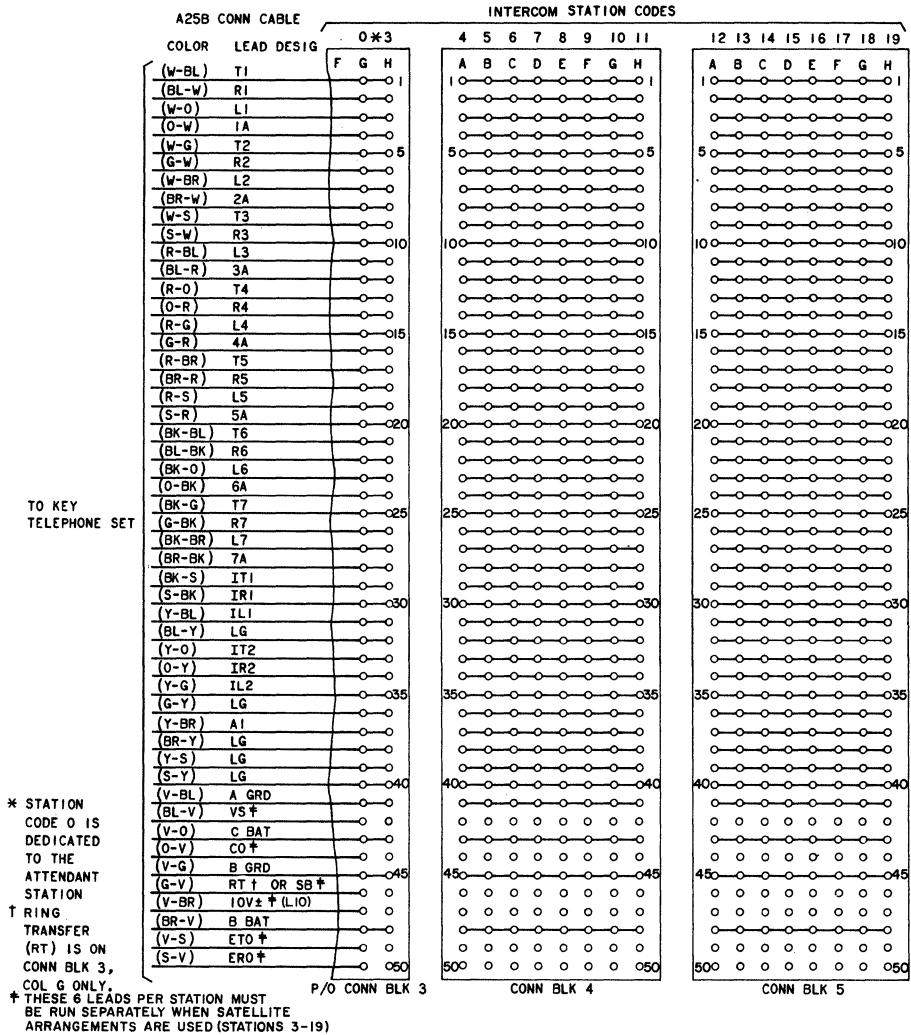


Fig. 16—Station Connections

After the cables are terminated, B bridging clips must be placed as shown in Fig. 18 to tie the lamp and lamp ground leads together.

3.13 Connector cables are plugged into the connectors of the terminal block and routed to the KSU. The cables are terminated in the

KSU as shown in Fig. 17. For this example, the cable from connector No. 1 is terminated where the cable for the station appearing on column H of the terminal block (code 14) would be terminated if home run; eg, block 5, column C of the KSU. Cable No. 2 provides the additional lamp and lamp ground leads, plus the individual code leads, for



the stations on column G (spare) and column A (station code 4) of the 14A1-100 terminal block so the leads for code 4 are terminated on block 4, column A. In addition, the four A1 leads can be obtained on any of the spare terminations of the satellite stations. Cables 3 and 4 are terminated in a like manner on the designated blocks and columns.

#### D. Satellite Plan Using Nomograph

**3.14** The same basic rules used with the 14A1-100 terminal block apply for satellites using standard 66-type connecting blocks. Sufficient conductors must be run from the KSU to the satellite to provide a one-time appearance of all common station leads, individual code leads, and enough L and LG multiples (see paragraph 3.07).

**3.15** The number of additional conductors required per L and LG lead is determined using the nomograph shown in Fig. 19. To use the nomograph, it is necessary to know three items:

- (a) The distance from the KSU to the satellite location
- (b) Number of stations to work from the satellite
- (c) Distance from satellite location to farthest station working from satellite.

By plotting the values on the proper scales and connecting them, the required number of additional conductors required per L and LG lead can be determined. The three required values are plotted on scales A, B, and E, respectively, in Fig. 19. The number of additional leads required per L and LG lead will be found on scale D. Scales C1 and C2 are used only to establish reference points.

**3.16** To illustrate the use of the nomograph, assume a satellite location is 400 feet from the KSU, eight stations are to be fed from the satellite, and the farthest station is 175 feet from the satellite. These figures are used as an example shown in Fig. 19 and are shown as dotted lines. To determine the number of extra leads required, use the nomograph as follows:

- (1) Locate the distance from the KSU to the satellite on scale A (400 feet).

- (2) Locate number of stations served by satellite on scale B (8 stations).
- (3) Using a straight edge, connect the points on A and B and extend the line until it crosses scale C1.
- (4) Note the point at which the line crosses C1 (approximately 33); find the same point on C2 and mark.
- (5) Locate the distance from the satellite to the farthest station (175 feet) on scale E.
- (6) Using a straight edge, connect points on C2 and E.
- (7) The point where the line from C2 to E crosses scale D indicates the number of additional conductors required (6 in the example) for each L and LG lead.

#### E. Telephone Sets

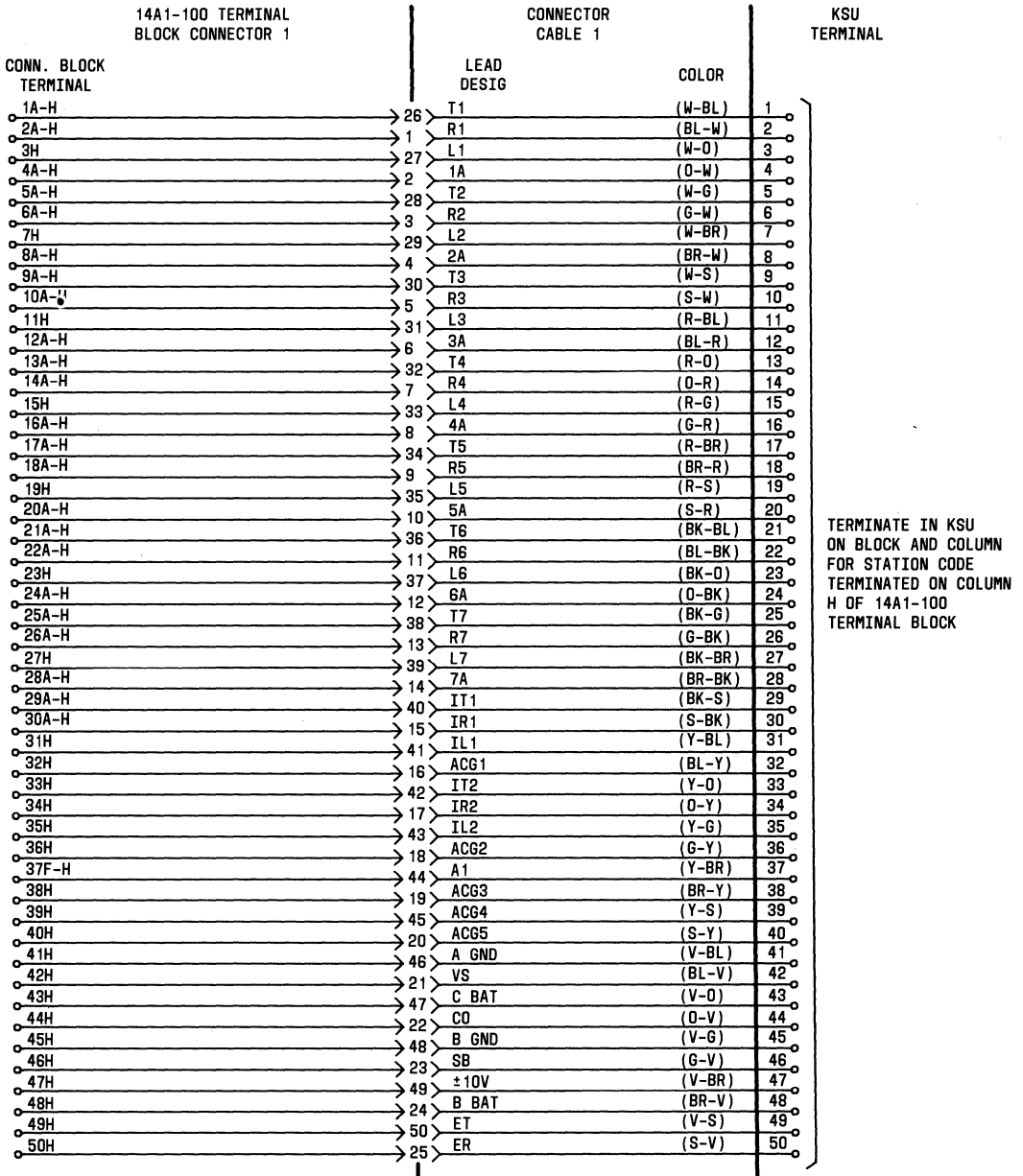
**3.17** Install telephone sets at desired locations. Install any telephone set options at this time. Refer to Section 503-701-110 for schematics and additional information on the 832- and 2832-type telephone sets. For information on the 575AM and 2575AM telephone sets, refer to Section 503-603-120.



***The telephone which is to be used as the attendant station (code 0), without ring transfer, must be modified. Move the V-BR lead from terminal 28 on the set terminal board to terminal 14 and the G-V lead from terminal 8 to terminal 16. If the V-BR lead is not moved, the lamp under the HOLD key will be lit at all times.***

**3.18** Where a wall-mounted telephone is desired, install either a wall-type set (832/2832DM or EM) or a D-180656 Kit of Parts for converting desk sets to wall sets. The method of mounting wall-type sets is illustrated in Fig. 20. The D-180656 Kit of Parts (Fig. 21) consists of a mounting shelf and a telephone set retaining clamp. Install the mounting shelf using appropriate fasteners for the surface on which it is to be mounted. Insert the telephone set mounting cord down through the opening at the rear of the shelf. Insert the retaining

SECTION 518-450-100



TERMINATE IN KSU  
ON BLOCK AND COLUMN  
FOR STATION CODE  
TERMINATED ON COLUMN  
H OF 14A1-100  
TERMINAL BLOCK

Fig. 17—Connections for 14A1-100 Terminal Block (Sheet 1 of 4)

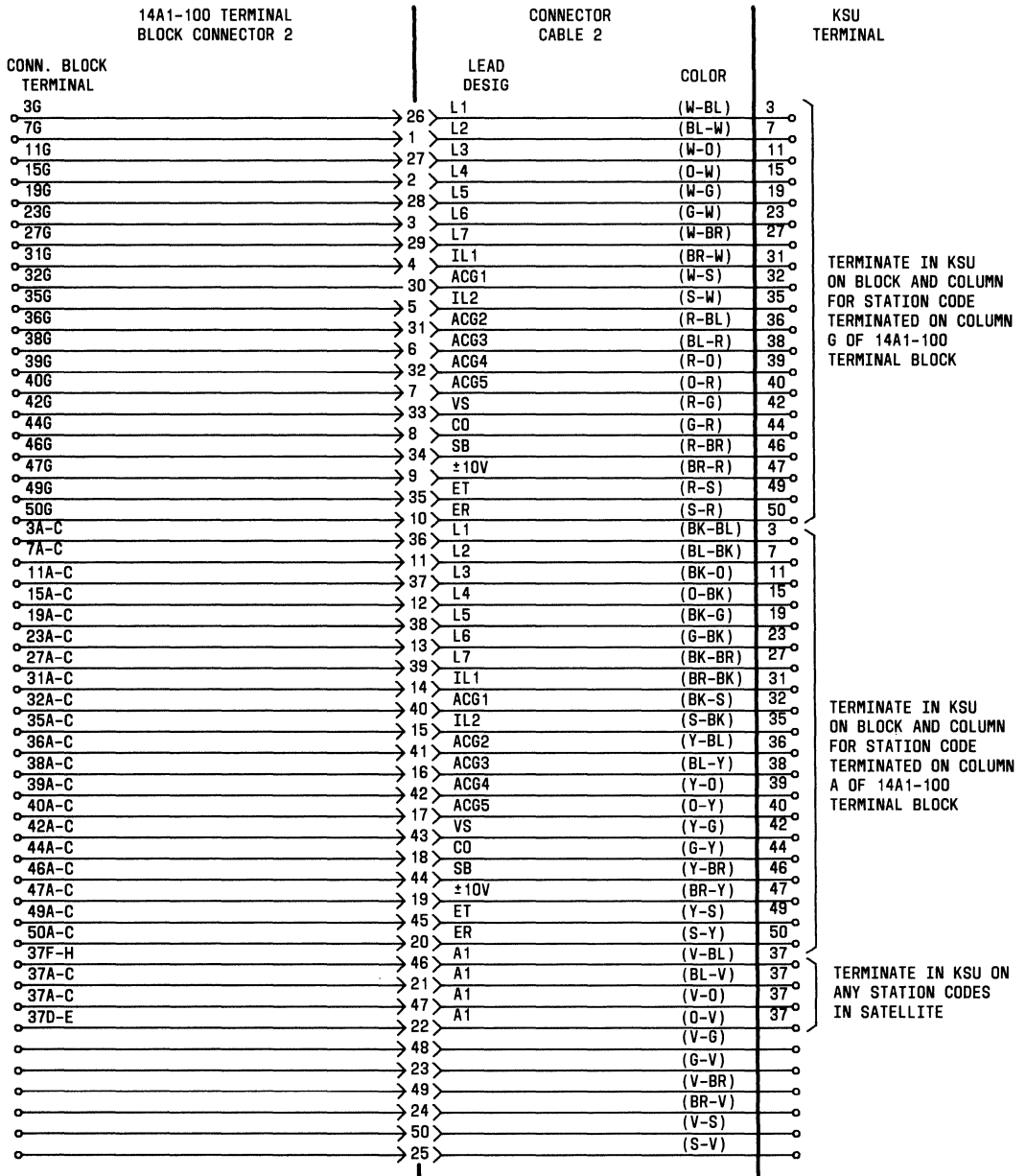


Fig. 17—Connections for 14A1-100 Terminal Block (Sheet 2 of 4)

SECTION 518-450-100

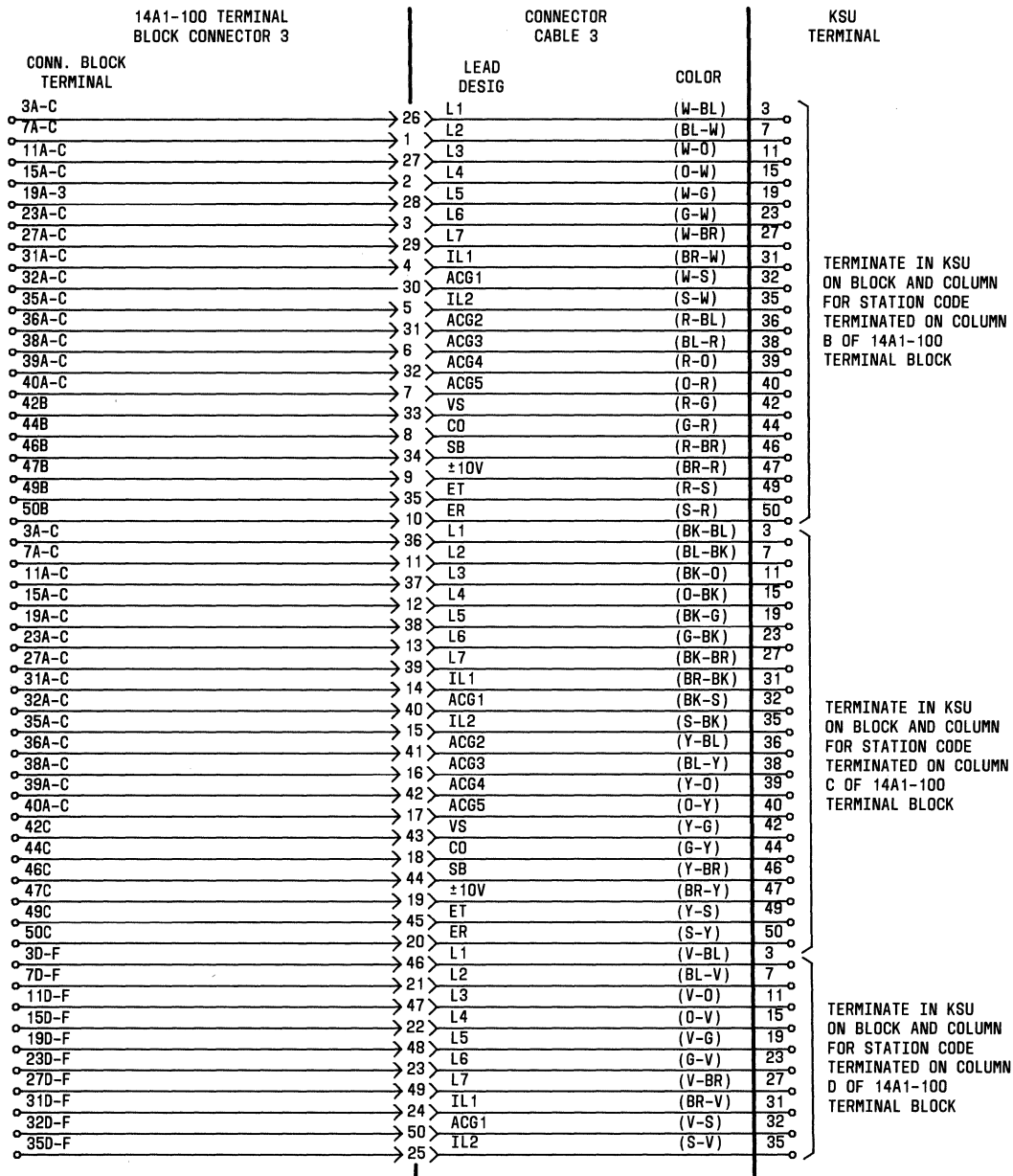
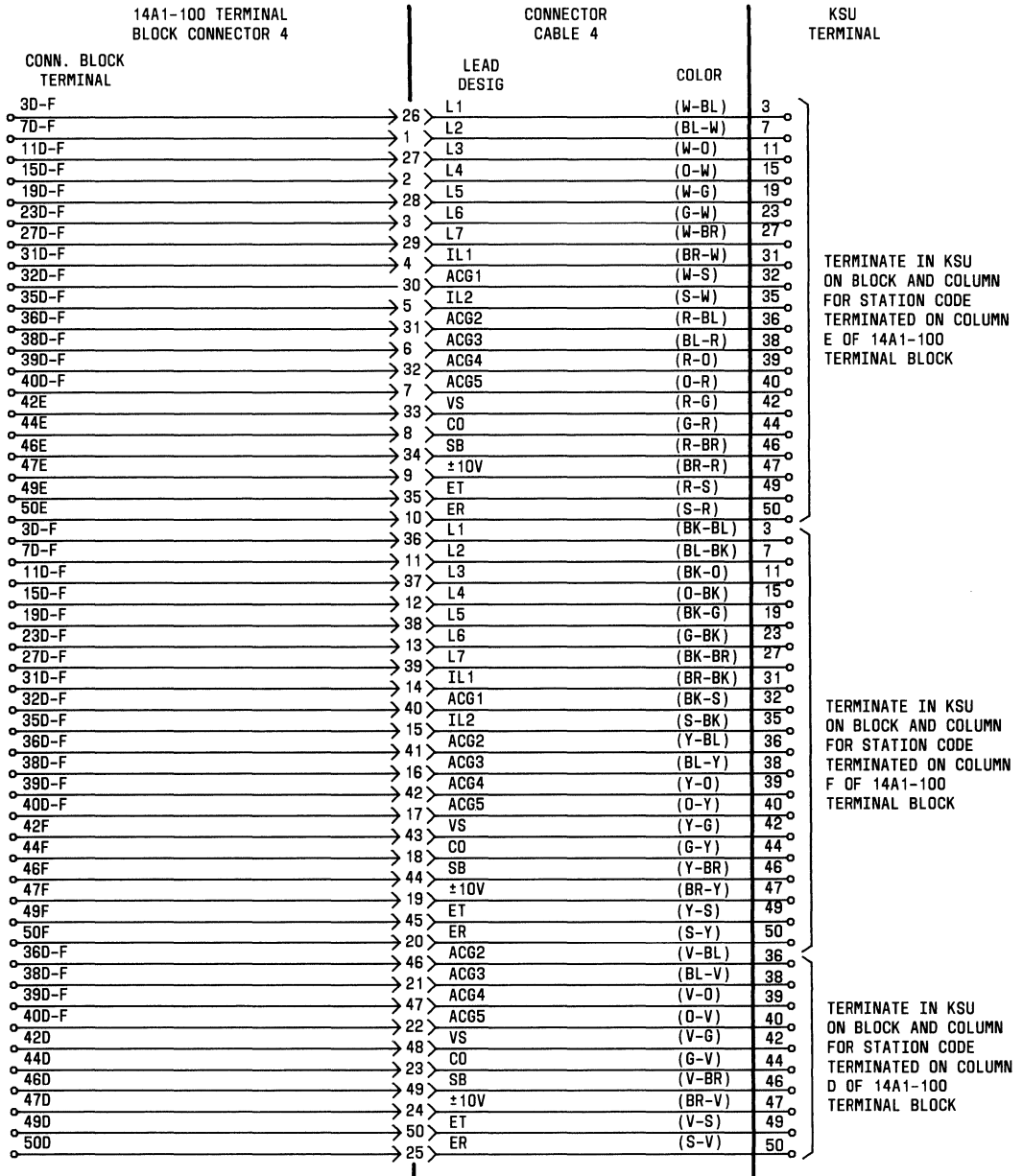


Fig. 17—Connections for 14A1-100 Terminal Block (Sheet 3 of 4)

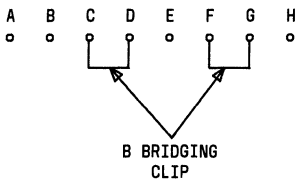


TERMINATE IN KSU ON BLOCK AND COLUMN FOR STATION CODE TERMINATED ON COLUMN E OF 14A1-100 TERMINAL BLOCK

TERMINATE IN KSU ON BLOCK AND COLUMN FOR STATION CODE TERMINATED ON COLUMN F OF 14A1-100 TERMINAL BLOCK

TERMINATE IN KSU ON BLOCK AND COLUMN FOR STATION CODE TERMINATED ON COLUMN D OF 14A1-100 TERMINAL BLOCK

Fig. 17—Connections for 14A1-100 Terminal Block (Sheet 4 of 4)



PLACE CLIPS ON ROWS:  
3, 7, 11, 15, 19, 23, 27,  
31, 32, 35, 36, 38, 39, 40

**Fig. 18—Position of B Bridging Clips on 14A1-100 Terminal Block**

clamp (screw down) through the slot of the shelf, up into the base of the telephone set. Check that the pads on the telephone set base fit in the slots in the shelf and tighten the retaining clamp until the telephone set is held firmly in place.

**Note:** It may be necessary to slightly bend the top slotted portion of the 833A adapter so that the headed rivets of the base pan align and seat properly.

**3.19 Consoles:** Up to three DSS or MW consoles, in any combination, can be used with a 7A Communication System. Consoles are usually associated with stations which are designated as attendant positions. Some systems will have only one attendant position; in such cases, either an MW or a DSS console or both can be located at the attendant position. If another station is designated as an alternate attendant position, a second or third console might be located there.

**Note:** Terminations and power are provided in the 7A Communication System for either a DSS or MW selector console. If a second or third console is required, additional power and external terminations must be supplied.

#### 4. FEATURES (IDENTIFICATION, OPERATION, CONNECTIONS, AND TESTING)

##### BASIC FEATURES

###### A. Automatic Button Restoration (ABR)

**4.01** Automatic button restoration is a feature of the 832- and 2832-type telephone sets used with the 7A Communication System. When the

handset is replaced, all depressed buttons return to the unoperated position. This prevents inadvertent intrusion on calls in progress and insures that multiple buttons will not be left depressed on a set causing an undesired conference from the idle set.

**4.02** The intercom-only telephone sets, 575AM and 2575AM, do not have ABR.

**4.03** On 832- and 2832-type telephone sets equipped with a RECALL button, this feature should be used for flashing, instead of the switchhook. Otherwise, the ABR will release the line button when the switchhook is operated. On 832/2832A sets without recall, hold down the line button while flashing with the switchhook.

**4.04** Automatic button restoration is a mechanical function of the telephone set; no wiring is required and field adjustment of the mechanism is not recommended.

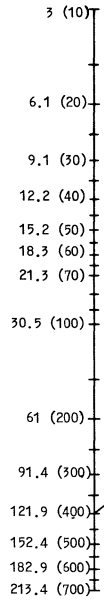
###### B. Common Audible

**4.05** The 7A Communication System is factory-wired for the attendant station (intercom code 0) to receive **tone ringing** whenever there is an incoming call on any of the CO/PBX lines. (The lamp under the associated CO/PBX line button flashes for visual identification of the calling line.) See Fig. 22 for connections.

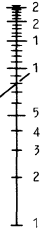
**4.06** The attendant answers all incoming calls and either takes a message or forwards the call to the desired party using the intercom. To forward a call, the attendant puts the incoming call on hold (CO/PBX line lamp goes from steady to wink), then picks up an idle intercom path, dials the desired station, and voice signals that there is a call on a particular CO/PBX line. By observing the CO/PBX line lamp (going from wink to steady), the attendant is able to determine when the call is picked up. If after a suitable period of time the call is not picked up, the attendant may again pick up the line and proceed per local instructions.

**4.07** Common audible is derived through diodes located on connecting block 1. As factory-wired, there is one diode per CO/PBX line connected to a common audible terminal. A factory-provided strap (on the installer's side of block 1) connects the common audible terminal to station code 0.

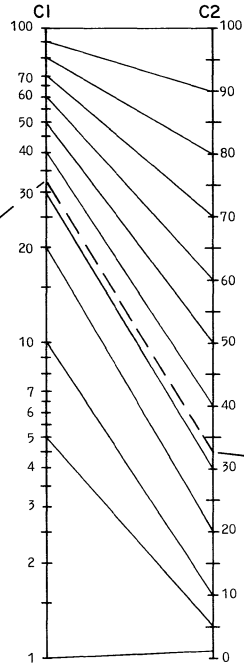
**A. DISTANCE FROM KSU  
TO SATELLITE  
IN METERS (FEET)**



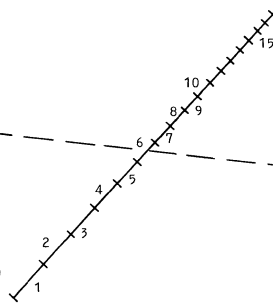
**B. NUMBER OF  
STATIONS WIRED  
FROM SATELLITE**



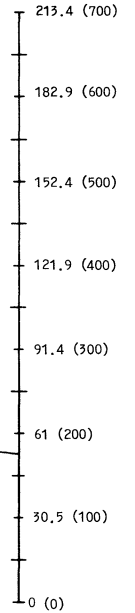
**C. REFERENCE SCALES**



**D. NUMBER OF  
ADDITIONAL LEADS  
REQUIRED**



**E. DISTANCE FROM  
SATELLITE TO  
FARTHEST STATION  
IN METERS (FEET)**



**Fig. 19—Satellite Nomograph**

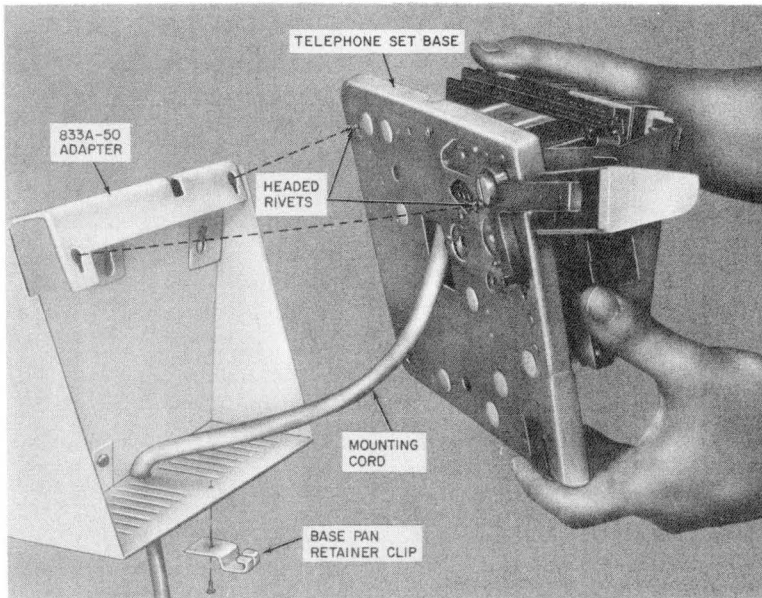


Fig. 20—Installation of Wall Telephone Set

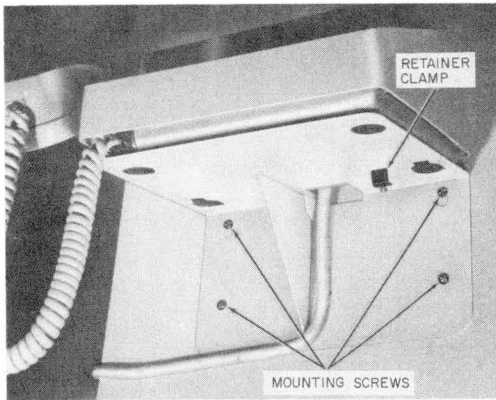


Fig. 21—Shelf for Wall Mounting COM KEY Telephone Set (D-180656 Kit of Parts)

4.08 To move the common audible signal to a station or stations other than, or in addition to, the attendant station (code 0), make the following changes on connecting block 1:

- (1) Remove the factory-provided strap between terminals F9 and C1.



*Up to ten stations, including the attendant, can be wired for common audible only if capacitor C1 is connected to fuse F12 as shown in Part E of Fig. 74. If it is not, only one station can have common audible.*

- (2) Run a strap from the common audible terminal F9 to the CO/PBX ring terminal (or terminals) in row C of the desired station (or stations) code. Use a continuous strap if more than one station code is connected to the common audible ring terminal.

4.09 To remove a particular CO/PBX line from the common audible group, remove the



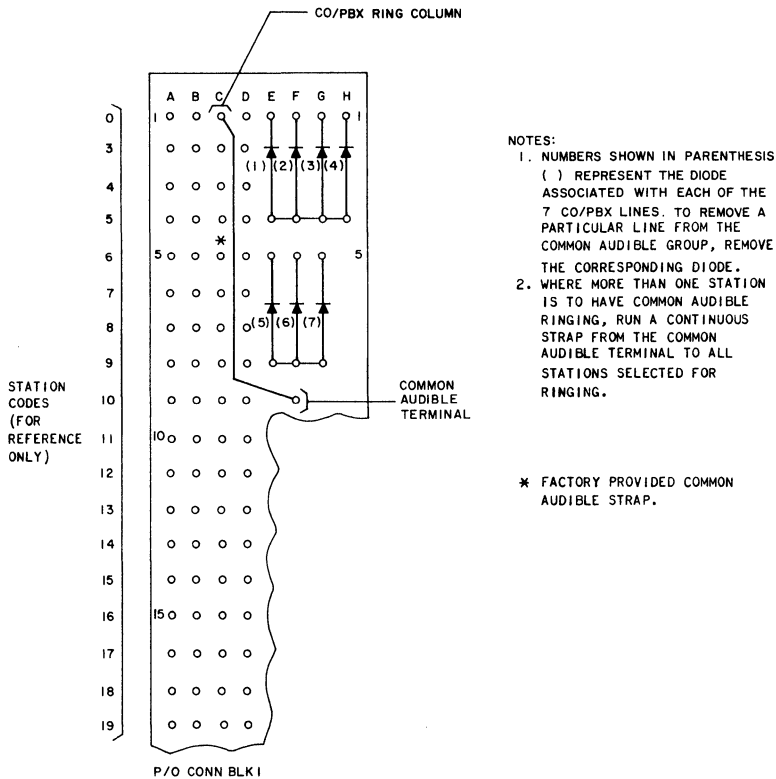


Fig. 22—Connections for Common Audible

corresponding common audible diode from connecting block 1 (Fig. 22). When a CO/PBX is removed from the common audible ringing arrangement:

- The CO/PBX line must be connected to ring a selected station(s) via a CO ringing arrangement as described in paragraph 4.26
- The ringing cannot be transferred through the ring transfer arrangement.

### C. Multiline Conferencing

4.10 Multiline conferencing is a feature of the telephone sets used in the system. Since there is no amplification involved, this type of conferencing is limited.

**Note:** Transmission levels will be reduced and transmission is not guaranteed.

- 4.11 Conferencing is accomplished by simultaneously depressing the CO/PBX line buttons of the CO/PBX lines to be conferenced.



**Intercom and CO/PBX lines cannot be conferenced together.**

- 4.12 All lines that are conferenced together may be put on hold simultaneously by depressing the HOLD button.

**4.13** To make a call during a conference:

- (1) Depress HOLD button—all buttons restore.
- (2) Select an idle line.
- (3) Dial call.
- (4) If it is desired to add this call to the conference while holding this CO/PBX line button down, depress the conferenced CO/PBX line buttons.
- (5) To reenter conference again after call is completed, simultaneously depress conferenced buttons again.

**4.14** If it is desired to add another call to the conference, while holding the conferenced CO/PBX line buttons down, depress button of CO/PBX line to be added.

**4.15** To prevent dropping one of the participants when setting up a conference, ensure that the conferenced CO/PBX line buttons are held down when adding another station.

**Remember:** *The system may be disabled if multiple buttons are left depressed at an idle station after a conference.*

**4.16** Conferencing is a mechanical function of the telephone set and requires no wiring.

#### **D. Pickup, Hold, and Illumination**

**4.17** The system provides pickup on CO/PBX and intercom lines and hold on CO/PBX lines. Lamps provide the following information: steady lamps are for line busy, flashing lamps for incoming calls, and winking lamps for hold.

**4.18** The CO/PBX and intercom lines appear on the same buttons at all stations. By observing the lamps associated with the CO/PBX and intercom line buttons, the station user can readily determine the status of each line. Any station user can pick up any idle line or place any CO/PBX line on hold.

#### **E. Tone and Voice Signaling**

**4.19** All stations are alerted to an incoming call by a distinctive tone signal. The CO/PBX ringing is a frequency-shifting tone. Intercom

ringing is a single tone followed by voice signaling. Voice signaling is used in conjunction with tone signaling when calling a station on the intercom. When a station receives incoming CO/PBX tone signals and is simultaneously signaled on the intercom, the intercom signal is given preference.

#### **F. 2-Path Intercom**

**4.20** The intercom has two separate talking paths.

A path is selected by depressing one of the two intercom buttons on the telephone set. There is no privacy on either path and any station may break into an existing conversation.

**4.21** When it is desirable for a station to pick up only the two intercom lines and not have access to the CO/PBX lines, a 575AM or a 2575AM telephone set can be used. The 575AM and 2575AM telephone sets are connected to the 570-type KSU by A25B connector cables (Fig. 23).

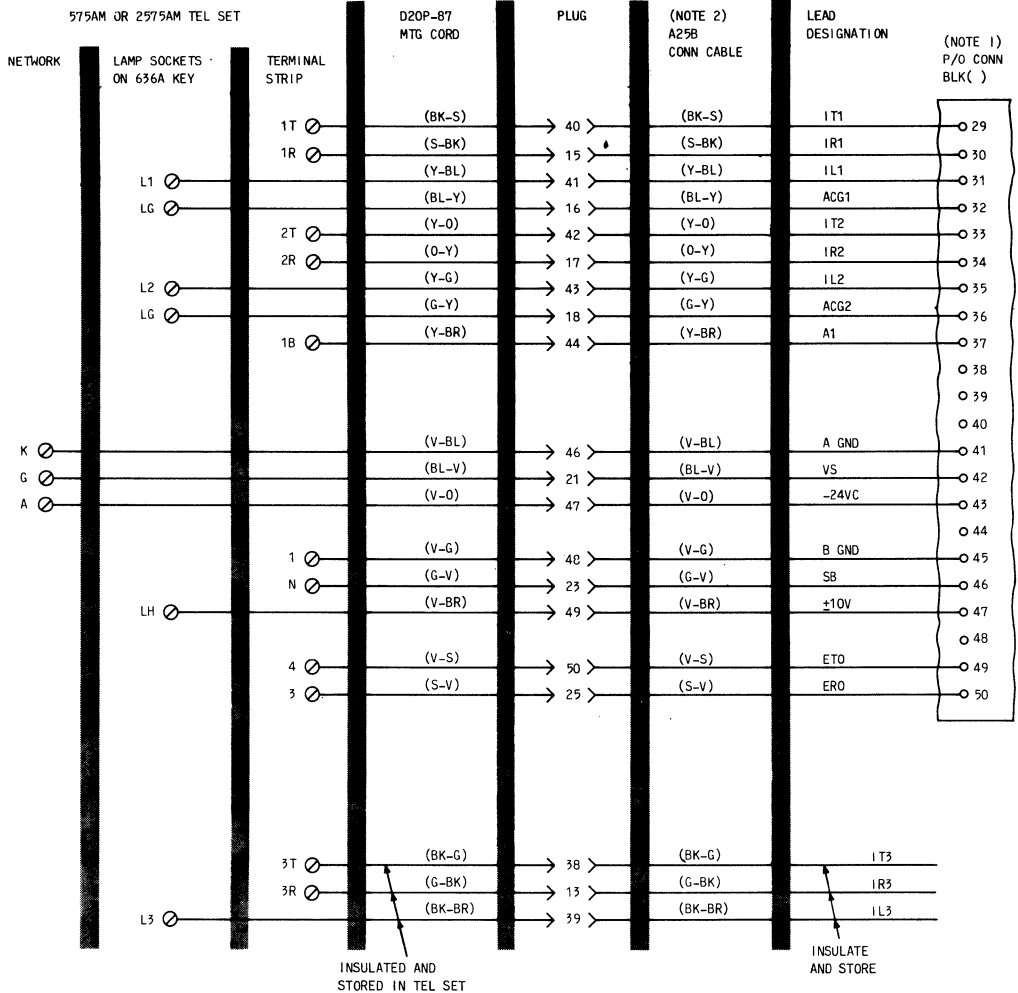
**4.22** The selector, used to select and alert the called stations, is shared between the two paths. The alerting signal at the called station is a tone burst followed by a voice signal from the calling station. The lamp signals on the intercom are as follows: When the selector has seized a path, the lamp associated with that path will flash on all telephone sets. This shows the called party which path to answer. When the called party answers, the flashing intercom lamp lights steadily. When an intercom path is idle, the associated lamp is off.

**4.23** To place an intercom call:

- (1) Select idle intercom path and depress associated button.
- (2) Lift telephone handset.

**Note:** If lamp is flashing on other intercom path, dialing cannot take place until the selector is released. While the selector is seized by another station, no dial tone or other indication is available.

- (3) Dial selected station—tone burst signals called station.
- (4) Calling station makes announcement or waits for called party to answer. When called party picks up, intercom lamp will go steady.



NOTES:

1. TERMINATE CONNECTOR CABLE FOR INTERCOM ONLY STATION ON SAME BLOCK(S) AS ASSIGNED FOR FULL SERVICE STATION.
2. ONLY LEADS SHOWN ARE REQUIRED. TERMINATE BALANCE OF CONN CABLE ON SAME COLUMN OF CONN BLOCK EXCEPT FOR 3RD IC PATH.

Fig. 23—Connections for Intercom-Only Telephone

4.24 Intercom is factory-wired, requiring the 424C, 456B, and 460B KTUs. See Fig. 24 for KTU locations in the KSU. The intercom code of a station is determined by the column on connecting blocks 3, 4, or 5 on which the station cable is terminated. See paragraph 3.05(8) and Fig. 16.

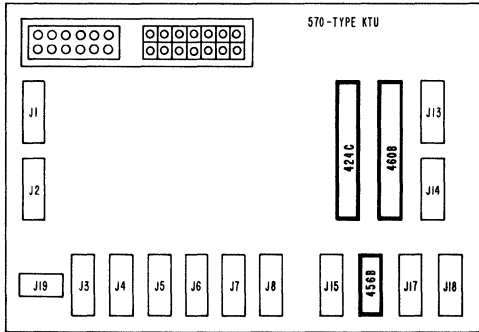


Fig. 24—Location of 424C, 456B, and 460B KTUs, 2-Path Intercom

**OPTIONAL FEATURES**

**A. CO Ringing**

4.25 The CO ringing feature permits a station not wired for common audible to receive the ringing signal on a selected CO/PBX line. Any combination of stations may be connected for CO ringing on a one-line per-station basis.

**Remember:** *The CO ringing is tone ringing.*

4.26 A terminal representing each CO/PBX line is brought out on connecting block 1, row 21 (see Fig. 25). To connect CO ringing, on connecting block 1, column C, select the terminal associated with station to ring on a particular CO/PBX line. Then run a strap (RC-) from the station terminal in column C to the particular CO ring terminal in row 21. Figure 25 illustrates station 3 strapped (RC-1) to the CO ring terminal (in row 21) of CO/PBX line 1 and station 16 strapped (RC-2) to the CO ring terminal of CO/PBX line 2. In this instance, CO/PBX line 1 will ring at station 3 and the second CO/PBX line will ring at station 16.

**B. External Signaling Circuit**

4.27 Where external signaling devices (such as bells, gongs, chimes, lights or buzzers) are to be connected to the 7A Communication System, a 22A-49 apparatus unit must be provided. The 22A-49 apparatus unit is externally mounted and connections are made to the KSU with inside wire. Also, an external power supply must be provided to operate the signaling devices. The 22A-49 apparatus unit may be used to activate external signaling devices that are operated by an open circuit (through a relay break contact) or that are operated by a circuit closure (through a relay make contact).

**Caution:** *The 22A-49 apparatus unit contains a nonadjustable, mercury-wetted, sealed contact relay and must be mounted in a vertical upright position.*

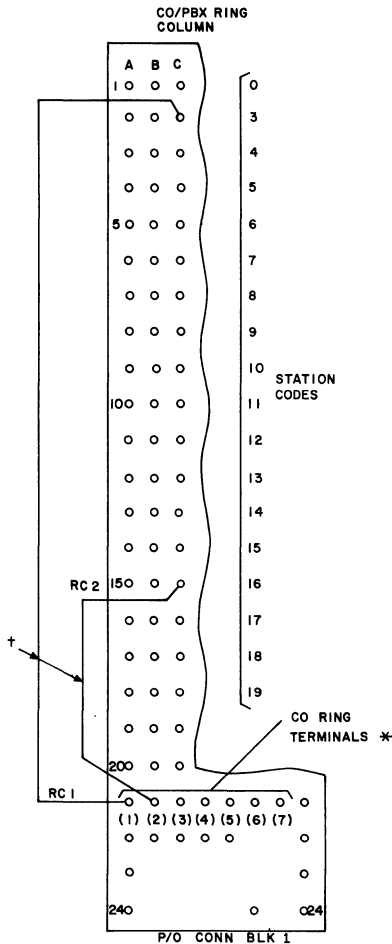
4.28 The 22A-49 apparatus unit is used to activate external signaling devices that are connected for:

- Station codes (see Fig. 26)
- Common audible (see Fig. 27)
- CO/PBX ringing (see Fig. 27)
- Ring transfer (see Fig. 27).

4.29 One 22A-49 apparatus unit is required for each station code or each CO/PBX line equipped with an external signaling device. Connections for station codes are shown in Fig. 26. Connections for common audible, CO ringing and ring transfer are shown in Fig. 27. The maximum resistance of each lead between the KSU and the 22A-49 apparatus unit is 25 ohms.

4.30 The KS-16301 type auxiliary signals or ringers are recommended as external signaling devices for use with the 7A Communication System. See Fig. 28 for connections. Refer to Section 463-110-100 for identification, installation, operation, maintenance, and ordering information on the KS-16301 type signals.

4.31 The external power supply used to operate the signaling devices must be properly fused and have the capacity to adequately power the signaling devices. The ac power receptacle should



\* NUMBERS SHOWN IN PARENTHESIS ( ) REPRESENT THE 7 INCOMING CO/PBX LINES. NUMBERS ARE FOR REFERENCE ONLY AND DO NOT APPEAR ON THE BLOCK.

+ CONNECTIONS AS SHOWN CAUSE STATION 3 TO RING ON LINE 1 AND STATION 16 TO RING ON LINE 2.

Fig. 25—Connections for CO/PBX Ringing

meet requirements per paragraph 3.02. Information found in Section 167-416-201, 167-440-201, or 167-446-101 may be used as a guide toward selecting an appropriate power supply. Do not use a power supply that exceeds the contact rating of the 22A-49 apparatus unit.

C. Intercom Preset Conference

4.32 Intercom preset conference allows up to five preselected stations to be alerted simultaneously by dialing code 19.



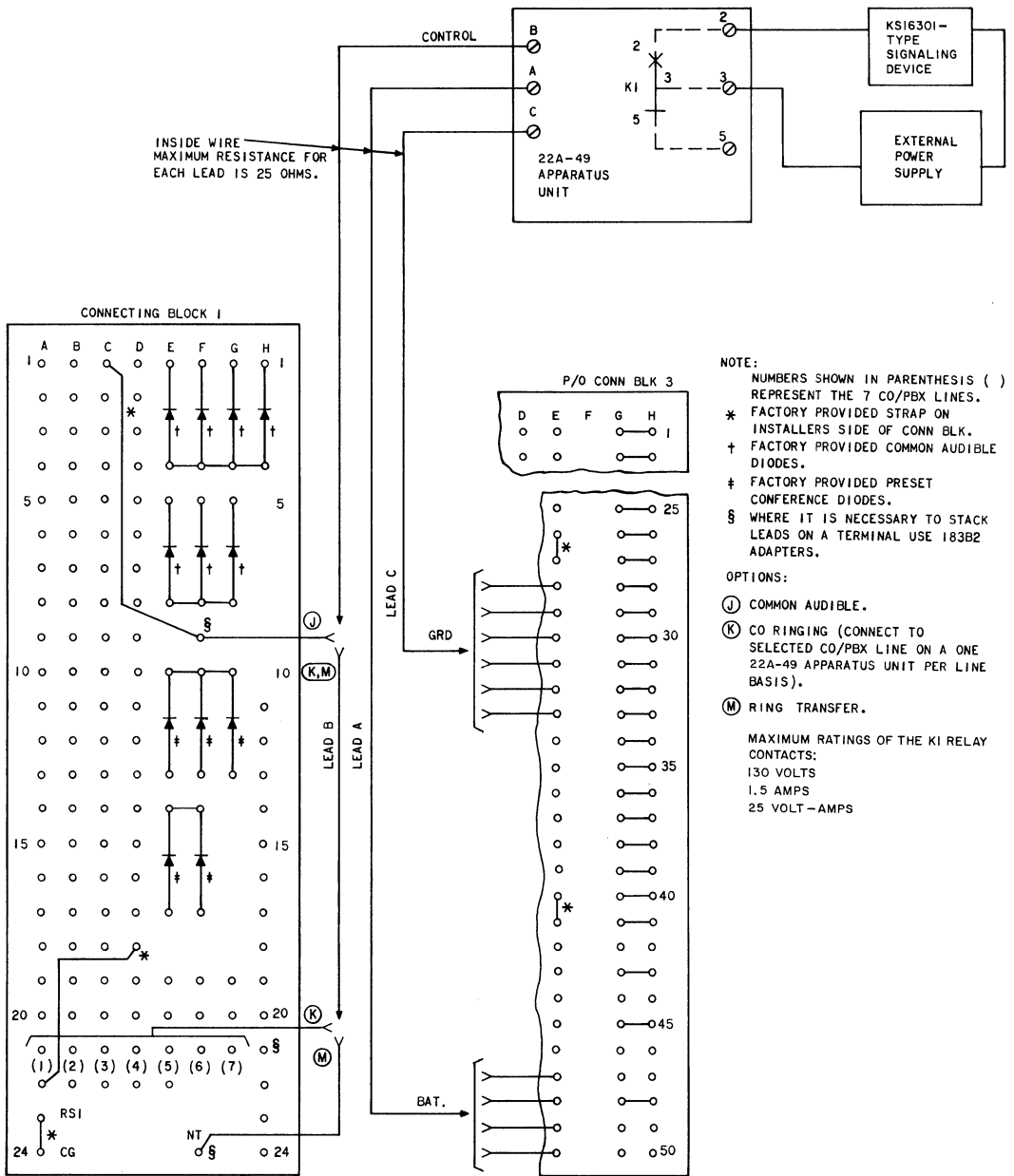
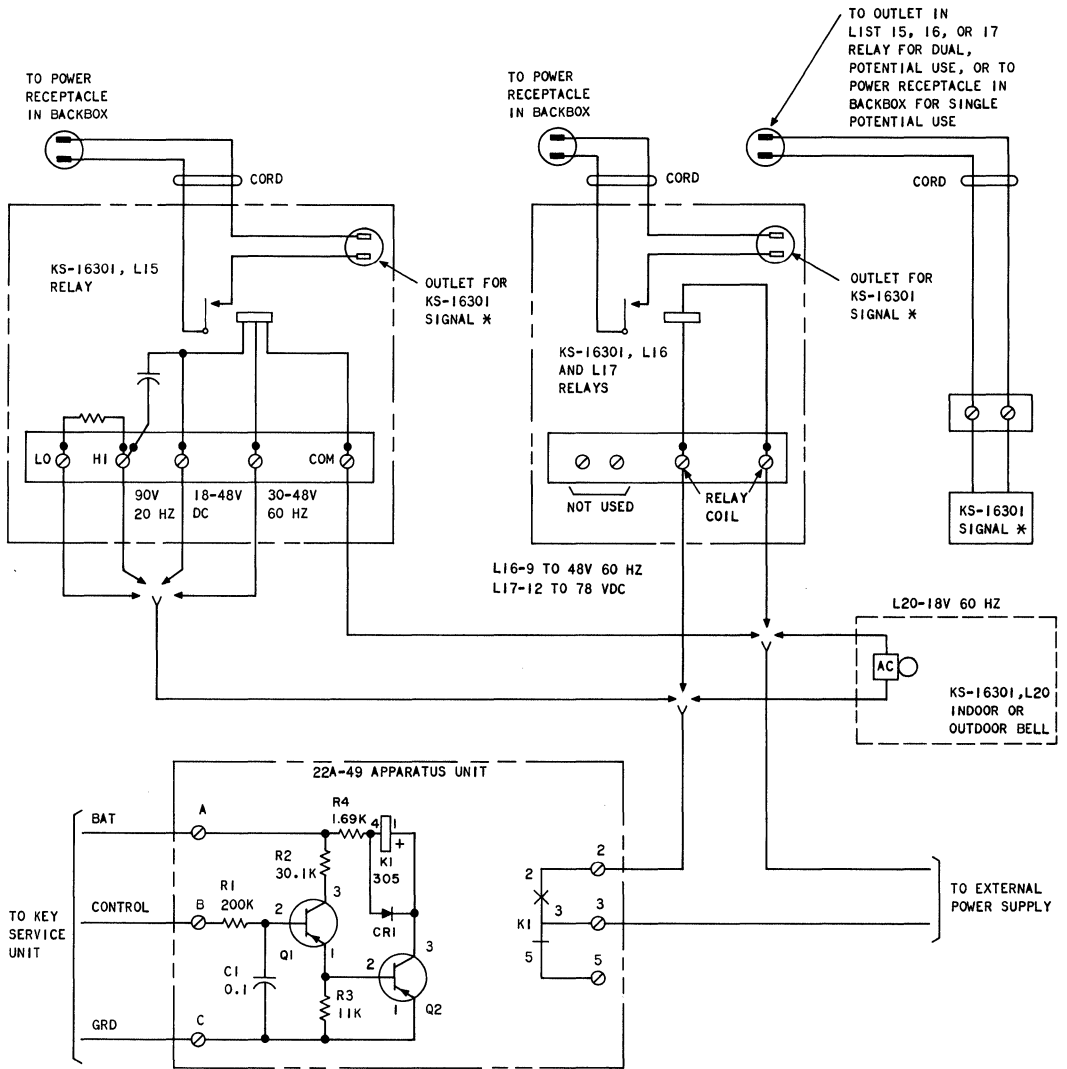


Fig. 27—Common Audible, CO/PBX Ringing or Ring Transfer Connections for External Signaling Circuit (22A-49 Apparatus Unit)



\* LIST 1, 2, 3, 4, OR 5

NOTE:  
THE 22A-49 APPARATUS UNIT MUST  
BE MOUNTED IN A VERTICAL UPRIGHT  
POSITION.

Fig. 28—Connections for 22A-49 Apparatus Unit and KS-16301 Type Signals



**4.33** When preset conference is used, station code 19 is forfeited. Signaling via preset conference takes precedence over CO/PBX ringing at a preset conference station.

**4.34** To connect preset conference, strap the terminals in the preset conference row to the desired stations in column D, connecting block 1 (Fig. 29). For example, Fig. 29 shows that stations 5, 10, and 15 are wired for preset conference.

**Note:** Any intercom station may originate preset conference, but only those stations wired for preset conference will be alerted.

**4.35** To use preset conference:

- (1) Lift handset
- (2) Select idle intercom path and depress associated button
- (3) Dial 19—tone burst signals all stations wired for preset conference

**Note:** Attendant may use DSS code 19 if equipped with DSS console.

- (4) Announcement is made to all preset conference stations simultaneously.

#### D. Music-On-Hold

**4.36** The music-on-hold feature transmits music to calling or called parties on CO/PBX lines that are placed on hold.

**4.37** Music-on-hold is provided on CO/PBX lines by a 451A or B KTU (with 400G or earlier KTUs in a 570A KSU), a 498A KTU equipped with a 116A1 CM (with any 400-type KTUs in a 570B KSU), a 33A voice coupler, and a customer-provided music source. The customer-provided music source must have an output impedance low enough to drive an 8-ohm load without distortion. The music source must also be adjustable so the listening level of the music-on-hold may be adjusted.

**Caution:** *The output of the CP music source must furnish ac coupling only—thus blocking all direct current to the input terminals of the 33A voice coupler.*



**The CP music source should be able to deliver up to one watt into an 8-ohm load. The 33A voice coupler will accept input from any customer-provided apparatus that does not blow the fuses in the voice coupler. If the customer wants a copy of the technical reference covering the 33A voice coupler, contact the local Telephone Company Business Office or the Marketing Representative. If a service call is caused by a malfunction of the customer-provided equipment, billing should be made in accordance with Section 660-101-312.**

**4.38** Make connections as follows:

(a) If the KSU is a 570A (MD), plug the 451-type KTU into J18. If the KSU is a 570B, plug the 116A1 CM into J1/J2 on the 498A KTU and then plug the 498A into J18 on the KSU. See Fig. 30 for KTU location.

(b) Install 33A voice coupler (Fig. 9) as follows:

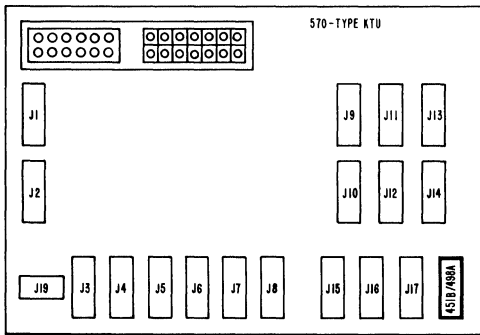
- (1) Remove cover from voice coupler
- (2) Mount voice coupler externally to KSU (wherever customer desires)
- (3) Connect voice coupler to KSU as shown in Fig. 31
- (4) Have customer connect voice coupler to his music source as shown in Fig. 31.

**Caution:** *Ensure that 35P fuses are installed with the spring at the bottom. If fuses are improperly installed, blown fuses may cause damage to customer's amplifier.*

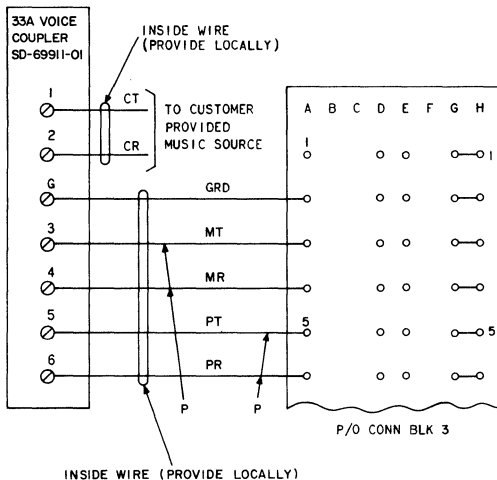
- (5) Replace cover on voice coupler.
- (c) Adjustment procedures for music-on-hold is as follows:

- (1) Turn potentiometer on 33A voice coupler to full counterclockwise position
- (2) Place call to a 7A station





**Fig. 30—Location of Music-On-Hold Circuit**



**Fig. 31—Connections for 33A Voice Coupler**

of stations as fixed by an option strap in the KSU. The flexible station ring transfer arrangement utilizes a 6041G key to permit any one of up to five stations or groups of stations to be selected for ring transfer of incoming CO/PBX calls.

**4.40** To operate ring transfer wired for fixed station transfer, depress RING TR button on attendant telephone set (locking it down). To transfer ringing back to the attendant station,

depress RING TR button again (which releases it). While the button is depressed, the lamp under it is lit (steady).

**4.41** To operate ring transfer arrangement for flexible station transfer, depress button on the 6041G key associated with the station or stations to receive incoming CO/PBX calls. Then depress RING TR button on the attendant telephone set (locking it down). While the button on the attendant set is depressed, the lamp under it is lit (steady). To transfer ringing back to the attendant station, depress the RING TR button again (which releases it). Afterward, operate the release button on the 6041G key.

**4.42** The attendant telephone set must be equipped with a ring transfer button to control ring transfer. Where the 832/2832C, CM or EM telephone set is installed as an attendant station, the factory-provided RING TR button must be wired in. See Fig. 32 for connections. Where the 832A or 2832A telephone set is installed as an attendant station, a D-180487 Kit of Parts must be added to the telephone set as follows:

- (1) Remove faceplate
- (2) Pry apparatus blank off locating pins (located below and to the right edge of key strip)
- (3) Press ring transfer button (651C key) on locating pins
- (4) Connect leads according to Fig. 32
- (5) Install designation strip in key cap
- (6) Replace faceplate.

**4.43** For fixed station ring transfer, in the KSU, run a strap from the RT terminal (column F, terminal 24) on connecting block 1 to the station code or station codes (column C, connecting block 1) selected for ring transfer. For example, Fig. 32 shows station 12 wired for ring transfer. When more than one station code is connected to the RT terminal, run a continuous strap to all stations (ten maximum) selected for ring transfer.

**4.44** For flexible station ring transfer:

- (1) Install a 6041G key at the attendant station

- (2) Provide three cable pairs or six 24-gauge conductors between the 6041G key and the KSU
- (3) Connect one conductor (common lead) to terminal M of the 6041G key and strap terminals M and X together (see Fig. 32 or 33)
- (4) Terminate the remaining five conductors on terminals 1H, 2H, 3H, 4H, and 5H of the 6041G key
- (5) At the KSU, terminate one conductor (common lead) on the RT terminal (column F, terminal 24) of connecting block 1
- (6) Terminate the remaining five conductors on the terminals of connecting block 1, column C, corresponding to the codes of the stations selected for ring transfer (see Fig. 32)
- (7) Install designation strip on 6041G key—  
Designate the first button (position A) as RELEASE and label the remaining buttons according to the stations they connect for ring transfer.

#### F. Paging and Background Music

- 4.45** In the 7A Communication System, paging may be:
- (a) Provided for up to seven speakers, using indoor or outdoor speakers
  - (b) Connected to a COAM paging system
  - (c) Connected to a separate paging system provided by the telephone company.
- 4.46** For background music, a 33A voice coupler must be installed and connected to the KSU and customer-provided music source according to paragraph 4.38(b). When the paging system is not being used, the customer-provided music source may be used to provide background music over the paging speakers.
- 4.47** A paging system should be loud enough to be heard but not loud enough to annoy those who work near the speakers. The number and location of speakers are influenced mainly by the environment in which they will be located. Figure 34 shows several examples of speaker placement.

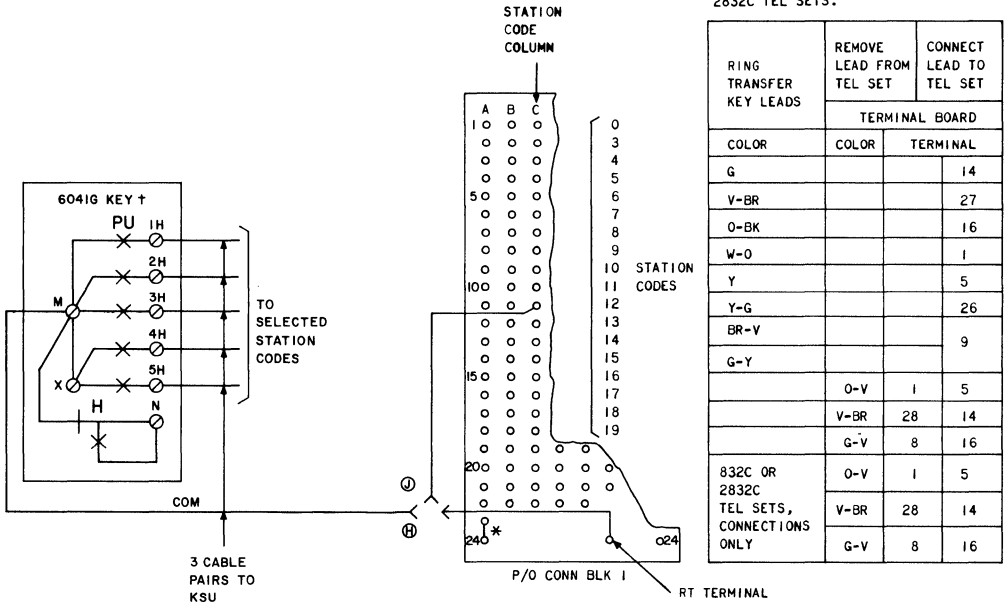
It may be necessary to experiment with speaker placement on site to achieve the desired results. Noisy locations may require additional speakers or an auxiliary paging system. Refer to Section 981-251-100 for general information on loudspeaker paging system.

**Caution:** Avoid placing loudspeakers directly in front of or close to stations that will utilize the paging system. An undesirable oscillation (squeal) can result from such speaker placement. A minimum separation of 60 feet between telephone sets and loudspeakers is recommended. The problem can also be reduced by using a 456B voice and tone alerting circuit KTU instead of a 456A.

- 4.48** The system is factory-wired so paging may be activated by dialing code 2.
- 4.49** Make connections as follows.
- (1) Install 457C KTU in J15. See Fig. 35 for KTU location.
  - (2) If background music is provided, install the 33A voice coupler according to paragraph 4.38(b).
  - (3) Connect paging speakers as shown in Fig. 36. Speaker wiring should be run separately and not a part of a voice cable. Quad inside wire should be used with both pairs connected. (Where it may become necessary to "stack" wires on the connecting block terminals, use 183B2 adapters.) Speakers connected in this manner can be located a maximum of 320 feet from the KSU. Indoor speakers should be hung as close to the ceiling as possible.
- Note:** If the customer does not have music-on-hold but does have background music, turn the potentiometer in the 33A voice coupler fully clockwise. Have customer adjust his music level.
- 4.50** The KS-21880L1 loudspeaker (Fig. 10) is an indoor speaker. It is wall-mounted or may be mounted over an outlet box. A mounting clip is furnished with the speaker. To mount speaker (see Fig. 10), screw mounting clip to wall or outlet box, slip speaker baffle over mounting clip and

TELEPHONE SET CONNECTIONS FOR RING TRANSFER.

- D-180487 KIT OF PARTS REQUIRED FOR 832A AND 2832A TEL SETS.
- CONNECTIONS ONLY FOR 832C AND 2832C TEL SETS.



\* FACTORY-PROVIDED STRAP ON INSTALLERS SIDE OF BLOCK  
 + REFER TO SECTION 512-210-103 FOR ORDERING INFORMATION ON 6041G KEYS.

OPTIONS:

- Ⓜ FIXED STATION RING TRANSFER. . . . . ANY STATION MAY BE SELECTED FOR RING TRANSFER. TRANSFER TO STATION 12 IS SHOWN HERE.
- Ⓜ FLEXIBLE STATION RING TRANSFER. . . . . ANY ONE OF UP TO FIVE STATIONS MAY BE SELECTED FOR RING TRANSFER THROUGH 6041G KEY

Fig. 32—Connections for Ring Transfer

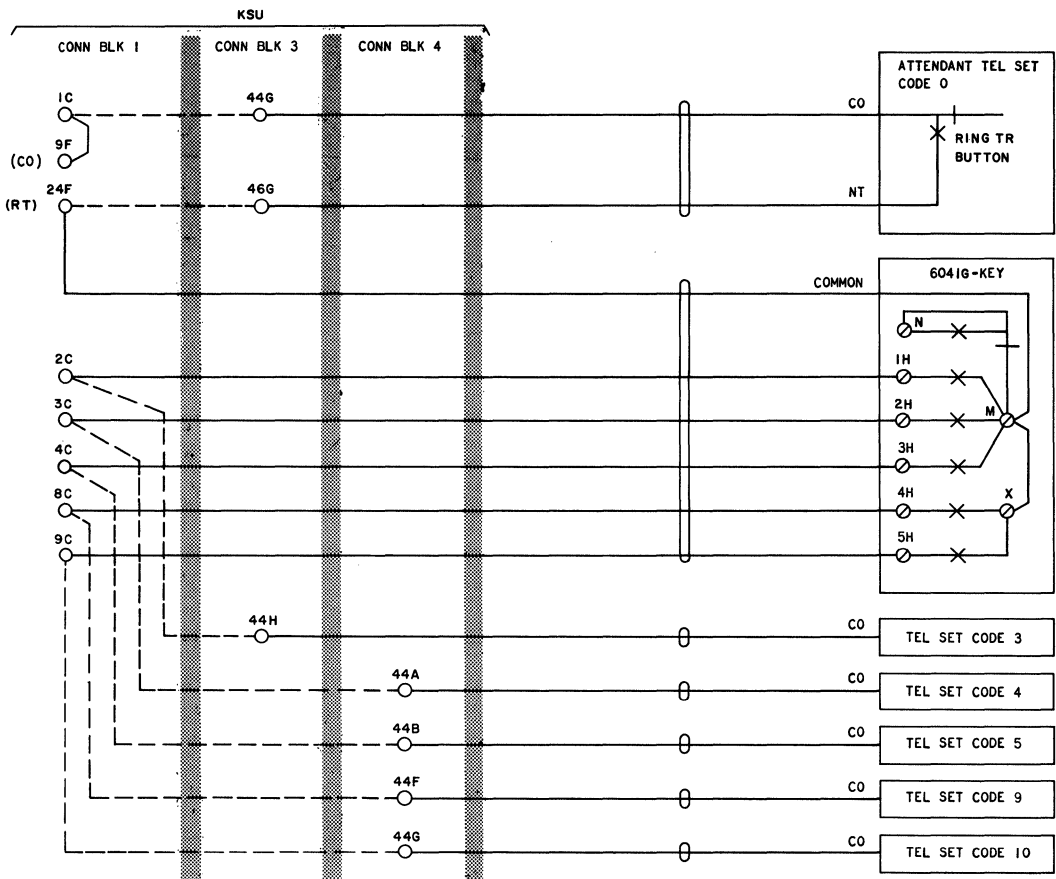
pull speaker down until it is firmly held by the mounting clip. Speaker volume is controlled by a potentiometer (with screwdriver adjustment slot) located in the bottom of the speaker. Adjust speaker volume after speaker is mounted.



*Speaker volume level will be affected by changes in room content. The addition of furniture, fixtures, draperies, carpeting or wall covering may necessitate increasing speaker volume, which, however, may increase the tendency*

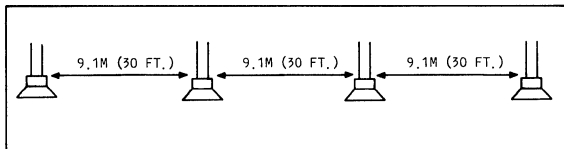
*of the system to "squeal" because of feedback between loudspeakers and telephones. If this occurs, try to change the relative positions of loudspeakers and telephones, if possible. If a 456A voice and tone alerting circuit is used, replace it with a 456B.*

4.51 The KS-21939L2 loudspeaker (Fig. 11) is applicable to locations with adverse weather conditions. The loudspeaker is equipped with a

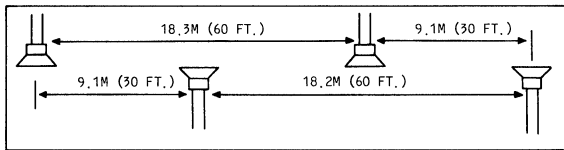


NOTE:  
 1. ANY STATION MAY BE SELECTED FOR RING TRANSFER.  
 TRANSFER TO STATION 3, 4, 5, 9 OR 10 IS SHOWN HERE.  
 2. DOTTED LINES INDICATE FACTORY WIRING IN KSU.

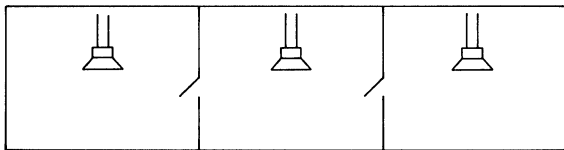
Fig. 33—Example of Connections for Flexible Station Ring Transfer Arrangement



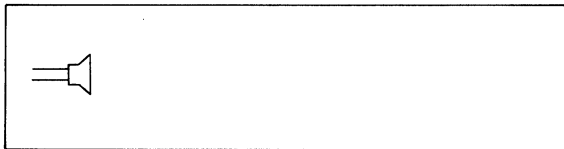
EXAMPLE A - SPEAKERS LOCATED ON ONE WALL OF ROOM (NOTES 1, 2 AND 3)



EXAMPLE B - SPEAKERS LOCATED ON OPPOSITE WALLS OF ROOM (NOTES 1 AND 2)



EXAMPLE C - SPEAKERS LOCATED IN INDIVIDUAL ROOMS (NOTES 1, 2 AND 4)



EXAMPLE D - OUTSIDE SPEAKER (HORN) LOCATION (NOTES 2 AND 5)

NOTES:

1. EXAMPLES A, B AND C ARE FOR QUIET OR OFFICE TYPE ENVIRONMENTS, LESS THAN 65DB SOUND PRESSURE LEVEL (SPL). ALL SPEAKERS SHOULD BE LOCATED AT LEAST 18.3 METERS (60 FEET) FROM ANY STATION USED FOR PAGING.
2. SPEAKER WIRING SHOULD BE RUN SEPARATELY, NOT PART OF A VOICE CABLE, QUAD CABLE SHOULD BE USED WITH BOTH PAIRS CONNECTED. SPEAKERS SHOULD BE HUNG AS CLOSE TO THE CEILING AS POSSIBLE. MAXIMUM SPEAKER DISTANCE FROM THE KSU IS 97.6M (320 FT.) USING QUAD WIRE.
3. SPEAKERS REACH A DEPTH OF 9.1M (30 FT.). IF ROOM IS OVER 9.1M (30 FT.) WIDE, FACING SPEAKERS SHOULD BE USED.
4. ONE SPEAKER WILL SERVE A ROOM UP TO 7.6M BY 7.6M (25 BY 25 FT.)
5. ONE SPEAKER (HORN) MOUNTED 6.1M (20 FT.) ABOVE GROUND LEVEL WILL COVER AN AREA APPROXIMATELY 24.4 BY 30.5M (80 BY 100 FT.). IF THE HORN IS MOUNTED LESS THAN 6.1M (20 FT.) ABOVE GROUND LEVEL, TWO HORNS MUST BE USED. HORNS SHOULD NOT BE MOUNTED LESS THAN 4.6M (15 FT.) ABOVE GROUND LEVEL. IF MORE THAN ONE HORN IS USED, THEY SHOULD BE MOUNTED VERTICALLY, RATHER THAN SIDE-BY-SIDE.

Fig. 34—Example of Paging Speaker Location

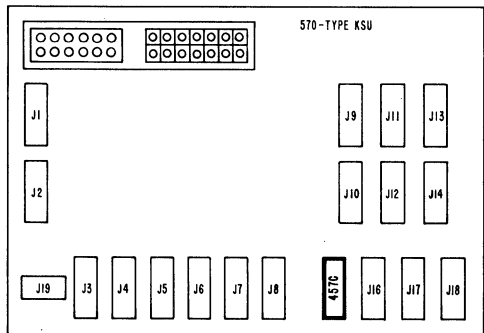
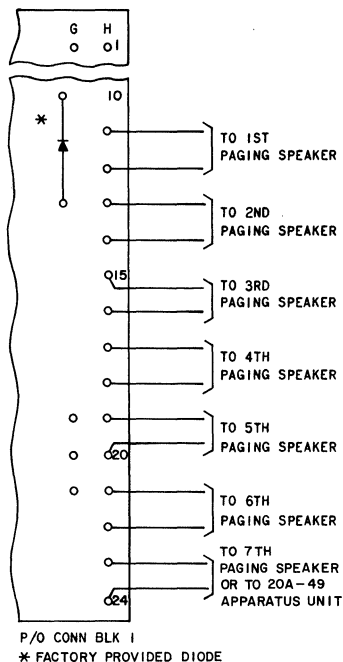


Fig. 35—Location of 457C KTU, Paging Amplifier

swivel mounting bracket for mounting on a flat surface. Also the speaker can be fastened to a 1/2-inch pipe or conduit. The loudspeaker is equipped with a screwdriver adjusted volume control. Screw terminals are provided for connections to the speaker.



**When using outdoor speakers, the speaker leads must be protected in accordance with local instructions or Section 460-100-400.**



**Fig. 36—Connections for Paging Speakers (or 20A-49 Apparatus Unit)**

**4.52** Alignment procedure for paging and background music is as follows:

- (1) Dial paging code and adjust potentiometer on each speaker for proper volume while paging in a normal voice
- (2) Disconnect
- (3) Have customer adjust potentiometer on voice coupler for desired level of background music over paging system
- (4) Inform customer after alignment is complete that if the gain of the music source is readjusted, the background music and music-on-hold will be affected.

**Note:** If the customer has paging and music-on-hold but does not want background music, the potentiometer on the voice coupler should remain in the counterclockwise position.

**4.53** A COAM paging system or a separate telephone company-provided paging system is connected to the 7A Communication System through a 20A-49 apparatus unit (see Fig. 37). The 20A-49 apparatus unit is mounted externally to the KSU.

(a) Connect the 20A-49 apparatus unit as follows.

- (1) Remove cover from the 20A-49 apparatus unit.
- (2) Mount the 20A-49 apparatus unit within 200 feet of KSU (wherever customer desires).
- (3) Connect the apparatus unit to the KSU as shown in Fig. 37. Wiring should be run separately and not be a part of the voice cable.
- (4) Have customer connect paging system to apparatus unit, using shielded wire, as shown in Fig. 37.
- (5) Replace cover on apparatus unit.

(b) Adjustment procedure for the 20A-49 apparatus unit is as follows:

- (1) Turn potentiometer to full counterclockwise position
- (2) Select an idle intercom path and dial 2 (paging code)
- (3) Using normal voice level, make test announcement while turning potentiometer clockwise until suitable voice level for COAM equipment is reached

**Note:** Where the COAM paging equipment has full control of the paging volume, turn the potentiometer of the 20A-49 apparatus unit to the full clockwise position.



**The 20A-49 apparatus unit provides a nominal 300-ohm output to a customer-owned paging system (Fig. 37). It does not provide a means to activate the customer's equipment; therefore, the customer's equipment must be in the ON mode at all times.**



- (4) Disconnect call.



***If a service call is caused by a malfunction of the customer-provided equipment, billing should be made in accordance with Section 660-101-312.***

### G. Power Failure Ringer

**4.54** For each location to be equipped with power failure transfer, a power failure ringer (E1C) must be installed. Install the E1C ringer near telephone set location. See Fig. 38 for connections.

### H. Power Failure Transfer

**4.55** Utilizing a 452A KTU and externally mounted E1C ringers, this feature provides an audible indication of incoming CO/PBX calls during a power failure condition.

**4.56** The tip and ring of all CO/PBX lines are wired to line ringers through normally made contacts of relays in the 452A KTU. The relays are held operated while local power is available. When power is lost to the KSU, the relays release and the tip and ring of the CO/PBX lines are cut through to the line ringers.

**4.57** The tip and ring from each CO/PBX line is brought out on connecting block 1 (Fig. 38). The tip and ring of the desired CO/PBX line may be strapped to the V-S and S-V pair of the desired station by connections as shown in Fig. 38. In this instance, the tip and ring of the first CO/PBX line is strapped to the V-S and S-V pair of station 3. This puts line ringing at station 3 if power failure should occur. The tip and ring may also be connected between the KSU and the external ringer by an auxiliary cable.

**4.58** Install 452A KTU in J1. See Fig. 39 for KTU location.

### I. Privacy

**4.59** Privacy prevents a station from bridging into a CO/PBX call in progress. Privacy is a station feature, and each station that is to be excluded (locked out) must be equipped with a privacy circuit board.

**4.60** A privacy circuit, D-180486 Kit of Parts, must be added to an 832/2832A (MD), B

(MD), BM, or DM telephone set used as a privacy station. The 832/2832C (MD), CM, and EM telephone sets are wired at the factory with the privacy circuit operational.

**4.61** The privacy circuit operates only when the telephone set is off-hook. The circuit monitors the A lead to determine the status of the line. A ground (or positive potential) on the A lead indicates the line is busy, operates the privacy circuit, and the station attempting to bridge is excluded. A negative potential on the A lead does not cause the privacy circuit to operate and the set is not excluded. There is no privacy on the intercom paths.

**4.62** Mount the D-180486 Kit of Parts (privacy circuit) as follows.

- (1) Remove faceplate.
- (2) Mount privacy circuit board on the two standoffs located at the left front of the telephone set base (Fig. 40).
- (3) Fasten privacy circuit board to standoffs using mounting screws furnished with the telephone set.
- (4) Connect leads according to Table E.
- (5) To test privacy circuit:
  - (a) At a station other than the one being tested, lift handset and depress a CO/PBX line button
  - (b) At station being tested, lift handset and depress CO/PBX line button on same line; no side tone should be heard
  - (c) Repeat test on all CO/PBX lines
  - (d) Test all sets equipped with a privacy circuit.

**4.63** To change a privacy station to a nonprivacy station, disable the privacy circuit according to Table F or G.

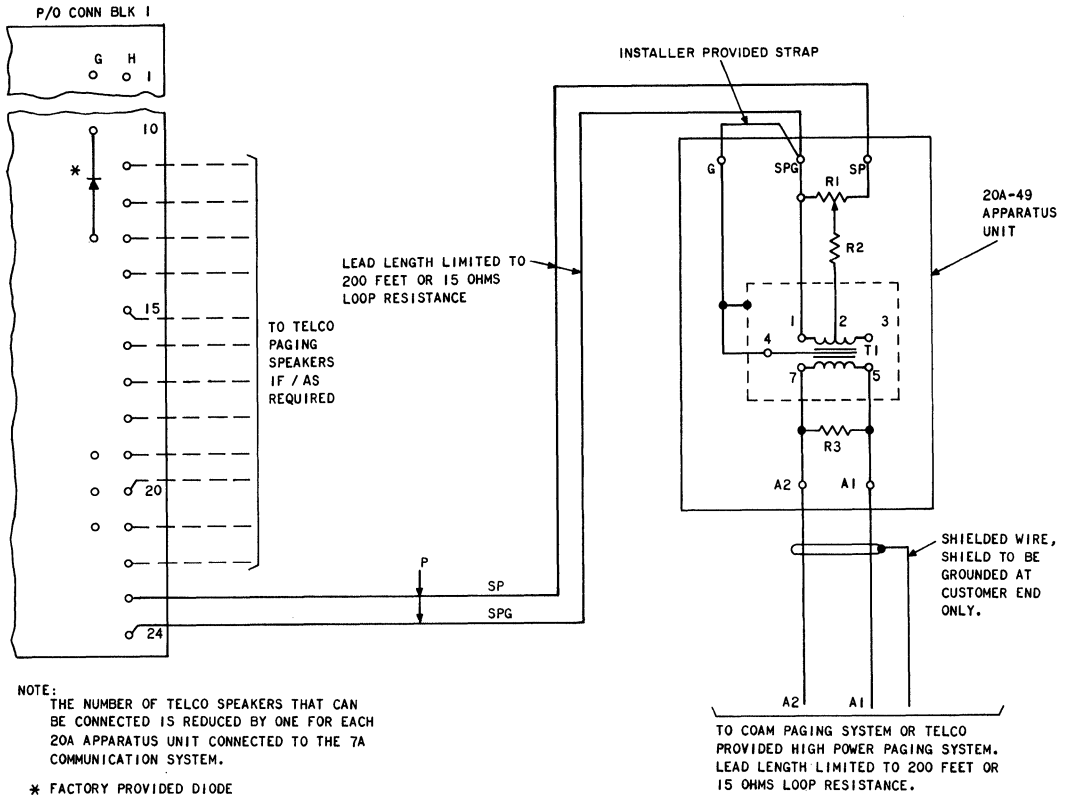


Fig. 37—20A-49 Apparatus Unit, Connections

**J. Privacy Release**

**4.64** Privacy release permits a second privacy-equipped (locked out) telephone to be bridged into a call on a CO/PBX line.

**4.65** A privacy release button, D-180488 Kit of Parts, must be added to an 832A or 2832A telephone set for privacy release. Refer to Table D for a summary of sets which are factory-equipped with the privacy release feature.

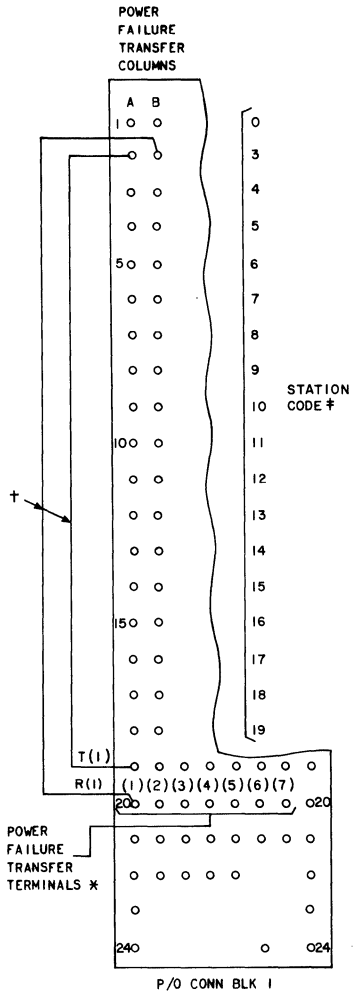
**4.66** When a station is off-hook with a CO/PBX line button depressed, any station equipped with a privacy circuit will be locked out from that

CO/PBX line. To permit a privacy-equipped station to bridge into a call:

- (1) Depress (and hold down) the PRIV RLS button at the station where the CO/PBX line is picked up
- (2) Observe that line lamp changes from steady to wink (the line goes on hold)

The privacy-equipped station may now bridge into the call.

- (3) Observe that line lamp changes from wink to steady (indicating station has entered the call)



\* NUMBERS SHOWN IN PARENTHESIS ( ) REPRESENT THE 7 INCOMING CO/PBX LINE NUMBERS ARE FOR REFERENCE ONLY AND DO NOT APPEAR ON THE BLOCK.

† CONNECTIONS AS SHOWN PUTS POWER FAILURE IN THE STATION CABLE FOR STATION 3

‡ A GIVEN STATION MAY PICK UP ONLY ONE POWER FAILURE LINE.

§ USE INSIDE WIRE FOR RINGER CONNECTIONS.

CONNECT POWER FAILURE RINGER (EIC) BY ONE OF THE FOLLOWING METHODS:

	FROM TEL SET TERMINAL	TO RINGER TERMINAL	LEAD DESIGNATION
1	20	5	ER
	21	6	ET
2	PIN 25	5	ER
	PIN 50	6	ET
3	TERM 50	5	ER-
	TERM 49	6	ET-

Fig. 38—Connections for Power Failure Transfer

(4) Release the PRIV RLS button.

4.67 To allow an additional privacy-equipped station to bridge into the call, both stations must depress their PRIV RLS buttons simultaneously. The line lamp will change from steady to wink. As the third station bridges into the call, the line

lamp will become steady. The PRIV RLS buttons are then released.

4.68 The D-180488 Kit of Parts (privacy release button) is mounted in the 832A or 2832A telephone set and connected as follows:

(a) Remove faceplate

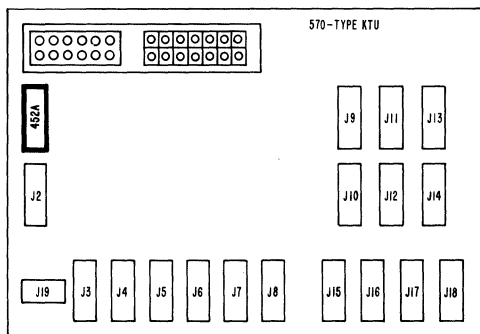


Fig. 39—Location of 452A KTU, Power Failure Transfer

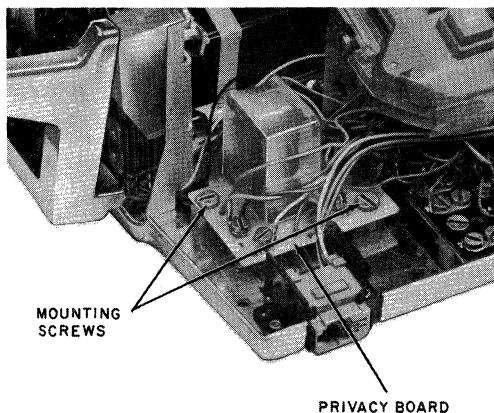


Fig. 40—Privacy Circuit Mounted in Telephone Set

- (2) Pry apparatus blank off locating pins (located below and to the right edge of key strip)
- (3) Press privacy release button (651D key) on locating pins
- (4) Connect leads according to Table H
- (5) Install designation strip in key cap.

4.69 Where privacy release is no longer required, the privacy release button may be disabled. See Table I or J for connections.

#### K. Recall

4.70 Recall provides the same functions as switchhook flash without restoring the line buttons. Recall is accomplished by depressing the RECALL button on the telephone set. The RECALL button is designated with an amber cap.

**Caution: If CO/PBX lines are conferenced and the RECALL button is depressed, the conferenced lines may be disconnected.**

4.71 A recall button, D-180591 Kit of Parts, must be added to an 832A or 2832A telephone set if this feature is required. All other 832- and 2832-type telephone sets are factory-equipped with a RECALL button.

4.72 The D-180591 Kit of Parts (recall button) is mounted in the 832A or 2832A telephone set and connected as follows:

- (1) Remove faceplate
- (2) Pry apparatus blank off locating pins (located below and to the right edge of key strip)
- (3) Press recall button (651F key) on locating pins
- (4) Connect leads according to Table K
- (5) Install designation strip in key cap and install amber key cap on RECALL button.

4.73 The 832A and 2832A telephone sets equipped with RECALL buttons are electrically equivalent to the 832/2832B, BM, and DM telephone sets.

TABLE E

**832/2832A, B, BM, AND DM TELEPHONE SET CONNECTIONS  
FOR PRIVACY CIRCUIT (D-180486 KIT OF PARTS)**

COLOR	CONNECT LEAD TO TEL SET TERMINAL	MOVE LEAD	
		FROM TEL SET TERMINAL	TO PRIV BOARD TERMINAL
O*	8		
BR*	F on Network		
S*	15‡		
BK*	12		
BL*	6		
R†		13	P2
G-W†		13	P1
Y†		6	R1
O†		F on Network	T

\* Privacy board leads.

† Tel set leads.

‡ Store slate lead under screw terminal S2 when privacy release is provided (832A/2832A only).

#### L. Speakerphone

**4.74** Normal speakerphone service may be provided at all stations in the system. Connect speakerphone as follows:



***When installing a 3B or 4A speakerphone in conjunction with a modular 832- or 2832-type telephone set, determine if there is an orange (O) lead on terminal 27 of the telephone set terminal board. If there is, move it to terminal 22. Failure to move this lead will cause the telephone set dial to be inoperative when the speakerphone is in use.***

#### 3B Speakerphone

**4.75** Connect the D10R cord between the telephone set and 55B control unit. Connect the 666B transmitter, 760A loudspeaker, and 2012B transformer to the 55B control unit. See Table L for connections. Plug 2012B transformer into ac receptacle. (Refer to Section 512-620-487 for illustrations and additional information on 3B speakerphone connections.)

#### 4A Speakerphone

**4.76** Install 223A adapter within cord length (7 feet) of telephone set. Connect M16C cord to telephone set as shown in Table M. Plug loudspeaker, transmitter, and power cords into 223A adapter. Plug 85B1 power unit into ac receptacle. (Refer to Section 512-740-471 for

TABLE F

**832/2832A, B, BM, AND DM TELEPHONE SET CONNECTIONS  
TO REMOVE PRIVACY CIRCUIT**

COLOR	DISCONNECT LEAD FROM TEL SET TERMINAL	MOVE LEAD	
		FROM PRIVACY BOARD TERMINAL	TO TEL SET TERMINAL
O*	8		
BR*	F on Network		
S*	15‡		
BK*	12		
BL*	6		
R†		P2	13
G-W†		P1	13
Y†		R1	6
O†		T	F on Network

\* Privacy board leads.

† Tel set leads.

‡ Remove slate lead from under screw terminal S2 when privacy release is provided (832A/2832A only).

TABLE G

**ALL 832/2832-TYPE TELEPHONE  
SET CONNECTIONS TO DISABLE  
PRIVACY CIRCUIT**

COLOR	MOVE LEAD IN TEL SET	
	FROM TERM.	TO TERM.
O	8	*
BK	12	*

\* Insulate and store.

illustrations and additional information on 4A speakerphone connections.)

**Note:** Speakerphone does not prevent normal use of the telephone set for originating, receiving, or transferring calls.

**4.77** To originate a call using speakerphone:

- (1) Depress CO/PBX or intercom button associated with an idle line.
- (2) Momentarily depress transmitter ON button. ON lamp lights and dial tone is heard through the loudspeaker.
- (3) Dial number in normal manner.
- (4) When called party answers, transmitter and loudspeaker are used to carry on the conversation. Adjust volume level as desired.

**4.78** To answer an incoming call using speakerphone:

- (1) When audible tone signals an incoming call, depress CO/PBX or intercom button associated with flashing lamp.

TABLE H

**832A AND 2832A TELEPHONE SET CONNECTIONS FOR  
PRIVACY RELEASE BUTTON (D-180488 KIT OF PARTS)**

TEL SET LEAD	PRIVACY BOARD LEAD	PRIVACY RELEASE KEY LEADS	MOVE LEADS FROM TEL SET TERM.	CONNECT TO TEL SET TERM.	MOVE LEADS TO PRIVACY BOARD TERM.
		O-BK		10	
		BK-BL		15	
		G-Y		27	
		Y-G		27	
		G-W		2*	S2†
BK			15	2*	S2†
	S†		15		S2

\* If telephone set does not have privacy circuit.

† If telephone set has privacy circuit and privacy release is now being added.

TABLE I

**832A AND 2832A TELEPHONE SET CONNECTIONS  
TO REMOVE PRIVACY RELEASE BUTTON**

TEL SET LEAD	PRIVACY BOARD LEAD	PRIVACY RELEASE BUTTON LEADS	REMOVE FROM TEL SET TERM.	MOVE LEADS	
				FROM PRIVACY BOARD TERM.	TO TEL SET TERM.
		O-BK	10		
		BK-BL	15		
		G-Y	27		
		Y-G	27		
		G-W	2*	S2	
BK			2*	S2	15
	S†			S2	15

\* If telephone set does not have privacy circuit.

† If telephone set has privacy circuit and privacy release is being removed.

TABLE J

ALL 832/2832-TYPE TELEPHONE  
SET CONNECTIONS TO DISABLE  
PRIVACY RELEASE BUTTON

COLOR	MOVE LEAD IN TEL SET	
	FROM TERM.	TO TERM.
O-BK	10	15

TABLE K

832A AND 2832A TELEPHONE SET CONNECTIONS  
FOR RECALL BUTTON (D-180591 KIT OF PARTS)

651F KEY	CONNECT TO	
	TERMINAL BOARD	NETWORK
W		GN
W		R
Y	4	
Y	6	

*Note:* Remove Y strap from 4 and 6 on telephone set terminal board.

4.79 To disable transmitter when it is desired not to transmit conversation from the surrounding area to the distant station:

- (1) Depress transmitter ON button during entire period transmitter is to be disabled.

*Note:* With transmitter disabled, conversation will not be transmitted to the distant station; however, the distant party may be heard over the loudspeaker.

- (2) Release transmitter ON button and system is restored to hands-free operation.

4.80 To transfer from handset to speakerphone operation:

- (1) Put line on hold
- (2) Hang up handset
- (3) Turn speakerphone on
- (4) Depress line button.

4.81 To transfer from speakerphone to handset operation, lift handset during speakerphone operation to automatically transfer to handset operation. When it is necessary to transfer back to speakerphone, refer to paragraph 4.80 to prevent disconnect.

4.82 To terminate a call on speakerphone, momentarily depress transmitter OFF button.

*Note:* Restore depressed line buttons after a conference call.

#### M. Station Busy Consoles

4.83 The 570-type KSU has the capacity for one station busy console—either DSS or MW. However, a maximum of three consoles can be connected to a COM KEY 718 System (refer to **N. Multiple Consoles**). If one DSS console is to be connected, terminate the A25B connector cable on column E of block 3 (Fig. 41). If one MW console is to be connected, terminate the cable on column D of block 3 (Fig. 42). Schematics of the 6A1 and 6B1 consoles are provided at the end of the section (Fig. 87 and 88).



***If any DSS consoles are to be installed, be sure that the D0-D1 and CG0-CG1 straps on connecting block 3 are removed (see connection diagrams). If no DSS consoles are installed, be sure that straps are in place.***

#### Station Busy Console (6A1) With DSS

4.84 By first selecting an idle intercom path, then depressing the appropriate button on the 6A1 console, an attendant may signal any station over the intercom or make announcements over



**TABLE I**  
**3B SPEAKERPHONE CONNECTIONS**

CONNECT LEADS FROM				LEAD DESIG	CORD COLORS			CONNECT LEADS TO 55B CONTROL UNIT TERM. ‡	
TEL SET TERM.	TRMTR TERM.	SPEAKER TERM.	TRNSF TERM.		DIOR	T7A	R2FK		
24				P4*	W-S			13	
				IR†				6	
30				P3*	S-W			4	
				IT†				15	
25†				T1	W-BL			1	
RR § *									
6				R1	BL-W			10	
29				LK	W-BR			35	
8				AG	BR-W			11	
10				A1	W-G			2	
19¶					O-W			32	
**					W-O			23	
	8			LK		BK-O		35	
	7			F1		G-Y		17	
	5			S		O-BK		18	
	6			A1		Y-O		19	
	3			M2		BK-S		16	
	2			P1		BL-R		8	
	1			M1		S-BK		7	
			††		SP2			G	20
			††		SP1			R	29§ §
				‡‡	TF1				27
			‡‡	TF2				36	

*Note:* On modular sets, move orange lead from terminal 27 on tel set terminal board to terminal 22.

\* For rotary dial tel set.

† For TOUCH-TONE tel set.

‡ Strap terminals 4 and 5 on control unit when used with TOUCH-TONE tel sets.

§ Located on network.

¶ Also remove W-S lead from tel set amplifier terminal 1 and connect it to terminal 19.

\*\* Connect W-O lead to terminal 1 on tel set amplifier.

†† Speaker terminals are not designated.

‡‡ Use inside wire.

§ § Connect lead to terminal 30 if a reduction in volume is desired.

**TABLE M**  
**4A SPEAKERPHONE CONNECTIONS**

M16C CORD		TELEPHONE SET TERMINAL	
LEAD COLOR	LEAD DESIG	832-TYPE	2832-TYPE
W-BR	A1	10	10
W-O	AG	8	8
BL-W	R1	6	6
W-BL	T1	RR (Network)	25
G-W	P4	24	
	IR		24
W-G	P3	30	
	IT		30
O-W	LK	29	29

*Note:* To reduce the volume of voice signaling or ringing while on speakerphone, make the following changes:

- (1) Remove W-S from terminal 1 of telephone set amplifier and connect to S-W of M16C cord using spare terminal or D-161488 connector.
- (2) Connect BL-R of M16C cord to amplifier terminal 1.
- (3) On modular sets, move orange lead from terminal 27 on tel set terminal board to terminal 22.

the paging system. The console also provides the attendant with a visual indication of a busy station. Seventeen buttons on the console correspond to the station codes (codes 3 through 19); one button is associated with paging, one button is arranged for recall, and one button is spare. See Fig. 87 for schematic of 6A1 selector console.

**4.85** Any station having the handset off-hook lights a lamp under the associated button on the 6A1/DSS console as a visual indication of a busy station. The operated switchhook contacts of a telephone set extend ground over an SB( ) lead, through the KSU to the 6A1 console, thus lighting the lamp under the associated button in the DSS field.

**4.86** To DSS from the 6A1 console:

- (1) Lift handset on the associated telephone set.

- (2) Select idle intercom path and depress intercom button.

- (3) On the 6A1 console, momentarily depress button on DSS field corresponding to desired station—tone burst signals called station.

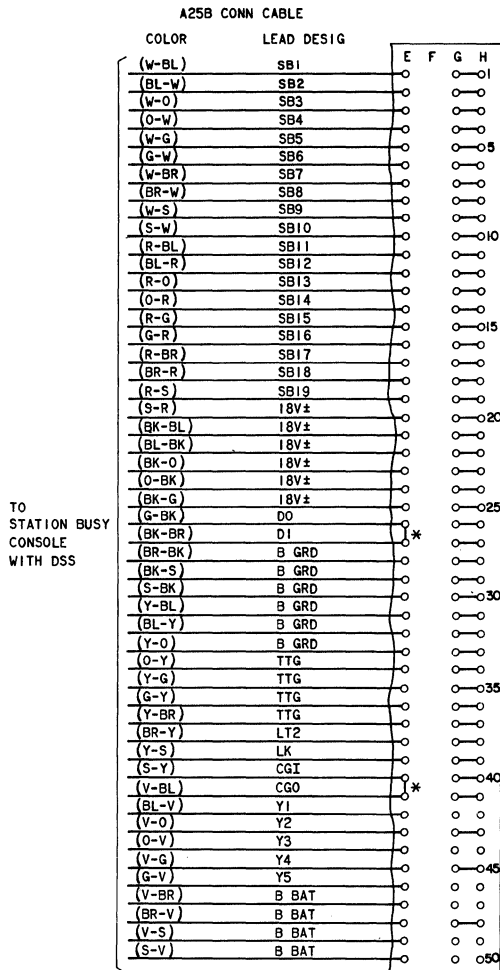
- (4) Announcement may now be made to called party.

**4.87** If called party may be reached at another station, proceed as follows:

- (1) Momentarily depress RECALL button on DSS console—dial tone will be returned.

- (2) Momentarily depress button on DSS field corresponding to desired station—tone burst signals called party.

- (3) Announcement may now be made to called party.

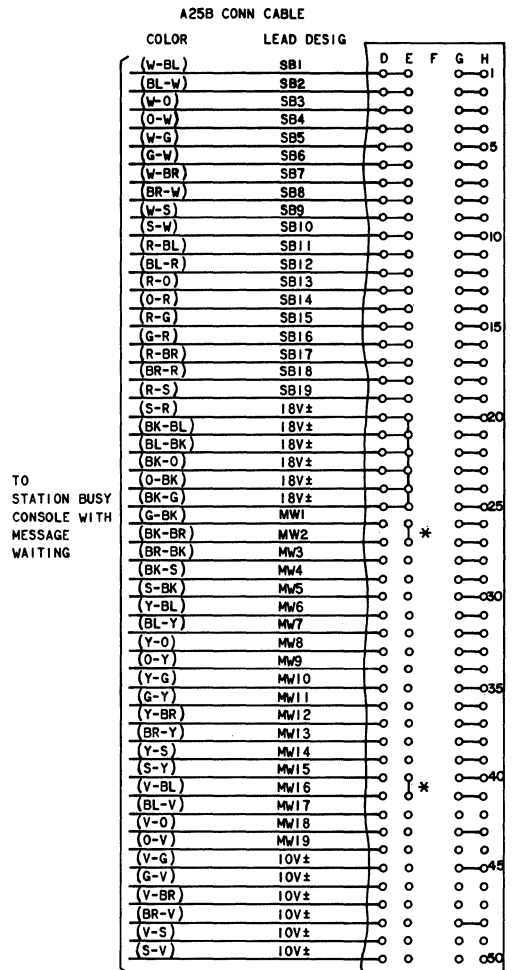


\* FACTORY PROVIDED STRAPS MUST BE REMOVED WHEN DSS CONSOLE IS CONNECTED. IF CONSOLE IS REMOVED, THE STRAPS MUST BE REPLACED.

P/O CONN BLK 3

Fig. 41—Connections for One DSS Console

**Note:** The selector may be repeatedly recalled (without losing the seized intercom path) by repeatedly depressing the RECALL



\* BE SURE FACTORY PROVIDED STRAPS ARE IN PLACE WHEN THE SYSTEM IS NOT EQUIPPED WITH A DSS CONSOLE.

P/O CONN BLK 3

Fig. 42—Connections for One MW Console

button and the DSS button. If intercom call is answered at any point, you must hang up and start over.

4.88 To page from the 6A1/DSS console:

- (1) Lift handset on the associated telephone set.
- (2) Select idle intercom path and depress intercom button.
- (3) Momentarily depress PAGE button on DSS console—tone burst will be heard over paging system loudspeakers.
- (4) Speak into handset transmitter to make announcement.
- (5) Replace handset.

#### Station Busy Console (6B1) With MW

4.89 By depressing the appropriate button on the 6B1 console, an attendant may signal any station that there is a message waiting by lighting the lamp under the station HOLD button. The console also provides the attendant with a visual indication of a busy station. Seventeen buttons on the console correspond to the station codes (3 through 19); three buttons are not used. See Fig. 88 for schematic of 6B1 console.

4.90 To signal an intercom station that there is a message waiting at the attendant, the attendant depresses the MW button associated with the desired station. The button will lock down in a partially depressed state causing the lamp under the HOLD button of the called station to light (steady). This steady lamp alerts the station user that he has a message waiting and to call the attendant. When the station calls the attendant, the attendant then depresses the associated MW button to release it.

**Note:** When more than one MW console is installed, the MW signal can only be retired at the console originating the signal since the key must be physically released.

4.91 The station busy feature of the 6B1/MW console is similar to that of the 6A1/DSS console described in paragraph 4.85.

**Caution:** *Although all CO/PBX and intercom line buttons may be unoperated, a busy station indication is displayed*

*at the 6A1/DSS or 6B1/MW console when a station handset is left off-hook.*

#### N. Multiple Consoles

4.92 Although the 570-type KSU was originally designed for one station busy console, up to three consoles in any combination can be supplied. Extra power and, in some cases, additional terminations are required. Extra power is required because the  $\pm 18$ -volt supply in the KSU is capable of powering only one console. Each additional console requires one ampere at  $\pm 18$  volts. The additional power can be supplied by a separately ordered and installed 215C1 power unit. Use a separate 18-gauge wire for each  $\pm 18$ -volt lead required. In addition, the ground terminals of the 215C1 power unit should be strapped to the  $\pm 18$ -volt ground terminal of the KSU power unit (Fig. 43). A 215C1 power unit fused for  $\pm 18$  volts can be used for three leads.

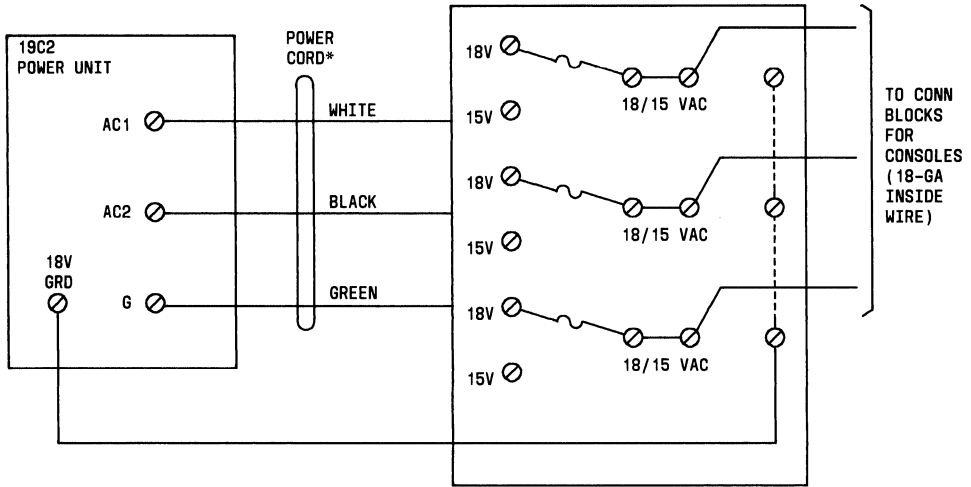
4.93 The connections for multiple consoles are shown in Fig. 44 through 50. Refer to Table N for console connection figures. Since there are terminations for only one DSS and one MW console within the KSU, additional blocks which must be mounted external to the KSU are required when more than one console of either type is required. When 66M1-50 blocks are used, B bridging clips are used as straps for common leads. Where a second wire must be connected to a terminal, 183B2 adapters are used.

4.94 In any installation requiring a DSS console, the factory-provided D0-D1 strap (26E to 27E) and the CG0-CG1 strap (40E to 41E) on block 3 of the KSU must be removed. If all DSS consoles are removed, the straps must be replaced. When more than one DSS console is required, the CG0-CG1 leads must be wired in a series loop.

4.95 At multiple console installations, the station busy and message waiting features for the attendant station (station 0) can be activated if desired. The DSS feature is *not* activated, and intercom calls from the second and/or third multiple console station must be made by dialing.

4.96 To activate station busy and message waiting for station 0:

- (1) Remove the power failure transfer feature at station 0, if provided (see Fig. 38). If



\* DANGER: DO NOT CONNECT POWER CORD WHILE 19C2 IS TURNED ON.

Fig. 43—215C1 Power Unit Wiring

TABLE N  
CONSOLE CONNECTION INDEX  
(SEE NOTE)

		NUMBER OF MW (6B1) CONSOLES			
		0	1	2	3
Number of DSS (6A1) Consoles	0		Fig. 42	Fig. 46	Fig. 50
	1	Fig. 41	Fig. 44	Fig. 48	
	2	Fig. 45	Fig. 47		
	3	Fig. 49			

Note: Determine number of DSS consoles and MW consoles to be installed and select applicable connection diagram from table.

the feature must still be provided, a separate pair of wires must be run back to the KSU.

(2) Install the ring transfer option in the attendant station 0 telephone set if not already wired (Fig. 32).

(3) At the station 0 telephone set, move the (V-S) mounting cord lead from terminal 21 to 8 and the (S-V) cord lead from terminal 20 to 28.

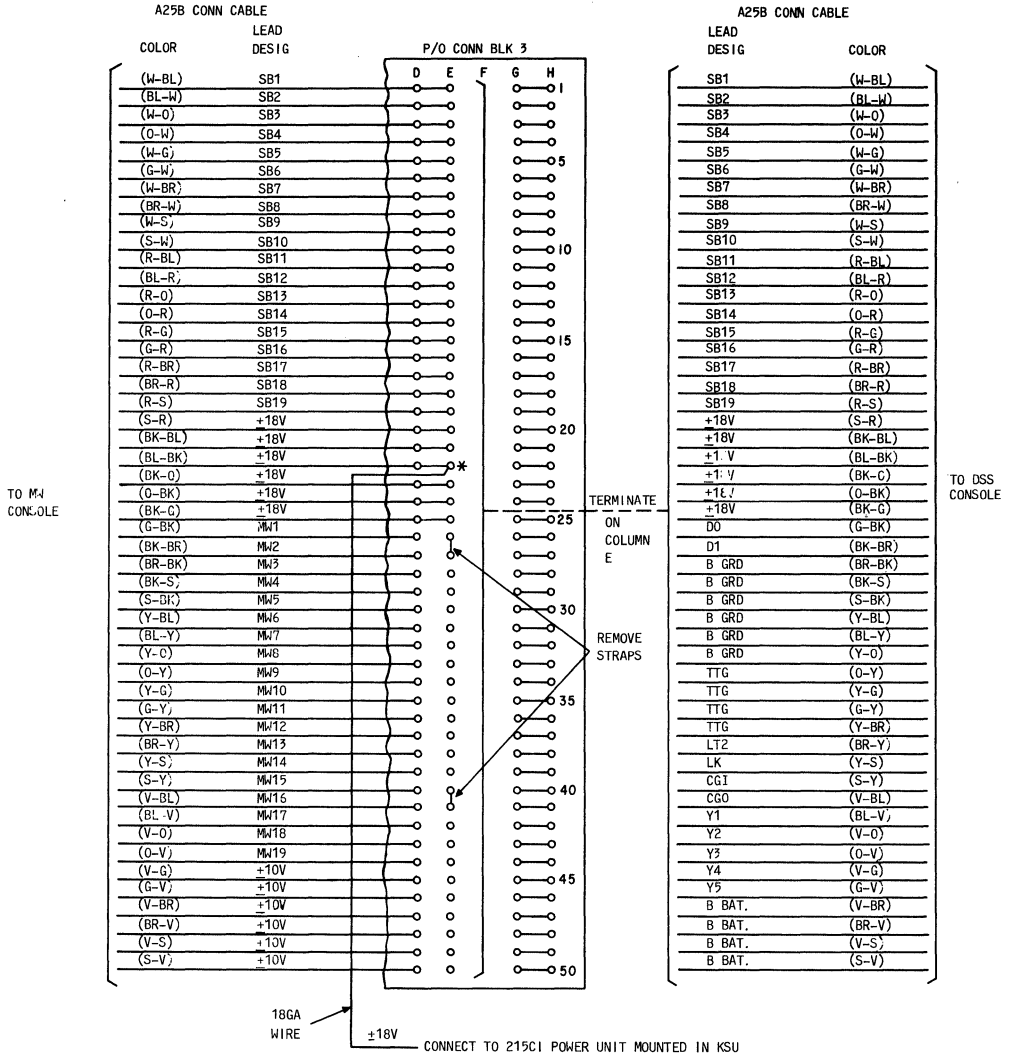
(4) At the KSU, strap terminal 1A of block 1 to terminals 1D and 1E of block 3. Also strap 1B of block 1 to 26D of block 3. Use 183C2 adapters if required.

(5) Block the station 0 button inoperative (second button in bottom row) on any DSS consoles installed.

**O. Station Restriction**

**4.97** This feature prevents any outgoing CO/PBX calls from being made at a restricted station.

**4.98** The restricted station may receive calls, but cannot call out on CO/PBX lines. This is accomplished by adding a diode (rotary dial sets only) and reversing two leads in the telephone set. On TOUCH-TONE sets, two leads must be reversed in the telephone sets (see Table O.)



REMOVE +18V FUSE ON 19C2A POWER UNIT IN KSU

\* INSTALL 183B2 BRIDGING ADAPTER ON COLUMN E, ROWS 22-23 TO ENABLE CONNECTION OF EXTERNAL ±18V POWER SOURCE.

Fig. 44—Connections for One MW Console and One DSS Console

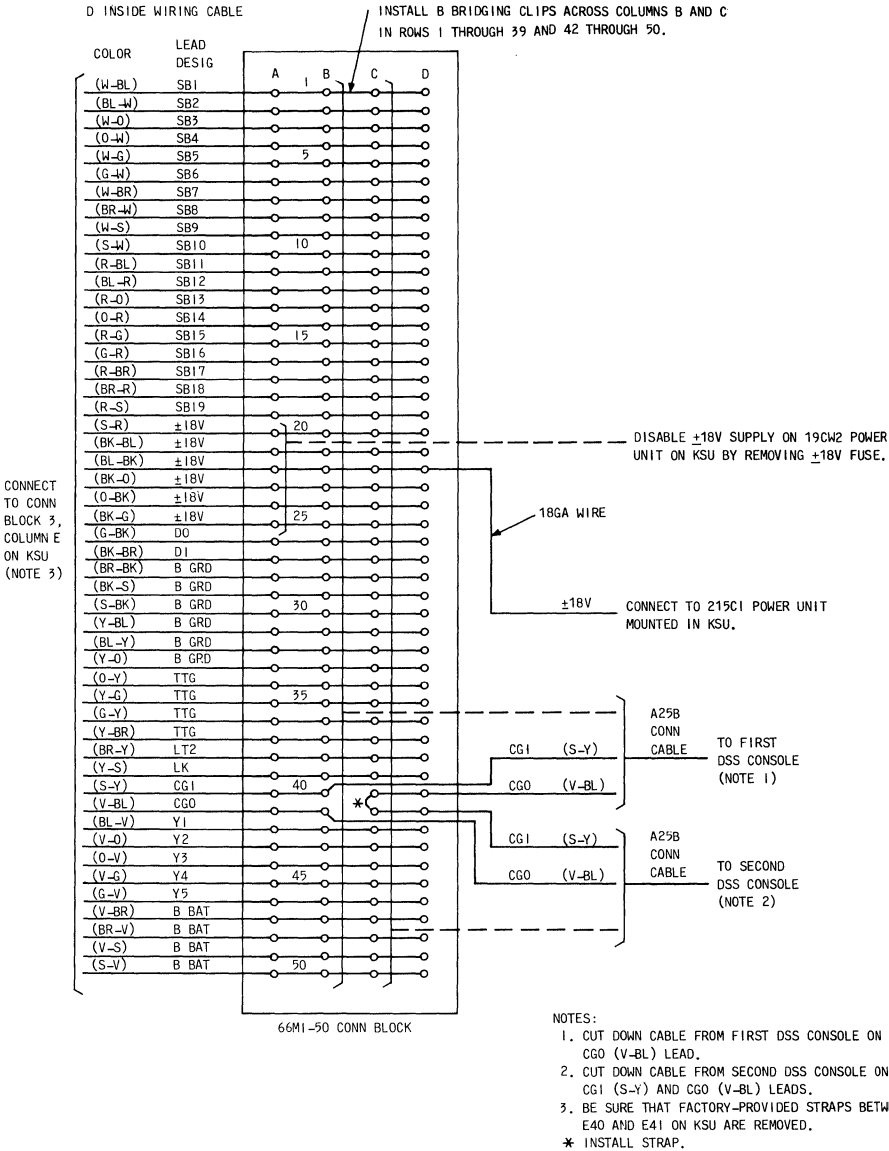


Fig. 45—Connections for Two DSS Consoles

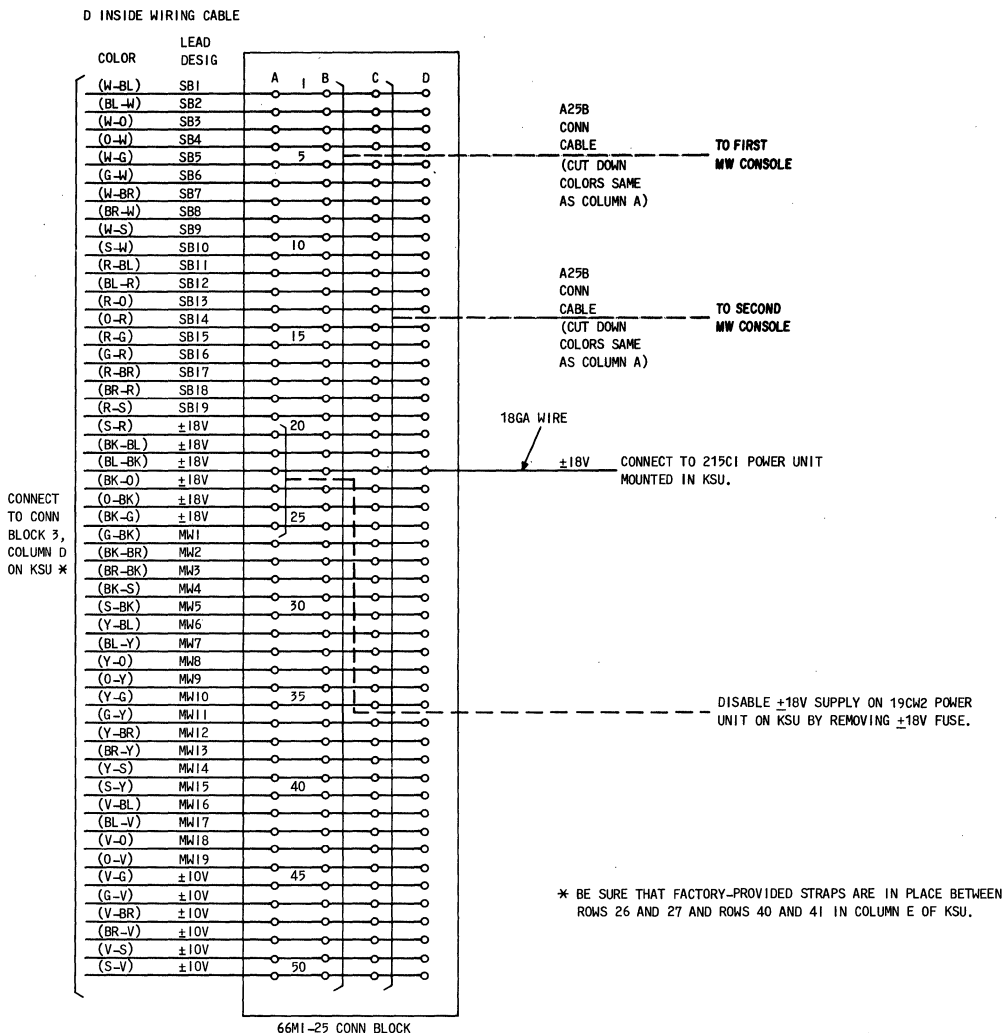


Fig. 46—Connections for Two MW Consoles

**Caution:** Make sure bare leads of the diode do not come into contact with the case of the network, other network terminals, or other parts of the telephone set. Use insulating sleeving where required.

P. TOUCH-TONE Dialing

4.99 Where TOUCH-TONE dial telephone sets are used with the 7A Communication System; a 440A (MD) or 478B KTU (TOUCH-TONE adapter) is required. These are the only TOUCH-TONE



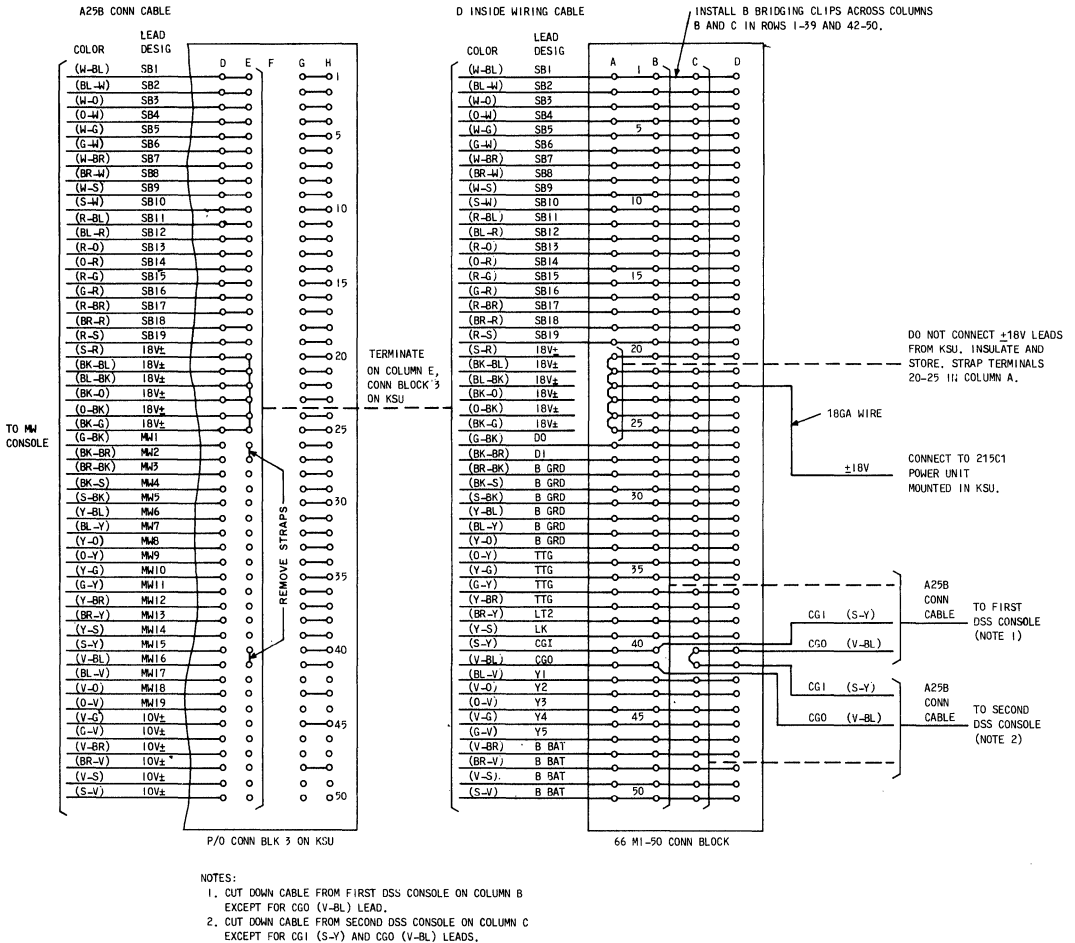


Fig. 47—Connections for One MW Console and Two DSS Consoles

adapters usable in this system and are installed in J13 and J14. See Fig. 51 for KTU location.

**Note:** Do not use a 494A KTU (TOUCH-TONE selector) with COM KEY 718 due to an incompatibility with the DSS console circuitry.

The adapter converts the multifrequency tones from the telephone set dial to contact closures which

supply ground to the proper leads in the code selector circuit, 424B or 424C KTU.

**4.100** When the adapter used is a 478B, be sure that A and B ground are available at the J13/14 connector (Fig. 74 and 85). If these grounds are not connected, install the D-180720 Kit of Parts supplied with the 478B KTU. Figure 52 is a

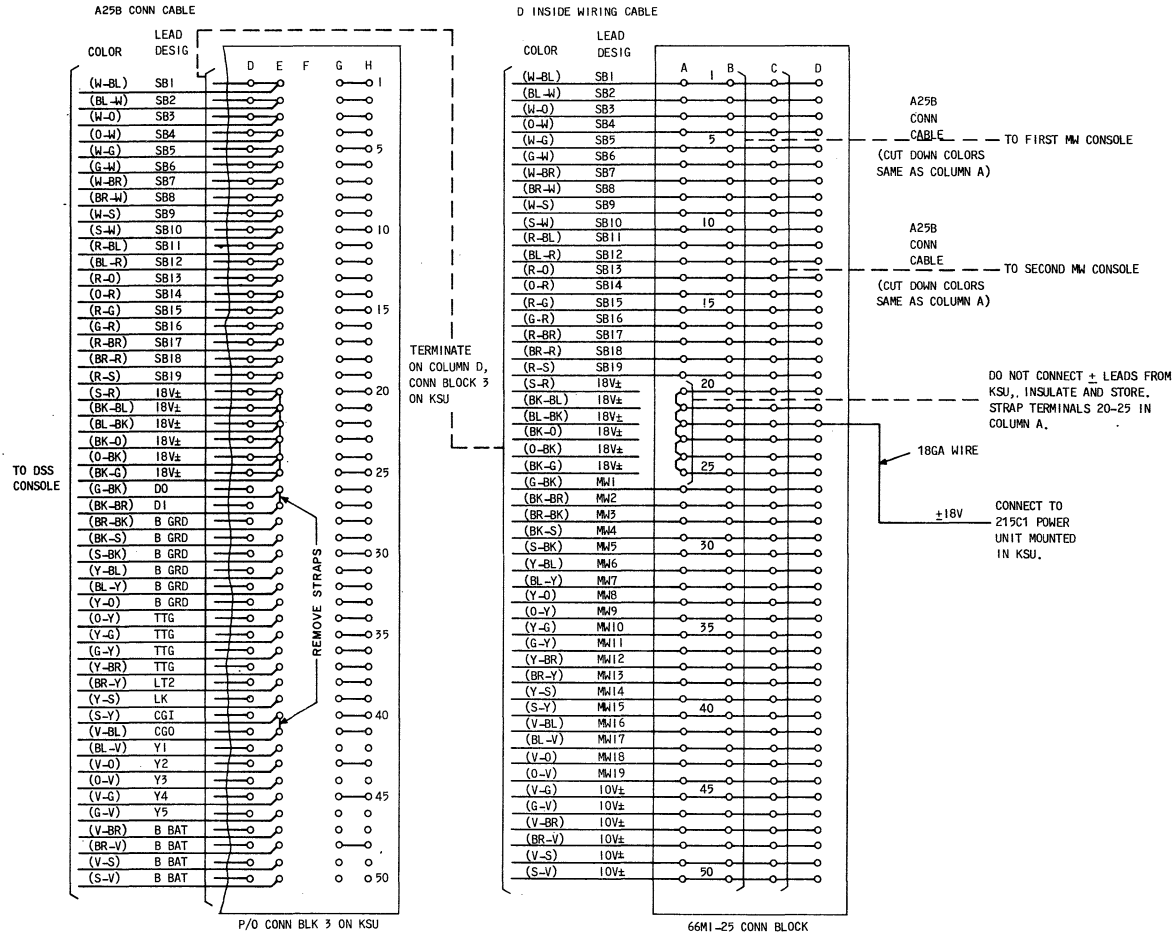


Fig. 48—Connections for One DSS Console and Two MW Consoles

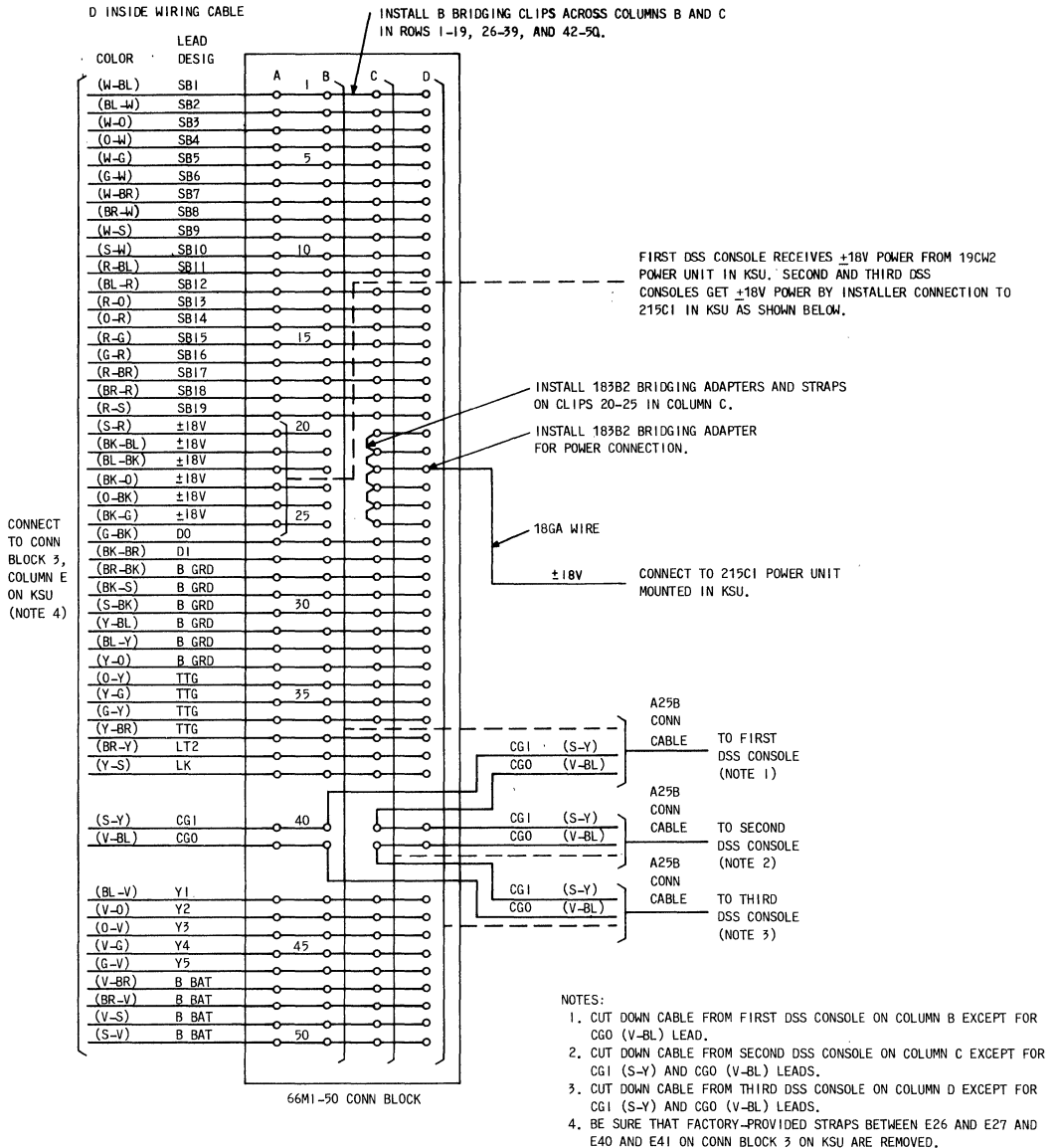


Fig. 49—Connections for Three DSS Consoles

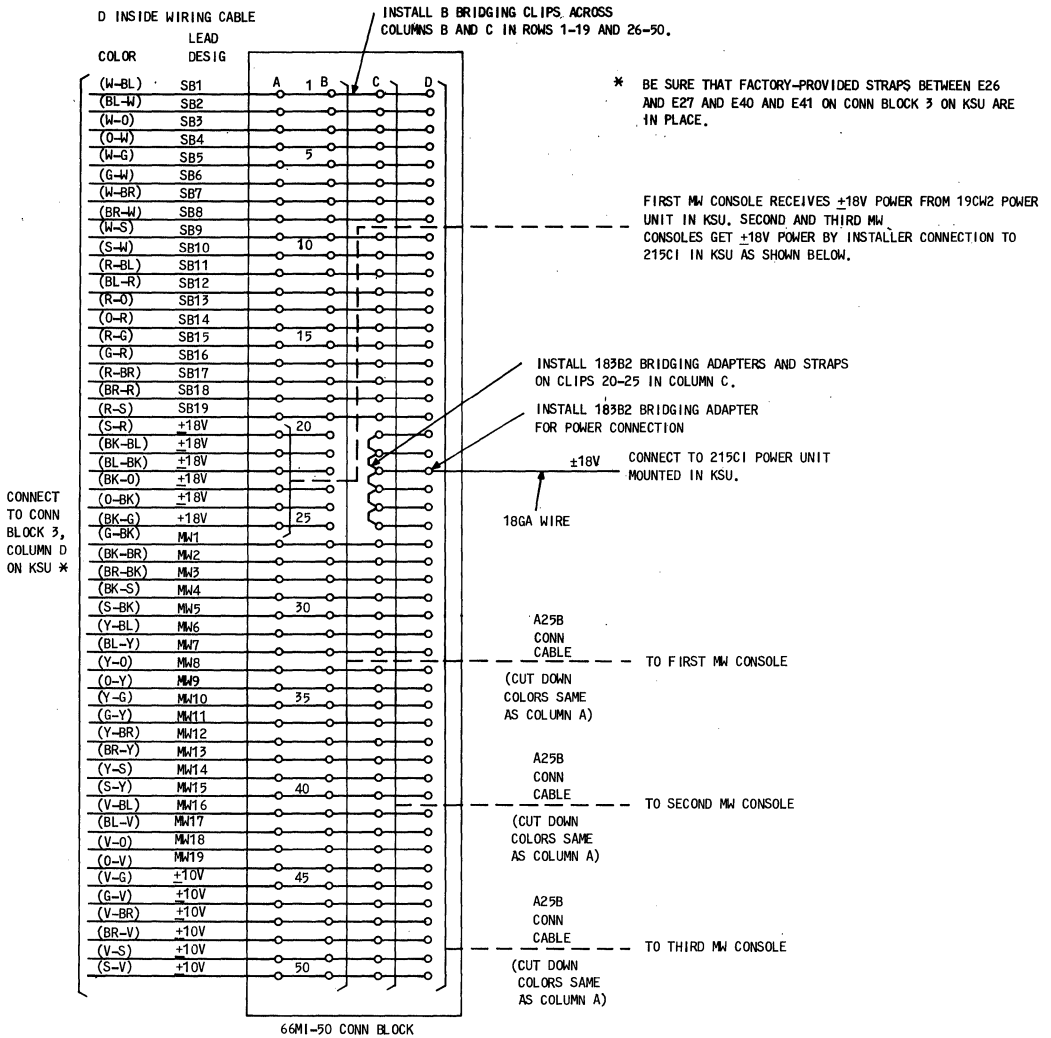


Fig. 50—Connections for Three MW Consoles

duplication of the instruction sheet supplied with the kit of parts.

4.101 Remove the RS1 to CG strap in column A of connecting block 1 when any TOUCH-TONE adapter KTU is installed (Fig. 53).

Q. Automatic, DC Signaling, Private Line Circuit

4.102 Private line service can be supplied in the 570B KSU only if music-on-hold is not also being furnished. A circuit incompatibility exists between the private line circuit and the music-on-hold circuit. A 415A KTU is

TABLE O

STATION RESTRICTION CONNECTIONS

TYPE TEL SET		INSTALL DIODE	MOVE LEAD	
			FROM	TO
832				
	(G)		22	4
	(R)		4	22
2832	(G)		22	4
	(R)		4	22

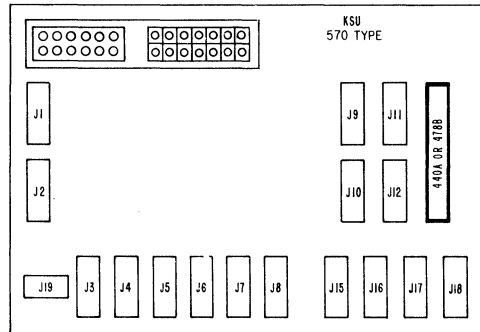


Fig. 51—Location of 440A (MD) or 478B KTU TOUCH-TONE Adapter

required for each private line circuit desired and is plugged into the KSU in place of one of the CO/PBX line circuits. Each private line installed will reduce the number of CO/PBX lines by one. In addition, a 415A KTU or equivalent is required at the distant end.

**4.103** Install the 415A KTU in jacks 1 through 7 and connect tip and ring to the distant end to block 3 with the incoming CO/PBX lines (Fig. 25).

## 5. GENERAL MAINTENANCE

**5.01** Maintenance of the 7A Communication System is limited to normal station repairs and wiring checks of the KSU and replacement of defective components.

**5.02** For more detailed maintenance information, refer to Part 6 of this practice.

**5.03** When trouble is encountered, **first make a thorough check of all connections**, then make the following checks before replacement of KTUs, power unit, or KSU is considered.

### (a) *570-Type KSU*

- Fuses in place and not blown
- Lamps not burnt out
- KTUs securely mounted in proper connectors with retainers and/or guide assemblies in place
- Wiring checked on connecting blocks.

### (b) *Externally Mounted Units*

#### *33A Voice Coupler*

- Fuses positioned properly and not blown
- COAM music source operative and meets requirements in paragraph 4.37.

#### *20A-49 Apparatus Unit*

- Volume control (potentiometer) not turned off on unit
- Volume control (potentiometer) not turned off on loudspeakers.

#### *22A-49 Apparatus Unit*

- Unit fastened securely and mounted in a vertical position.

#### *Loudspeakers*

- Wiring and connections checked.

No field maintenance is to be performed on the externally mounted units.

### (c) *KTUs*

- Securely placed in proper connectors.
- Replace a suspected KTU with one known to be in good working order to determine whether trouble is in KTU or external to it.
- Should the replacement KTU not clear the trouble, the trouble is external and **the original KTU should be returned to service.**

No field maintenance is to be performed on KTUs.

### (d) *Power Unit*

- Fuses in place and not blown

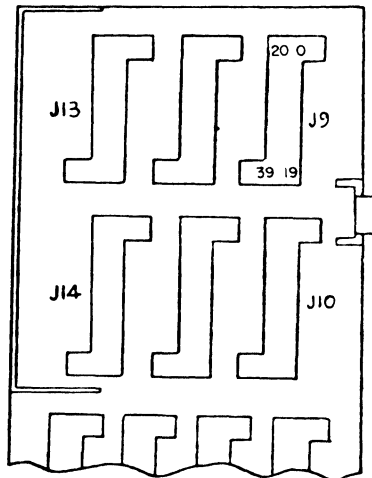
INSTALLATION INSTRUCTIONS FOR D-180720 KIT QF PARTS  
(570A KSU)

This instruction sheet is intended to assist the installer when equipping a 478B KTU in 570A KSUs having serial number 16390 or lower. These KSUs require AGRD and BGRD wiring on connectors J13 and J14 when a 478B KTU is to be equipped in place of a 440A KTU. Discard this kit of parts if 478B KTU is to be equipped in 570A KSUs having serial number 16391 and higher.

PROCEDURE

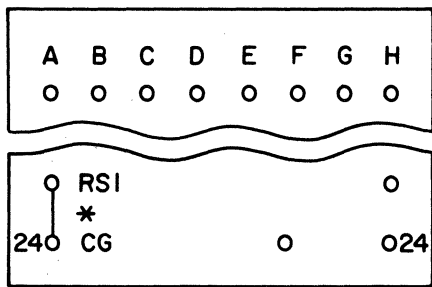
1. Remove cover from KSU.
2. Open right gate.
3. Connect wires as shown below by following cable paths and tying in place where needed. Connections are made by sliding terminals of each lead assembly on to connector wire-wrap contacts.

<u>Signal</u>	<u>From</u>	<u>To</u>
AGRD	J9-3 or J10-3	J13-3, J14-3
BGRD	J10-37	J13-15, J14-15



4. Plug 478B KTU in connectors J13 & J14.
5. Close and lock gates.
6. Reassemble cover on to KSU.

Fig. 52—Instruction Sheet for D-180720 Kit of Parts



P/O CONN BLK I

\* FACTORY PROVIDED STRAP

**Fig. 53—Removal of RS1 to CG Strap for TOUCH-TONE Intercom**

- AC power cord properly secured in both the ac receptacle and the power unit connector
- Power present at the ac receptacle
- Circuit and frame grounds properly connected.

(e) **Telephone Sets**

- Set plugged in securely
- Volume control not turned off
- Lamps not burnt out.

**A. Trouble Analysis**

**5.05** Table P is to be used as an aid to diagnose and correct troubles in the system. The troubles should be identified before using the table; then the cause may be recognized and a solution effected.

**6. DETAILED MAINTENANCE**

**6.01** Maintenance information is included as an aid in locating and clearing trouble in the 7A Communication System at the time of installation or on subsequent repair visits. Analysis of the trouble reported may be helpful in narrowing the search for the source of trouble. For instance, if a lamp does not light at a particular station or group of stations, the trouble is more likely in a

telephone set or its wiring—if the lamp does not light at any station, the trouble is more likely in the KSU.

**6.02** Maintenance information for the following circuits is provided:

- CO/PBX line circuits—400-Type KTU
- CO/PBX line ringing arrangements
- Power failure transfer circuit—452A KTU
- Intercom circuits—424-type, 440A (MD) or 478B, 456-type, 460B KTUs
- Paging circuit—457C KTU
- Background music
- Music-On-Hold—451-Type or 498A KTU
- Power distribution.

**6.03** If analysis and/or testing indicates trouble in the KSU, the source can be further identified using the supplied information in the following sequence:

- (1) The description of each circuit and the purpose of the KTUs can be used to determine what units may be involved.
- (2) Once the involved circuit has been determined, use the sequence table which gives an operational procedure for testing the circuit and, where a failure is encountered, the most likely causes or KTUs that could cause the condition.
- (3) If the trouble is suspected in or isolated to a particular KTU, further aids are given in the form of a lead table and an input and output table. The lead table defines each lead, its function in the circuit, and its termination on the KTU and mating connector(s). The input and output table can be used to ensure that proper potentials are available at, or being supplied by, the KTU under any circuit conditions shown required in the Remarks column. Only tests that can be made with a 1013A hand test set or equivalent have been included. Further tests are possible but may require more sophisticated test equipment. If the KTU tests defective, replace it.



TABLE P

TROUBLE ANALYSIS TABLE

TROUBLE	POSSIBLE CAUSE	POSSIBLE SOLUTION
No side tone on CO/PBX line.	<ul style="list-style-type: none"> <li>a. Incoming CO/PBX line is dead.</li> <li>b. Incoming tip and ring terminated on the wrong terminals.</li> <li>c. Line circuit (400-type KTU) not plugged in correctly.</li> <li>d. Diode(s) in polarity guard may be defective.</li> <li>e. Switchhook pileup on telephone set is defective.</li> <li>f. Privacy circuit in the telephone set may be operating (if the set is equipped with a privacy circuit).</li> <li>g. If dial restriction diode is installed in the set, tip and ring may be reversed.</li> </ul>	<p>Check incoming tip and ring with test set.</p> <p>Check connections.</p> <p>Check that KTU is properly seated in connector and is located in the right connector. See Fig. 6.</p> <p>Replace diodes with ones known to be good.</p> <p>Change out telephone set.</p> <p>Check to see if privacy relay is falsely operating when going off-hook.</p> <p>Check station cutdown and polarity of dial restriction diode.</p>
Line busied out (lamp steady).	<ul style="list-style-type: none"> <li>a. Lamp and A leads reversed.</li> <li>b. Lamp and A leads shorted.</li> </ul>	<p>Check station cutdown for that line.</p> <p>Check station cutdown for that line.</p>
Dial tone over an answered call or two lines seized together.	<ul style="list-style-type: none"> <li>a. Two lines conferenced from an idle station set.</li> </ul>	<p>Check stations to ensure that no idle sets have more than one line button depressed.</p>
Intercom oscillates (repeatedly comes up; then drops) when seized.	<ul style="list-style-type: none"> <li>a. Selector (424B/424C KTU) not plugged in correctly.</li> <li>b. D0-D1 strap is missing (if no DSS console is provided).</li> <li>c. DSS console unplugged or not connected (if DSS console is provided).</li> </ul>	<p>Check that KTU is properly seated in connector and is located in the right connector. See Fig. 6 and 24.</p> <p>Check option strap. See Fig. 41.</p> <p>Check DSS console cutdown. Check that DSS console is properly plugged in.</p>
Incorrect intercom codes are dialed (TOUCH-TONE dial set).	<ul style="list-style-type: none"> <li>a. Y3 relay in selector (424B/424C KTU) is not dropping.</li> </ul>	<p>Check that RS1-CG strap is removed. See 4.99 and Fig. 53.</p>

TABLE P (Contd)

TROUBLE ANALYSIS TABLE

TROUBLE	POSSIBLE CAUSE	POSSIBLE SOLUTION
Incorrect intercom codes are dialed when using DSS console.	a. Y3 relay in selector (424B/424C KTU) is not dropping.	Check that CG0-CG1 strap is removed. See Fig. 41.
Cannot dial on intercom. On going off-hook, calling station hears tone burst.	a. 478B or 440A KTU is not plugged in correctly. b. Rotary dial system with CG-RS1 strap missing. c. If DSS console is provided, connections may be bad. d. Grounded network.	Check that KTU is properly seated in connector and is located in the right connector. See Fig. 6 and 51. Check CG-RS1 strap. See Fig. 3 or 53. Check DSS console cutdown. Check that console is properly plugged in. Clear ground or replace network.
Hold lamp on attendant's set is always lit.	a. Attendant set is not modified or is improperly modified.	Disable hold lamp at attendant's set (3.17).
No music-on-hold or distorted music-on-hold.	a. 451A/451B KTU is not plugged in properly. b. Music source volume too low. c. Music source unable to drive the 451A KTU. d. Blown fuse or improperly wired 33A voice coupler.	Check that KTU is properly seated in connector and is located in the right connector. See Fig. 6 and 30. Gradually increase volume while listening. See 4.37. Source must be approx. 8 ohms or less. Check fuses in 33A and verify wiring.
Low or no volume on ringing or voice signaling.	a. Volume control turned off or set too low. b. Defective volume control. c. Defective speaker.	Turn on or adjust volume control. Replace telephone set. Replace speaker.
False hold condition when changing lines or lightly touching line buttons.	a. Incorrect sequence of BD contact on line key.	Replace key or replace telephone set.
Low output from paging speaker.	a. 20A-49 potentiometer set too low. b. Wrong speakers used.	Adjust potentiometer on 20A-49 apparatus unit. Use only 45-ohm speakers.

TABLE P (Contd)

TROUBLE ANALYSIS TABLE

TROUBLE	POSSIBLE CAUSE	POSSIBLE SOLUTION
Cannot transmit over paging speakers.	a. 457C KTU is not plugged in correctly. b. Speakers wired wrong. c. Defective speaker. d. Wrong speaker used. e. Speaker located too far from KSU. f. Potentiometer in K8 speaker turned too low.	Check that KTU is properly seated and is in right connector. See Fig. 35. Check connections. See Fig. 36. Replace speaker. Use only 45-ohm speakers. Use quad wire. Speaker should be within 320 feet of KSU. Adjust potentiometer.
Cannot transmit over COAM paging system.	a. 457C KTU is not plugged in correctly. b. Potentiometer in 20A-49 apparatus unit turned too low. c. Customer's paging system turned off or Trouble in COAM paging equipment.	Check that KTU is properly seated and is in right connector. See Fig. 6 and 35. Adjust potentiometer. Proceed as follows: <ol style="list-style-type: none"> <li>1. Test for hazardous voltages at terminals A1 and A2 of 20A-49 apparatus unit.</li> <li>2. Remove customer's connections from terminals A1 and A2.</li> <li>3. Have attendant dial paging code.</li> <li>4. Monitor across terminals A1 and A2 with 1013A test set.</li> <li>5. If attendant can be heard with 1013A test set, advise customer of results of test. <i>Do not</i> attempt any tests or repairs on customer's equipment.</li> </ol>

**Note:** No attempt should be made to repair or modify KTUs in the field. Replace defective KTUs with one known to be in working order. If replacing a KTU does not clear the trouble, **the original unit should be put back in service.**

(4) If trouble is indicated in the factory wiring of the KSU, a point-to-point wiring schematic is furnished for each circuit. The distribution of all power in the KSU is also separately supplied in case it is found a particular potential is missing. Any wiring that is not designated

by color will consist of standard strapping. All factory wiring is shown as solid lines—dashed lines indicate wiring external to the KSU or installer placed.

#### Line Circuits—400-Type KTU

**6.04** The 400-type KTU provides the control functions between one CO/PBX line and the telephone sets, including line pickup, hold, lamp and tone ringing control. The KTU also assures outgoing service during power failure. Option straps should be placed on the 400A through G

KTU when used with the 7A Communication System to provide short timeout (Z), lamp wink on hold (Y), and interrupted audible signal (W). The 400H KTU should have the CO/PBX line option (T) and interrupted ring (W). The hold abandon option (S or R) will depend on the serving central office.

**6.05** Tables Q, R, S, and Fig. 54 through 67 are provided as an aid for maintenance of the CO line circuits.

#### CO/PBX Line Ringing Arrangements

**6.06** Provision is made to program several arrangements involving ringing on the CO/PBX lines. These include:

- Common audible—as factory-wired, station 0 will receive all incoming CO/PBX calls (option K)
- The common audible can be moved to a different station by replacing option K with a jumper from terminal 9F to the desired CO( ) lead
- The CO/PBX lines can ring at additional stations other than the attendant by connecting the RC leads to the CO leads (option S)
- Calls can be transferred to one alternate station other than the attendant by adding option J on block 1.

**Note:** In any of the arrangements, a maximum of 10 stations can be wired to ring on common audible. However, a station cannot ring on more than one line.

**6.07** Tables T, U, and Fig. 68 are provided as an aid for maintenance of the CO/PBX ringing arrangements.

#### Power Failure Transfer Circuit—452A KTU

**6.08** This circuit provides for incoming audible signals on an optional basis in the event of loss of commercial power or operation of the -24V relay battery fuse (B battery) in the 570-type KSU. The tip and ring of each CO/PBX line is brought through normally closed contacts on the 452A KTU relays. These relays are operated as long as B battery is supplied to the KSU. If the battery is lost, the relays release, extending the lines to

connecting block 1 where a cross-connect must be placed (Fig. 38). The cross-connect in turn extends the tip and ring to the (V-S) (S-V) pair of the desired extension. An external ringer must be connected to these leads at the telephone set or some other accessible point.

**6.09** Tables V, W, X, and Fig. 69 are provided as an aid for maintenance of the power failure transfer circuit.

#### Intercom and Paging Circuits—424B or C, 440A (MD) or 478B, 456A or B, 457C, and 460B KTUs

**6.10** The intercom circuitry provides two separate paths for calls within the system with each path appearing on a button on the telephone sets. Basic intercom features are supplied by the following KTUs:

- 424B or C KTU—Selector circuit
- 456A or B KTU—Voice and tone alerting circuit
- 460B KTU—2-path access circuit.

To provide the optional intercom features, the following additional units are required:

- 440A (MD) or 478B KTU—TOUCH-TONE adapter circuit
- 457C KTU—Paging amplifier circuit.

An additional optional feature, intercom preset conferencing, can be supplied by making wiring changes on the connecting block field.

#### A. Selector Circuit—424B or C KTU

**6.11** This circuit is the basic, selector-only, 19-code rotary intercom circuit. Of the available codes, 0 is used as the attendant code, 1 is the first digit of the 2-digit codes, 2 is the paging code, and 3 through 19 are assigned as station codes. The 424B or C KTU selects and alerts the desired intercom station. Station selection can be by rotary dial, TOUCH-TONE dial, or DSS console, if provided.

TABLE Q

400-TYPE KTU LINE CIRCUIT

At station, depress associated line button and go off-hook.

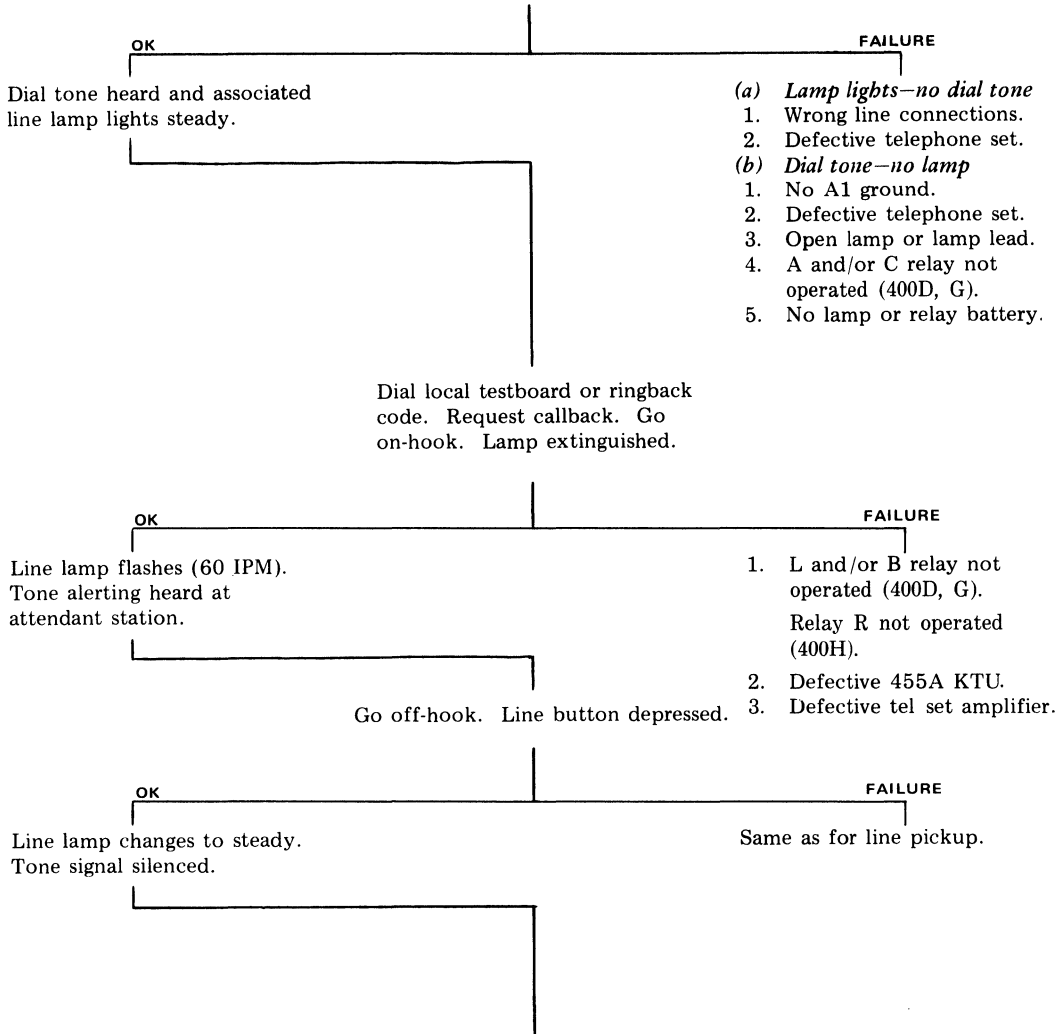
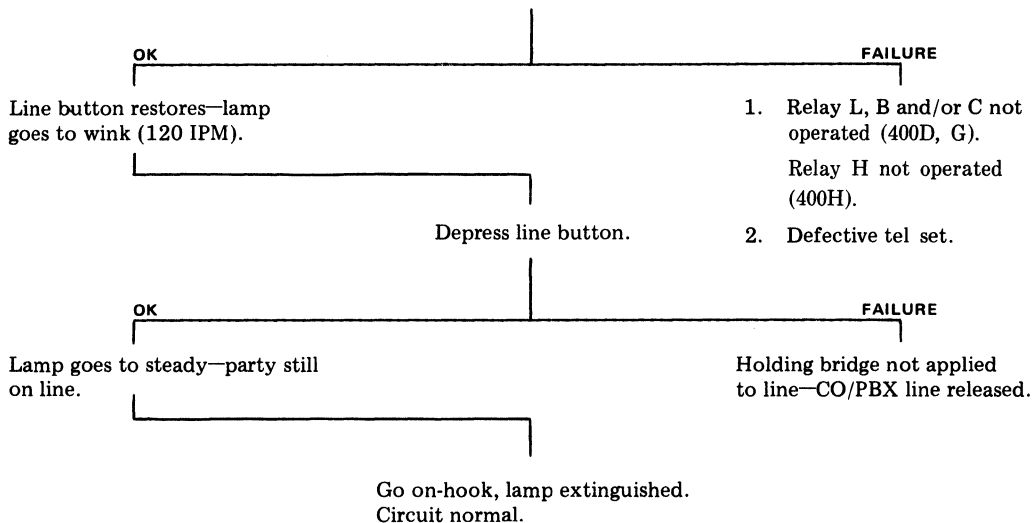


TABLE Q (Contd)

## 400-TYPE KTU LINE CIRCUIT

With party on line, depress HOLD.



### B. TOUCH-TONE Adapter Circuit—440A (MD) or 478B KTU

6.12 The adapter circuit is used to convert the multifrequency signals from the station to contact closures which supply ground on the proper Y1-Y5 leads to the 424B or C selector. Operation of the proper counting relays in the selector alerts the designated station in the same manner as for a rotary dial call. The adapter also grounds the LK lead after the first digit of a 2-digit code is dialed to remove dial tone. When the adapter is not in use, a path is completed through the H and L relays for the CG0-CG1 lead which operates the selector counting relays on rotary dialed calls.

### C. Voice and Tone Alerting Circuit—456A or B KTU

6.13 The 456A or B KTU consists primarily of an oscillator circuit and a preamplifier circuit. The oscillator is designed to give a 1-second burst of tone as the alerting tone on intercom calls. The preamplifier is used for the voice signaling. A

voice input to the paging circuit (optional) is also furnished from this circuit.

### D. 2-Path Access Circuit—460B KTU

6.14 The 460B KTU performs the following functions:

- Provides talk battery for the two intercom paths
- Controls all intercom lamp functions
- Provides the common control circuitry to connect the selector to one path at a time and a detect circuit to free the selector at the proper time if a second intercom call is waiting, and connects the tone alert and TOUCH-TONE adapter (if provided) to the selected path
- Connects dial tone to the tip of the intercom path selected.

**TABLE R**  
**LEAD TABLE—400-TYPE KTU**

LEAD DESIG.	FUNCTION	KTU/CONNECTOR PIN NUMBER J2 - J8
A	A lead—primary control lead from telephone set. Status of A lead determines idle, off-hook, or hold indication.	16
L	Lamp lead—provides proper 10V ac signal to telephone set lamp to indicate line status.	8
R(CO)	Ring side of CO/PBX line <i>from</i> office.	9
R(STA)	Ring side of line—output <i>toward</i> station.	13
T(CO)	Tip side of CO/PBX line <i>from</i> office.	14
T(STA)	Tip side of line—output of KTU <i>toward</i> station.	12
RC	Ringling control—tone signal control lead. Connects tone from generator to amplifier of telephone set as an audible signal.	1

6.15 Tables Y, Z, AA, AB, AC, AD, and Fig. 70 are provided as an aid for maintenance of the intercommunications circuits.

#### E. Paging Circuit—457C KTU

6.16 The paging circuit is enabled by dialing a digit 2 on either of the intercom paths. This completes a circuit between the SS lead from the 456B KTU through the selector to the PC lead in the 457C KTU. This applies the input on the PA lead from the 456B KTU to the amplifier, and short-circuits the input from the CP music source on leads MT and MR, if provided. Voice and tone inputs on the PA lead are then heard in the speakers.

6.17 Tables AE, AF, AG, and Fig. 71 are provided as an aid for maintenance of the paging circuit.

#### Background Music

6.18 Background music can be supplied over the paging speaker when paging is not taking place, using the amplifier circuitry in the 457C

KTU. The CP music source is fed through a 33A voice coupler which acts as a combination interface and protective device. The level of the sound at the speakers involves interaction of the volume control settings at the music source, voice coupler, and the individual speakers.

#### Music-on-Hold—451-Type or 498A KTU

6.19 The same music source used for background music can be multiplied at the 33A voice coupler to furnish music-on-hold. The 451-type KTU or a 498A equipped with a 116A1 CM is required to furnish an output to the seven CO/PBX lines. When the lines are in a talk condition, the output of the 451-type KTU is shorted by contacts in the associated line circuit. When placed on hold, the output is impressed on the ring side of the CO/PBX line and can be heard by the held party. The 498A KTU recognizes changes on the A and L leads in the hold condition. When the line is placed on hold, the 498A KTU provides a balanced music connection on the tip and ring.

6.20 Tables AH, AI, AJ, AK, and Fig. 72 are provided as an aid in the maintenance of

TABLE 5

## INPUTS AND OUTPUTS—400-TYPE KTU

TEST FROM	TO	MON/TALK SWITCH	TEST FOR	REMARKS
INPUTS				
14	9	TALK	CO/PBX dial tone	
B BAT	15		B Ground	
	6		MG — interrupter ground	
GROUND or 15	2	MON	LW — 10V± at 120 IPM	With interrupter running
	7		LF — 10V± at 60 IPM	
	4		10V steady	
	11		RN — interrupted tone ringer signal	
	17	TALK	B Battery	Interrupter running
OUTPUTS				
12	13	TALK	CO/PBX dial tone	
GROUND	8	MON	10V± steady	Ground pin 16
	1		Tone ringing signal	CO/PBX ringing on line

background music and music-on-hold circuits using a 451-type KTU in a 570A KSU (MD).

**6.21** Tables AH, AI, AL, AM, and Fig. 73 are provided as an aid in the maintenance of music-on-hold circuits using a 498A KTU in a 570B KSU.

**Power Distribution**

**6.22** Refer to Fig. 74 for power distribution circuit information.



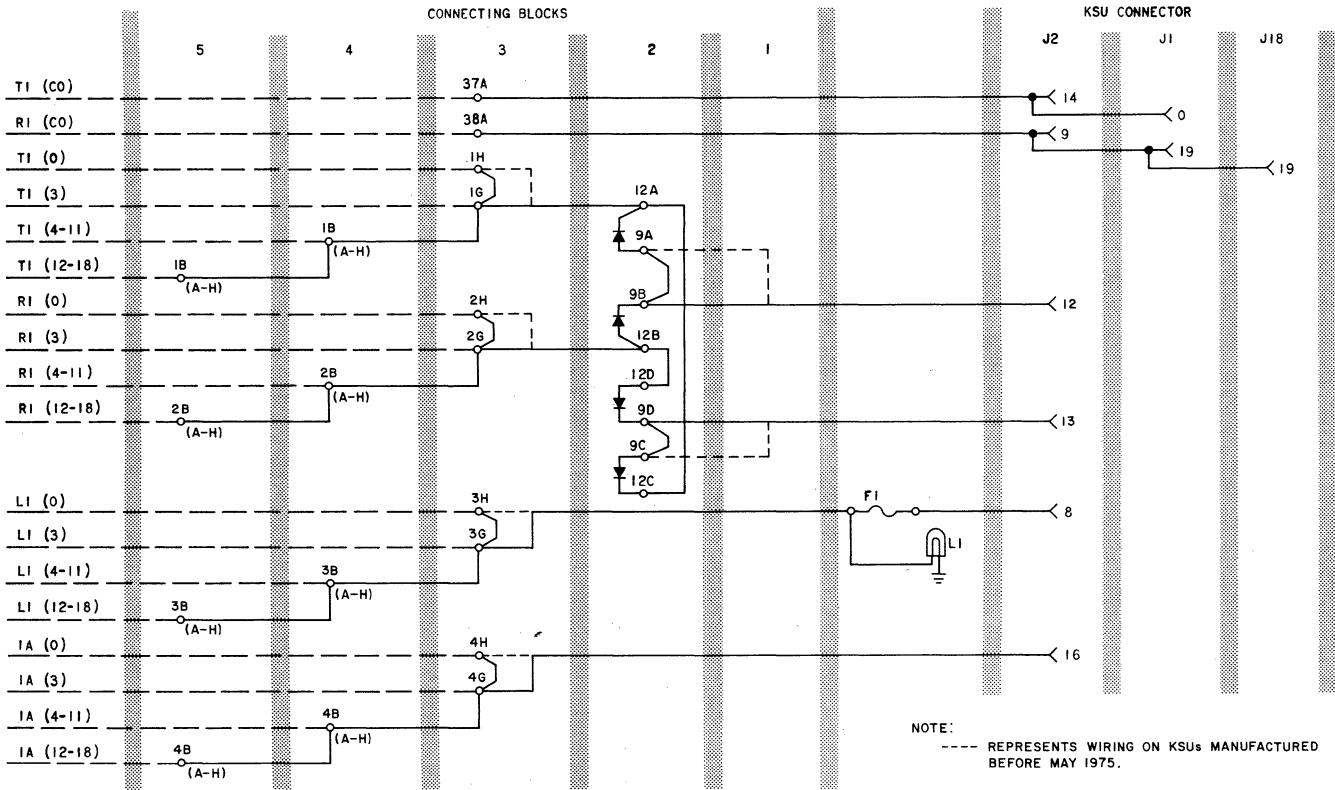


Fig. 54—First Line Circuit (570A KSU)

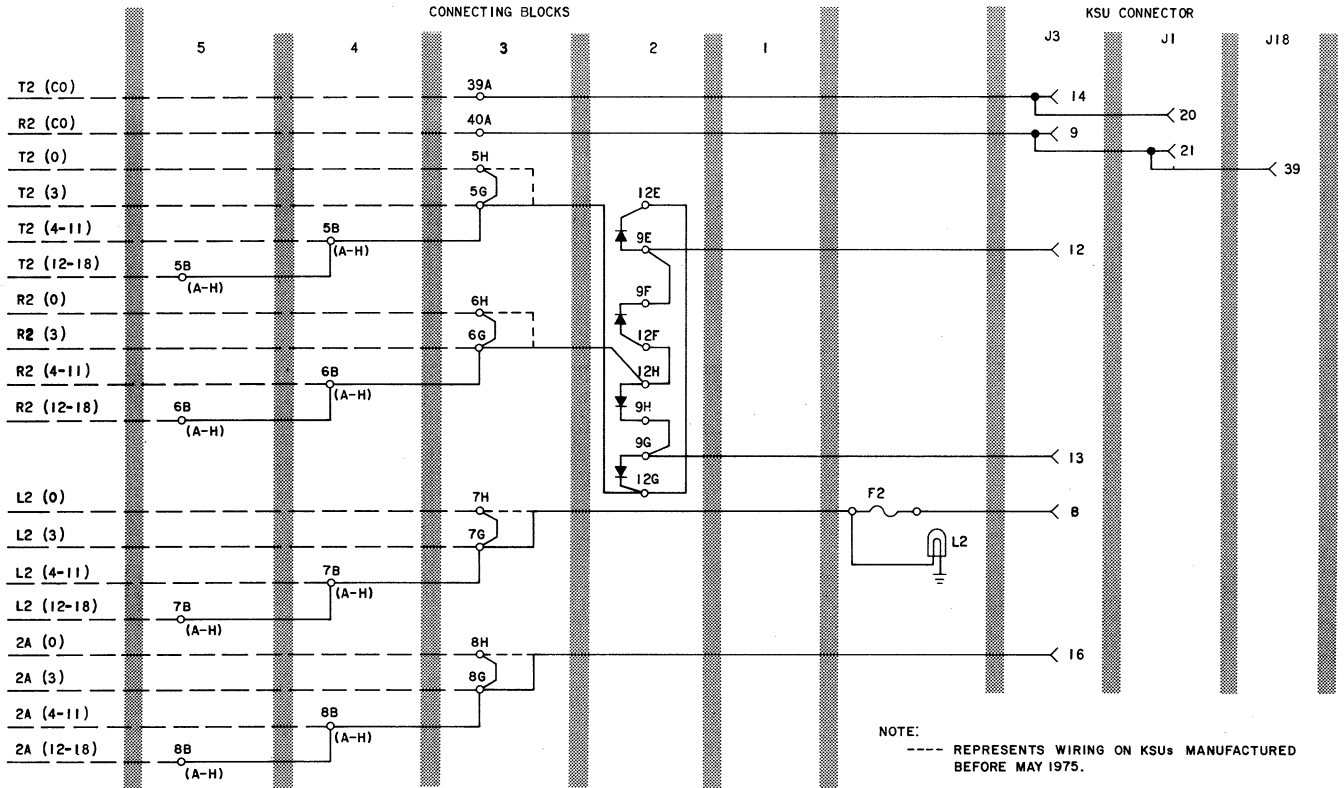
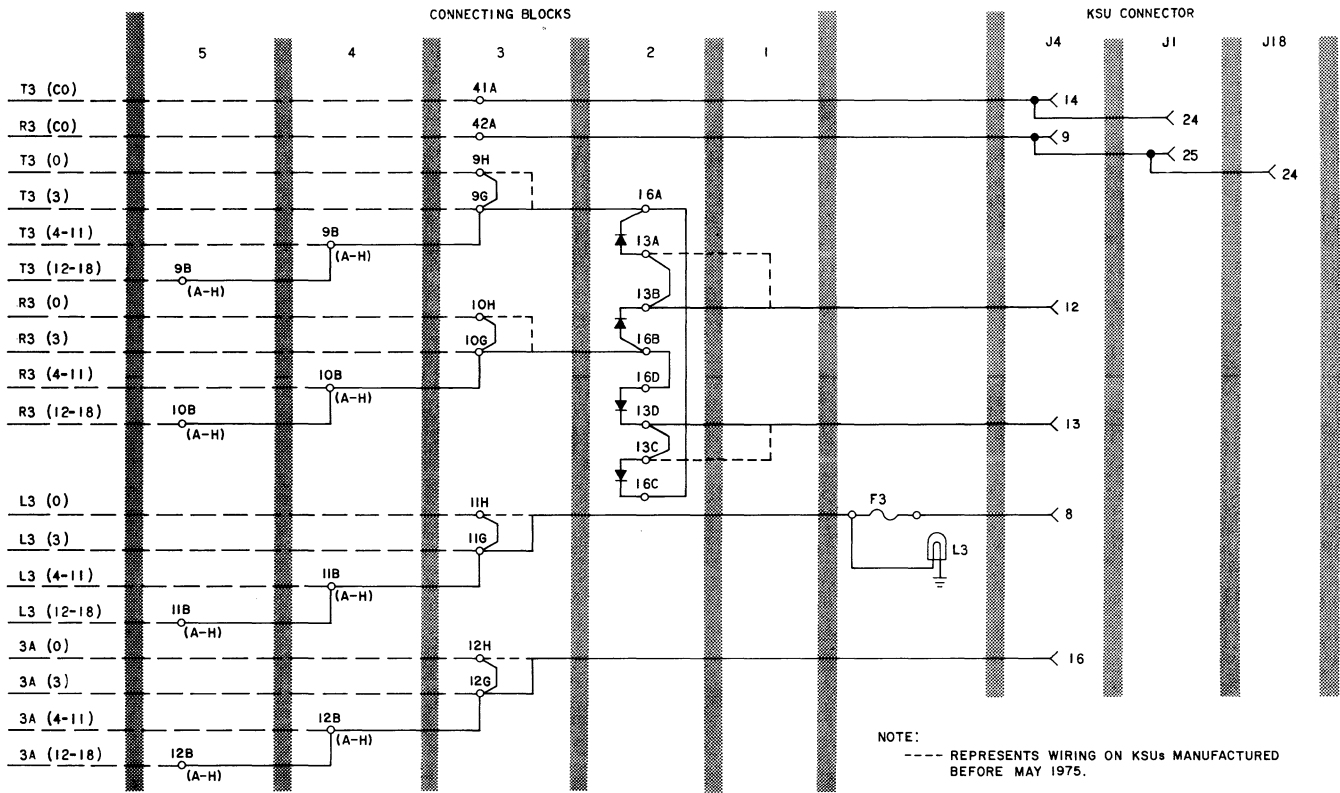


Fig. 55—Second Line Circuit (570A KSU)



NOTE:  
 ---- REPRESENTS WIRING ON KSUs MANUFACTURED  
 BEFORE MAY 1975.

Fig. 56—Third Line Circuit (570A KSU)

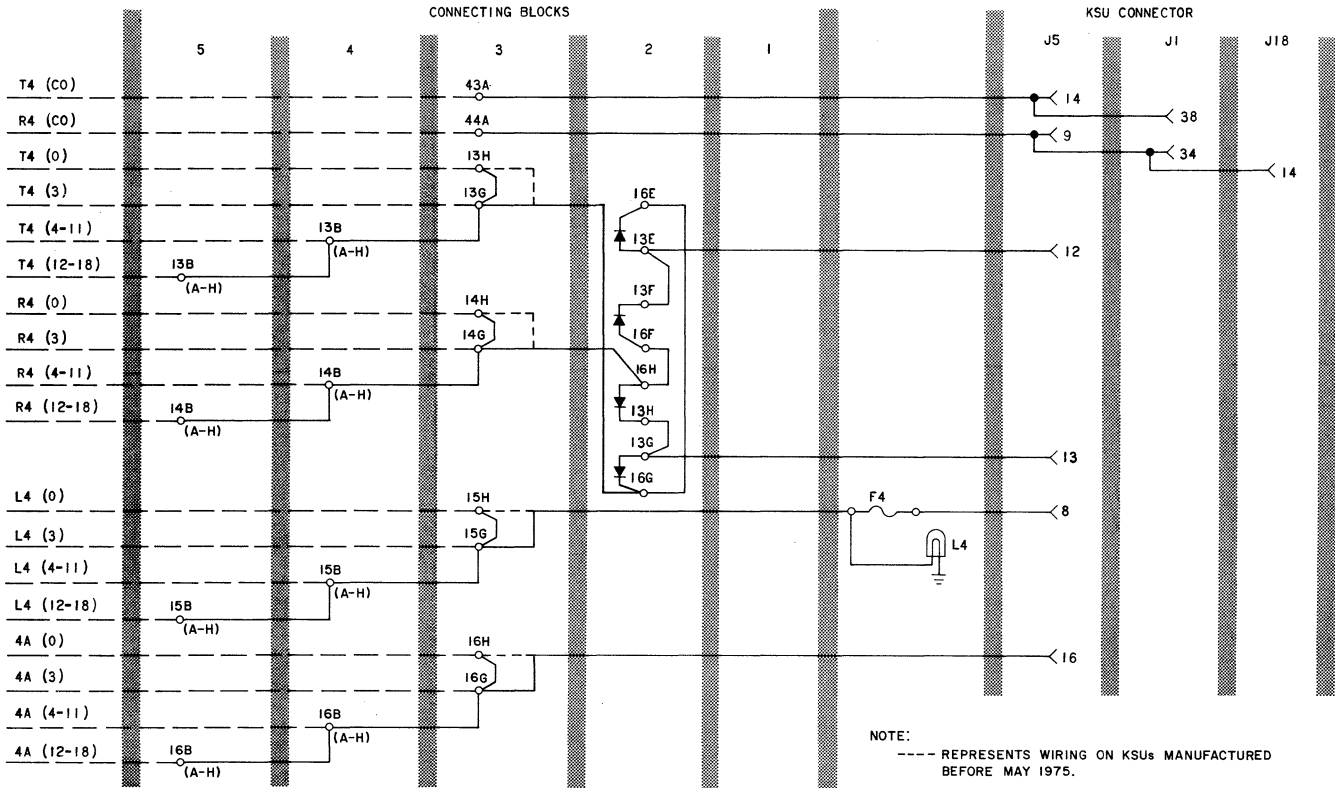


Fig. 57—Fourth Line Circuit (570A KSU)

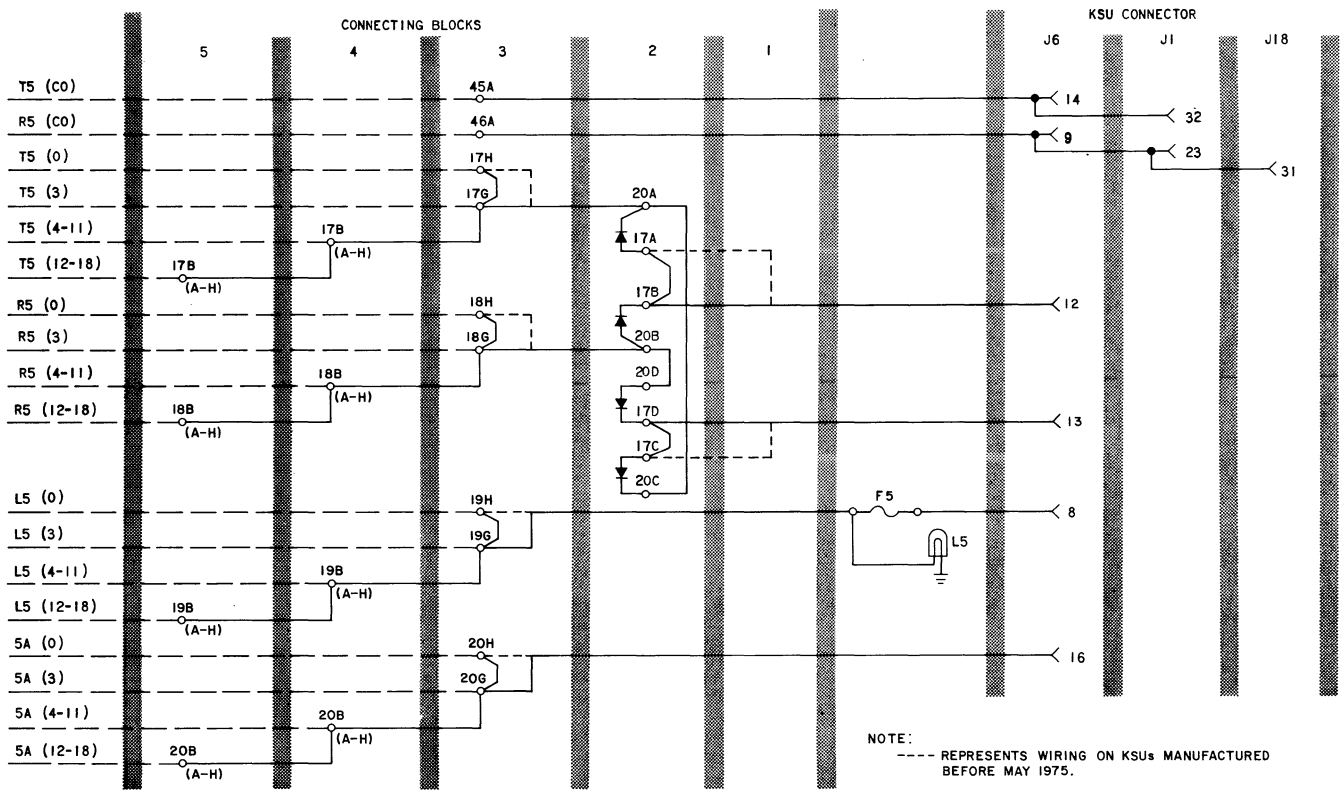
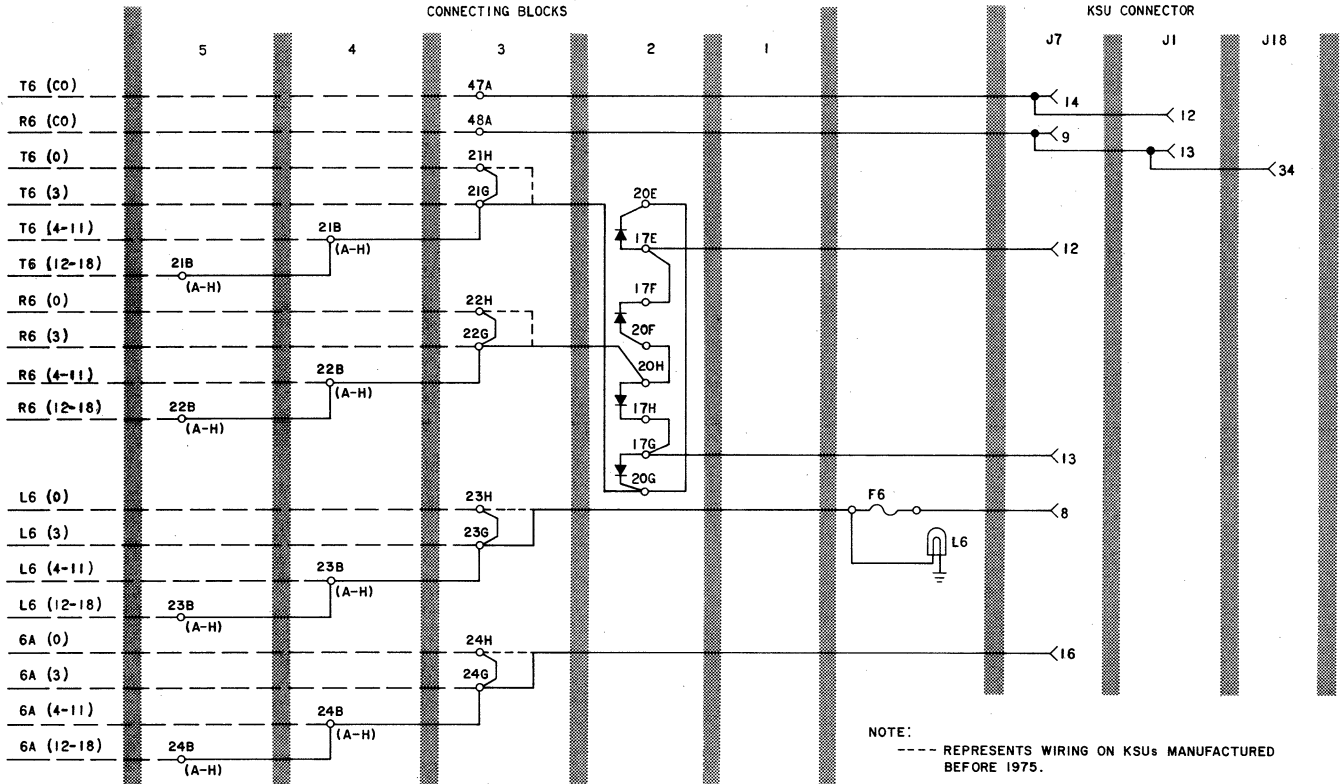


Fig. 58—Fifth Line Circuit (570A KSU)



NOTE:  
 ----- REPRESENTS WIRING ON KSUs MANUFACTURED BEFORE 1975.

Fig. 59—Sixth Line Circuit (570A KSU)

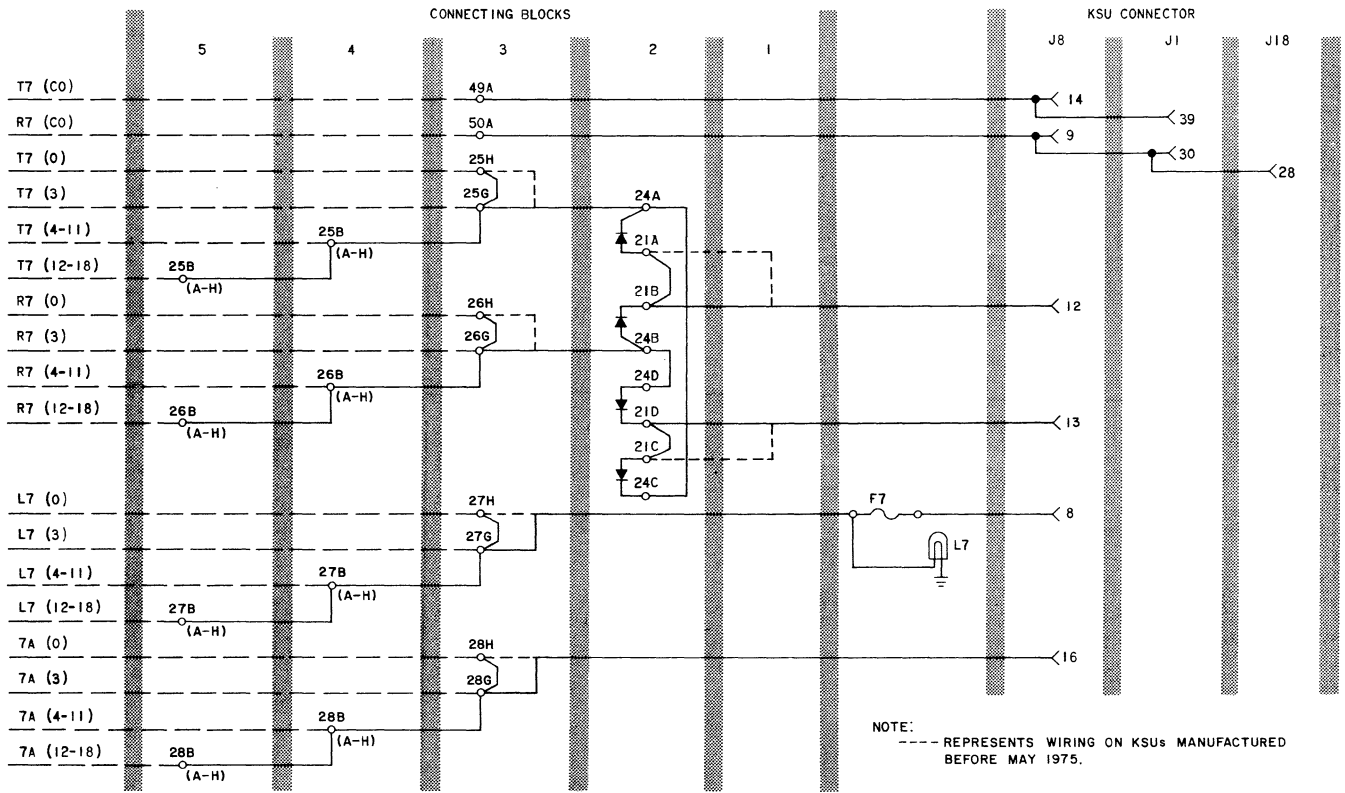


Fig. 60—Seventh Line Circuit (570A KSU)

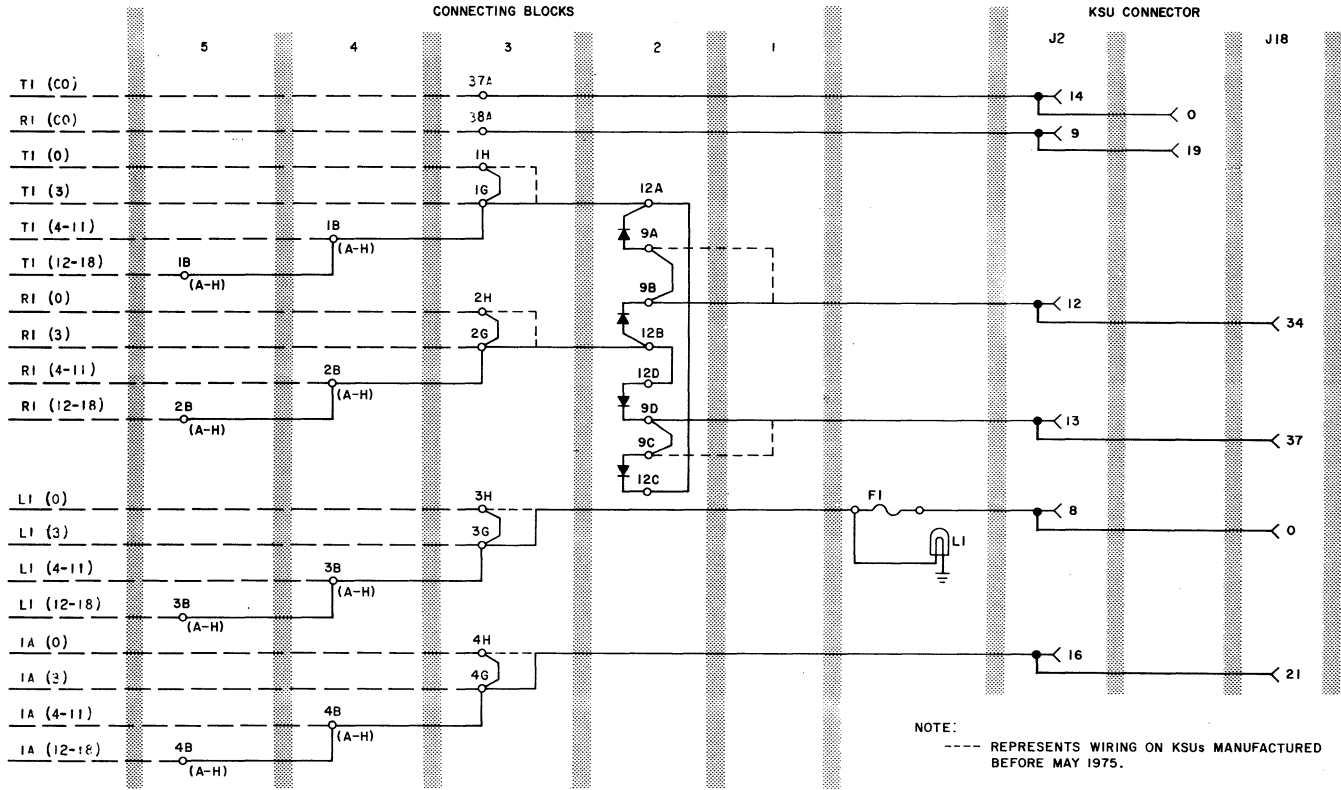


Fig. 61—First Line Circuit (570B KSU)



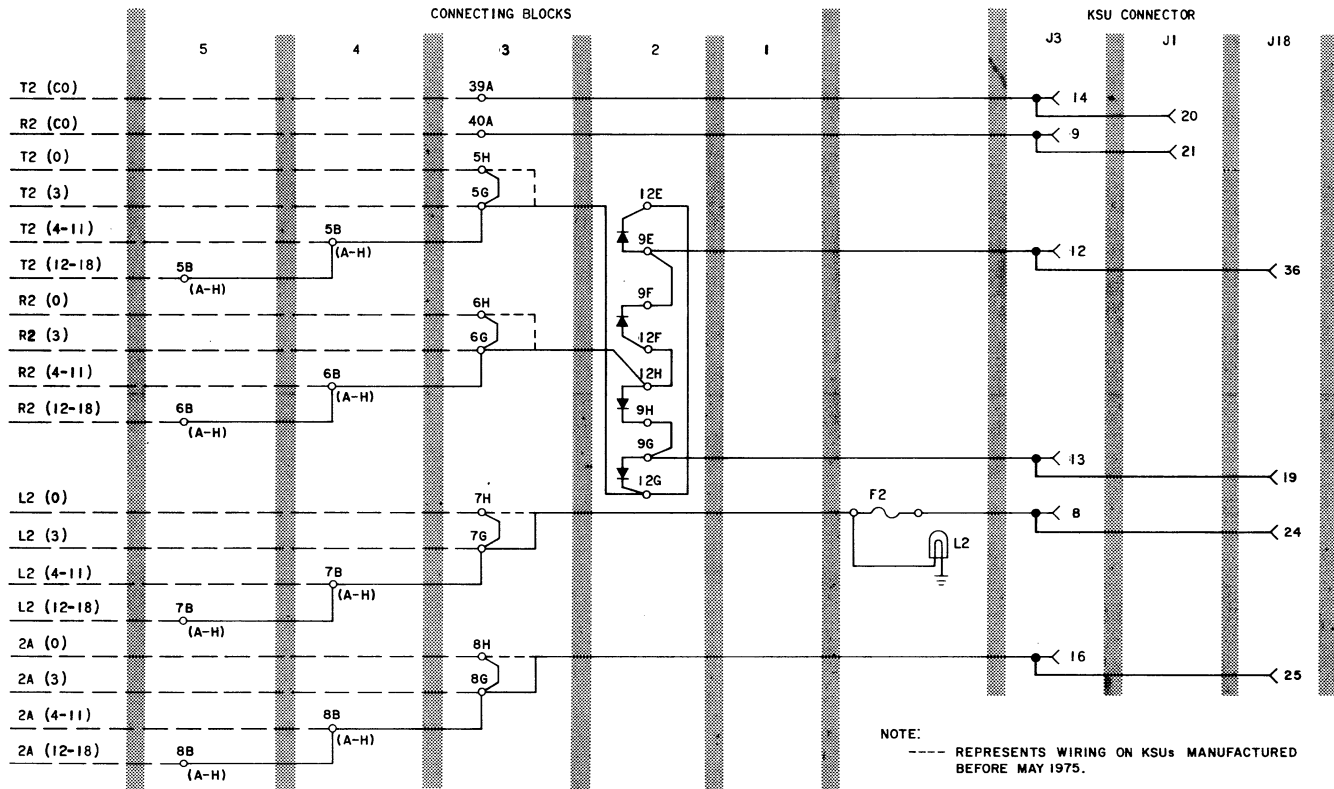
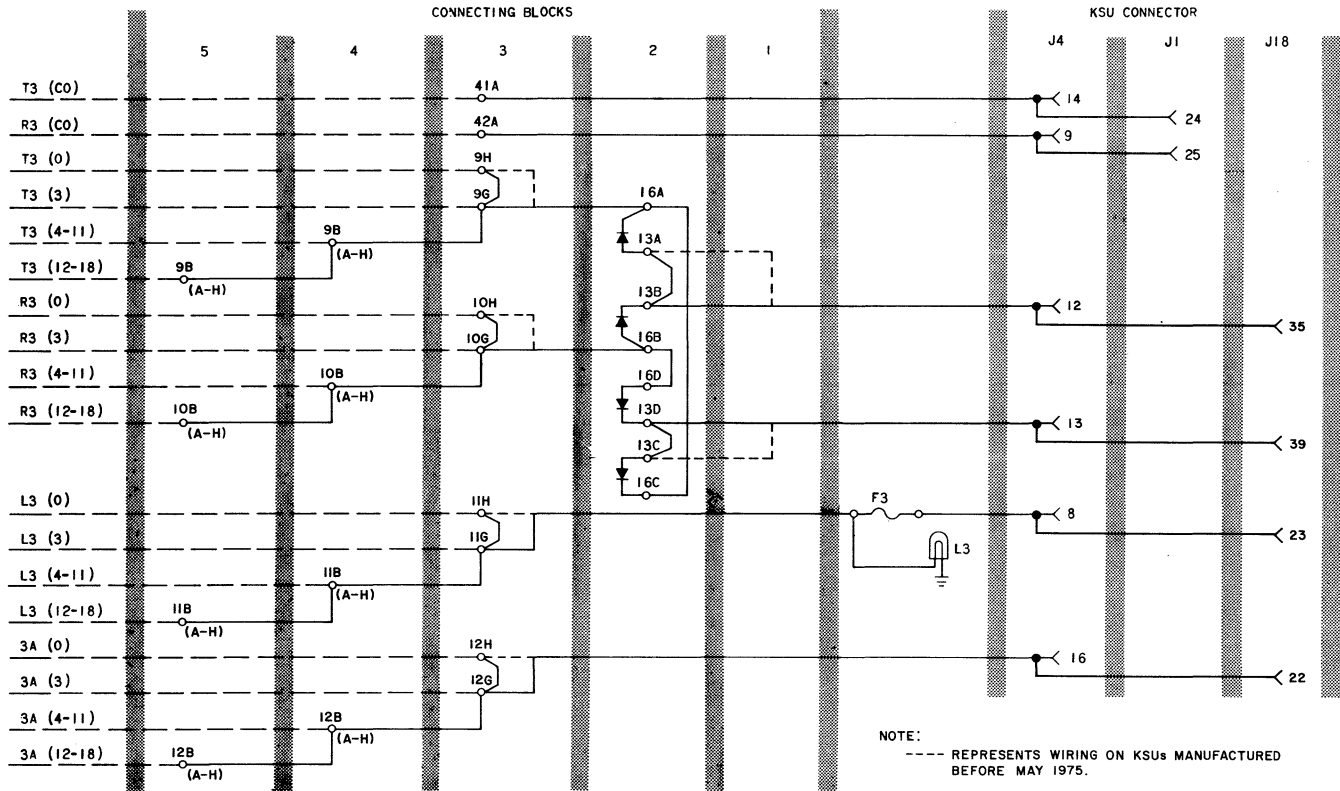


Fig. 62—Second Line Circuit (570B KSU)



NOTE:  
 ---- REPRESENTS WIRING ON KSUs MANUFACTURED  
 BEFORE MAY 1975.

Fig. 63—Third Line Circuit (570B KSU)

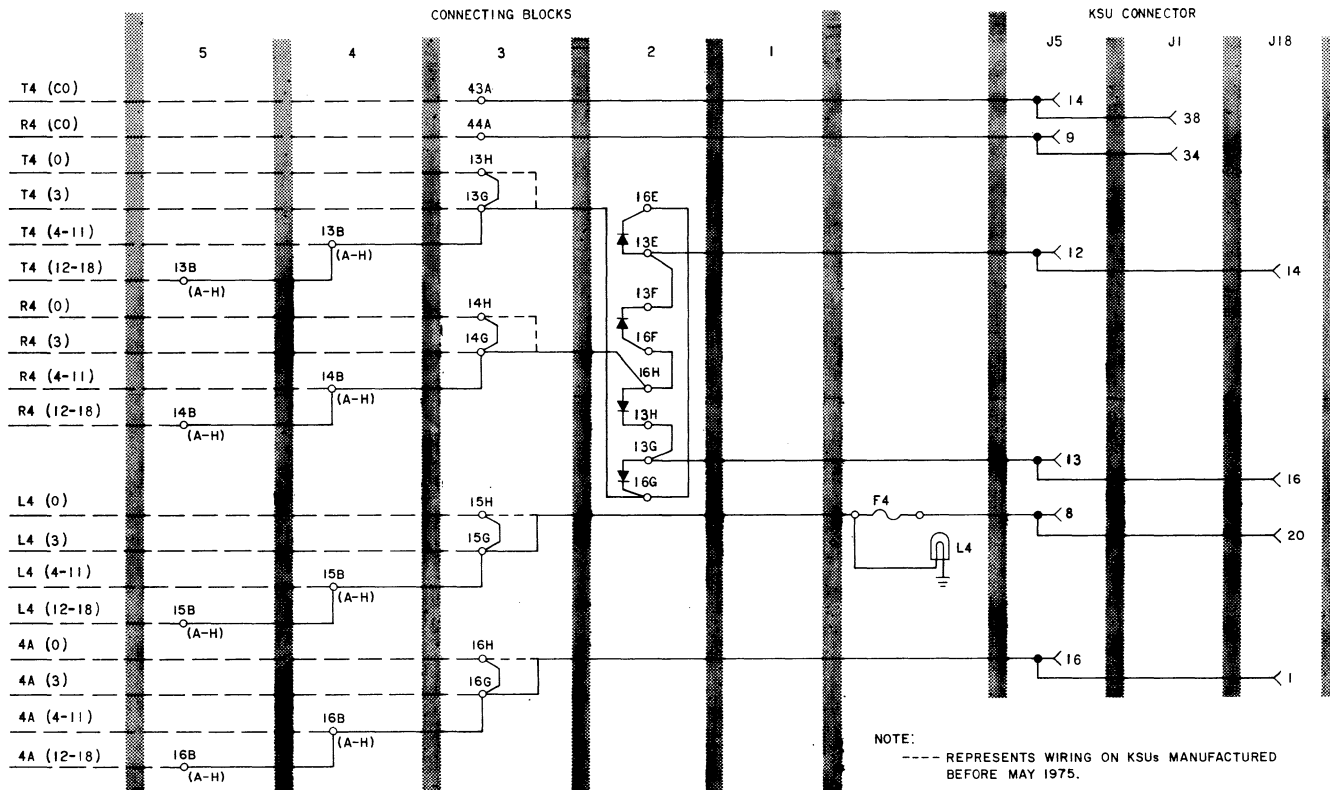


Fig. 64—Fourth Line Circuit (570B KSU)

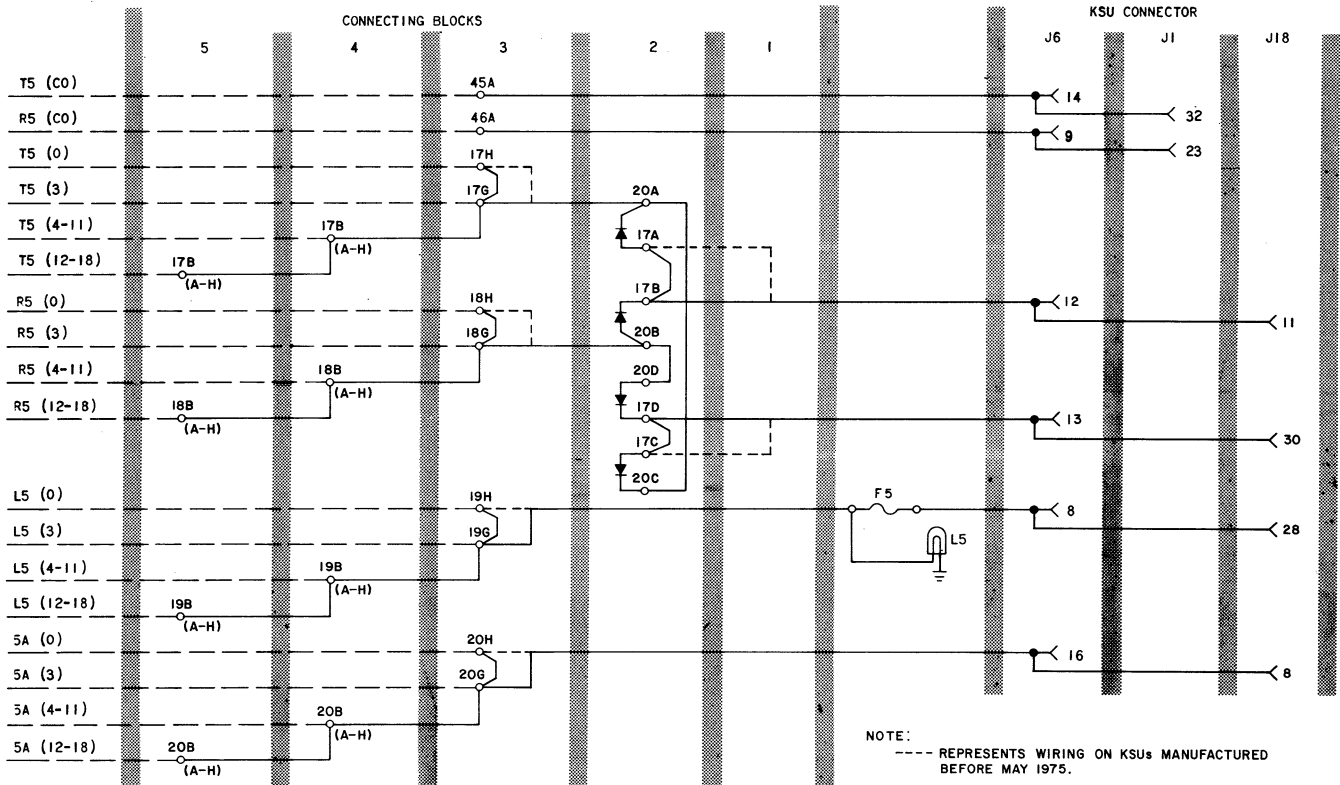
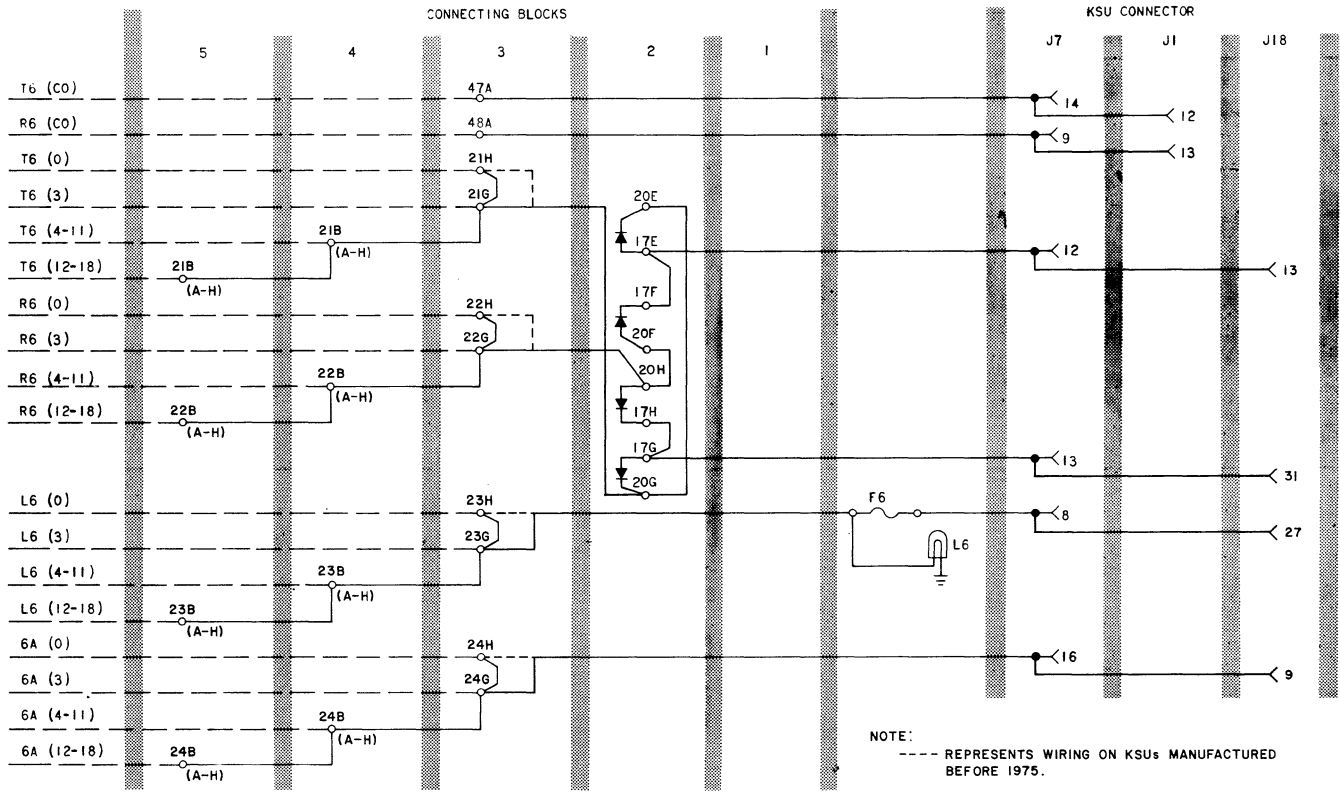


Fig. 65—Fifth Line Circuit (570B KSU)



NOTE:  
 ---- REPRESENTS WIRING ON KSUs MANUFACTURED  
 BEFORE 1975.

Fig. 66—Sixth Line Circuit (570B KSU)

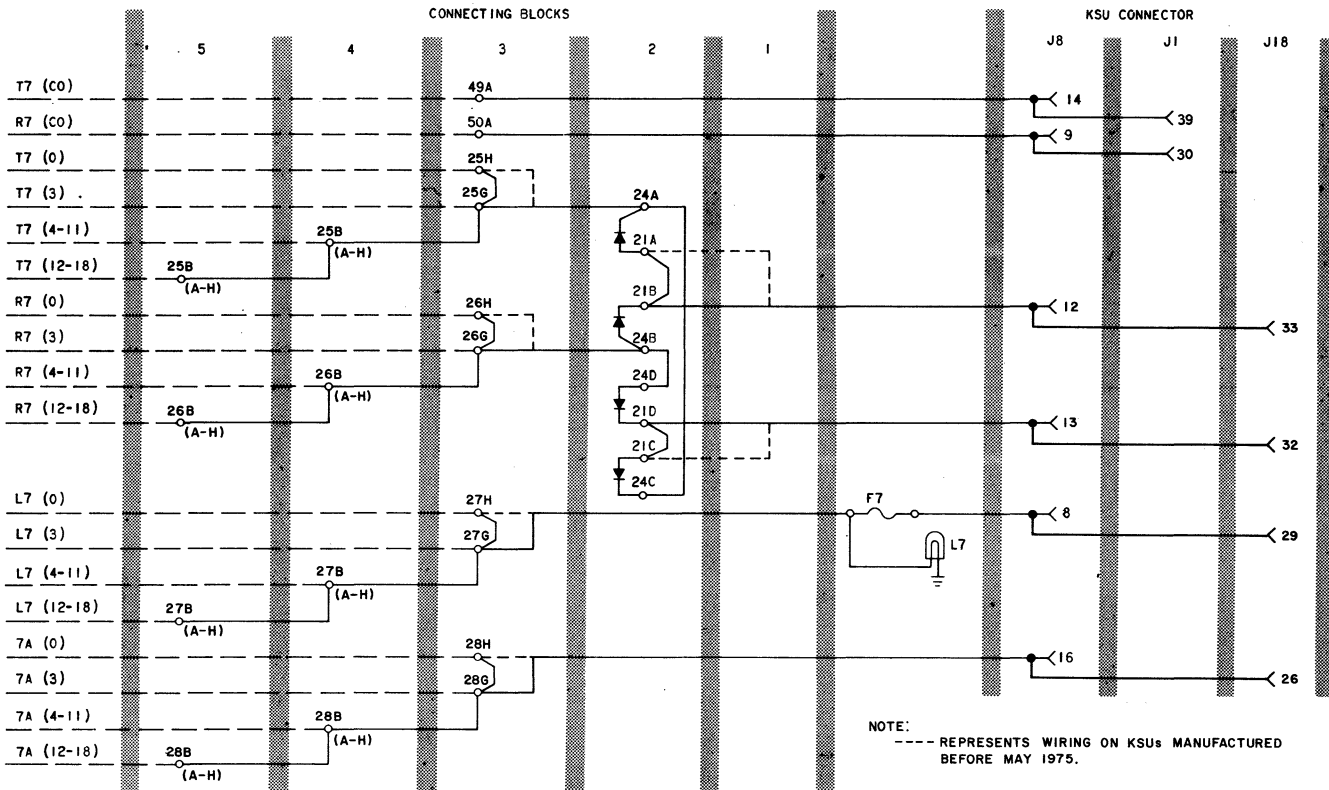


Fig. 67—Seventh Line Circuit (570B KSU)

**TABLE T**  
**CO/PBX LINE RINGING ARRANGEMENTS**

CO/PBX ringing on any line.

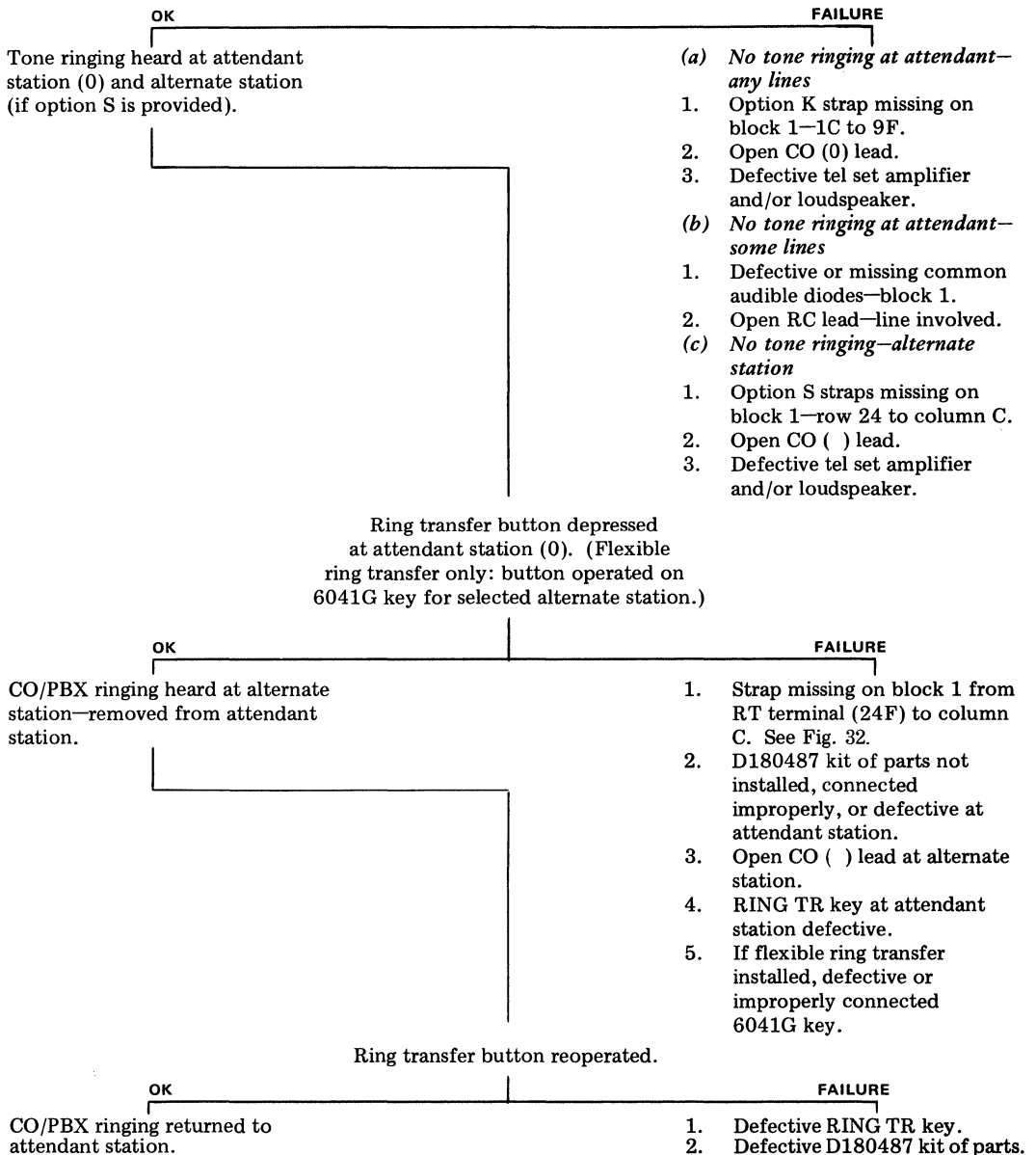


TABLE U

## LEAD TABLE—CO/PBX LINE RINGING ARRANGEMENTS

LEAD DESIG	FUNCTION
CO( )	Central Office ringing lead—tone ringing is applied to this lead from R.O lead of 455A KTU, interrupter, RN lead, 400-type KTU, RC( ) lead, common audible diodes, and cross-connect on block 1.
RT	Ring transfer—this lead transfers common audible ringing from CO(0) lead to designated alternate station under control of RING TR button at attendant set and jumper at block 1 (option J).
RC( )	Ringing control—tone ringing output from 400-type KTU to common audible diodes on block 1.



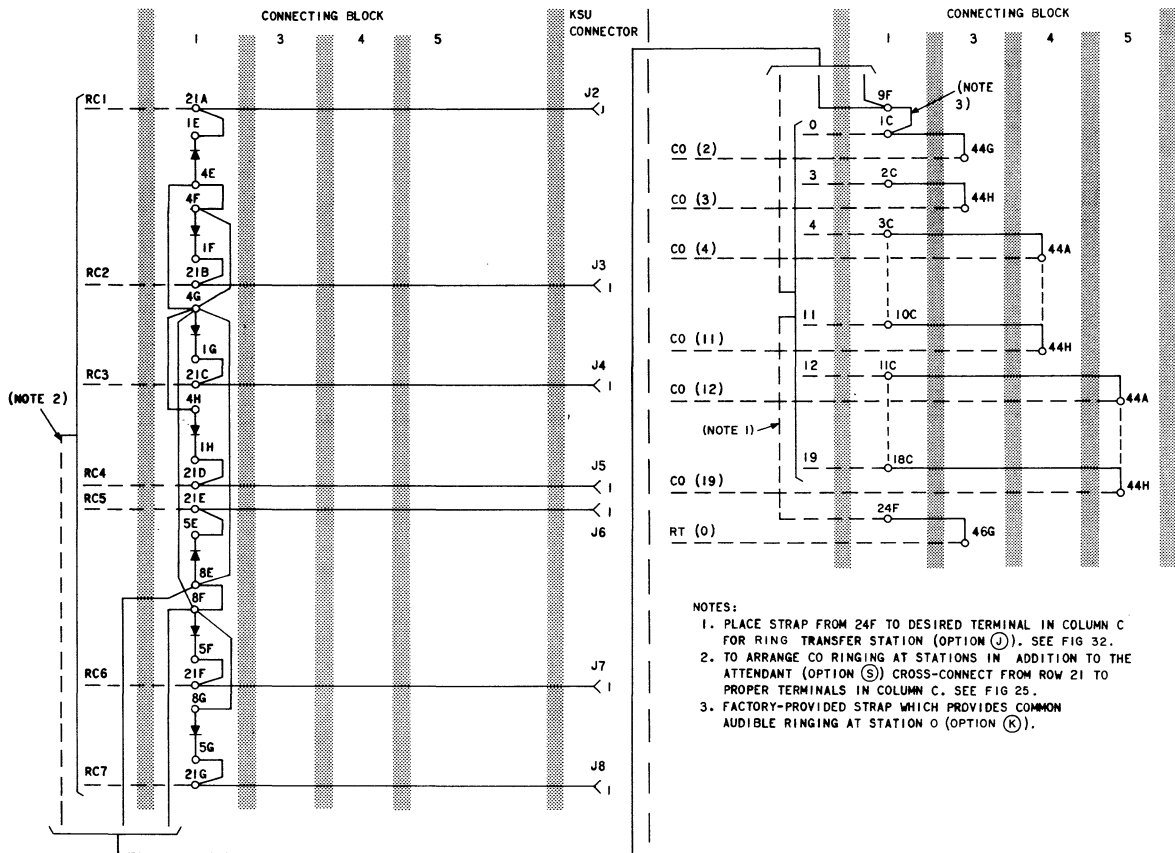


Fig. 68—CO Ringing Arrangement

TABLE V

POWER FAILURE TRANSFER CIRCUIT – 452A KTU

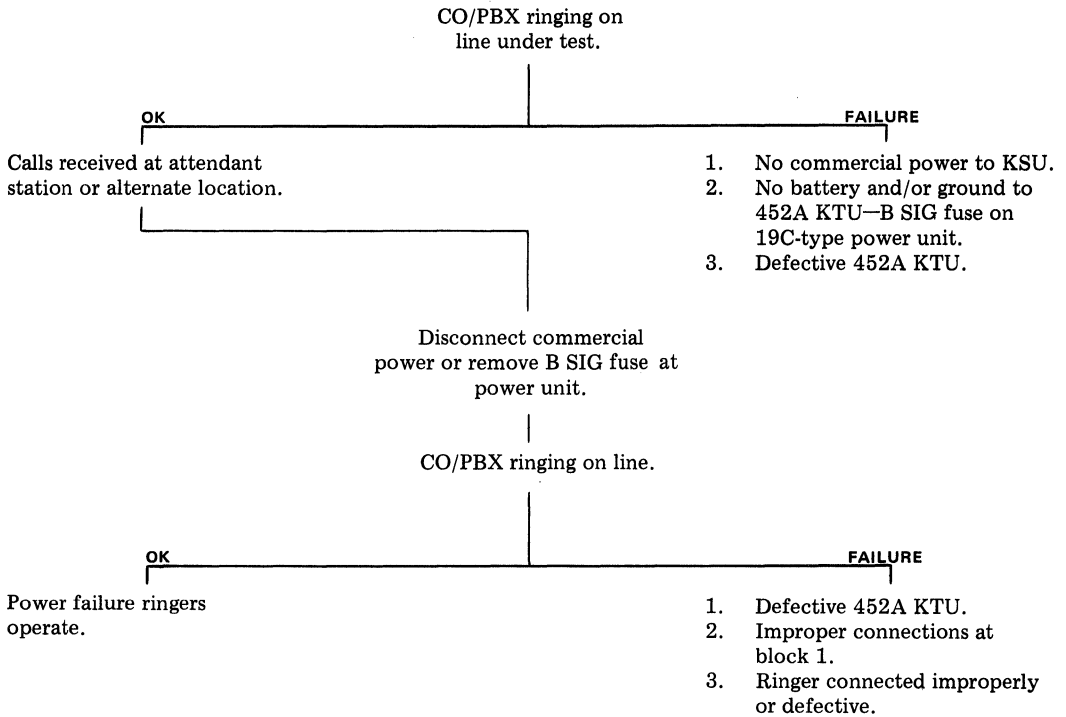


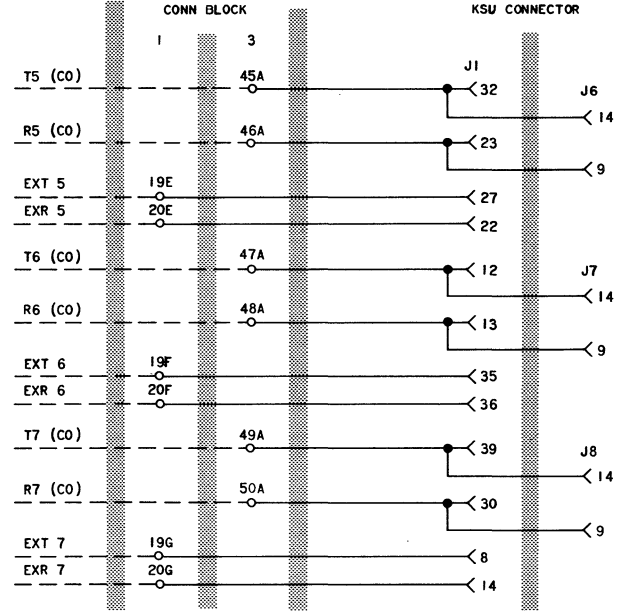
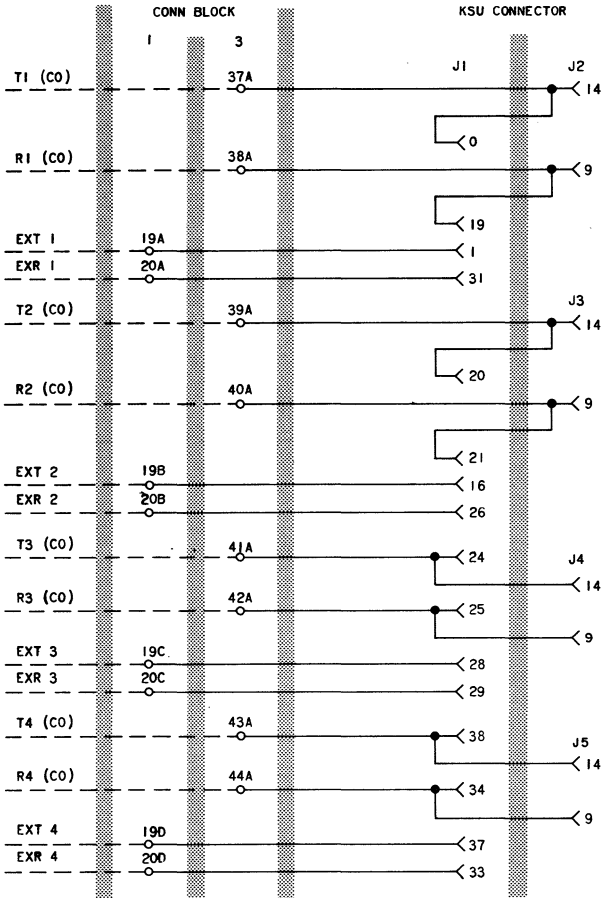
TABLE W

LEAD TABLE—452A KTU

LEAD DESIG.	FUNCTION	KTU/CONNECTOR PIN NO. J1
ET( )	Tip of extension ringer circuit from station (V-S)	
ER( )	Ring of extension ringer circuit from station (S-V)	
EXT( )	Tip side of audible circuit from KTU	1, 16, 28, 37, 27, 35, 8
EXR( )	Ring side of audible circuit from KTU	31, 26, 29, 33, 22, 36, 14
T(CO)	Tip side of CO/PBX line from office	0, 20, 24, 38, 32, 12, 39
R(CO)	Ring side of CO/PBX line from office	19, 21, 25, 34, 23, 13, 30

**TABLE X**  
**INPUTS AND OUTPUTS—452A KTU**

TEST FROM	TO	MON/TALK SWITCH	TEST FOR	REMARKS
<b>INPUTS</b>				
GROUND	17	TALK	B Battery	
17	9		B Ground	
<b>OUTPUTS</b>				
1	31	MON	CO/PBX ringing — Line 1	Power plug disconnected or —24V relay fuse removed.
16	26		CO/PBX ringing — Line 2	
28	29		CO/PBX ringing — Line 3	
37	33		CO/PBX ringing — Line 4	
27	22		CO/PBX ringing — Line 5	
35	36		CO/PBX ringing — Line 6	
8	14		CO/PBX ringing — Line 7	



NOTE:  
 EXT AND EXR LEADS MUST BE CONNECTED  
 TO DESIRED STATION AT BLOCK 1.  
 SEE FIG. 38

Fig. 69—Power Failure Transfer Circuit

**TABLE Y**  
**INTERCOM (IC) CALL**

Lift handset and depress  
button associated with  
idle IC path (lamp dark).

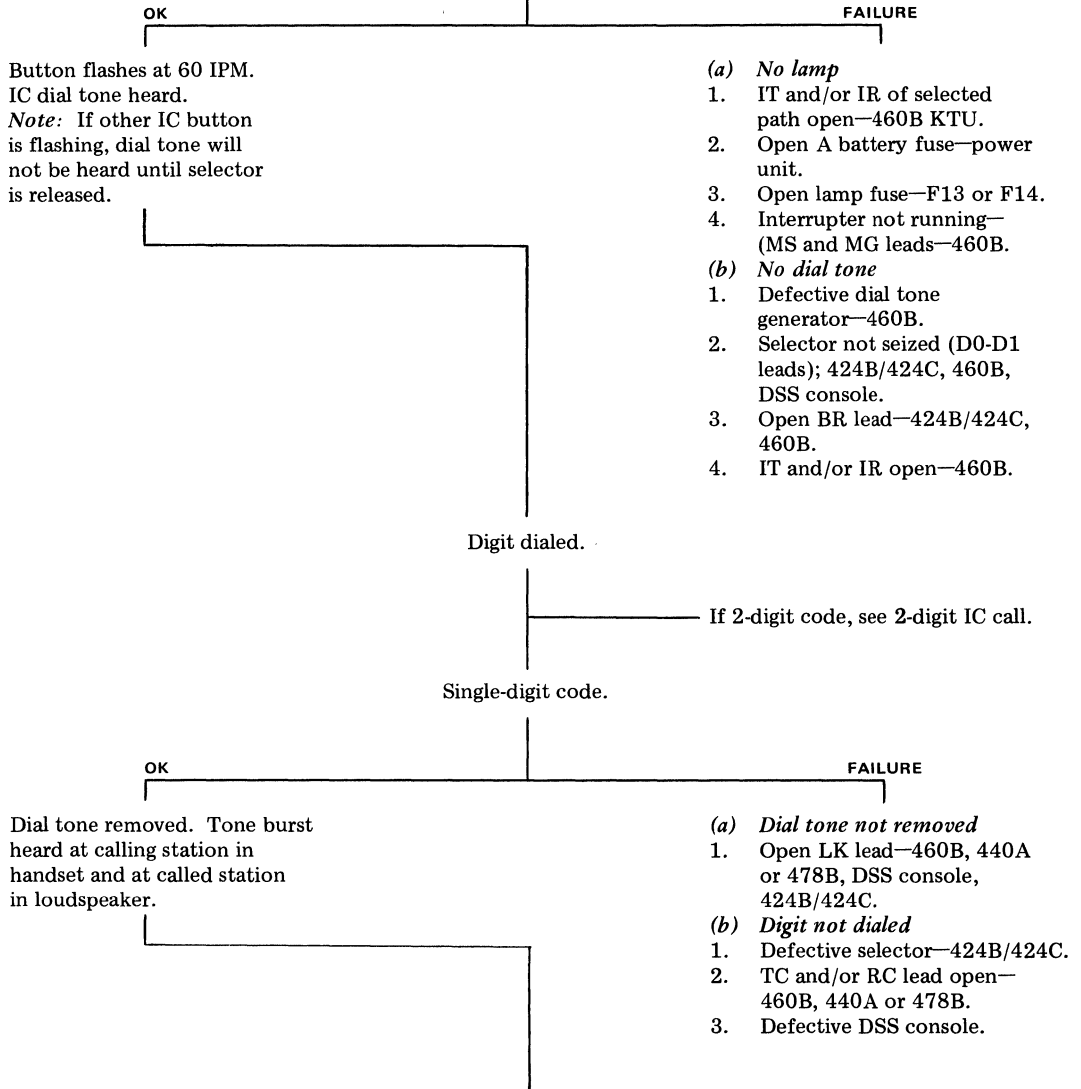


TABLE Y (Contd)  
INTERCOM (IC) CALL

- (c) *No tone burst*
  1. Open BY1 lead—424B/424C, 456B, 460B.
  2. Defective voice and tone-alerting circuit—456B.
  3. Open SS lead—456B, 424B/424C.
  4. Open VS lead—424B/424C.
  5. Defective tel set amplifier (called station).
- (d) *Lamp continues to flash*
  1. Open BY1 lead—424B/424C, 460B.
  2. Defective 2nd station detect circuit—460B.
  3. Selector not released.

Calling station makes announcement. Called station depresses same IC button.

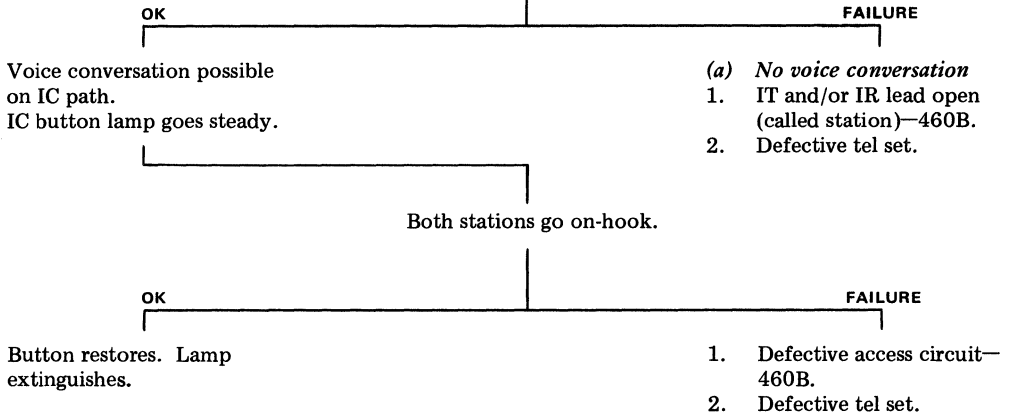
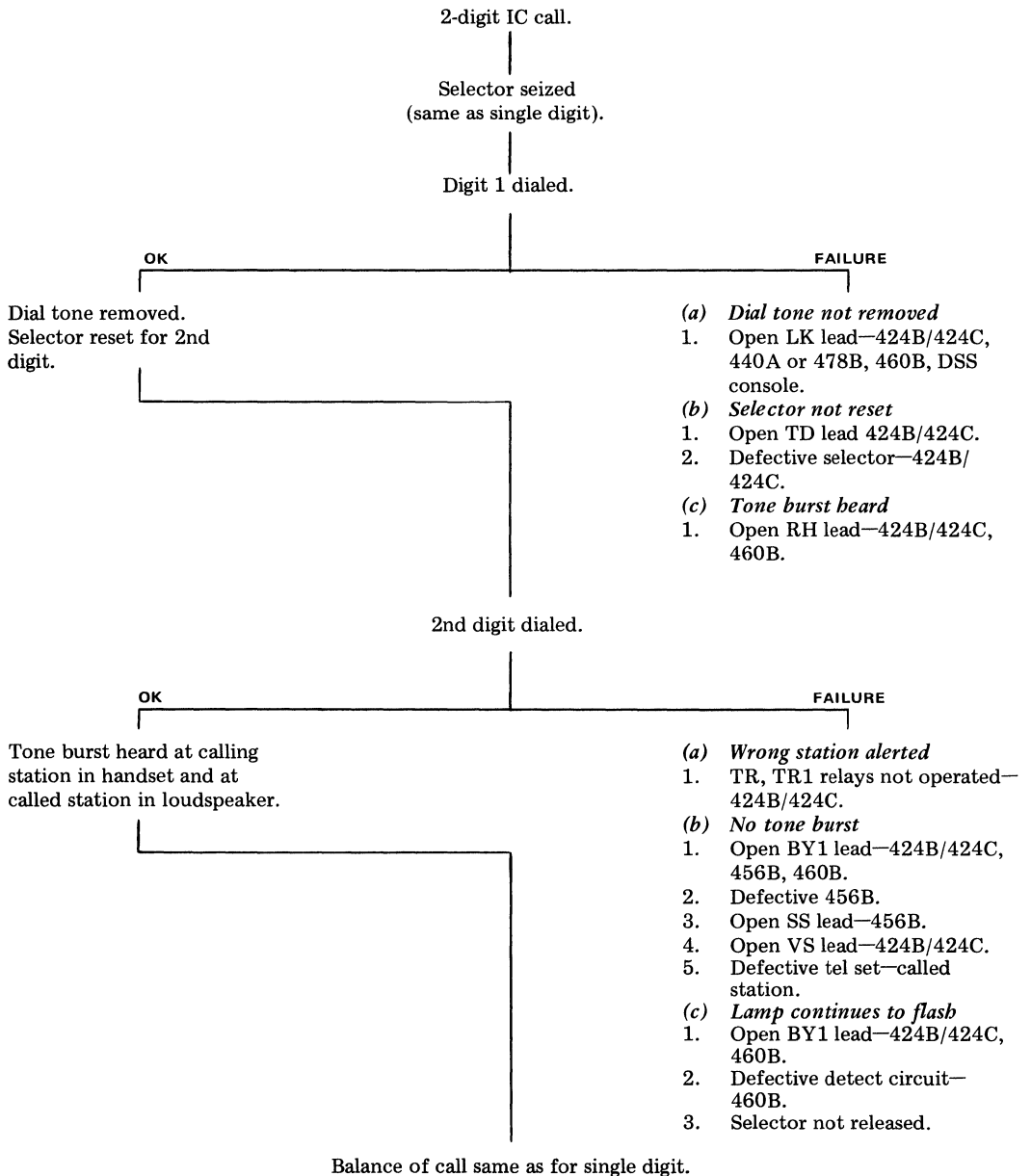


TABLE Y (Contd)

## INTERCOM (IC) CALL



**TABLE Z**  
**LEAD TABLE—INTERCOM CIRCUIT**

LEAD DESIG	FUNCTION	KTU/CONNECTOR PIN NUMBER
BR	Switched B battery — when 424B/424C KTU is seized, this lead applies —24V B to 460B KTU to start intercom dial tone.	J10-35 J12-35
BY1	Busy ground — applies ground after completion of dialing to enable the 2nd station detect circuit in the 460B KTU and start intercom ringing in the 456B KTU.	J10-19 J12-19 J16-19
CG1	Counter ground — applies ground to counting relays in 424B/424C either by M option strap or via DSS console Q option on non-TOUCH TONE calls.	J14-26
CG0	Counter ground — provides ground to counting relays (Y1-Y5) from RS2 lead (M option) or via 440A or 478B (N option) or via CG0 and CG1 leads of DSS console (Q option).	J10-21
D1	Off-hook detection — selector seizure output from 460B KTU (M option) or to D0 output of 460B via DSS console (Q option). If call is rotary dialed, D1 is also the dial pulse input from the 460B.	J10-16
D0	Dialing output — ground supply for talk battery when a path is seized; also, the seizure input for the 424B/424C selector by way of lead D1 if DSS is not provided (M option) or if provided (Q option) by way of the DSS console.	J12-16
IL1	Intercom lamp 1 — lamp circuit for path 1 to station 0 and 3-19.	J12-8
IL2	Intercom lamp 2 — lamp circuit for path 2 to station 0 and 3-19.	J11-16
IR1	Intercom ring 1 — ring side of path 1.	J12-14
IT1	Intercom tip 1 — tip side of path 1.	J12-34
IR2	Intercom ring 2 — ring side of path 2.	J12-0
IT2	Intercom tip 2 — tip side of path 2.	J12-1
LF2	Intercom flash — 60 IPM signal from the interrupter applied to all tel sets during the period an intercom path is seized until call is answered and selector is released.	J12-7



TABLE Z (Contd)

LEAD TABLE—INTERCOM CIRCUIT

LEAD DESIG	FUNCTION	KTU/CONNECTOR PIN NUMBER
LK	Dial tone disconnect — ground is applied to this lead by the selector after first digit of an intercom code is dialed to stop dial tone.	J10-30 J12-30 J14-26
LT2	Transfer digit 2 — provides ground from DSS console to operate TR, TR1 relays (codes 10-19).	J9-39
MG	Motor ground — ground to start interrupter motor when any intercom path is seized.	J11-6
MS	Motor start — from interrupter motor circuit, starts interrupter from MG when any path is seized.	J11-5
PA	Paging signal — output to the paging amplifier (457C KTU). Paging (optional) speakers must be connected as shown in Fig. 36.	J16-0
RC	Calling ring — common ring of intercom circuits to voice and tone-alerting circuit and to TOUCH-TONE adapter.	J12-13 J14-13 J16-9
RH	R relay hold — ground from LK lead is applied on this lead to 424B/424C KTU to prevent ringing until all dialing is completed.	J10-26 J12-26
RS1	Reset — provides ground for 424B/424C KTU selector timer over RS2 lead. If TOUCH-TONE is provided, N option furnishes ground to the counting relays via the adapter.	J10-38 J14-38
RS2	Reset — connected to RS1 (see above).	J9-19
SS	Station signaling input — when dialing is complete, this lead carries the tone burst to the selector where it is applied to the VS lead of the station selected.	J10-14 J16-1
TC	Calling tip — common tip of intercom paths to voice and tone-alerting circuit and TOUCH-TONE adapter.	J12-12 J14-12 J16-8
TD	Transfer digit — resets 424B/424C selector after 1st digit of a 2-digit code is dialed.	J9-16 J9-28

**TABLE Z (Contd)**  
**LEAD TABLE-INTERCOM CIRCUIT**

LEAD DESIG	FUNCTION	KTU/CONNECTOR PIN NUMBER
TG	To ground — provides ground to selector timer via the RS1 lead.	J9-38
TTG	TOUCH-TONE ground — supplies ground to control adapter when selector is seized (N option) or provides ground to DSS console selector relays (Q option).	J10-39 J14-36
VS0	Station ringing — voice signaling lead — code 0.	J9-34
VS3	Station ringing — voice signaling lead — code 3.	J9-25
VS4	Station ringing — voice signaling lead — code 4.	J9-26
VS5	Station ringing — voice signaling lead — code 5.	J9-20
VS6	Station ringing — voice signaling lead — code 6.	J9-21
VS7	Station ringing — voice signaling lead — code 7.	J9-32
VS8	Station ringing — voice signaling lead — code 8.	J9-30
VS9	Station ringing — voice signaling lead — code 9.	J9-29
VS10	Station ringing — voice signaling lead — code 10.	J9-14
VS11	Station ringing — voice signaling lead — code 11.	J9-8
VS12	Station ringing — voice signaling lead — code 12.	J9-22
VS13	Station ringing — voice signaling lead — code 13.	J9-24
VS14	Station ringing — voice signaling lead — code 14.	J9-27
VS15	Station ringing — voice signaling lead — code 15.	J9-0
VS16	Station ringing — voice signaling lead — code 16.	J9-1
VS17	Station ringing — voice signaling lead — code 17.	J9-33

TABLE Z (Contd)

LEAD TABLE—INTERCOM CIRCUIT

LEAD DESIG	FUNCTION	KTU/CONNECTOR PIN NUMBER
VS18	Station ringing — voice signaling lead — code 18.	J9-31
VS-19	Station ringing — voice signaling lead — code 19.	J9-9
Y1	Selector counter relay No. 1 ground — provides ground to operate Y1 counting relay from TOUCH-TONE adapter of DSS console.	J10-25 J14-14
Y2	Same as above except for Y2 relay.	J10-24 J14-30
Y3	Same as above except for Y3 relay.	J10-22 J14-29
Y4	Same as above except for Y4 relay.	J9-36 J14-32
Y5	Same as above except for Y5 relay.	J9-37 J14-33

TABLE AA

## INPUTS AND OUTPUTS—424B/424C KTU

TEST FROM	TO	MON/TALK SWITCH	TEST FOR	REMARKS
INPUTS				
GROUND	J10-18	TALK	A Battery	
	J10-17		B Battery	
J18-17	J9-15	TALK	B Ground	
J18-18	J10-3		A Ground	
OUTPUTS				
GROUND	VS lead	MON	1 sec. tone burst on VS lead of station tested. See Fig. 70 for VS lead assignment.	Tone burst heard after dialing proper digit(s)
B BAT	J10-19	TALK	Ground — BY1 lead	Dialing complete— 1- or 2-digit code
	J10-30		Ground — LK lead	After dialing 1st digit, dial tone should be removed
	J10-39		Ground — TTG lead	Selector seized
GROUND	J10-35			B BAT. — BR lead

TABLE AB

## INPUTS AND OUTPUTS—440A OR 478B KTU

TEST FROM	TO	MON/TALK SWITCH	TEST FOR	REMARKS
INPUTS				
GROUND	J14-8	TALK	A Battery	
A BAT.	J13-3	TALK	A Ground	Required for 478B KTU only
	J14-3			
J14-12	J14-13	MON	Multifrequency signals	Either IC path seized—any dial button depressed
OUTPUTS				
B BAT.	J14-26	TALK	B Ground — LK lead	1st digit of 2-digit code dialed
	J14-36		B Ground — TTG lead	Selector seized

**TABLE AC**  
**INPUTS AND OUTPUTS—456B KTU**

TEST FROM	TO	MON/TALK SWITCH	TEST FOR	REMARKS
<b>INPUTS</b>				
GROUND	J16-18	TALK	A Battery	
J16-18	J16-3		A Ground	
J16-8	J16-9		Talk Battery from 460B KTU — TC and RC leads	Any intercom path seized
J16-18	J16-19		Ground — from 424B/424C KTU (BY1 lead) after dialing is completed on any path	
<b>OUTPUTS</b>				
J16-8	J16-9	MON	Tone burst after dialing	Any code dialed — any path
GROUND	J16-1		Tone burst after dialing	Any code dialed — any path
	J16-0		Voice conversation on intercom paging calls.	Dial 2 if paging is furnished — tone burst and voice should be heard

**TABLE AD**  
**INPUTS AND OUTPUTS – 460B KTU**

TEST FROM	TO	MON/TALK SWITCH	TEST FOR	REMARKS	
<b>INPUTS</b>					
GROUND	J11-18	TALK	A BAT. – intercom talk battery		
	J11-17		B BAT. – intercom relay battery		
	J12-4	MON	10V± steady lamp voltage – paths 1 and 2		
	J12-35	TALK	B Battery		Selector seized
	J12-7	MON	10V± at 60 IPM – lamp flash		Interrupter running
J11-17	J11-3	TALK	A Ground		
	J11-15		B Ground		
	J11-6		Ground – MG lead		
<b>OUTPUTS</b>					
J12-14	J12-34	TALK	Talk Battery – path 1	Selector seized	
J12-0	J12-1		Talk Battery – path 2		
GROUND	J12-8	MON	10V± at 60 IPM	Intercom path 1 seized	
	J12-9			Intercom path 2 seized	
	J11-16				
	J11-19				
J12-12	J12-13	TALK	Talk BAT. – TC and RC leads	Any path seized	

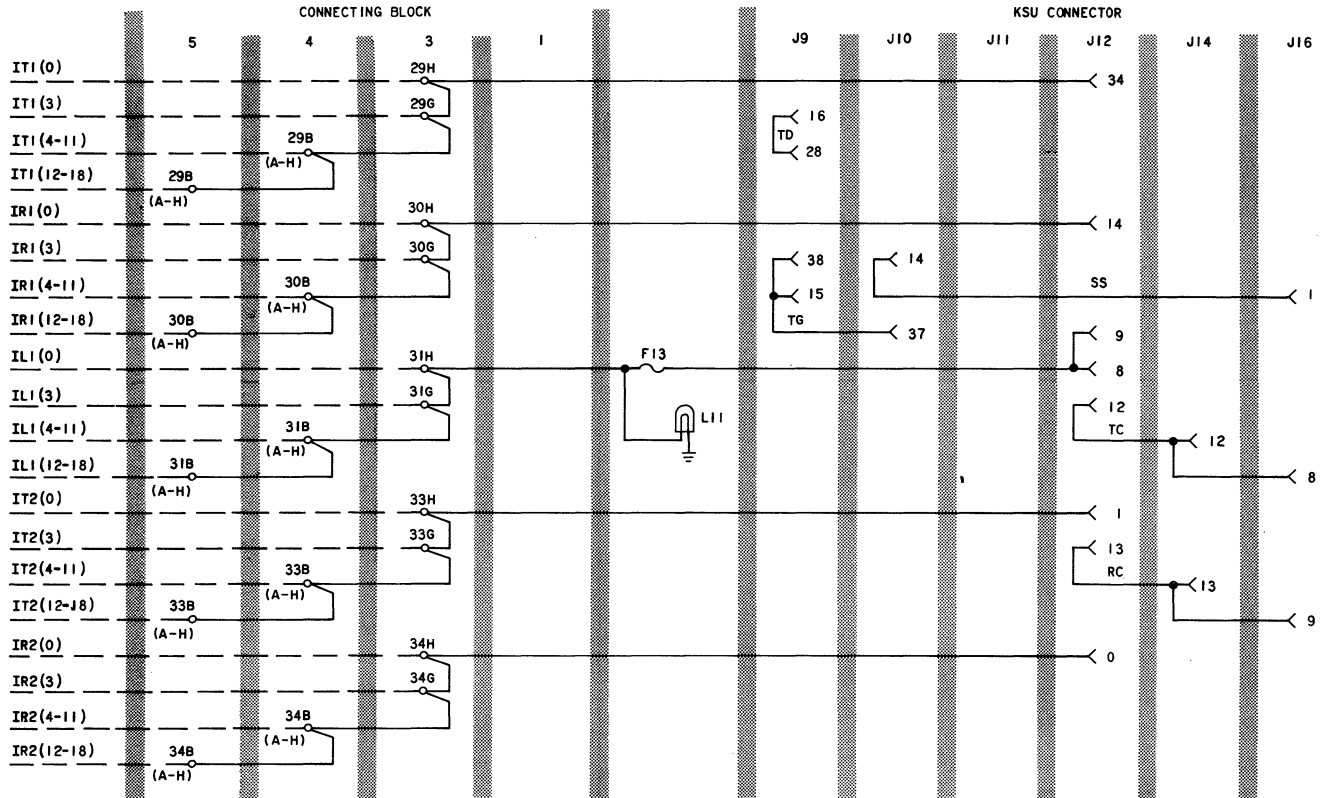


Fig. 70—Intercom Circuit (Sheet 1 of 4)



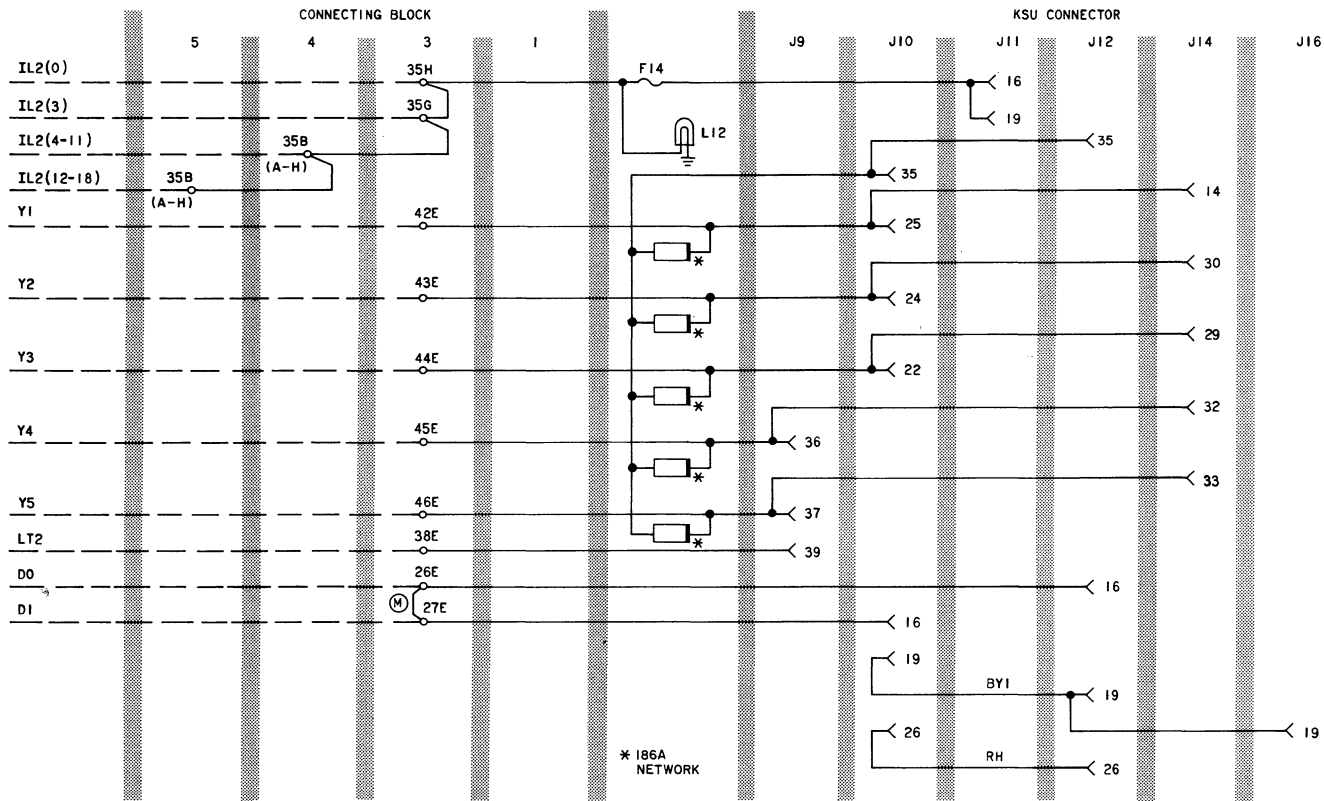


Fig. 70—Intercom Circuit (Sheet 2 of 4)

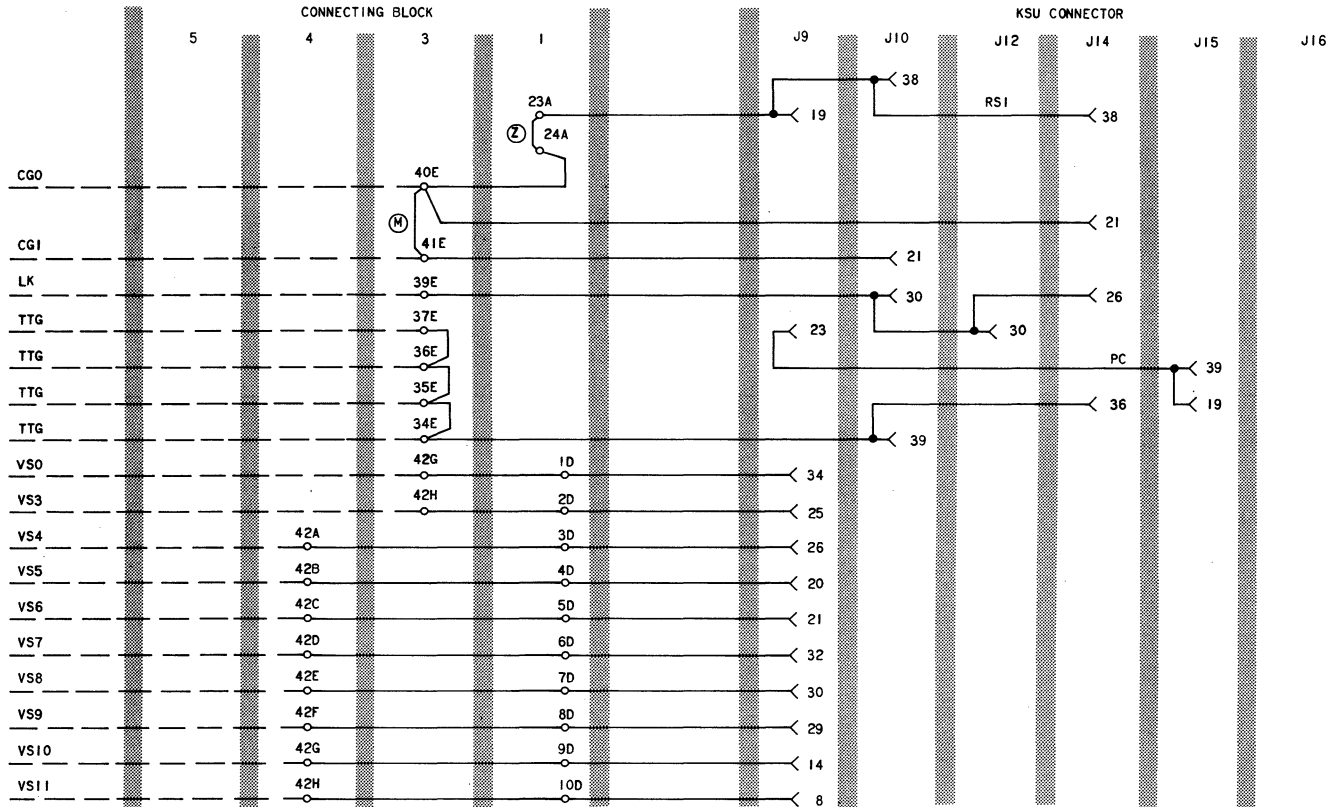


Fig. 70—Intercom Circuit (Sheet 3 of 4)

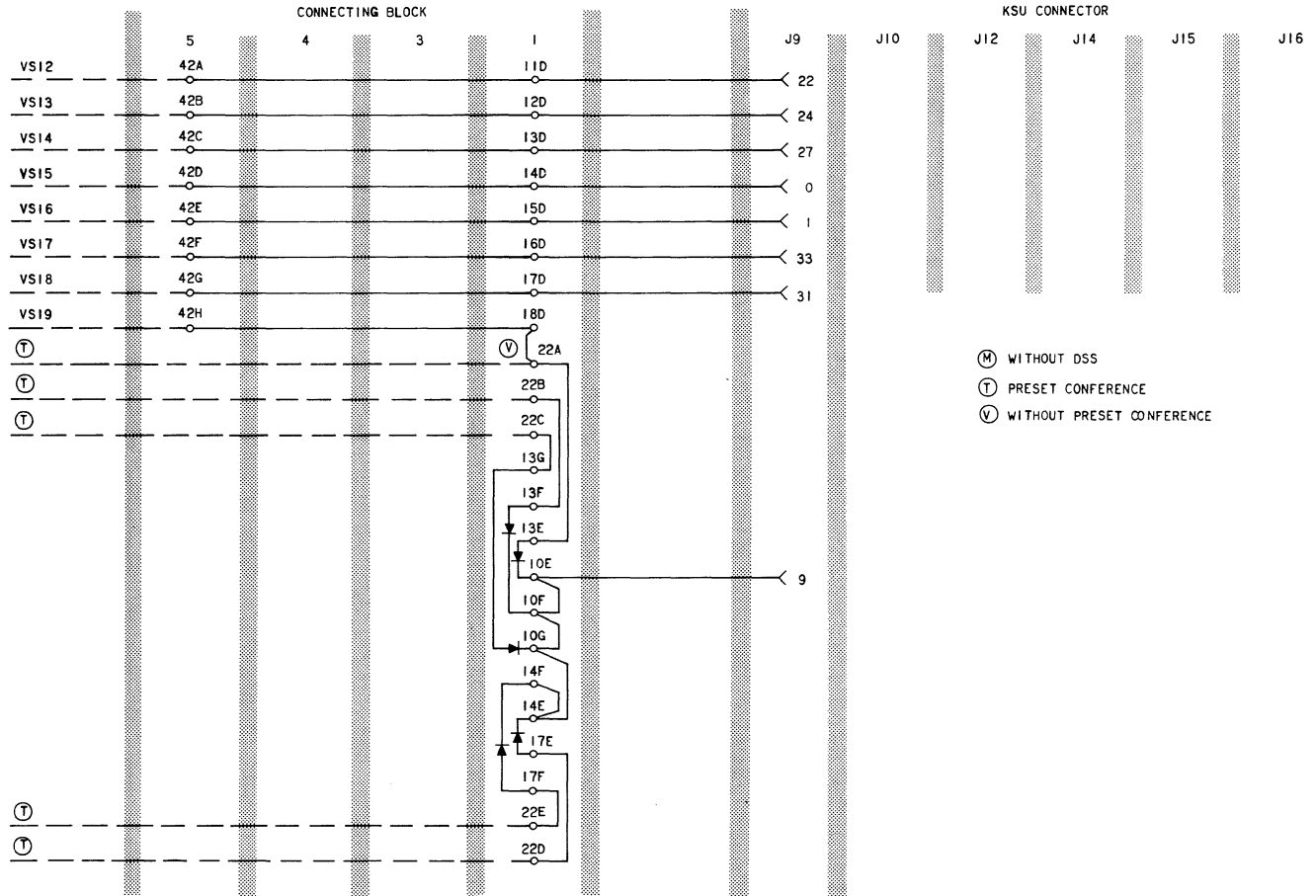
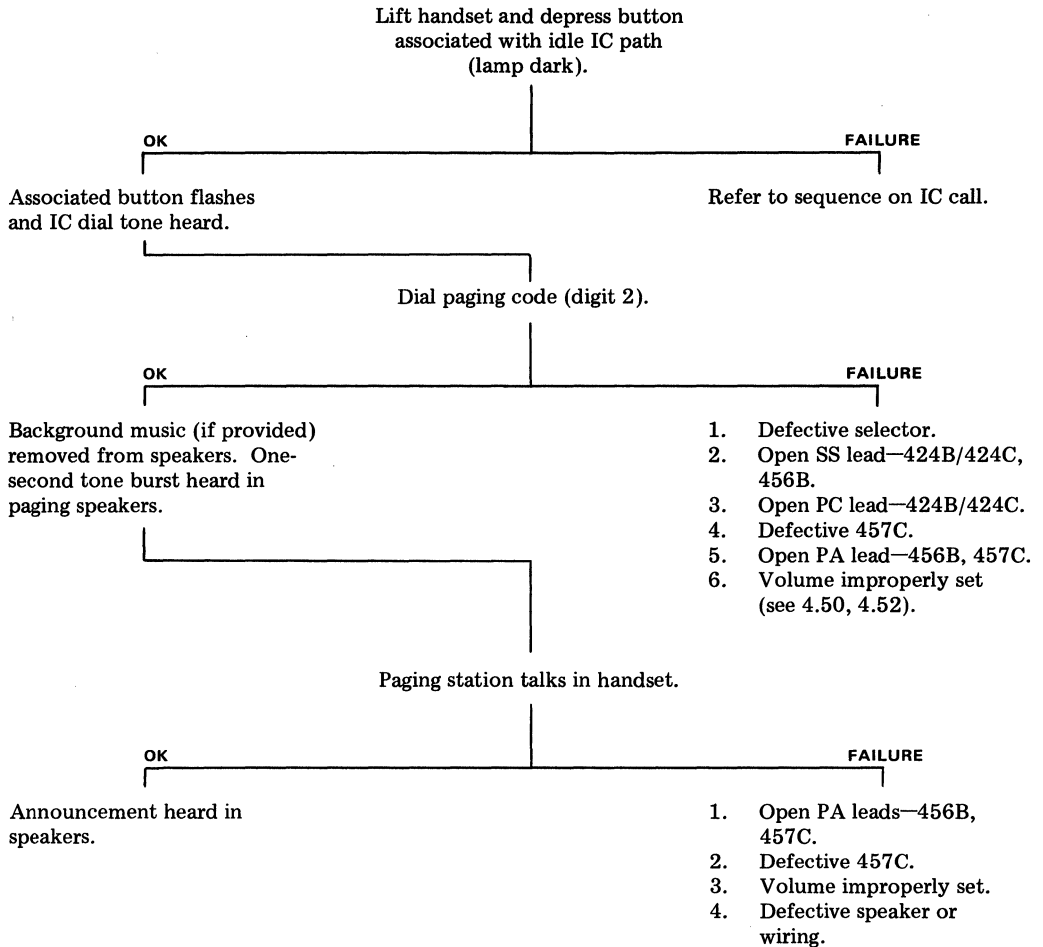


Fig. 70—Intercom Circuit (Sheet 4 of 4)

**TABLE AE**  
**PAGING—457C KTU**



**TABLE AF**  
**LEAD TABLE – 457C KTU**

LEAD DESIG.	FUNCTION	KSU/CONNECTOR PIN NO.
PA	Paging input – voice and tone alerting input from the 456B KTU.	J15-16
PC	Paging code – when code 2 is dialed, –24V is applied to this lead from 456B KTU to enable amplifier.	J15-19
P0-P1	Paging amplifier output – outputs from paging amplifier to speakers.	J15-0 J15-1

**TABLE AG**  
**INPUTS AND OUTPUTS – 457C KTU**

TEST FROM	TO	MON/TALK SWITCH	TEST FOR	REMARKS
<b>INPUTS</b>				
GROUND	J15-18	TALK	A Battery	
	J15-17		B Battery	
J15-17	J15-15		B Ground	
GROUND	J15-19		A Battery (PC lead)	Code 2 dialed
J15-8	J15-9	MON	Background music	If provided
<b>OUTPUTS</b>				
GROUND	J15-0	MON	Voice and tone alerting	Code 2 dialed; voice input at calling station
	J15-1			

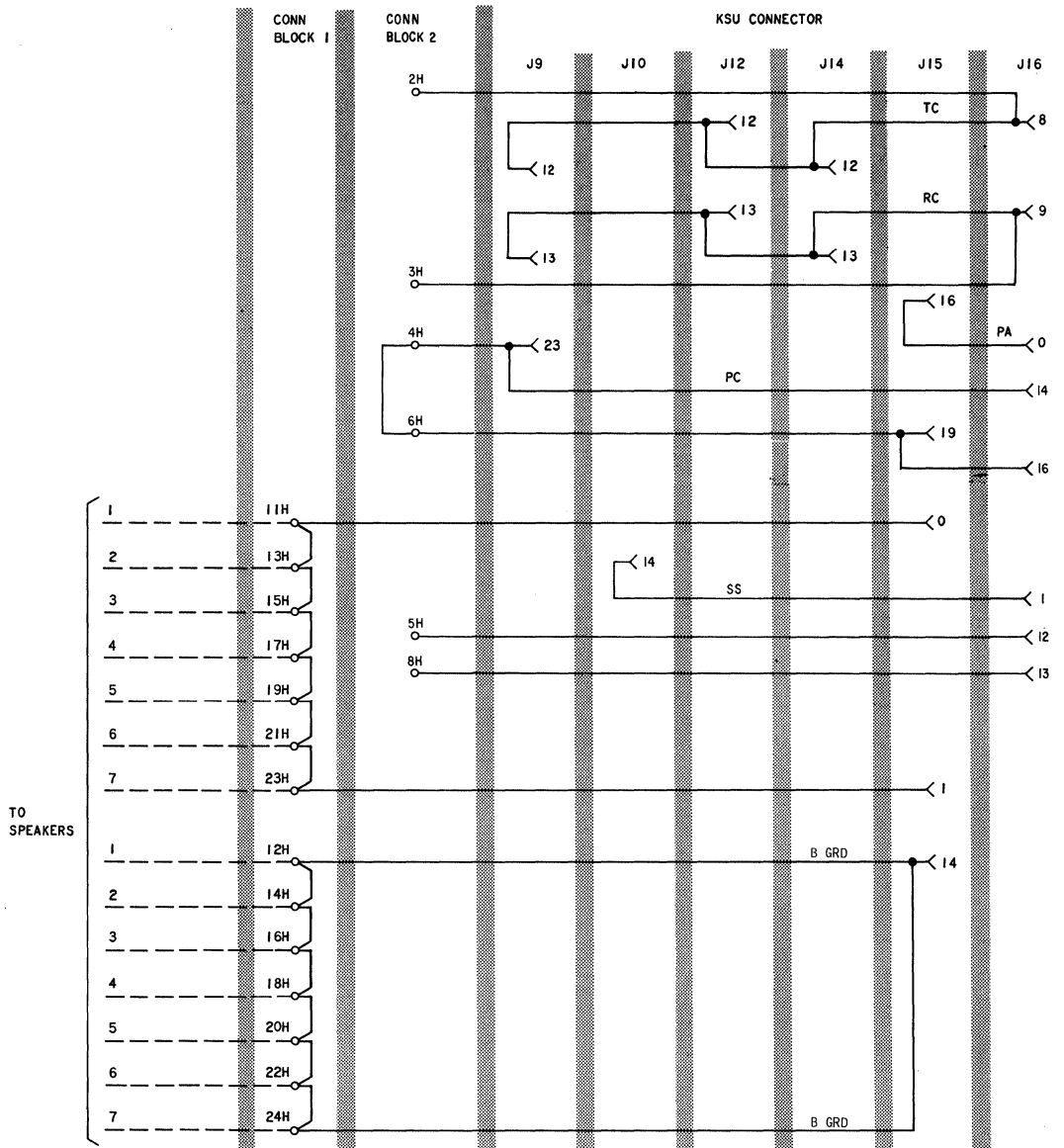
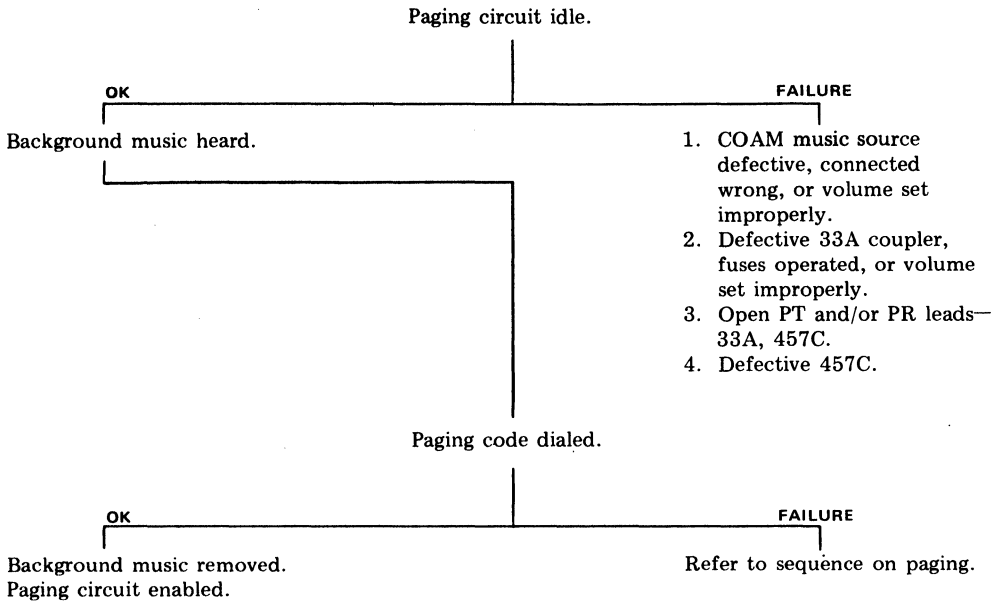


Fig. 71—Paging Connections

**TABLE AH**  
**BACKGROUND MUSIC**



**TABLE AI**  
**MUSIC ON HOLD**

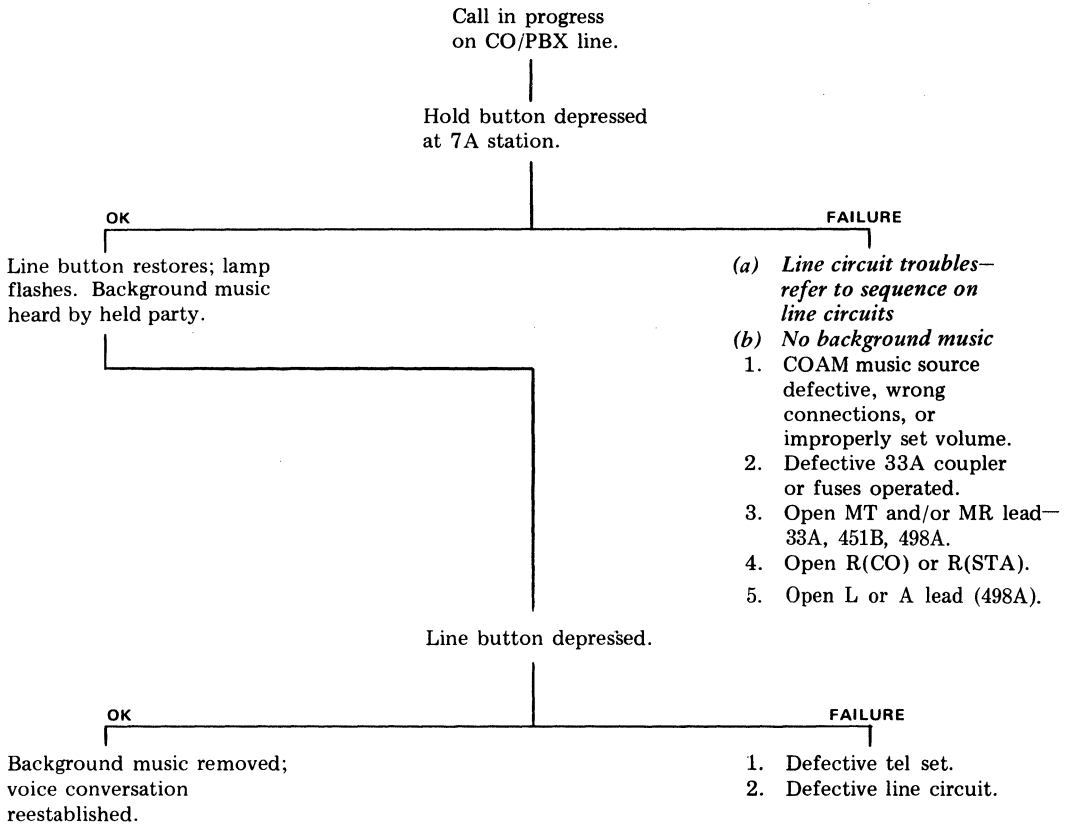




TABLE AJ

LEAD TABLE—451-TYPE KTU

LEAD DESIG	FUNCTION	KSU/CONNECTOR PIN NO.
MT	Music tip — tip side of music source input — through 33A voice coupler	J18-35
MR	Music ring — ring side of music source input — through 33A voice coupler	J18-36
R (CO)	Ring (Central Office ) — multiple of ring side of CO/PBX circuit	J18-19, 39, 24, 14, 31, 34, 28
R (STA)	Ring (Station) — multiple of ring side of line toward station	J18-20, 30, 25, 9, 16, 32, 29

TABLE AK

INPUTS AND OUTPUTS—451-TYPE KTU

TEST FROM	TO	MON/TALK SWITCH	TEST FOR	REMARKS
INPUTS				
J18-35	J18-36	MON	Music-on-hold output	Music source connected
OUTPUTS				
J18-19	J18-20	MON	Music-on-hold output	CO/PBX line 1 on hold
J18-39	J18-30		Music-on-hold output	CO/PBX line 2 on hold
J18-24	J18-25		Music-on-hold output	CO/PBX line 3 on hold
J18-14	J18-9		Music-on-hold output	CO/PBX line 4 on hold
J18-31	J18-16		Music-on-hold output	CO/PBX line 5 on hold
J18-34	J18-32		Music-on-hold output	CO/PBX line 6 on hold
J18-28	J18-29		Music-on-hold output	CO/PBX line 7 on hold

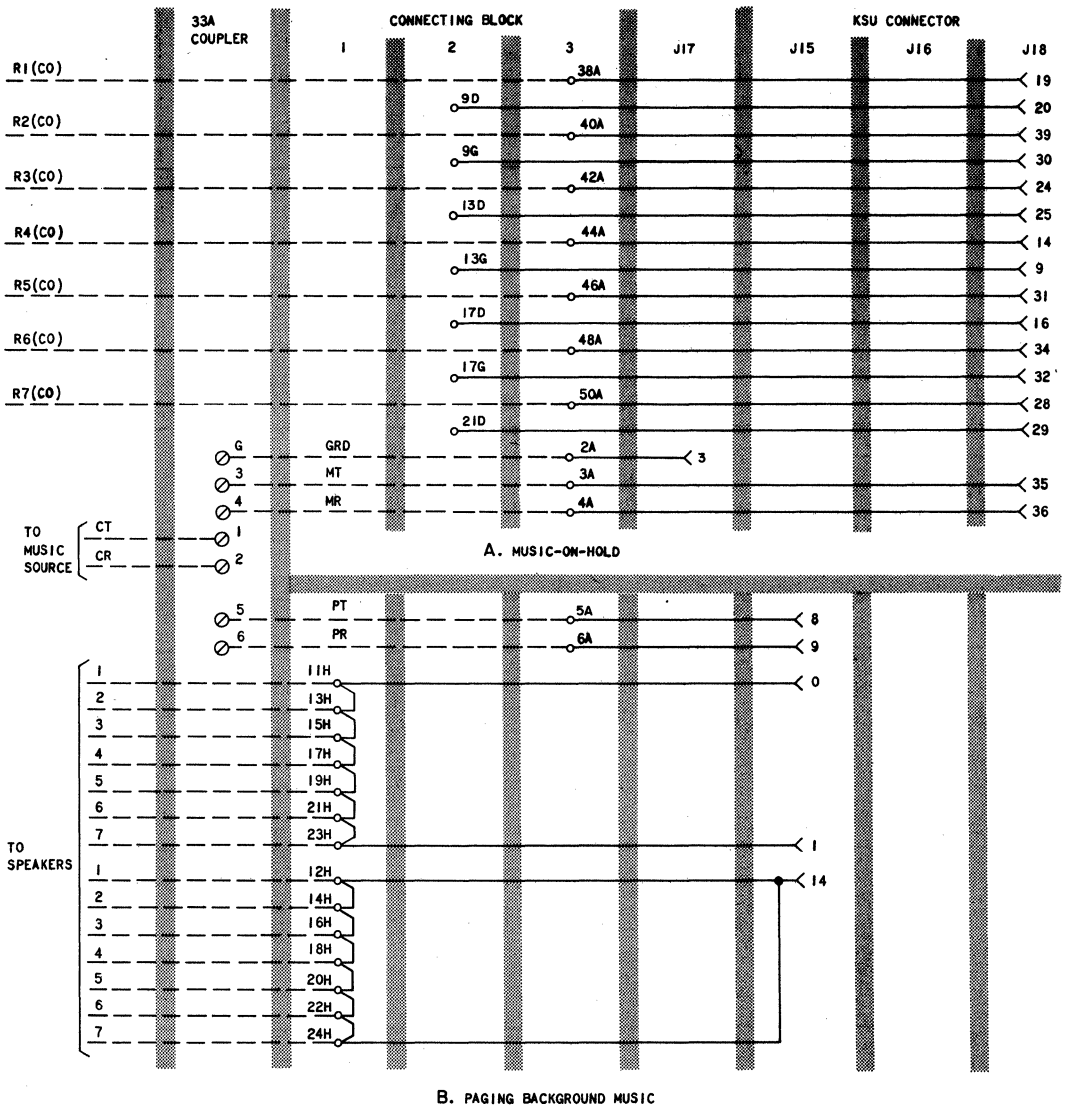


Fig. 72—Music-On-Hold and Background Music (570A KSU)

TABLE AL

LEAD TABLE – 498A KTU EQUIPPED WITH 116A1CM

LEAD DESIG	FUNCTION	KSU/CONNECTOR PIN NO.
MT	Music tip – tip side of music source input – through 33A voice coupler	J18-12
MR	Music ring – ring side of music source input – through 33A voice coupler	J18-38
R (STA)	Ring (Station) – multiple of ring side of line toward station	J18-37, 19, 39, 16, 30, 31, 32
T (STA)	Tip (Station) – multiple of tip side of line toward station	J18-34, 36, 35, 14, 11, 13, 33
L	Lamp – multiple of lamp lead toward station	J18-0, 24, 23, 20, 28, 27, 29
A	A lead – multiple of A lead toward station	J18-21, 25, 22, 1, 8, 9, 26

TABLE AM

INPUTS AND OUTPUTS – 498A KTU

TEST FROM	TO	MON/TALK SWITCH	TEST FOR	REMARKS
INPUTS				
J18-12	J18-38	MON	Music-on-hold input	Music source connected
OUTPUTS				
J18-34	J18-37	MON	Music-on-hold output	CO/PBX line 1 on hold
J18-36	J18-19		Music-on-hold output	CO/PBX line 2 on hold
J18-35	J18-39		Music-on-hold output	CO/PBX line 3 on hold
J18-14	J18-16		Music-on-hold output	CO/PBX line 4 on hold
J18-11	J18-30		Music-on-hold output	CO/PBX line 5 on hold
J18-13	J18-31		Music-on-hold output	CO/PBX line 6 on hold
J18-33	J18-32		Music-on-hold output	CO/PBX line 7 on hold

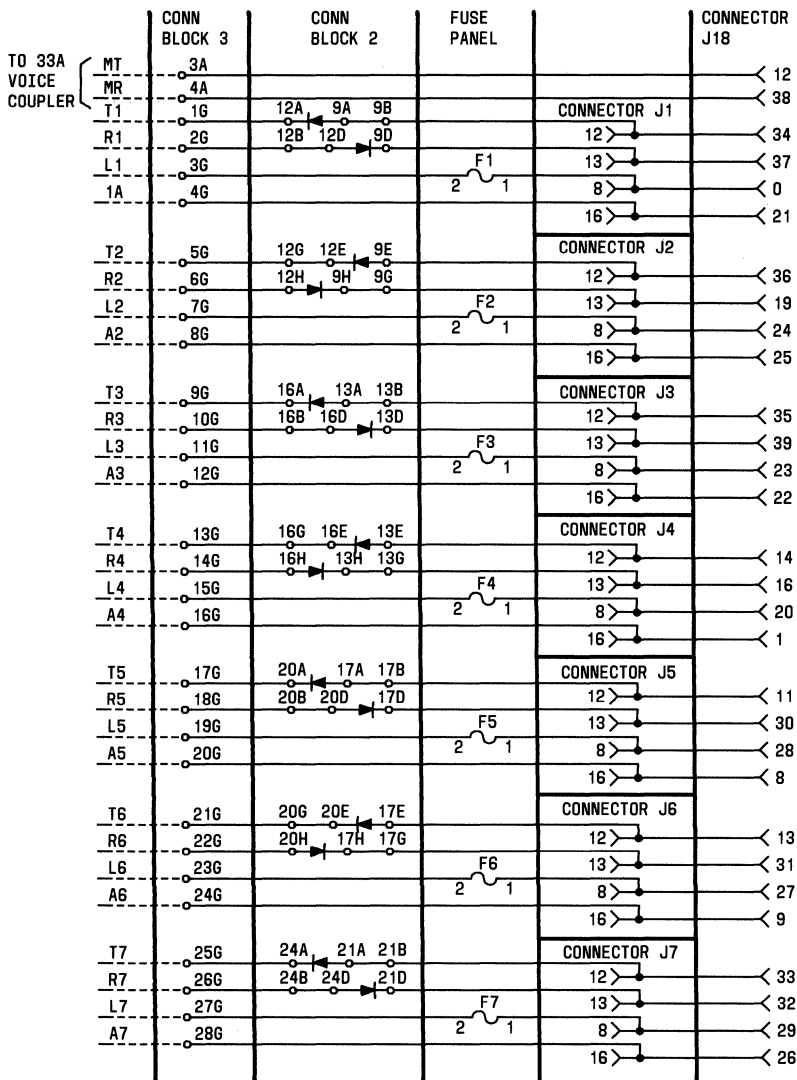


Fig. 73—Music-On-Hold (570B KSU)

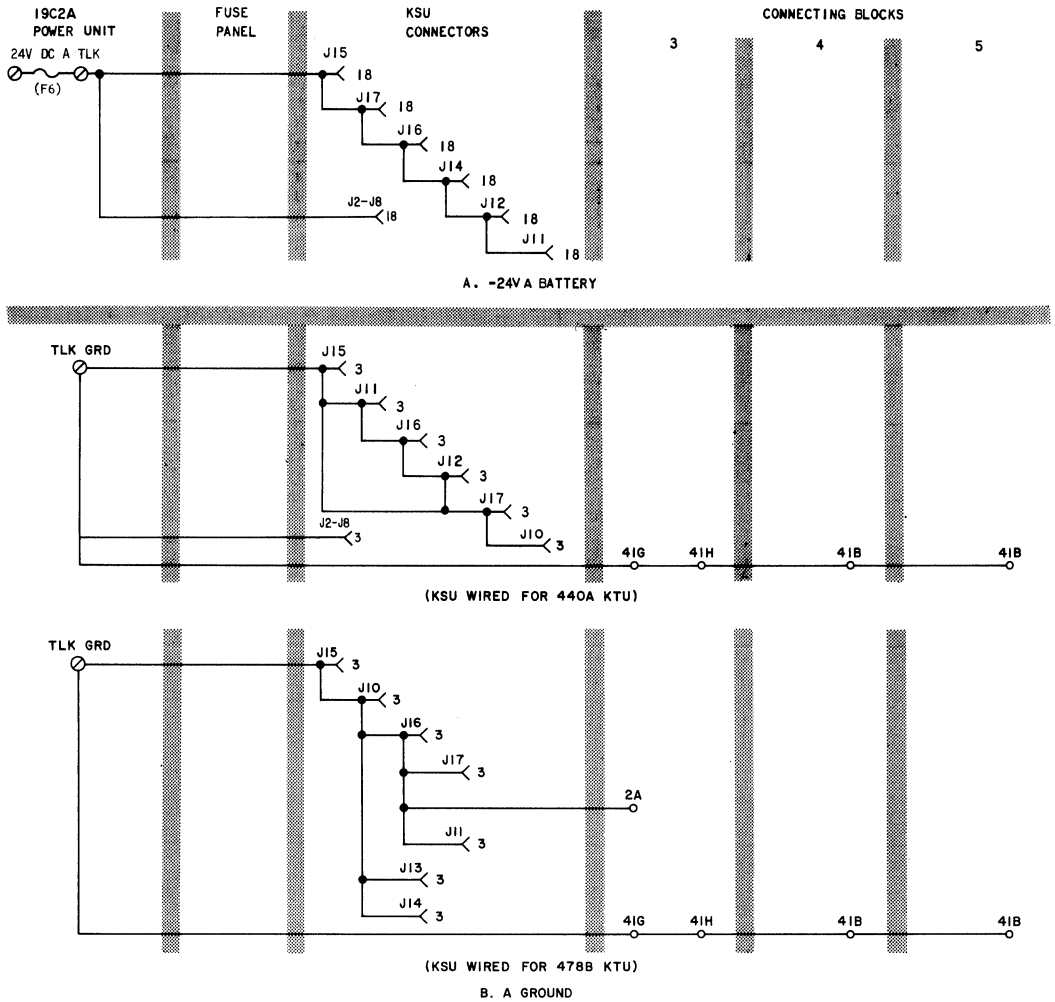


Fig. 74—Power Distribution (Sheet 1 of 6)

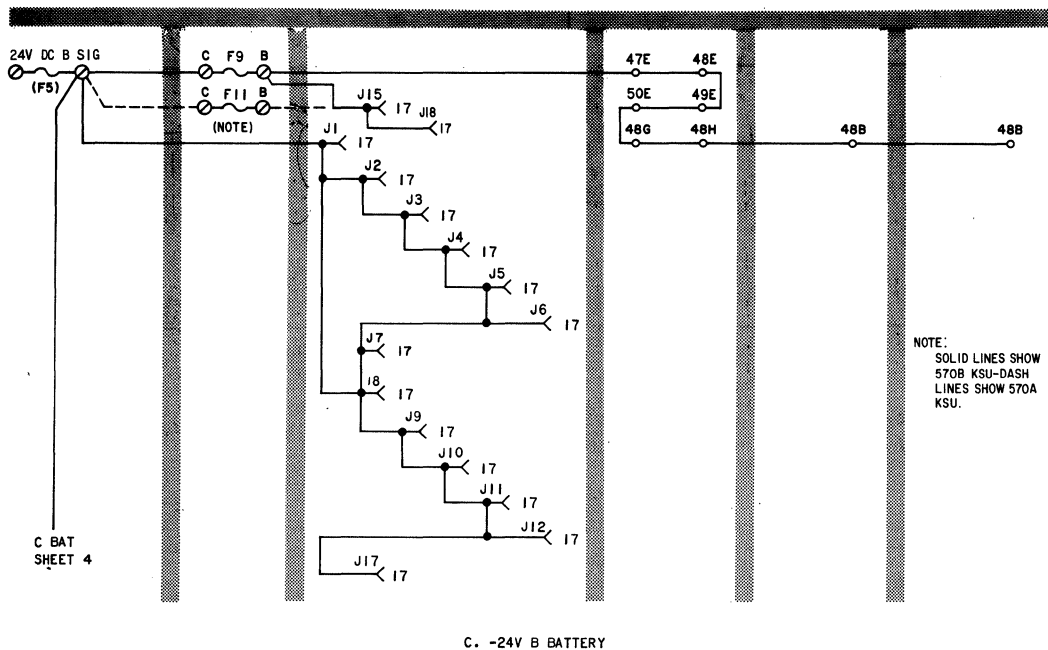


Fig. 74—Power Distribution (Sheet 2 of 6)



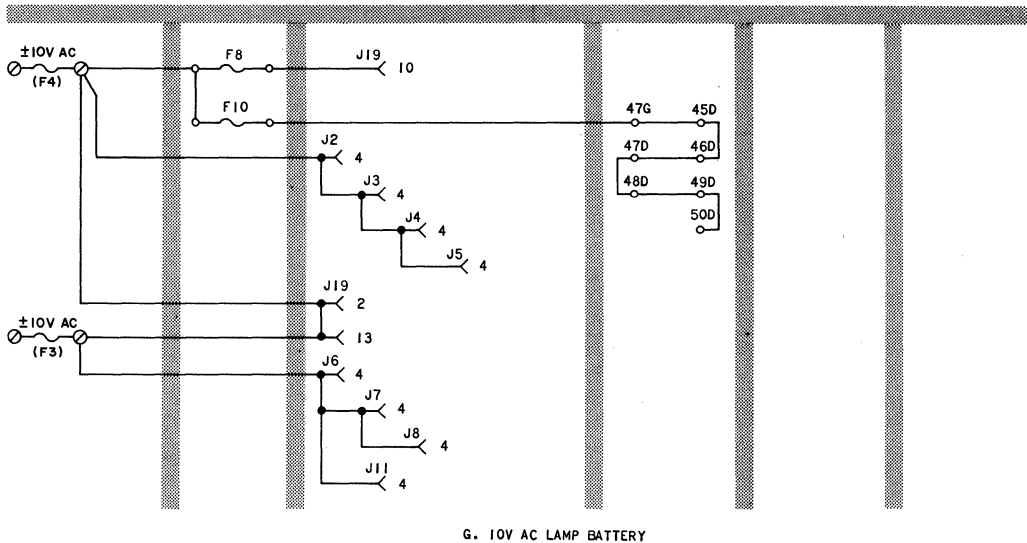
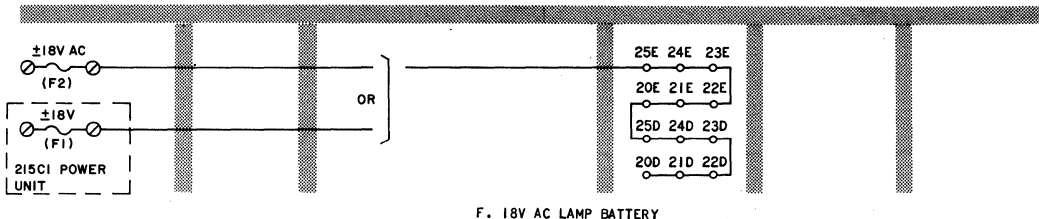
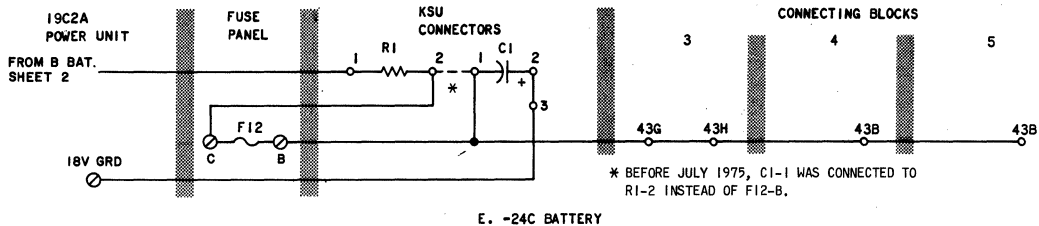


Fig. 74—Power Distribution (Sheet 4 of 6)







19C2A  
POWER SUPPLY

FUSE  
PANEL

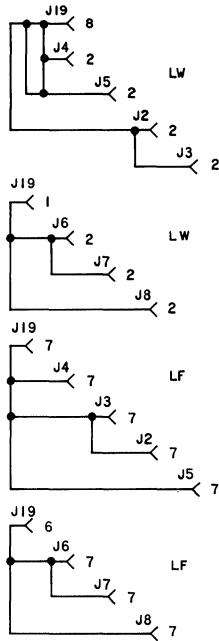
KSU  
CONNECTOR

CONNECTING BLOCKS

3

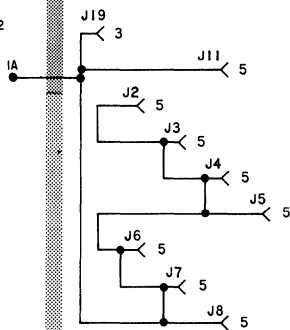
4

5



K. STATION LAMP FUNCTIONS

CONN.  
BLOCK 2



L. MOTOR START (MS) LEAD

Fig. 74—Power Distribution (Sheet 6 of 6)

400G OPTIONS

OPT	FEATURES	
Z	TIMEOUT	SHORT TIME DELAY (APPROX 5 SECONDS)
Y	VISUAL HOLD CKT	LAMP WINK
W	AUDIBLE SIGNAL	INTERRUPTED RING

NOTES:

1. REQUIRES A MOUNTING FACILITY EQUIPPED WITH AN 18-, 20-, OR 40-PIN CONNECTOR.

2. THE STATUS OF THE RELAYS FOR ALL FUNCTIONS OF THE KTU ARE AS FOLLOWS:

RELAY	FUNCTION		
	INC RING CYCLE	ANS OR INIT CALL	HOLD
A	R	0	R
B	0	R	0
C	R	0	0
L	0*	R	0

R = RELEASED  
 0 = OPERATE  
 \* = FOLLOWS RINGING

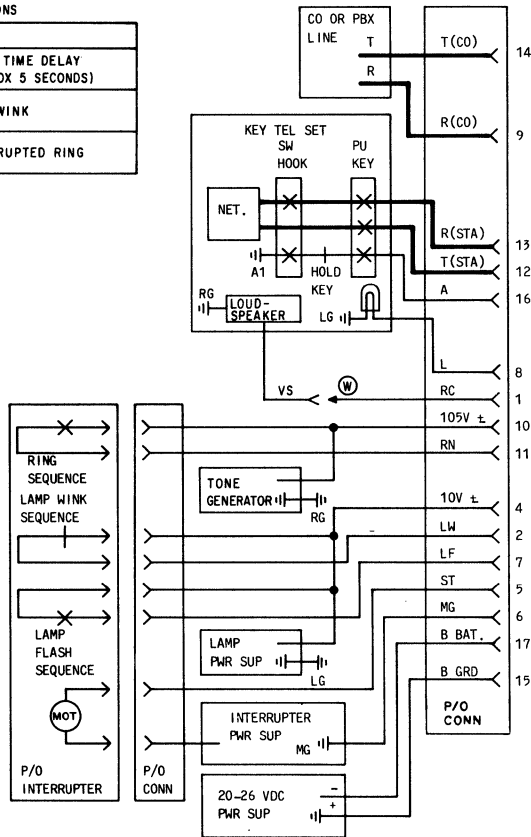


Fig. 75—Condensed Functional Schematic of 400G KTU (CO/PBX Line Circuits) (Sheet 1 of 2)

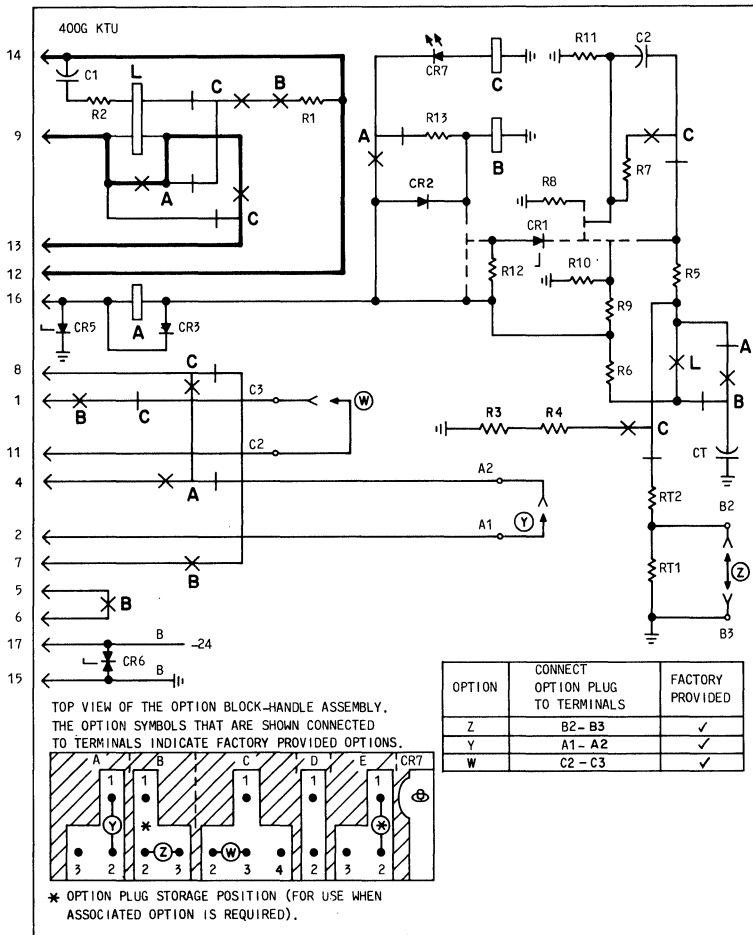


Fig. 75—Condensed Functional Schematic of 400G KTU (CO/PBX Line Circuits) (Sheet 2 of 2)

OPTIONS

OPT	FEATURES		
T*	CO OR PBX LINE CIRCUIT		
W*	INTERRUPTED RING		
V	AUDIBLE SIGNAL	COMMON AUDIBLE WITH GROUND FOR RELAY CONTROL	
S*	HOLD CIRCUIT RELEASE	LONG HOLD ABANDON TIMEOUT (FOR ESS #1, ESS #2, 812 PBX, 770 PBX, DIMENSION PBX)	
R		SHORT HOLD ABANDON (FOR ALL OTHERS)	
Y †	TIME OUT	WITH	14 SECONDS
		WITHOUT	6 SECONDS

\*FACTORY INSTALLED

†AW OPTION PLUG IS NOT PROVIDED. USE KS21290, L7 OPTION PLUG COU CODE 841-732-613

NOTES:

1. REQUIRES A MOUNTING FACILITY EQUIPPED WITH AN 18-, 20-, OR 40-PIN CONNECTOR.
2. THE STATUS OF THE RELAYS FOR ALL FUNCTIONS OF THE KTU ARE AS FOLLOWS:
3. R109 AND Q105 PROVIDE ON ISSUE 2 OR LATER
4. T-OPTION ISSUE 1 ONLY. OPTION PLUGS J1 AND J2 HAVE BEEN REMOVED ON ISSUE 2 OR LATER
5. NOT PROVIDED ON ISSUE 2 OR LATER

RELAY	FUNCTION		
	INCOMING RING-CYCLE	ANSWERING OR INITIATING CALL	HOLD
R	0	RL	RL
H	RL	RL	0

RL - RELEASED  
0 - OPERATED

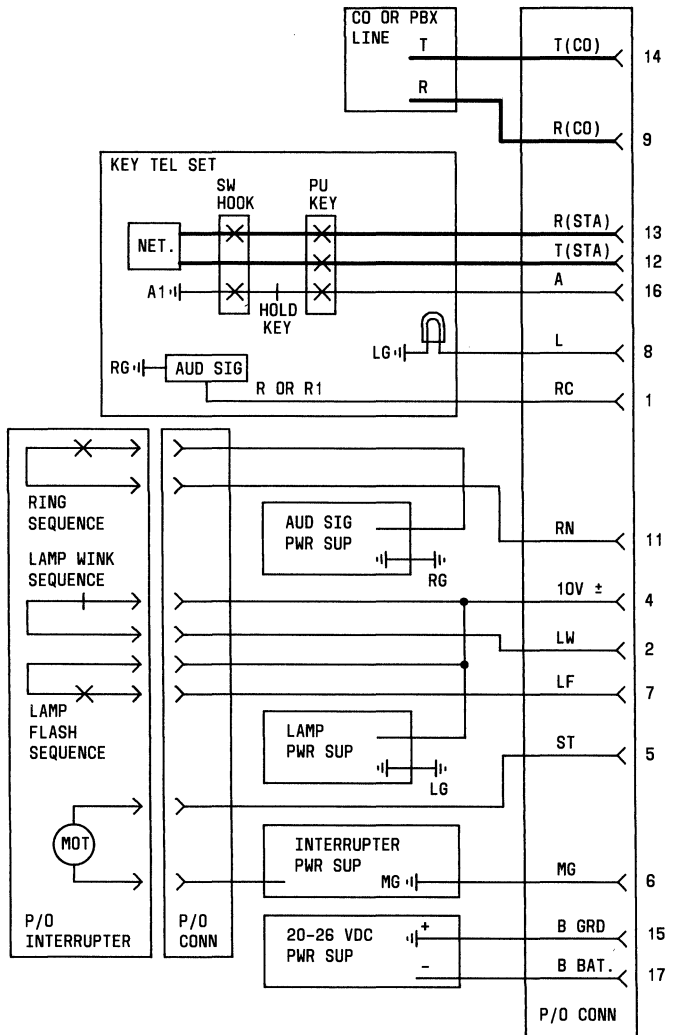


Fig. 76—Condensed Functional Schematic of 400H KTU (CO/PBX Line Circuit) (Sheet 1 of 2)

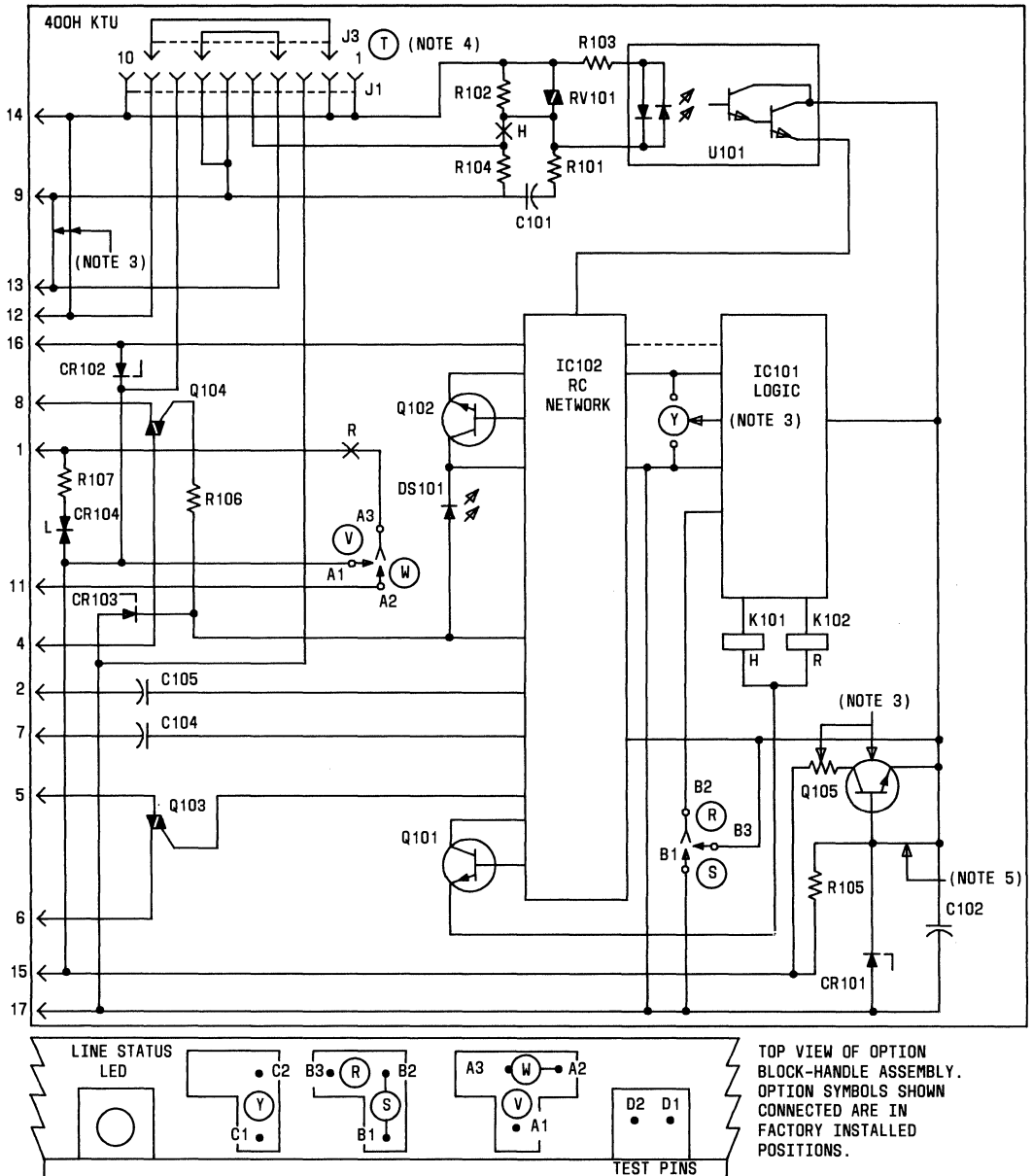


Fig. 76—Condensed Functional Schematic of 400H KTU (CO/PBX Line Circuit) (Sheet 2 of 2)

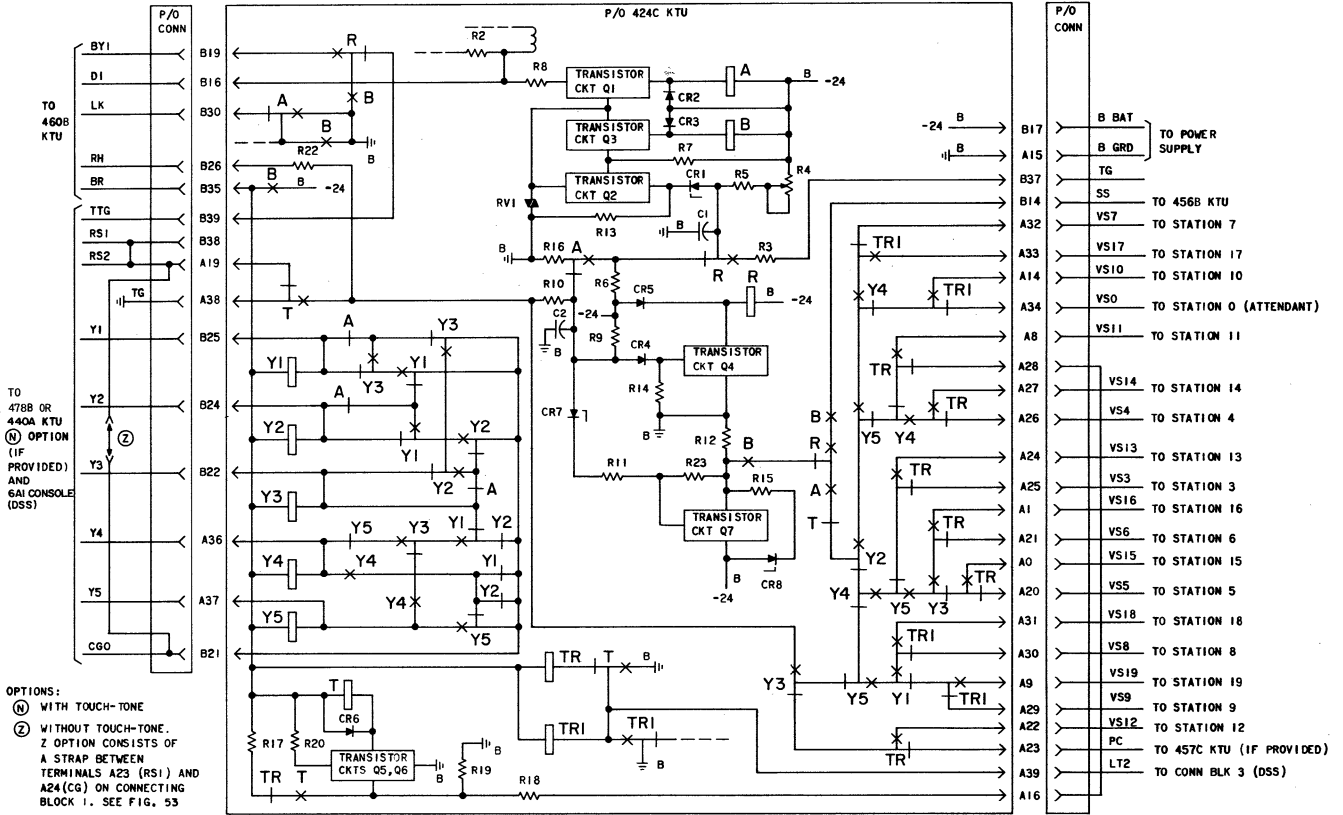


Fig. 77—Condensed Functional Schematic of 424C KTU (Dial Intercom 19-Code Selector Circuit)





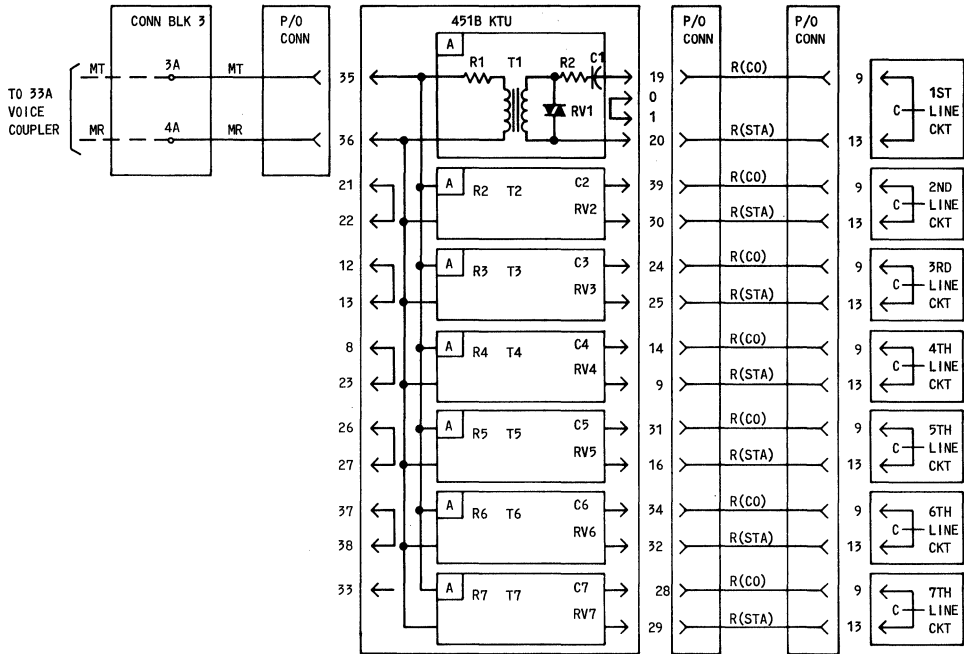


Fig. 79—Condensed Functional Schematic of 451B KTU (Music-On-Hold Circuit)

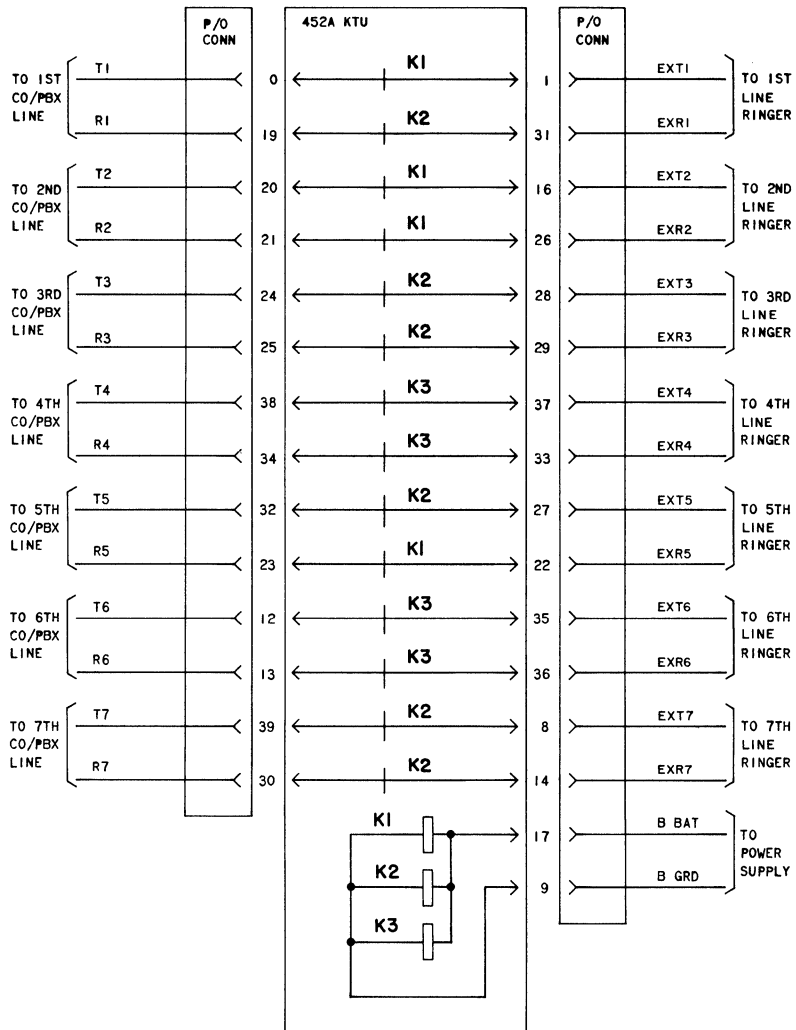


Fig. 80—Condensed Functional Schematic of 452A KTU (Power Failure Transfer Circuit)

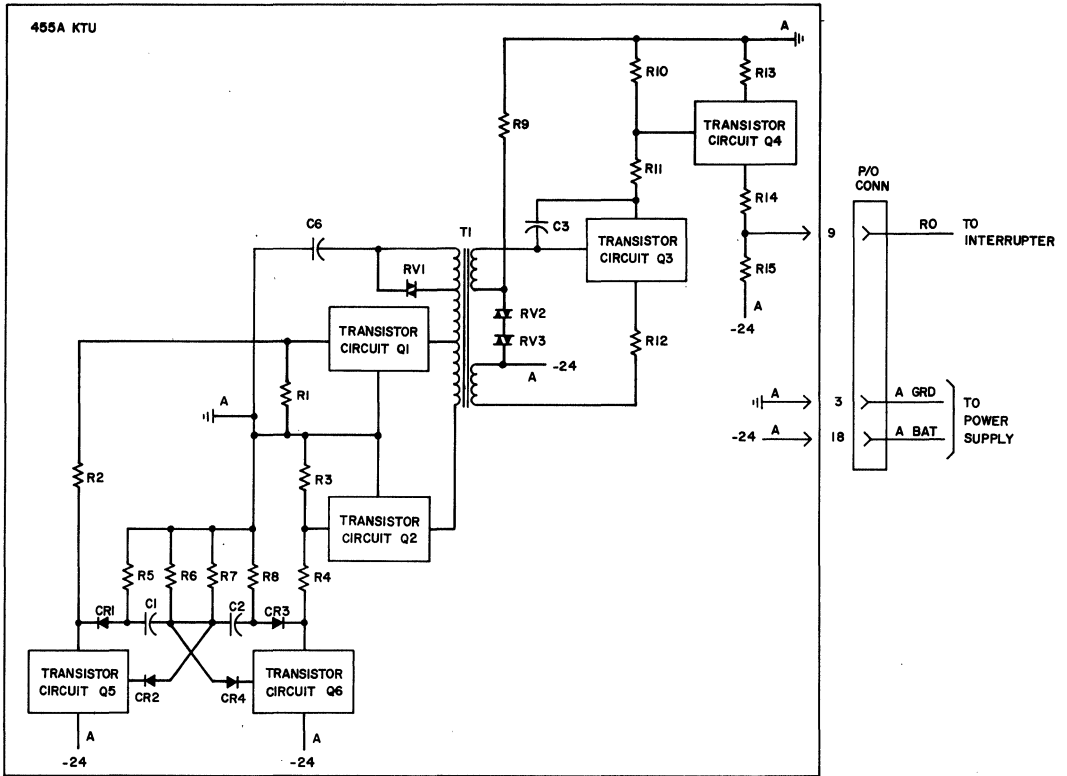


Fig. 81—Condensed Functional Schematic of 455A KTU (Tone-Ringing Signal Generator Circuit)

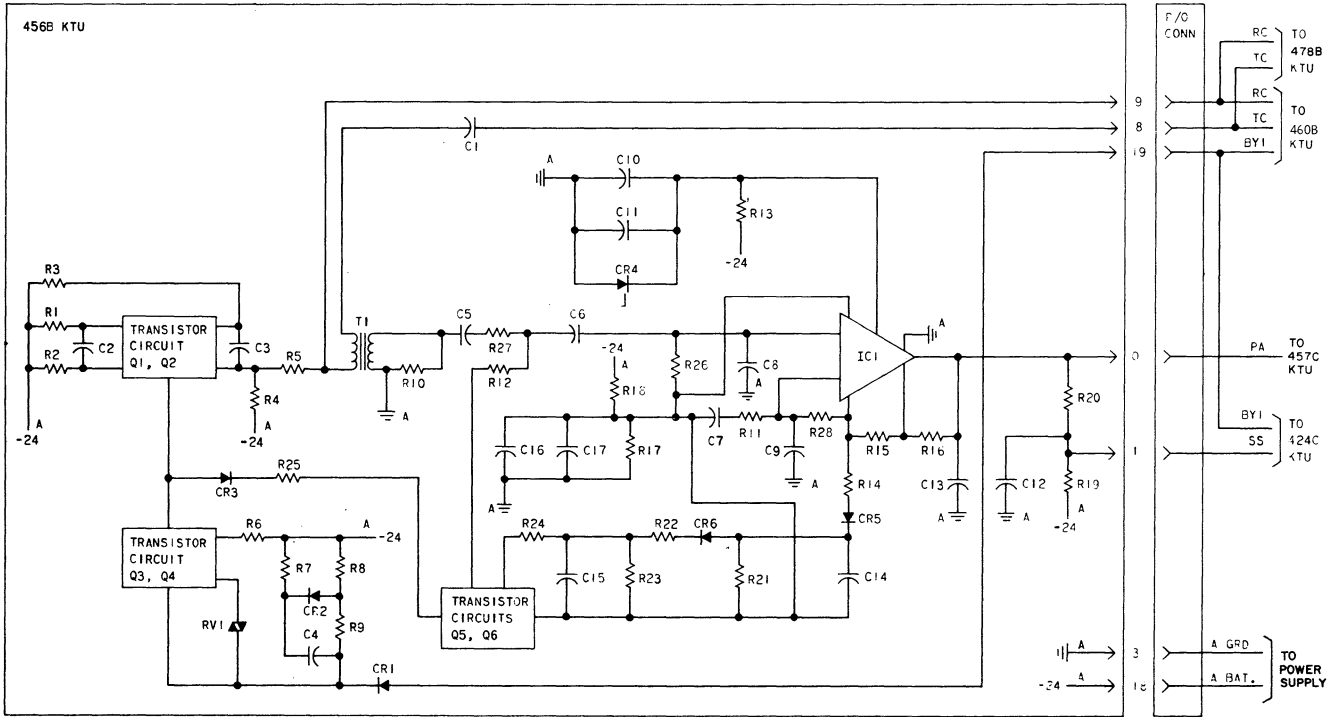


Fig. 82—Condensed Functional Schematic of 456B KTU (Voice and Tone Alerting Circuit)



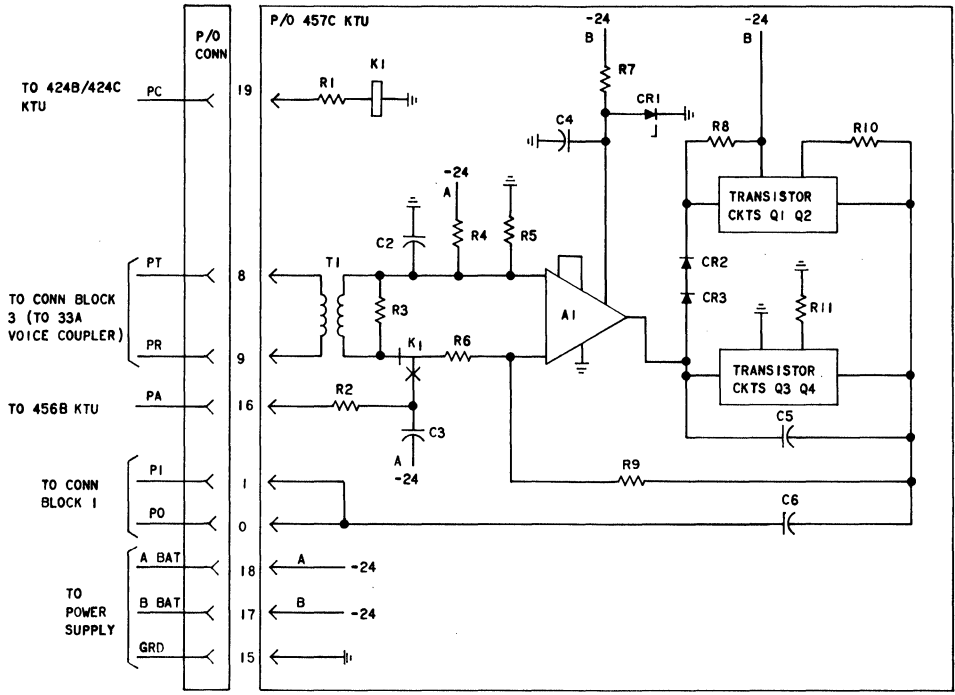


Fig. 83—Condensed Functional Schematic of 457C KTU (Paging Amplifier Circuit)

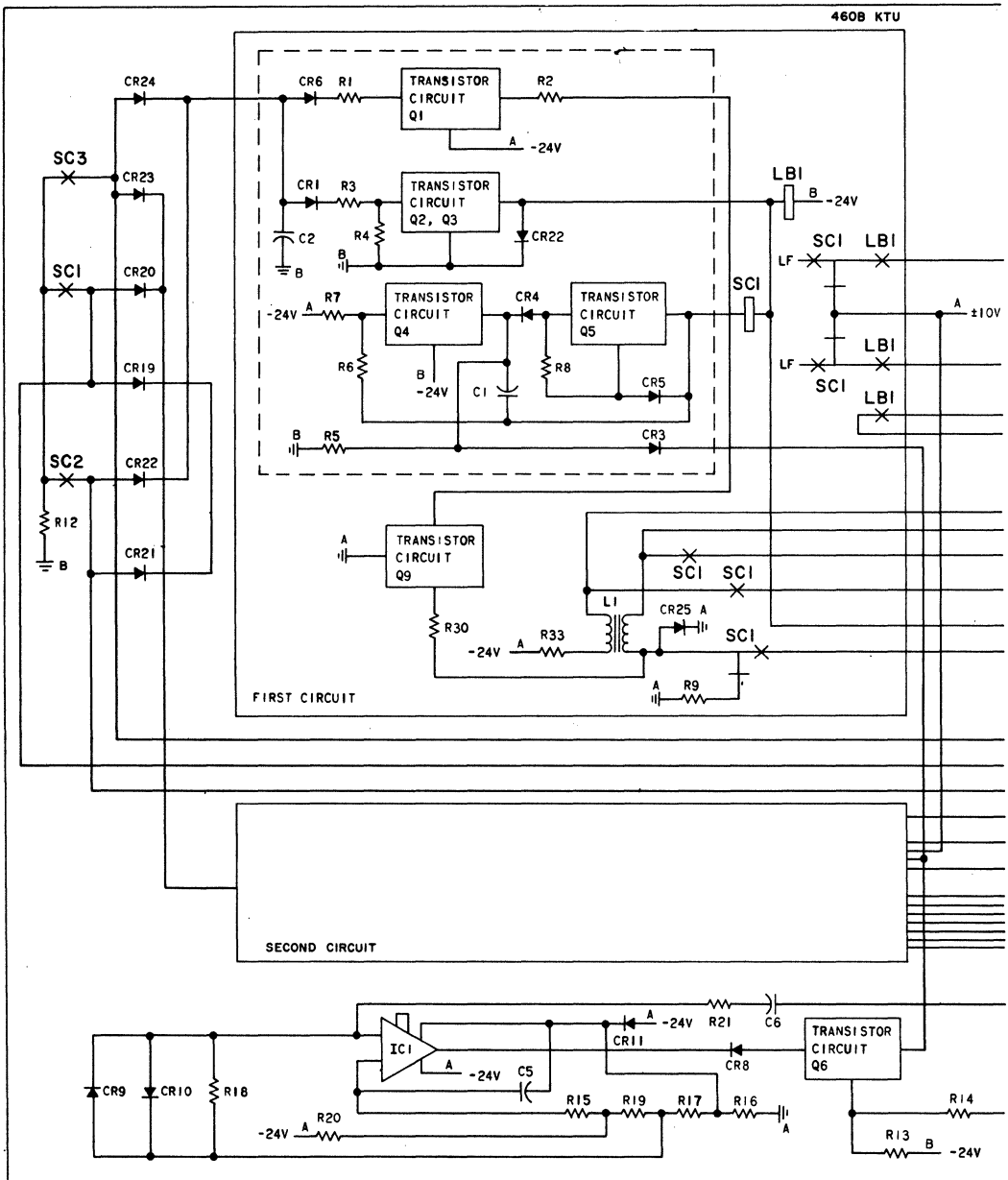


Fig. 84—Condensed Functional Schematic of 460B KTU (2-Path Intercom Access Circuit) (Sheet 1 of 2)



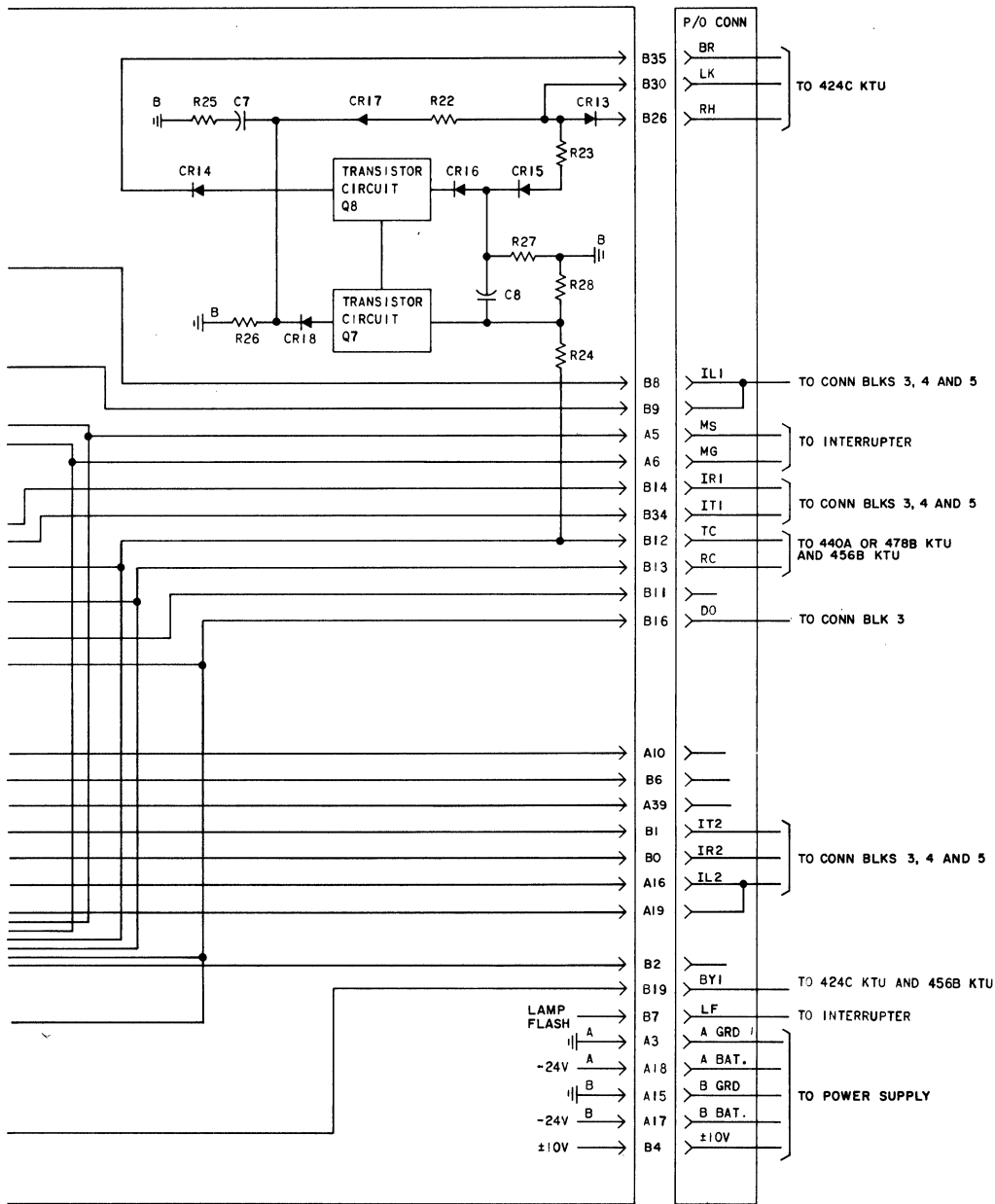


Fig. 84—Condensed Functional Schematic of 460B KTU (2-Path Intercom Access Circuit) (Sheet 2 of 2)

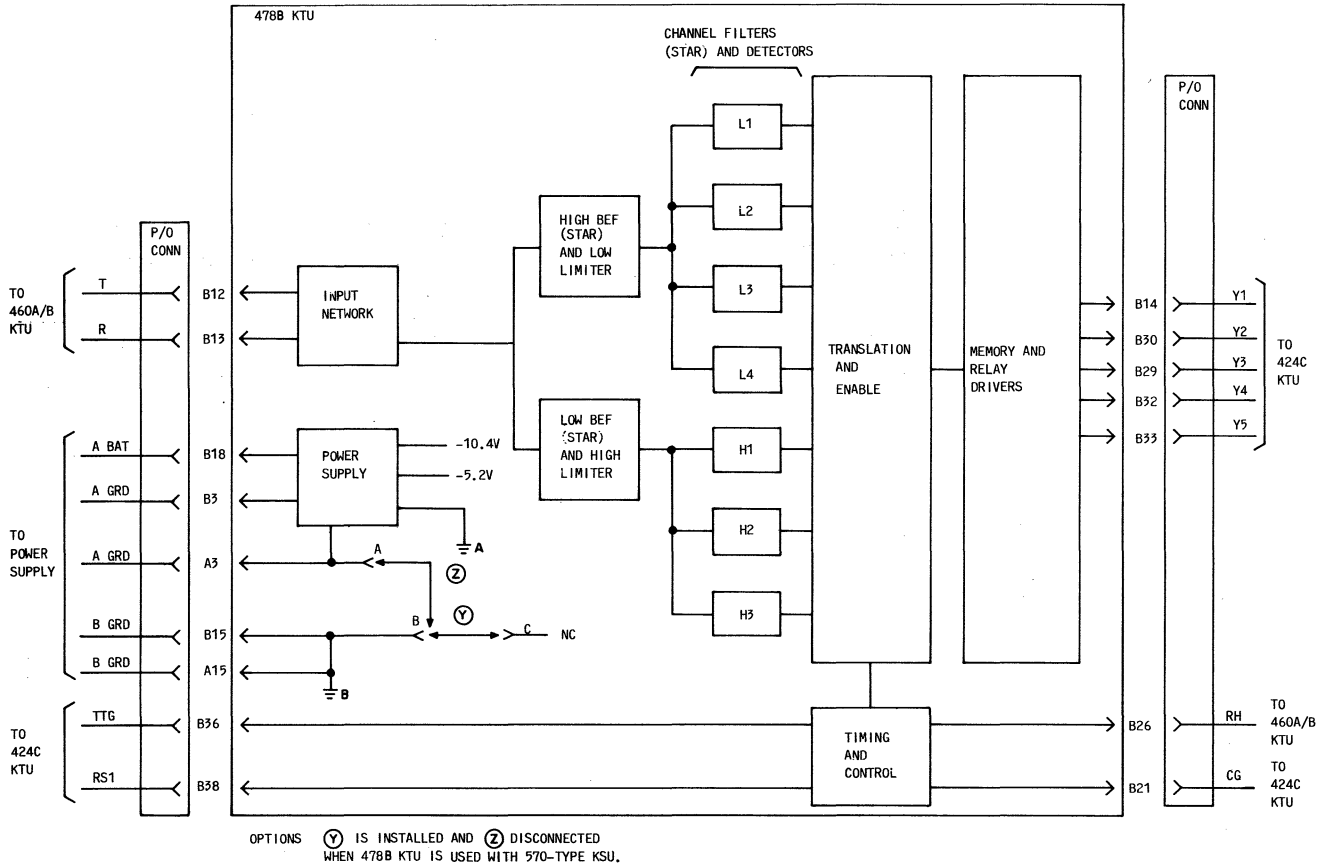


Fig. 85—Condensed Functional Schematic of 478B KTU (TOUCH-TONE Adapter Circuit)



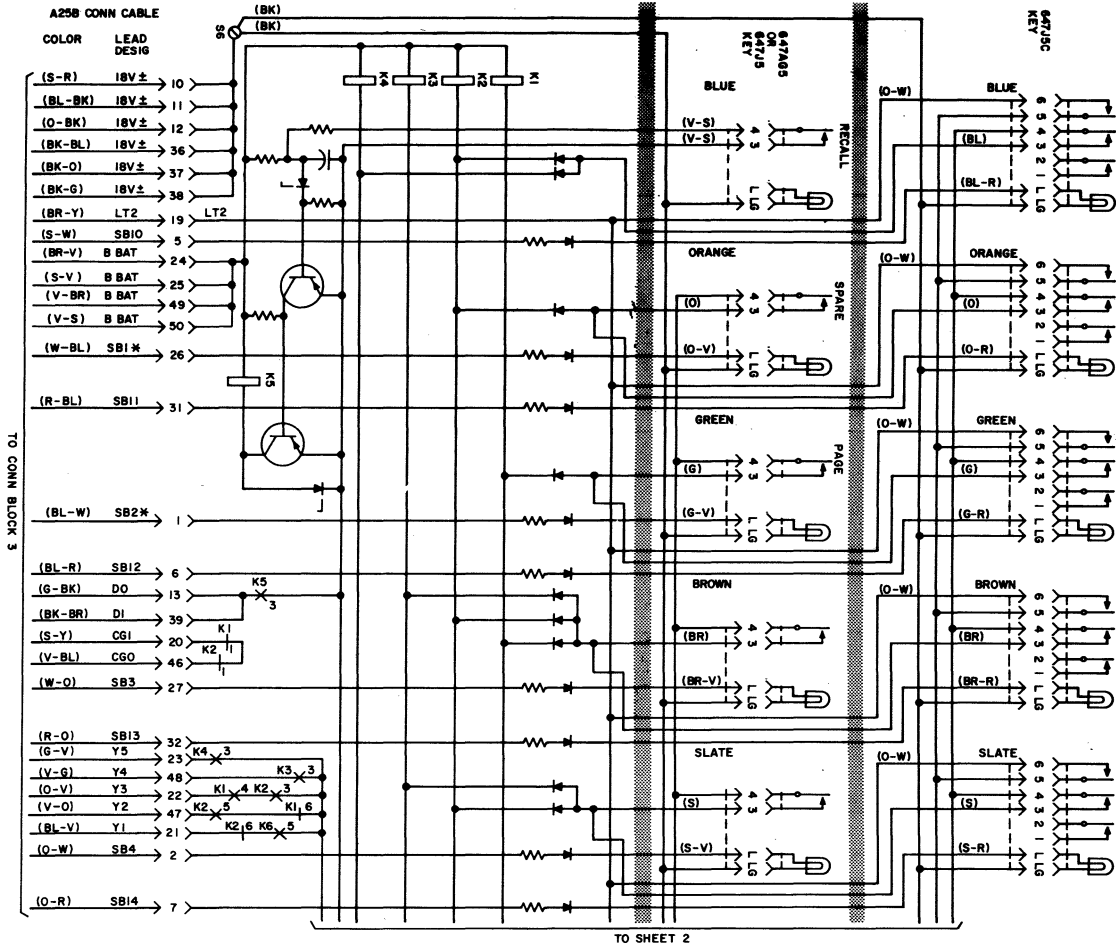


Fig. 87—6A1 Station Busy Console With DSS, Schematic (Sheet 1 of 2)

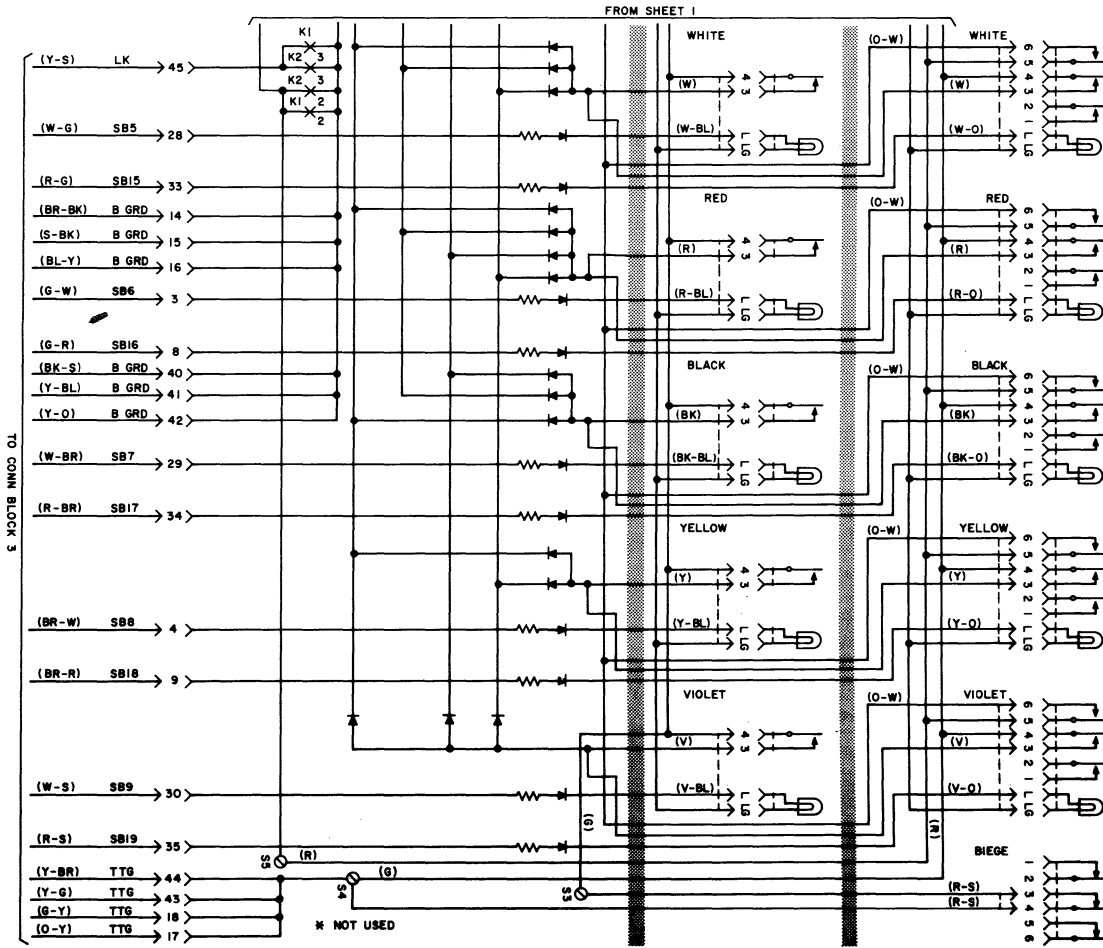


Fig. 87—6A1 Station Busy Console With DSS, Schematic (Sheet 2 of 2)

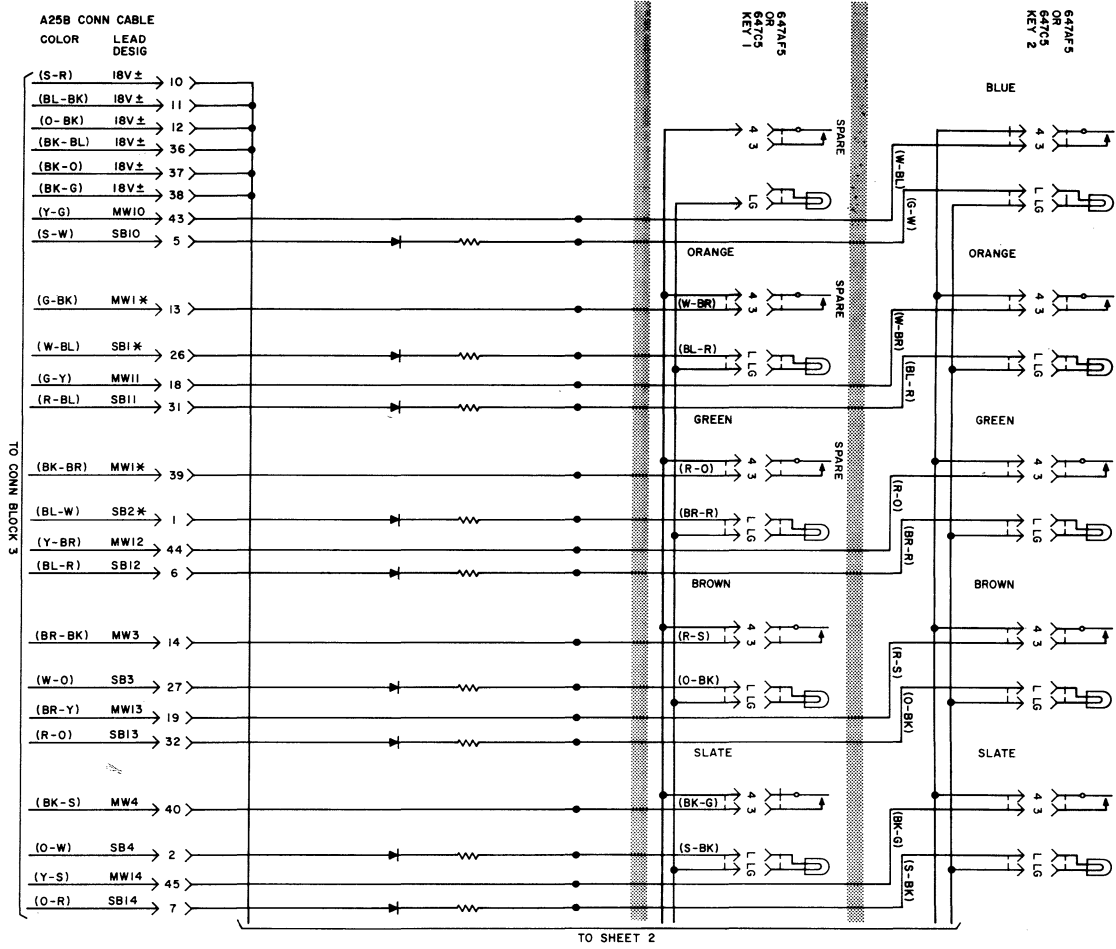


Fig. 88—6B1 Station Busy Console With MW, Schematic (Sheet 1 of 2)

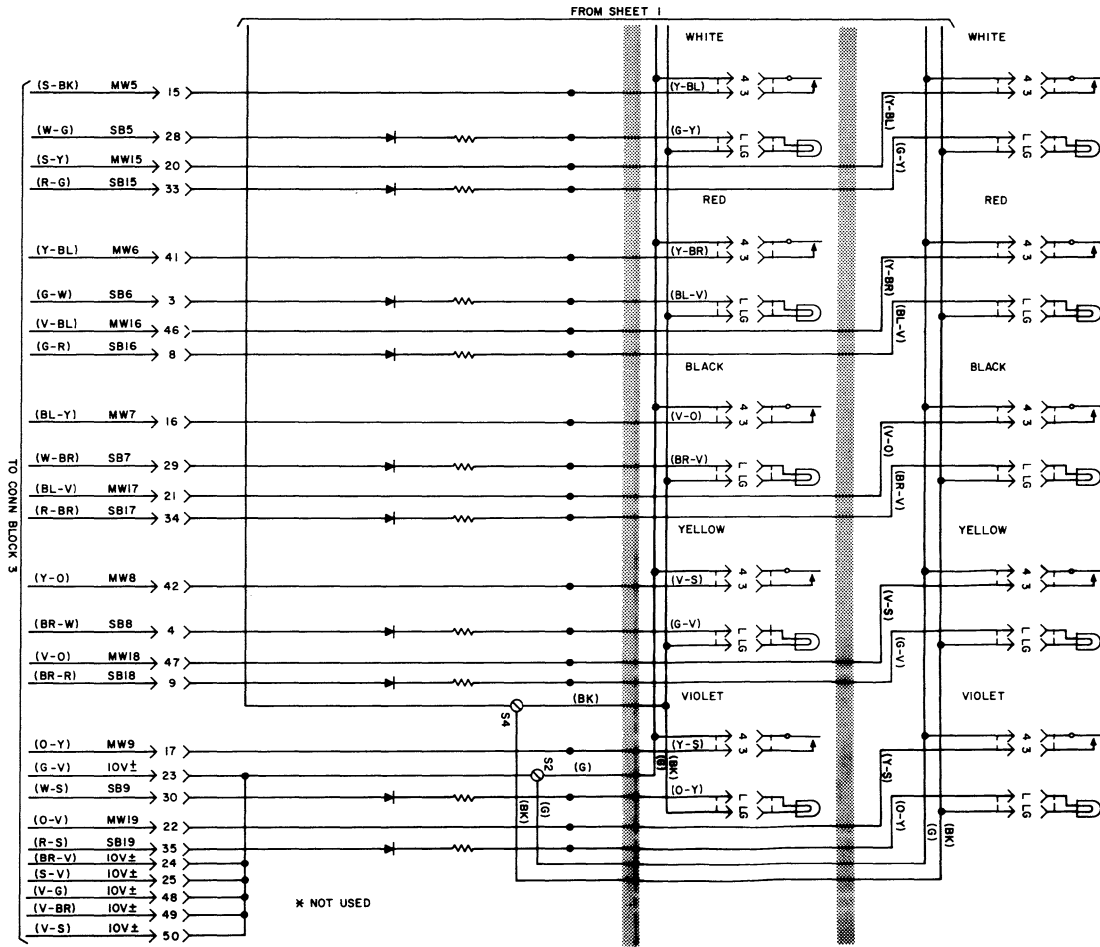


Fig. 88—6B1 Station Busy Console With MW, Schematic (Sheet 2 of 2)





## 14A COMMUNICATION SYSTEM (COM KEY\* 1434)

### 1. GENERAL

**1.001** This addendum supplements Section 518-450-102, Issue 3. Place this pink sheet ahead of Page 1 of the section.

**1.002** This addendum is reissued to:

- Provide additional information related to the Federal Communications Commission's (FCC) Registration Program
- Revise information supplied in Issue 1 of the addendum.

**1.003** This addendum was issued to add information on the treatment of central office (CO) lines under the FCC Registration Program and to add the output capacity of the 457C KTU (Paging Amplifier Circuit).

### 2. CHANGES TO SECTION

#### Issue 1 Changes

**2.001** On Page 3, after paragraph 1.05, add the following paragraph:

**1.06** Incoming CO lines to be installed in compliance with the FCC Registration Program must

be routed through a standard network interface. Information on approved interfaces is contained in Sections 463-400-100 through 463-400-150.

**2.002** On Page 21, at the end of paragraph 2.35, add the following: The output of the 457C KTU is 3 watts of peak power.

#### Issue 2 Changes

**2.003** Revise paragraph 1.06 as follows:

**1.06** The 14A Communication System has not been registered with the FCC and new systems will not be manufactured after January 1, 1980. Also after January 1, 1980, connection of customer-provided equipment (CPE) or telephone company-provided equipment to the 14A Communication System requires the use of a 33B voice coupler when providing music-on-hold and the 415C, 454C, 471C, and 479C key telephone units (KTUs) must be used when providing related services. Previously connected or Class C system components may be used for additions and maintenance at grandfathered installations for the life of the equipment, provided they are not modified. Class C components may also be used in new installations after January 1, 1980.

\*Trademark of AT&T.

#### NOTICE

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Bell System except under written agreement

**14A. COMMUNICATION SYSTEM**  
**(COM KEY\* 1434)**

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6. ELECTRICAL MAINTENANCE . . . . .	91	1. GENERAL	
CO/PBX LINE CIRCUITS . . . . .	92	1.01 This section contains identification, installation, connection, operation, and maintenance information for the 14A Communication System.	
STATION LINE RINGING ARRANGEMENTS . . . . .	92	1.02 This section is reissued to:	
INTERCOM CIRCUITS . . . . .	94	• Add information on the 580B key service unit (KSU) and show the 580A KSU rated MD	
A. Selector Circuit . . . . .	95	• Add information on the KS-21939,L2 loudspeaker which replaces the KS-16846,L2,	
B. TOUCH-TONE Adapter Circuit . . . . .	95		
C. Selector Extender Circuit . . . . .	96		

and change code of K8 loudspeaker to KS-21880,L1

- Add D-180759 kit of parts for installing 215C1 power unit
  - Show new method, using nomograph, for determining number of additional leads required in satellite installations
  - Add satellite information using 14A1-type terminal blocks
  - Add information on new music-on-hold circuit [498A KTU and 116A1 circuit module (CM)]
  - Add 400G and 400H KTUs
  - Add use of 415A KTU in 580B KSU
  - Delete two optional features and add these as basic features (Recall and Ring Transfer) in Part 4.
- CD- and SD-69655-01, Issue 2—833A and 2833A Telephone Circuits for Use With 14A Communication System
  - CD- and SD-69657-01, Issue 2—7A1, 7B1, and 7C1 Station Busy Selector Consoles for Use With 14A Communication System, 21A Communication System, 1A2 Key Telephone System
  - CD- and SD-69915-01, Issue 1—7A or 14A Communications System Customer Paging System Interface Circuit
  - CD- and SD-69922-01, Issue 2 —Audio Features, 451-Type and 498A KTU
  - CD- and SD-69924-01, Issue 1—7A Communication System External Signaling Circuit
  - CD- and SD-69931-01, Issue 1—TOUCH-TONE® Adapter Circuit
  - CD- and SD-69942-01, Issue 1—400H KTU

### 1.03 Further information may be found in:

- 463-341-102—Protective Connecting Arrangement FTP (33A Voice Coupler, SD-69911-01)
- 503-603-120—575AM and 2575AM Telephone Sets; Identification, Installation, Connections and Maintenance
- 503-701-110—832- and 2832-Type Telephone Sets; Identification, Installation, Connections and Maintenance
- 503-702-110—833- and 2833-Type Telephone Sets; Identification, Installation, Connections and Maintenance
- 512-620-487—Speakerphone System—3-Type; 832-, 833-, 2832- and 2833-Type Telephone Sets, Connections
- 512-740-471—Speakerphone System 4A; 832-, 833-, 2832- and 2833-Type Telephone Sets
- 518-010-105—Key Telephone System—Grounding and Special Protection Requirements
- CD- and SD-69653-01, Issue 3 —14A Communication System Circuit

If this section is to be used with equipment or apparatus reflecting a later issue of the drawing(s), reference should be made to the CDs and SDs to determine the extent of the changes and the manner in which the section may be affected.

**1.04** In installations which require more than 18 stations but no more than 7 CO/PBX lines, refer to Section 518-450-103. This section details the use of 832- or 2832-type telephone sets with a 580-type KSU (COM KEY 734).

**1.05** Condensed functional schematics of consoles and key telephone units are located at the end of this section.

## 2. DESCRIPTION OF APPARATUS

**2.01** The 14A Communication System will accommodate a maximum of 14 CO/PBX lines and 34 stations. It is wired for a 3-path intercom. A 580-type KSU houses the power supplies and KTU mountings. Telephone sets (833- and 2833-type) are special 20-button desk and wall sets providing basic services such as pickup, hold, recall, illumination, voice and tone signaling, multiline conferencing, and automatic button restoration (ABR). Optional system features are privacy

(lockout), privacy release, station restriction, loudspeaker paging (with or without background music), power failure ringing, music-on-hold (utilizing a customer-provided music source), intercom preset conference, station busy console with direct station selection (DSS), station busy console with message waiting (MW), TOUCH-TONE adapter, speakerphone, external signaling circuit, and connection to a customer-owned and maintained (COAM) paging system.

**2.02** In the 14A Communication System, each station has access to all CO/PBX lines and the three intercom paths. One station, selected as the attendant station (intercom code 0), is the only station factory-wired in the KSU for CO/PBX ringing on a common audible basis. Options are provided to permit CO/PBX lines to ring at other stations. ♦A maximum of three stations can be equipped with consoles to serve as attendant stations. The second and third attendant stations can be assigned any intercom code from 7 to 39.♦

**2.03** As factory-wired, incoming calls on the CO/PBX lines are answered at the attendant station. The attendant ascertains the person or station being called and places the incoming call on hold. The attendant may then page the called party, or dial the called station over an intercom path, to announce the incoming call. The attendant may reenter the call by depressing the associated CO/PBX line button.

**2.04** The attendant station (station code 0) is the only station that can divert its common audible ring via the optional ring transfer (formerly referred to as night transfer) feature.

**2.05** Any station may be optionally wired for CO/PBX ringing on a single line or for common audible ringing. Ringing is tone signaling. Stations cannot be wired for both common audible and CO/PBX ringing. In the 14A Communication System, as many as 10 stations may be wired for common audible ringing.

**Note:** To reduce C battery crosstalk, KSUs manufactured before June 1975 should be modified as shown in Fig. 81.

**2.06** Intercom station codes are 0 (attendant station) and 7 through 39. Codes 1, 2, and 3 are the first digits of the 2-digit station codes; codes 4, 5, and 6 are paging codes.

## 580-TYPE KSU

**2.07** The 580A (MD) KSU (Fig. 1 and 2) is a 120A apparatus box with a removable front and rear cover and is designed for floor mounting only (Fig. 1 and 2). It contains the following components:

- Two internally mounted power supplies and a KS-15900, L1 interrupter —
    - 29C1 power supply, SD-81877-01—refer to Section 167-446-101.
    - 67C1 power supply, SD-82090-01—refer to Section 167-454-101.
  - 15 internally mounted 66-type connecting blocks for option, station, and console connections.
  - Fuse panel (Fig. 3) which provides power distribution to connectors and station blocks.
  - Status lamps (Table A and Fig. 3) to indicate status of CO/PBX and intercom lines.
  - Designation strip holder and tab assembly serving as a retainer to lock KTUs in place.
  - 424C, 444-type, 453B, 454B, 455B, and 456B KTUs (furnished with the KSU).
  - Connectors to mount four 8-inch and twenty-five 4-inch KTUs.
  - ♦Current production (serial number 6184 and higher) wired to make 440A and 478A KTUs (TOUCH-TONE adapters) completely interchangeable.♦
- 2.08** ♦The 580B KSU is the same as the 580A except:
- All wiring for use of a 451-type KTU (music-on-hold) in J27 and J29 has been removed and replaced with wiring for the 498A KTU.
  - "C" battery has been added to J26 for future use.
  - Additional leads for planned feature additions have been brought out on terminals 1A to 15A of block 6.

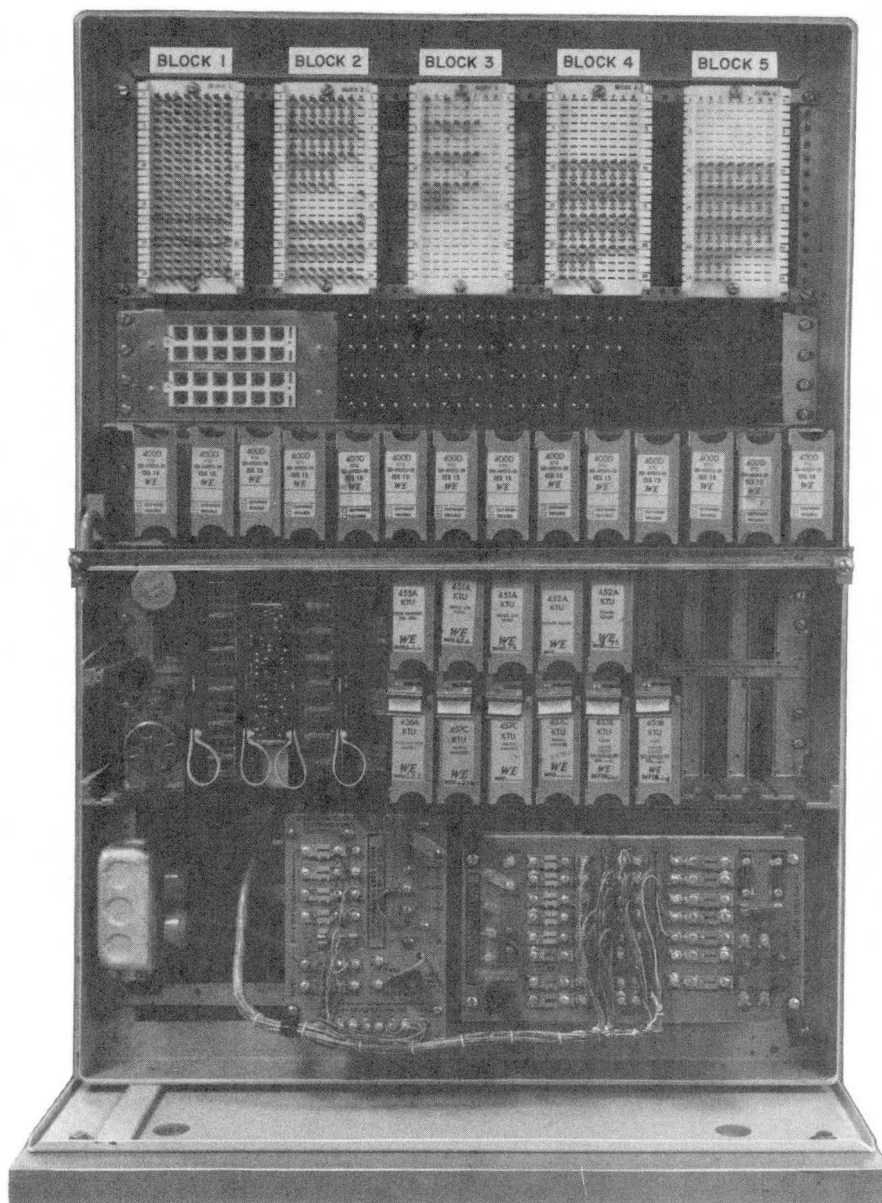


Fig. 1—580-Type KSU (Cover Removed)

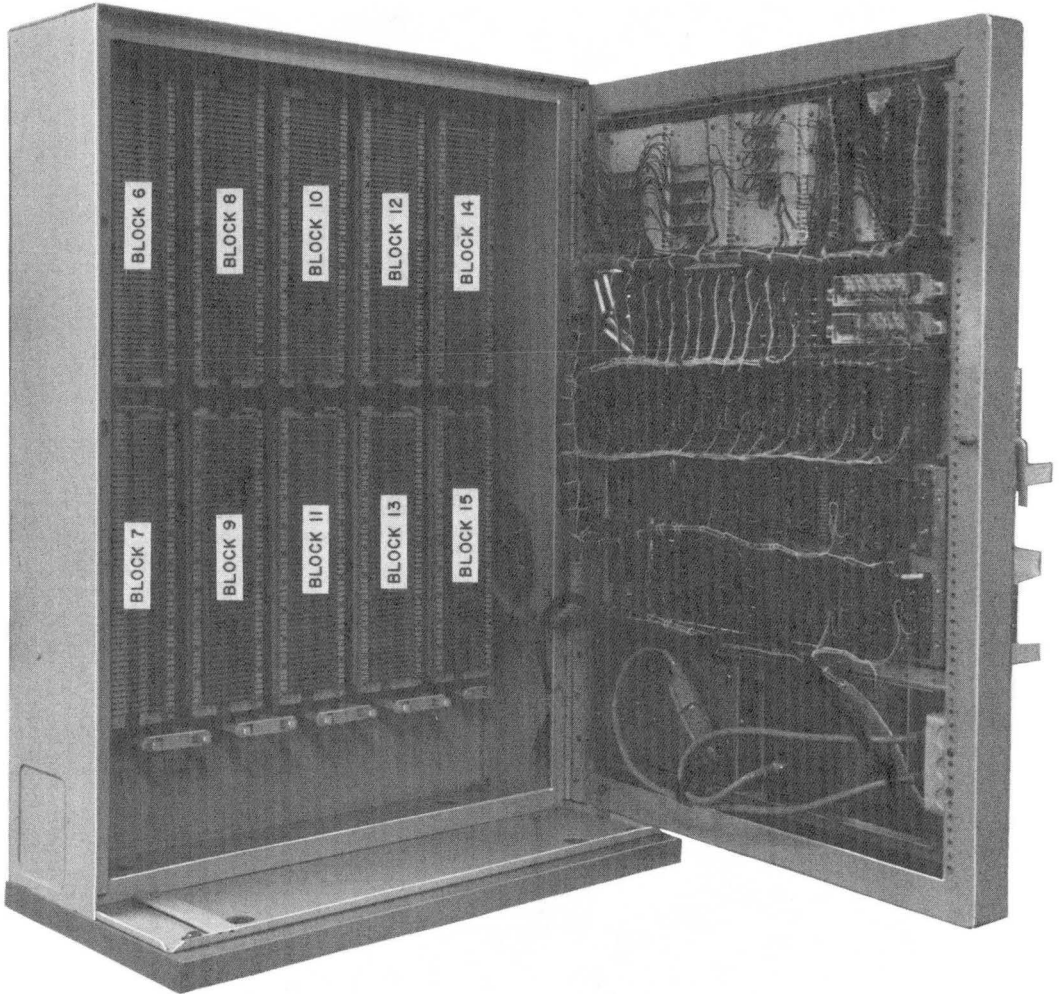


Fig. 2—580-Type KSU (Gate Open)

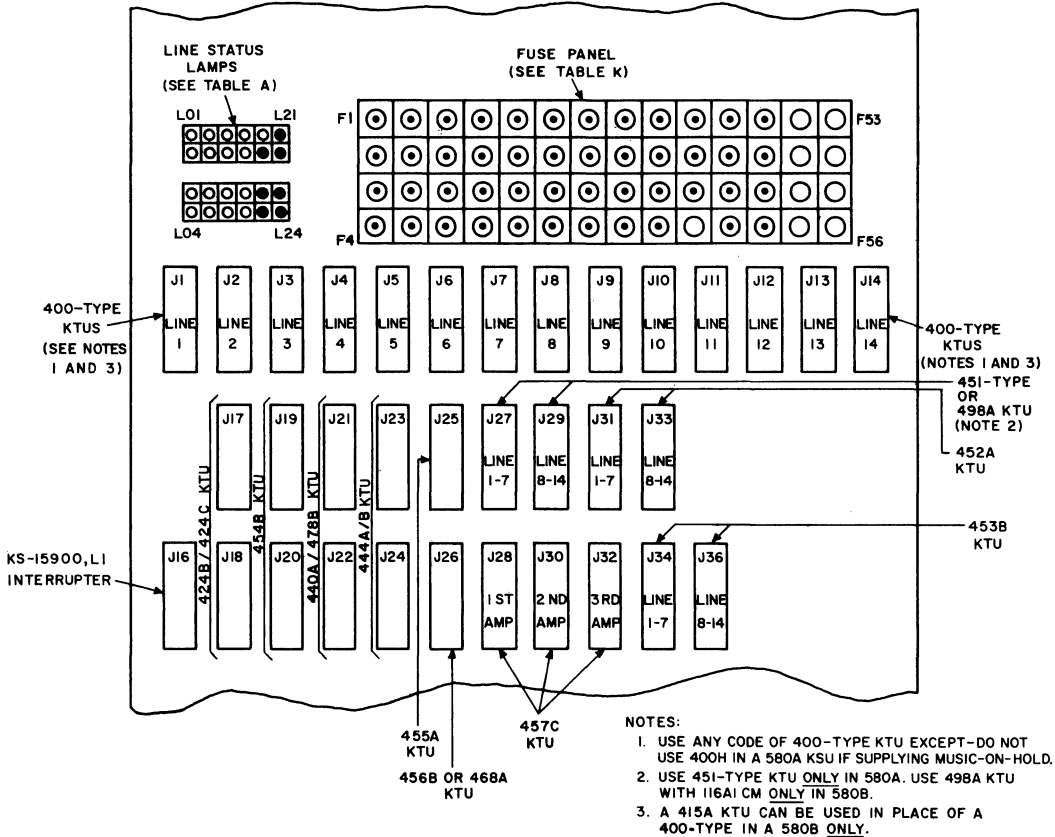


Fig. 3—580-Type KSU, Fuse Panel, Lamp Panel, and KTU Connector Arrangement

- “A” battery and “A” ground have been added to jacks 1 through 14 to permit use of a 415A KTU (automatic, dc signaling, private line circuit) in place of a CO/PBX line circuit.
- The 424C, 444-type, 453B, 454B, 455B and 456B KTUs are not supplied with the 580B KSU and must be ordered separately.⚡



*All station connections are made on the station connection field blocks using standard color-code cutdown. Except for satellite wiring plans and multiple consoles, this eliminates the need for an external cross-connection field.*

**2.09** All wiring connections are made on connecting blocks located in the KSU (Fig. 2). As all stations pick up all lines and each line appears on the same button at all telephone sets, all equipment connections are factory-wired to the connecting blocks.

**2.10** Fifteen 66-type connecting blocks are mounted in the KSU:

- (a) Connecting block 1 (Fig. 4) provides the terminals on which option straps are placed for connecting power failure ringing, CO ringing, preset conference, and ring transfer.



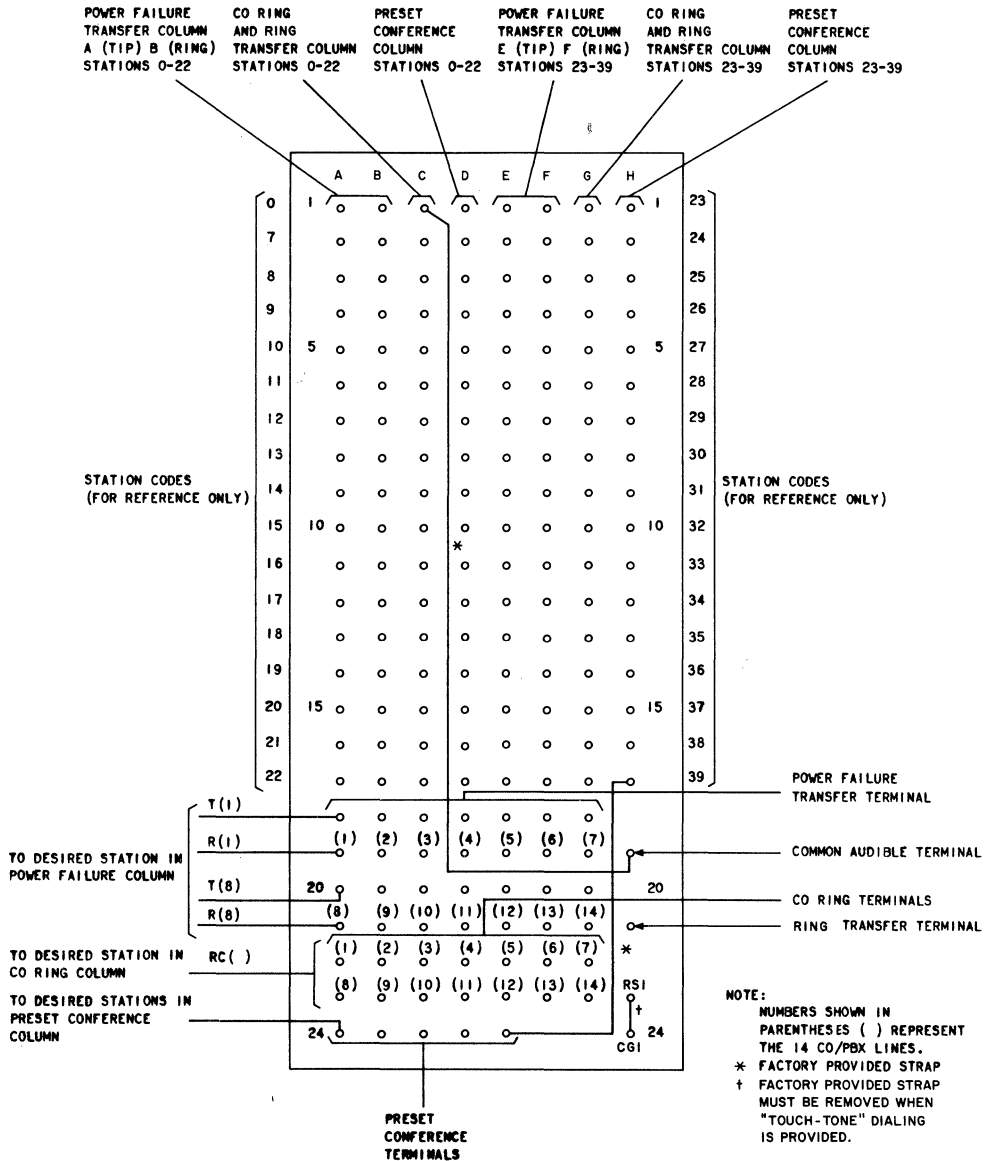


Fig. 4—Terminal Arrangement for Connecting Block 14

(b) Connecting block 2 (Fig. 5) contains the diode arrangement for intercom preset conference and common audible signaling. Terminals are provided for connecting paging speakers and/or 20A-49 apparatus units.

(c) Connecting block 3 (Fig. 6) contains the diode arrangement used with zone paging. Straps are placed on connecting block 3 to connect the zone to be paged to the desired code.

(d) Connecting blocks 4 and 5 (Fig. 7) contain the polarity guard diodes for the CO/PBX lines.

(e) Connecting blocks 6 and 7 (Fig. 8) provide terminals for connecting station code 0 (attendant station) and station code 7, the incoming CO/PBX lines, the optional 33A voice coupler, and the optional MW or DSS consoles.

(f) Blocks 8 through 15 provide the balance of the station terminations (Fig. 8).

**2.11** The block and column on which a station is cut down determines the intercom code assigned to that station. Intercom codes available are 0, and 7 through 39.

**2.12** The fuse panel in the 580-type KSU utilizes 70-type fuses which give a visual indication of fuse status. The 29- and 67-type power units are equipped with 24-type fuses which do not provide a fuse status indication (Table K).

**2.13** The lamp panel in the 580-type KSU provides a status lamp for each CO/PBX line and intercom path. The lamps give the same indication of line status (flash, steady, wink) as the line lamps on the telephone sets. See Fig. 3 and Table A.

#### CONSOLES

##### A. 7A1 Selector Console (Station Busy Console With DSS)

**2.14** The 7A1 selector console (Fig. 9) is a 40-button console providing a 33-button DSS field with station busy lamps. Of the seven remaining buttons, three are used as paging buttons, one is used as an intercom recall button, and three buttons are not used. Ivory (-50) is the standard console color, and a 7A2-\* faceplate must be ordered with each console. ♦Current production consoles are equipped

**TABLE A**

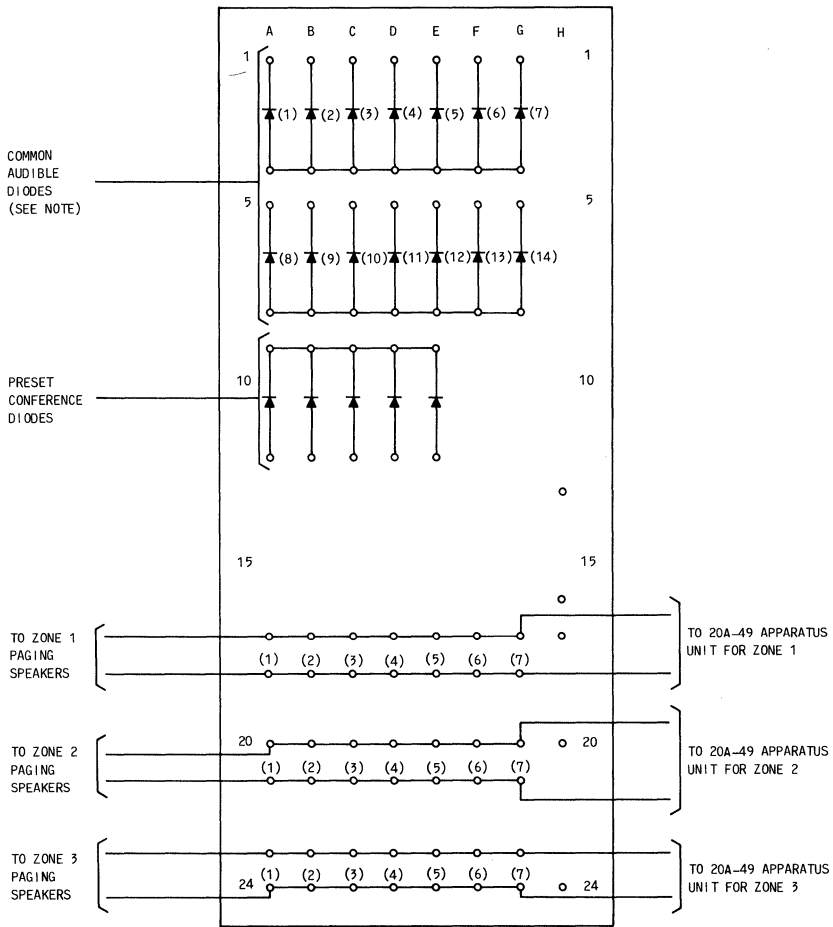
**LINE STATUS LAMPS**

DESIG	LAMP CODE	FUNCTION
L1	51A	1st CO/PBX Line Lamp
L2		2nd CO/PBX Line Lamp
L3		3rd CO/PBX Line Lamp
L4		4th CO/PBX Line Lamp
L5		5th CO/PBX Line Lamp
L6		6th CO/PBX Line Lamp
L7		7th CO/PBX Line Lamp
L8		8th CO/PBX Line Lamp
L9		9th CO/PBX Line Lamp
L10		10th CO/PBX Line Lamp
L11		11th CO/PBX Line Lamp
L12		12th CO/PBX Line Lamp
L13		13th CO/PBX Line Lamp
L14		14th CO/PBX Line Lamp
L15		1st Intercom Path Lamp
L16		2nd Intercom Path Lamp
L17		3rd Intercom Path Lamp
L18 Through L24		Spare

with an ivory mounting cord. Earlier production had a satin-silver cord.♦ The 7A1 selector console is normally used, in addition to the attendant's telephone set, to provide DSS on the intercom.

##### B. 7B1 Selector Console (Station Busy Console With MW)

**2.15** The 7B1 selector console (Fig. 10) is a 40-button console providing a 33-button



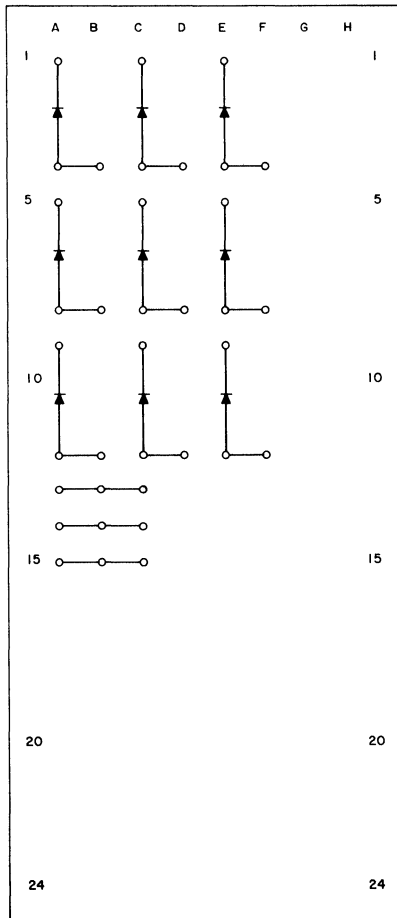
NOTE:  
 ATTENDANT COMMON AUDIBLE IS PROVIDED BY THE 14 DIODES SHOWN. TO REMOVE A CO/PBX LINE FROM THE COMMON AUDIBLE GROUP, REMOVE THE DIODE ASSOCIATED WITH THAT LINE.

Fig. 5—Terminal Arrangement for Connecting Block 2

message waiting field. Seven buttons are not used. Ivory (-50) is the standard console and mounting cord color, and a 7A2-\* faceplate must be ordered

\*Refer to Table B for color suffix.

for each console. The 7B1 selector console is normally used, in addition to the attendant's telephone set, to provide the message waiting feature.



NOTE:  
SEE TABLE E FOR ZONE PAGING CONNECTIONS.

Fig. 6—Terminal Arrangement for Connecting Block 3

**Note:** Connections are provided for one DSS or one MW console in the 580-type KSU. Additional consoles may be supplied (maximum of 3), but external connections and auxiliary power are required.

## EXTERNALLY MOUNTED APPARATUS

### A. 33A Voice Coupler

2.16 The 33A voice coupler (Fig. 11) is an interconnecting unit which provides a point of connection for a customer-provided music source used with music-on-hold and/or background music. The unit is 1-13/16 inches deep by 2-3/4 inches high by 4-3/8 inches in length and is wall-mounted externally from the KSU. A potentiometer (with screwdriver adjustment slot) controls the level of the background music. The unit contains two fuses for protection against hazardous voltages from the customer-provided music source.

### B. 20A-49 Apparatus Unit

2.17 The 20A-49 apparatus unit provides a point of connection or interface to a customer-owned and maintained (COAM) paging system. Also, the 20A-49 apparatus unit is used with a large high-power paging system provided by the telephone company. The unit is 1-13/16 inches deep by 2-3/4 inches high by 4-3/8 inches in length and is wall-mounted externally to the 580-type KSU. It presents a load to the 457C KTU equivalent to one loudspeaker and provides an output impedance to the COAM equipment of approximately 300 ohms. The output is transmitted to the COAM paging equipment through a transformer that is both electrostatically and electromagnetically shielded to minimize the possibility of introducing noise. A potentiometer (with screwdriver adjustment slot) is provided to adjust the signal level. Connections are made on five screw terminals. ⚡A contact closure is not provided in the unit.⚡

### C. 22A-49 Apparatus Unit

2.18 The 22A-49 apparatus unit is an external signaling circuit that activates a signaling device which is external to the telephone sets. The 22A-49 apparatus unit provides a contact closure or opens a contact. The contact closure is used to operate KS-16301 type signaling devices (Section 463-110-100) or other external alerting devices. The contact open may be used to operate signaling devices that are activated by an open circuit. The unit is 1-13/16 inches deep by 2-3/4 inches high by 4-3/8 inches long and is wall-mounted

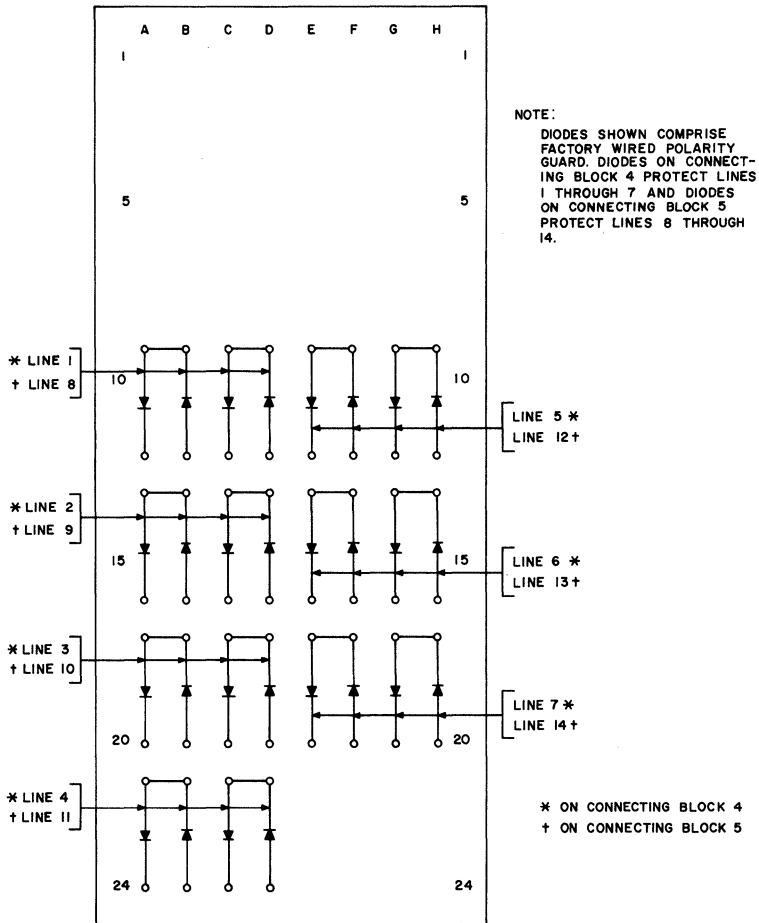


Fig. 7—Terminal Arrangement for Connecting Blocks 4 and 5

externally to the 580-type KSU. Connections are made on six screw terminals. The 22A-49 apparatus unit may be used to activate an external signaling device for:

- Common audible
- Station codes
- Station line ringing
- Ring transfer.

◆Note: The 22A-49 apparatus unit provides a steady signal; interrupted ringing is not provided.◆

D. ◆KS-21880,L1◆ Loudspeaker

2.19 The KS-21880,L1 loudspeaker (Fig. 12) is an indoor loudspeaker used for paging. It is 11 inches high by 10 inches wide by 6-1/2 inches deep. It has a potentiometer (with screwdriver adjustment slot) for volume control. The KS-21880,L1 loudspeaker is furnished with a walnut (woodgrain)

DSS CONSOLE TERMINALS  
MESSAGE WAITING  
CONSOLE TERMINALS

INTERCOM STATION CODES

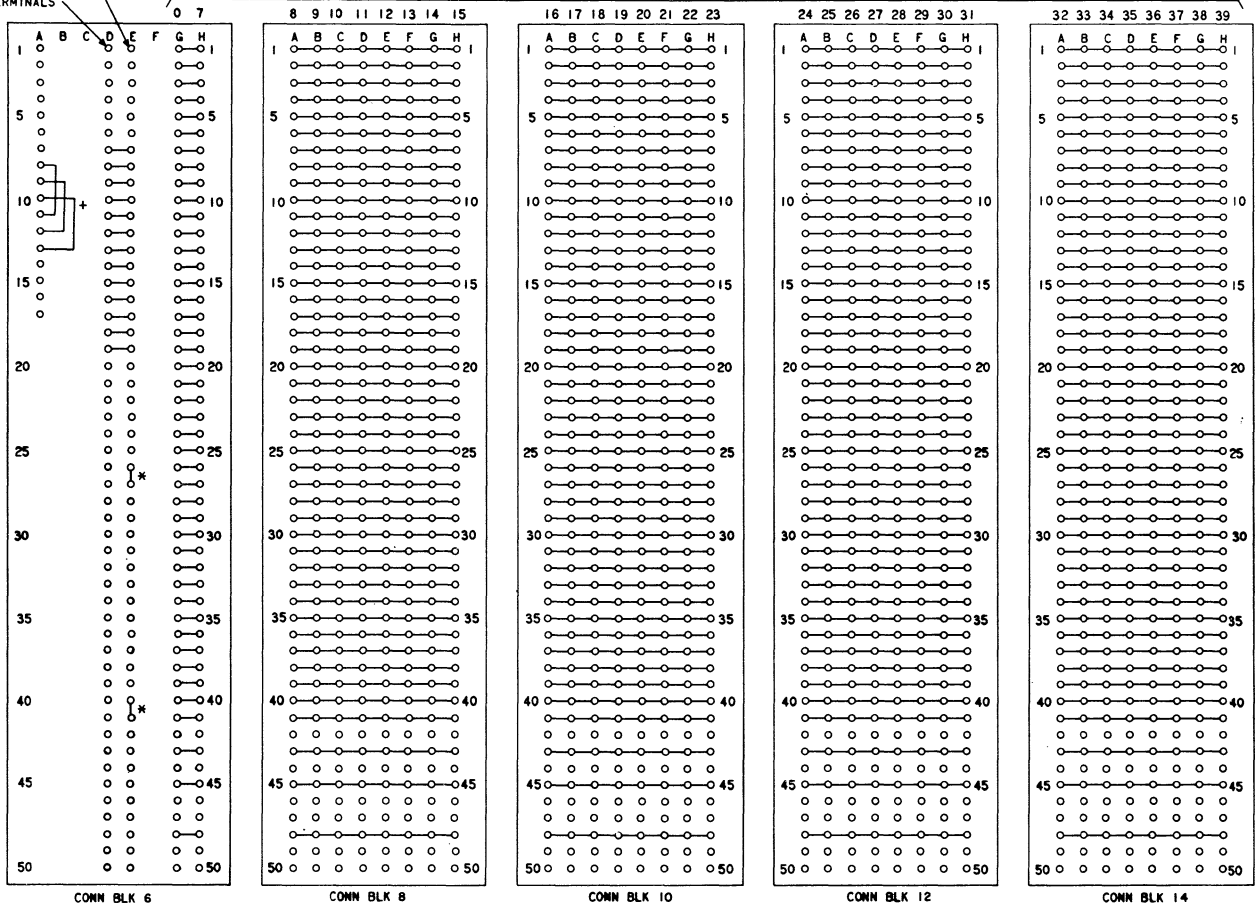
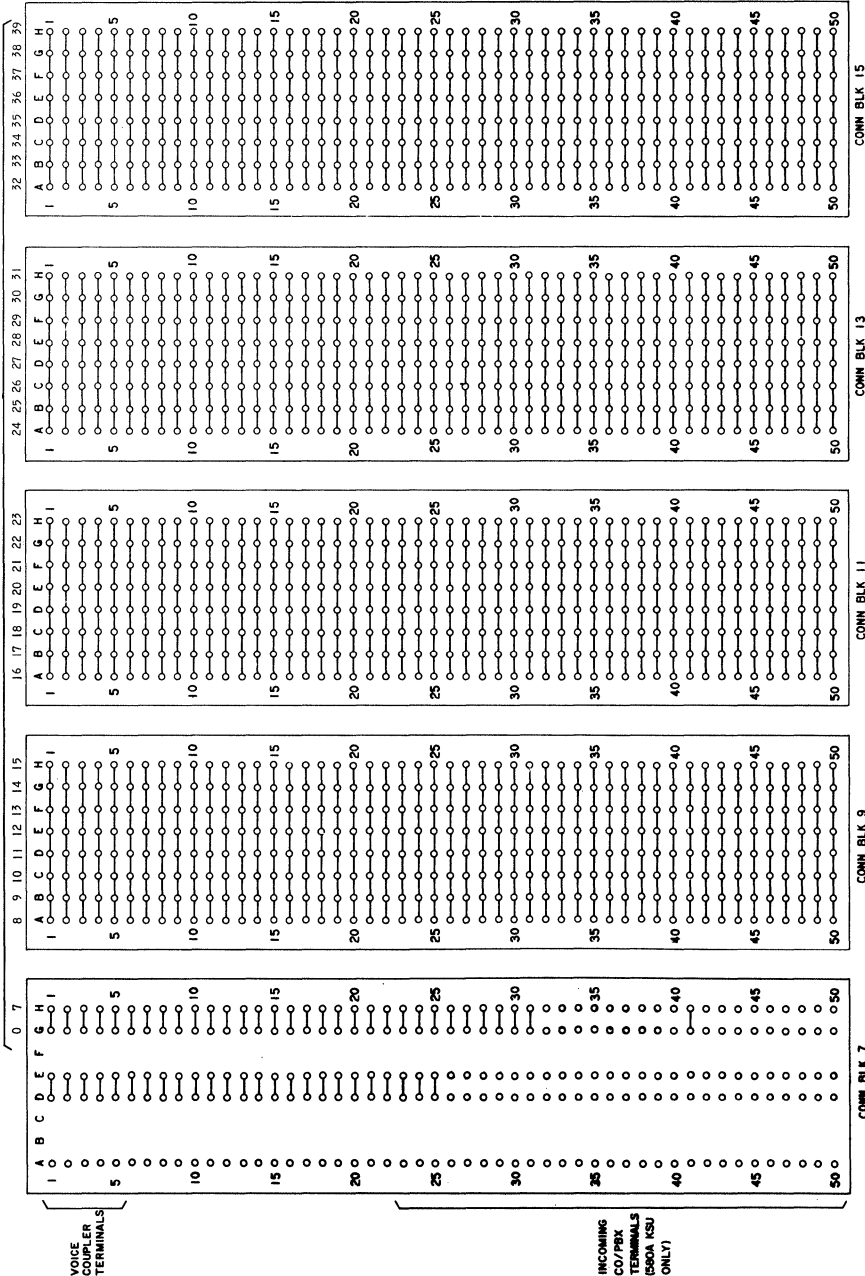


Fig. 8—Terminal Arrangement for Connecting Blocks 6 through 15 (Sheet 1 of 2)

INTERCOM STATION CODES



\* FACTORY PROVIDED STRAP. REMOVE WHEN DSS CONSOLE IS INSTALLED.  
 + FACTORY PROVIDED STRAPS-580B KSU ONLY

Fig. 8—Terminal Arrangement for Connecting Blocks 6 through 15 (Sheet 2 of 2)



Fig. 9—7A1 Selector Console (DSS)

finish only. ♦The K8 loudspeaker is directly interchangeable with the KS-21880,L1.♦

#### E. ♦KS-21939,L2 Loudspeaker

2.20 The KS-21939,L2 loudspeaker replaces the KS-16846,L2. It is a horn-type loudspeaker approximately 9-5/8 inches in diameter and is equipped with a screwdriver-adjusted volume control. The loudspeaker can be surface-mounted using the three holes in the swivel base; or, if desired, a List 3 can be ordered which is equipped with an adapter for mounting on a 1/2-inch pipe. The KS-21939,L2 is for use at all indoor or outdoor installations requiring a horn-type speaker, and it can be used as a direct replacement for the KS-16842,L2 at existing installations where a volume control is required.♦

## KEY TELEPHONE UNITS

2.21 The circuitry for the 14A Communication System is provided by 400-series KTUs. Condensed functional schematics of the KTUs used in the 14A System are located at the end of this section.

### A. 400-Type KTU (CO or PBX Line Circuit)

2.22 ♦The 400-type KTU is a 4-inch unit which provides the telephone set with CO or PBX line service. One 400-type line circuit is required for each line. If the units are being installed in a 580A KSU, any code of line circuit can be used, except a 400H cannot be used if music-on-hold is being supplied—the 400H is not compatible with the 451B KTU which must be used in the 580A. Any 400-type KTU, whether equipped with music-on-hold or not, may be installed in a 580B





Fig. 10—7B1 Selector Console (MW)

KSU. In a 580B, a 498A KTU equipped with a 116A1 circuit module (CM) must be used for music-on-hold. The 400-type KTUs occupy connectors J1 through J14 in the 580-type KSU. Additional information on the 400-type KTU may be found in Section 518-215-400 and CD/SD-69513-01 (400A, B, C, D), CD/SD-69651-01 (400G), or CD/SD-69942-01 (400H).‡

**B. †415A KTU (Automatic, DC Signaling, Private Line Circuit)**

**2.23** The 415A KTU is a 4-inch, 18-contact KTU for connecting stations in the system to a private line terminated at a distant station. Another 415A KTU, or other private line KTU which will respond to a dc signal, is required at the distant

end. The 415A can be installed in any of the CO/PBX jacks *of the 580B only*. **Do not use a 415A in the 580B KSU if music-on-hold is furnished.** The 580A does not have "A" battery and ground wired to these jacks and, therefore, will not accept the circuit. Additional information on the 415A KTU can be found in Section 518-215-400 and CD/SD-69559-01.‡

**C. 424-Type KTU (Dial Intercom, 19-Code Selector Circuit)**

**2.24** The 424-type KTU is an 8-inch dial selective intercom unit. (Additional information on the 424B/424C KTU may be found in CD- and SD-69567-01.) One 424-type KTU is required in this system and occupies connectors J17 and J18

**TABLE B**

**COLOR ORDERING GUIDE**

SPEAKERPHONE* LOUDSPEAKER, AND TRANSMITTER		TELEPHONE SETS, SELECTOR CONSOLES, HANDSETS, HOUSINGS, HANDSET CORDS		FACEPLATES	
SUFFIX	COLOR	SUFFIX	COLOR	SUFFIX	COLOR
- 3	Black	-50	Ivory	-100	Avocado
-50	Ivory			-108	Teak
				-109	Walnut
				-111	Gold
				-112	Orange
				-113	Brown
				-114	Red
				-115	Blue
				-118	Black
-51	Green				
-53	Red				
-56	Yellow				
-58	White				
-60	Light Beige				
-62	Aqua Blue				

\* The 4A speakerphone is not available in Ivory (-50). A D-180508 kit of parts is required to change the speakerphone to Ivory. Refer to Section 512-700-100 for kits of parts for other colors.

in the 580-type KSU. In the 14A Communication System, the 424-type KTU provides:

- Rotary dial selection
- 19 dial codes (nine single-digit and ten 2-digit codes).

**Note:** In the 14A Communication System, the first digits of the 2-digit codes are 1, 2,

and 3; therefore, 1, 2, and 3 are not available as single-digit codes. Codes 4, 5, and 6 are dedicated to paging which leaves codes 0 (attendant station) and 7 through 39 available for station codes.



**The 424C KTU provides circuit improvements over the 424B, such as greater tolerance to TOUCH-TONE dialing and elimination of speaker**

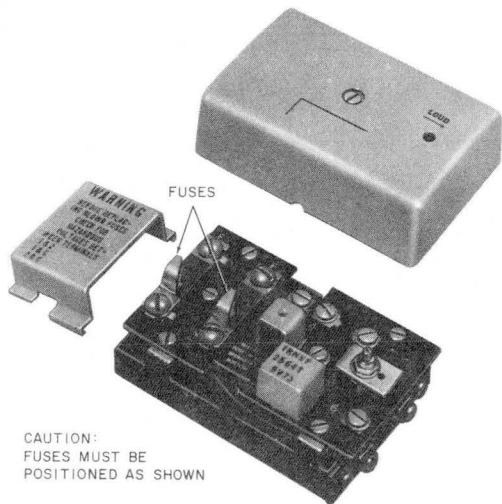


Fig. 11—33A Voice Coupler

*clicks. The 424B KTU can only be used in COM KEY 14 installations when these troubles are not encountered. In addition, the 424C must be used if a 478B KTU is used as the TOUCH-TONE adapter. The 424A KTU is not to be used in COM KEY 14.*

#### D. 440A or 478B KTU (TOUCH-TONE Adapter Circuit)

2.25 The 440A and 478B are 8-inch units that provide TOUCH-TONE dialing on intercom when used with the 424-type KTU. Additional information on the 440A KTU may be found in CD- and SD-69906-01 and on the 478B KTU in CD- and SD-69931-01. The 440A and 478B are electrically interchangeable, provided the 580A KSU has A GRD on pin 3 and B GRD on pin 15 of connectors J21 and J22. All 580-type KSUs with a serial number of 6184 or higher will have this option factory-wired. ♦For 580A KSUs with a lower serial number, a D-180720 kit of parts is supplied with the 478B KTU which permits application of the proper grounds. An instruction sheet (Fig. 13) is supplied with the kit of parts. ♦One TOUCH-TONE adapter is required in this system and occupies connectors J21 and J22 in the KSU.

#### E. 444-Type KTU (Selector Extender Circuit)

2.26 The 444A KTU is an 8-inch, 80-contact unit which expands the 19 codes of the 424C KTU (19-code selector circuit) to a total of 37 codes. ♦The 444B KTU is the same as the 444A except two option plugs have been added which have application only in the 21A Communication System. In the 14A System, the 444B should be used as supplied from the factory, that is, with the option plugs in positions 2-3 and 5-6. ♦When using the 444-type KTU, two more transfer digits are factory assigned and these digits may not be used as station codes. Digits 2 and 3 are used as the second and third transfer digits. (Additional information on the 444-type KTU may be found in CD- and SD-69653-01.) One 444-type KTU is required in this system and occupies connectors J23 and J24 in the 580-type KSU.

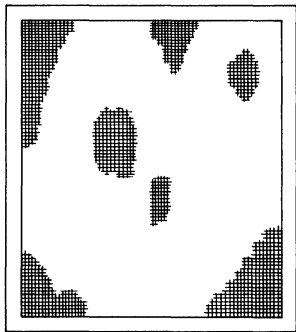
#### F. ♦451A, 451B, or 498A KTU (Music-On-Hold Circuit)

2.27 The music-on-hold circuit is a 4-inch unit that is used with an externally mounted 33A voice coupler to connect a customer-provided music source to lines that are placed on hold. If a 580A KSU is used, a 451-type KTU must be used. Do not use a 400H as a line circuit with a 451-type KTU. The 451-type KTU contains seven circuits requiring two per system installed in J27 and J29 of the 580A KSU. (Additional information on the 451-type KTU may be found in CD/SD-69922-01.)

2.28 If a 580B KSU is used, the music-on-hold circuit must be a 498A KTU equipped with a 116A1 CM and the line circuit any 400-type KTU. The 451-type KTU is not electrically compatible in a 580B KTU. The 498A KTU alone contains four circuits; an additional three circuits can be added by connecting a 116A1 CM to the KTU. When used with the 14A System, the 498A KTU should always be equipped with a 116A1 CM. The 498A KTUs equipped with circuit modules are installed in J27 and J29 of the 580B KSU. (Further information on the 498A KTU and 116A1 CM may be found in CD/SD-69922-01.) ♦

#### G. 452A KTU (Power Failure Ringing Circuit)

2.29 The 452A KTU is a 4-inch unit that automatically "cuts through" up to seven CO/PBX lines to external line ringers in the event of a power failure. (Additional information on the 452A KTU



FRONT VIEW

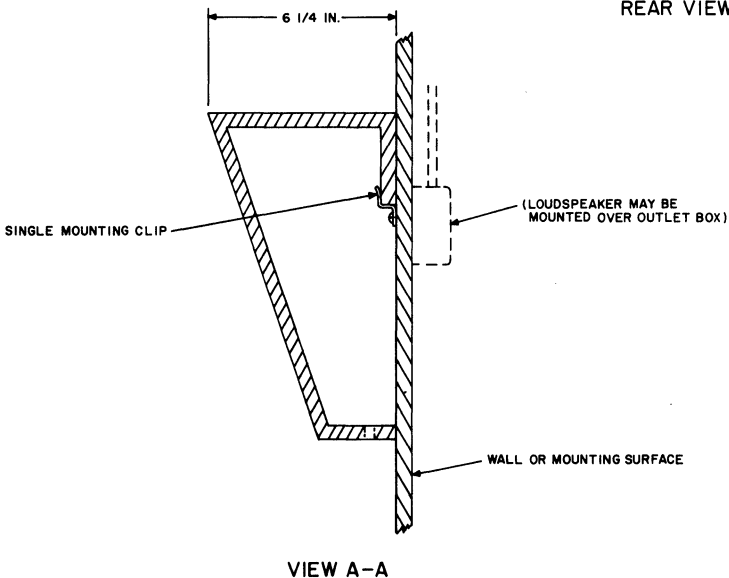
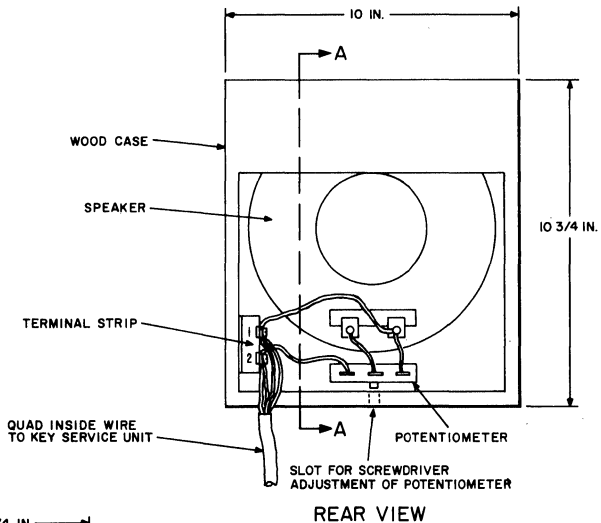


Fig. 12—KS-21880,L1 Loudspeaker, Connections and Mounting

INSTALLATION INSTRUCTIONS FOR D-180720 KIT OF PARTS  
(580A KSU)

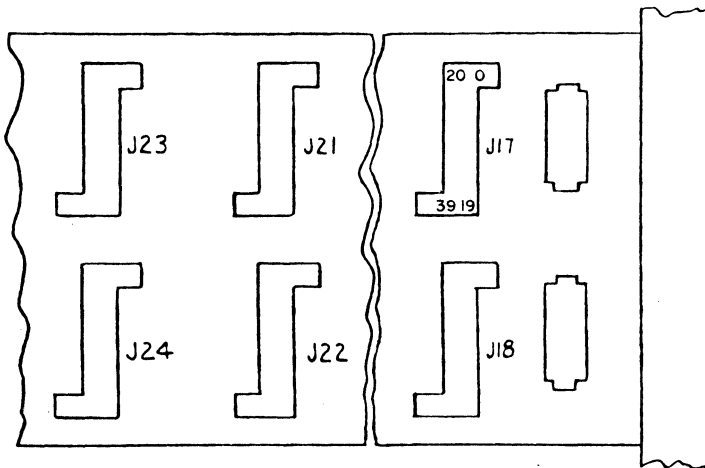
This instruction sheet is intended to assist the installer when equipping a 478B KTU in 580A KSUs having serial number 6183 or lower. These KSUs require AGRD and BGRD wiring on connectors J21 and J22 when a 478B KTU is to be equipped in place of a 440A KTU. Discard this kit of parts if 478B KTU is to be equipped in 580A KSUs having serial number 6184 and higher.

PROCEDURE

1. Remove cover from KSU.
2. Open gate.
3. Connect wires as shown below by following cable paths and tying in place where needed. Connections are made by sliding terminals of each lead assembly on to connector wire-wrap contacts.

<u>Signal</u>	<u>From</u>	<u>To</u>
AGRD	J18-3*	J21-3, J22-3
BGRD	J23-15	J21-15, J22-15

\* In some KSUs this connection must be soldered.



4. Plug 478B KTU in connectors J21 & J22.
5. Reassemble cover on to KSU.

Fig. 13—Facsimile of Instruction Sheet for D-180720 Kit of Parts

may be found in CD- and SD-69652-01.) Two 452A KTUs are required in this system (one for each seven CO/PBX lines used) and occupy connectors J31 and J33 in the 580-type KSU.

#### H. 453B KTU (Lamp Driver Circuit)

**2.30** The 453B KTU is a 4-inch unit that provides additional lamp current necessary to power the system lamps. Each KTU can serve up to seven CO/PBX lines. In the 14A System, the 400-type line circuits supply the lamp current for the line status lamps and the first ten stations. The lamps for the remaining 24 stations are driven from the two 453B KTUs which occupy connectors J34 and J36. (Additional information on the 453B KTU may be found in CD- and SD-69653-01.)

#### I. 454B KTU (3-Path Intercom Access Circuit)

**2.31** The 454B KTU is an 8-inch unit that contains three separate intercom paths. Path selection is based on operation of an associated intercom button on the key telephone sets. The 454B KTU also provides dial tone, seizes the code selector (424C KTU), and provides flashing lamp signal during selection and steady lamp during busy mode. The unit occupies connectors J19 and J20 in the 580-type KSU. (Additional information on the 454B KTU may be found in CD- and SD-69930-01.)

#### J. 455A KTU (Tone Ringing Signal Generator Circuit)

**2.32** The 455A KTU is a 4-inch unit containing the tone ringing generator that provides tone ringing on incoming CO/PBX calls. The 455A KTU occupies connector J25 in the 580-type KSU. (Additional information on the 455A KTU may be found in CD- and SD-69652-01.)

#### K. 456B KTU (Voice and Tone Alerting Circuit)

**2.33** The 456B KTU is a 4-inch unit that provides the following features on intercom calls:

- Ringback tone to calling party
- Tone alerting signal to called party
- Voice signaling to called party
- Input signal to paging amplifier.

**2.34** The 456B KTU occupies connector J26 in the 580-type KSU. (Additional information on the 456B KTU may be found in CD- and SD-69652-01.)

**Note:** The 456A KTU is rated MD but can be used in installations where paging feedback or radio frequency interference (RFI) is not encountered. Paging feedback can also be an installation problem and changing to the 456B will only help in marginal cases.

#### L. 457C KTU (Paging Amplifier Circuit)

**2.35** The 457C KTU is a 4-inch unit that contains the paging amplifier circuitry for paging and for customer-provided background music. The customer-provided music source can be connected to the paging speakers while the paging circuit is not in use. Three 457C KTUs can be used in the 14A System and seven loudspeakers can be connected to each unit. For paging, each 457C KTU may be accessed by a separate intercom code (for zone paging) or one intercom code may activate a combination of units. The 457C KTUs occupy connectors J28, J30, and J32 in the 580-type KSU. (Additional information on the 457C KTU may be found in CD- and SD-69652-01.)

### KITS OF PARTS

#### A. D-180486 Kit of Parts (Privacy Circuit)

**2.36** A D-180486 kit of parts provides the privacy or lockout feature in a telephone set. A station equipped with a privacy circuit is prevented from picking up a busy CO/PBX line. The privacy circuit does not provide privacy on the intercom lines. The D-180486 kit of parts can be added to all 833/2833-type telephone sets with the exception of the 833B/2833B(MD) and 833BM/2833BM, 833DM/2833DM telephone sets which are manufactured with an operational privacy circuit.

#### B. D-180656 Kit of Parts (Shelf for Wall Mounting Telephone Sets)

**2.37** The D-180656 kit of parts (Fig. 21) provides a method for wall mounting COM KEY telephone sets. The kit consists of a shelf assembly (ivory colored) and a retaining clamp. The shelf will incline the telephone set 15 degrees from the horizontal to facilitate its use.

**C. D-180759 Kit of Parts (for Adding 215C1 Power Unit to 580-Type KSU)**

**2.38** The D-180759 kit of parts provides for mounting a 215C1 power unit (required for multiple consoles) in 580A KSUs having a serial number lower than 14425. The kit consists of a new electrical outlet box, mounting bracket, and necessary hardware. The existing electrical box must be replaced with the box supplied with the kit. The 215C1 power unit is then mounted on the bracket which is part of the box.

**D. D-180720 Kit of Parts (for Adding 478B KTU to Earlier Model KSUs)**

**2.39** The D-180720 kit of parts is supplied with the 478B KTU and is required only when adding the KTU to 580A KSUs having a serial number below 6184. The kit consists of two wire assemblies equipped with terminals which are used to supply A GRD and B GRD to J21 and J22 of the KSU. Instructions (Fig. 13) are supplied with the kit of parts.¶

**TELEPHONE SETS**

**A. Full Service Telephone Sets**

**2.40** The 833- and 2833-type telephone sets are 20-button key telephone sets designed for use with the 14A Communication System. The sets are equipped with a loudspeaker for tone and voice signaling. A volume control is provided to control the level of the signal. Conferencing of two or more CO/PBX lines is accomplished by simultaneously depressing the buttons associated with the lines to be conferenced. ***Transmission cannot be guaranteed using this type of conferencing.*** CO/PBX lines cannot be conferenced with intercom lines. Automatic button restoration (ABR) restores all depressed buttons when the handset is replaced. The lamp under the HOLD button can be provided for use as a message waiting indicator.

***Caution: If multiple buttons are depressed at an idle station, the system may be disabled.***

**2.41** Telephone sets for the 14A Communication System are available in ivory (-50) only and are shipped from the factory with throw-away, protective faceplates. For each set, it is necessary

to order a colored faceplate from the complement of nine vinyl-clad metal decorator faceplates that are available (see Table B). ¶Current production sets are equipped with an ivory (-50) mounting cord. Earlier production had a satin-silver (-87) cord.¶

**833A (MD) Telephone Set**

**2.42** The 833A (MD) telephone set is a rotary dial desk-type key set. The set has 14 CO/PBX line buttons, 3 intercom line buttons, a HOLD button, a RECALL button, and a PRIV RLS (privacy release) button. The PRIV RLS button is *not* factory-connected and must be connected in the field when privacy release is to be provided. A privacy circuit (D-180486 kit of parts) can be installed in the set when privacy is required.

**833B (MD) Telephone Set**

**2.43** The 833B (MD) telephone set is a rotary dial desk-type key set. The set has 14 CO/PBX line buttons, 3 intercom line buttons, a HOLD button, RECALL, a PRIV RLS button, and a privacy circuit. All buttons and the privacy circuit are factory-connected.

**833BM Telephone Set**

**2.44** The 833BM telephone set is the same as the 833B (MD) telephone set except modular handset components are added.

**833C (MD) Telephone Set**

**2.45** The 833C (MD) telephone set is a rotary dial desk-type key set. The set has 14 CO/PBX line buttons, 3 intercom line buttons, a HOLD button, a RECALL button, and a RING TR (ring transfer) button. The RING TR button is not factory-connected and must be connected in the field when the set is used to provide ring transfer. A privacy circuit (D-180486 kit of parts) can be installed in the set when privacy is required.

***Note:*** In early production 833C telephone sets, the RING TR button was factory-connected.

**833CM Telephone Set**

**2.46** The 833CM telephone set is the same as the 833C (MD) telephone set except modular handset components are added.

**833DM Telephone Set**

**2.47** The 833DM telephone set is the same as the 833BM except it is designed for wall mounting.

**833EM Telephone Set**

**2.48** The 833EM telephone set is the same as the 833CM except it is designed for wall mounting.

**2833A (MD) Telephone Set**

**2.49** The 2833A (MD) telephone set is the same as the 833A (MD) telephone set except it is equipped with a TOUCH-TONE dial.

**2833B (MD) Telephone Set**

**2.50** The 2833B (MD) telephone set is the same as the 833B (MD) telephone set except it is equipped with a TOUCH-TONE dial.

**2833BM Telephone Set**

**2.51** The 2833BM telephone is the same as the 833B (MD) telephone set except it is equipped with a TOUCH-TONE dial and modular handset components have been added.

**2833C (MD) Telephone Set**

**2.52** The 2833C (MD) telephone set is the same as the 833C (MD) telephone set except it is equipped with a TOUCH-TONE dial.

**2833CM Telephone Set**

**2.53** The 2833CM telephone set is the same as the 833C (MD) telephone set except it is equipped with a TOUCH-TONE dial and modular handset components have been added.

**Note:** Early production 833C (MD) and 2833C (MD) telephone sets had the RING TR (ring transfer) button connected at the factory.

**2.54** The 2833DM telephone set is the same as the 2833BM except it is designed for wall mounting.

**2833EM Telephone Set**

**2.55** The 2833EM telephone set is the same as the 2833CM except it is designed for wall mounting.

**B. Intercom-Only Telephone Sets****575AM-50 Telephone Set**

**2.56** The 575AM-50 telephone set is a rotary dial, 6-button key set *arranged for intercom service only*. The set is equipped with a loudspeaker for tone and voice signaling. A volume control is provided to control the level of the signal. The first button (hold button position) is a red nonfunctional button (blocked nonoperative) which may be illuminated for use as a message waiting indicator. The second, third, and fourth buttons are illuminated intercom pickup buttons. The fifth and sixth are not illuminated and are blocked nonoperative.

**2.57** As shipped from the factory, only two intercom buttons (buttons two and three) are wired operational. When the 575AM-50 telephone set is used with the 14A System, it is necessary to connect mounting cord leads black-green and green-black to terminals 3T and 3H (of the terminal strip) and the black-brown lead to terminal L3 (of the lamp socket) in order to activate the third intercom button.

**2.58** The intercom pickup buttons on the 575AM-50 telephone set do not automatically restore to the nonoperated position when the handset is placed on-hook.

**2575AM-50 Telephone Set**

**2.59** The 2575AM-50 telephone set is the same as the 575AM-50 telephone set except it is equipped with a TOUCH-TONE dial.

**3. INSTALLATION****PLANNING**

**3.01** Survey the area to be served by the 14A Communication System. Select a location for the 580-type KSU that:

- Provides a safe working location



- Provides floor space away from foot traffic and is protected from vehicular traffic
- Has customer approval and is in his best interest
- Has adequate light and is always accessible
- Is protected from water damage or blows incidental to cleaning
- Is central to station locations to permit shortest cable runs
- Is clean, dry, well-ventilated, and free from corrosive fumes
- Is not subject to extreme temperatures
- Is near a commercial ac power receptacle not under the control of a switch.



***The floor should be level and not subject to heavy vibrations.***

**3.02** Arrangements should be made for the customer to provide a commercial ac power receptacle in accordance with the following:

- Not under control of a switch.
- Separately fused.
- Receptacle should be grounded 3-wire type.

**3.03** Select appropriate apparatus according to job requirements.

**Caution:** *The paging features of the 14A System can be inadequate for paging in noisy locations. A preinstallation survey should be made of noisy areas where paging is to be provided (see Section 981-251-100). The results of the survey may indicate:*

- *Additional loudspeakers, located closer together, will be required.*
- *An auxiliary paging system (telephone company or customer-provided) will be required.*

An auxiliary paging system requires the use of a 20A-49 apparatus unit.

#### ORDERING GUIDE

##### 3.04 Apparatus for Basic Service:

- Cable, Connector, A50B (order one for each 833- or 2833-type telephone set; length must be specified)
- Plate, Face, 833A—\* (order one for each 833-type telephone set)
- Plate, Face, 2833A—\* (order one for each 2833-type telephone set)
- Set, Telephone, 833BM-50 or 833DM-50 (has privacy release button; order as required for full service rotary dial stations)—faceplate must be ordered separately
- Set, Telephone, 833CM-50 or 833EM-50 (has ring transfer button; order as required for rotary dial station)—faceplate must be ordered separately
- Set, Telephone, 2833BM-50 or 2833DM-50 (has privacy release button; order as required for TOUCH-TONE dial stations)—faceplate must be ordered separately
- Set, Telephone, 2833CM-50 or 2833EM-50 (has ring transfer button; order as required for TOUCH-TONE dial station)—faceplate must be ordered separately
- ♦Unit, Service Key, 580B (424C, 444-type, 453B, 454B, 455A, and 456B KTUs are **not** included and must be ordered separately)
- Unit, Telephone Key, 400H (order one for each CO line as required in 580B KSU) (not compatible in 580A KSU with music-on-hold)
- Unit, Telephone Key, 400D or 400G (order one for each CO/PBX line as required in a 580-type KSU)♦
- Cord, Power (order required length)
  - 824013288 (P-40J328)—4 foot
  - 824013296 (P-40J329)—6 foot
  - 824010995 (P-40J099)—12 foot

\*Refer to Table B for color suffix.

**3.05 Optional Apparatus (order as required):**

- Cable, Connector, A25B (order one for each 575AM-50 or 2575AM-50 telephone set; length must be specified)
- Cable, Connector, A50B (order one for each selector console; length must be specified)
- Console, Selector, 7A1-50 (Station Busy Console with DSS)—order faceplate separately
- Console, Selector, 7B1-50 (Station Busy Console with MW)—order faceplate separately
- Coupler, Voice, 33A (order when music-on-hold or background music is provided)
- Diode, 446F, or equivalent (order one for each rotary dial station to be restricted)
- Key, 6041G-50 (order one when flexible station ring transfer is provided)
- Kit of Parts, D-180486 [Privacy Circuit—order one for each 833A/2833A(MD), 833C/2833C(MD), 833CM/2833CM, 833EM/2833EM telephone set to be equipped with privacy]
- Kit of Parts, D-180656 (Shelf Assembly—order one for each 833 and 2833 desk-type telephone set to be wall-mounted)
- ♦Kit of Parts, D-180759 (order one for each 580A KSU with serial number less than 14425 where 215C1 power unit is required for multiple consoles)♦
- Plate, Face, 7A2—\* (order one for selector console)
- Ringer, E1C (order one for each CO/PBX line to be wired for power failure ringing)
- Loudspeaker, ♦KS-21939,L2 (outdoor or indoor loudspeaker—order as required for paging locations requiring a surface-mounted horn-type loudspeaker)♦
- ♦Loudspeaker, KS-21939,L3—same as List 2 but arranged for mounting on 1/2-inch pipe♦
- Loudspeaker, ♦KS-21880,L1♦ (indoor loudspeaker—order as required for indoor paging locations)
- Set, Telephone, 575AM-50 (order as required for intercom-only rotary dial stations)
- Set, Telephone, 2575AM-50 (order as required for intercom-only TOUCH-TONE stations)
- Speakerphone, 3B—order one of each of the following for each station to be equipped with speakerphone:  
Cord, D10R—\* (specify length: 1 foot 4 inches, 9, 12, or 25 foot)  
Loudspeaker, 760A—\*  
Transformer, 2012B  
Transmitter, 666B—\*  
Unit, Control, 55B
- Speakerphone, 4A—order one for each station to be equipped:  
Adapter, 223-A-49 (includes M16C and M2FG cords)  
Loudspeaker, 108A—\*  
Transmitter, 680A—\*  
Kit of Parts, D-180508  
Unit, Power, 85B1-49
- Unit, Apparatus, 20A-49 (order when 14A System is connected to a customer's paging system or to a separate paging system provided by the telephone company)
- Unit, Apparatus, 22A-49 (order when signaling devices, external to telephone sets, are required)—signaling devices, bells, buzzers, horns, gongs, etc, and an external power supply must be ordered separately

\*Refer to Table B for color suffix.

- Unit, Power, 215C1 (auxiliary power supply for multiple consoles)
- Unit, Telephone Key, 415A (Automatic, DC Signaling, Private Line Circuit; order as required)◆
- Unit, Telephone Key, 440A (TOUCH-TONE Adapter Circuit) (order one for 14A System when TOUCH-TONE dialing is provided)
- Unit, Telephone Key, 451A or 451B (Music-On-Hold Circuit) (one unit for seven CO/PBX lines; order as required)
- Unit, Telephone Key, 452A (Power Failure Ringing Circuit) (one unit for seven CO/PBX lines; order as required)
- Unit, Telephone Key, 457C (Paging Amplifier Circuit) (one unit for each paging zone of up to seven loudspeakers; order as required)
- Unit, Telephone Key, 478B (TOUCH-TONE Adapter Circuit) (order one for 14A System when TOUCH-TONE dialing is provided)
- Unit, Telephone Key, 498A (when equipped with a 116A1 CM, supplies music-on-hold for seven lines in a 580B KSU).
- Module, Circuit, 116A1 (order one for each 498A KTU)◆
- Lamp, 51A
- Unit, Telephone Key, 424B or C (19-Code Selector Circuit)
- Unit, Telephone Key, 444A (Selector Extender Circuit)
- Unit, Telephone Key, 453B (Lamp Driver Circuit)
- Unit, Telephone Key, 454B (3-Path Intercom Access Circuit)
- Unit, Telephone Key, 455A (Tone Ringing Signal Generator Circuit)
- Unit, Telephone Key, 456B (Voice and Tone Alerting Circuit)
- Unit, Power, 29C1
- Unit, Power, 67C1.

(b) **7A1 and 7B1 Selector Consoles —**

- Base, 7A1 (for 7A1 selector console)
- Base, 7B1 (for 7B1 selector console)
- Cord, Mounting, D100J-50
- Housing, 6A1-50
- Key, 647AG5 or 647J5 (bottom key in 7A1)
- Key, 647J5C (top three keys in 7A1)
- Key, 647AF5 or 647C5 (all four keys in 7B1)
- Lamp, 51A
- Plate, Face, 7A2— (see Table B for color).

(c) **33A Voice Coupler —**

- Fuse, 35P (3/4 ampere).

(d) **575AM and 2575AM Telephone Sets —**

- Cord, D20P-87 (mounting cord)
- Cord, H4DU-50 (handset cord)

**3.06 Replaceable Components:**(a) **580-Type KSU —**

- Fuse, 24B (3A)
- Fuse, 24C (2A)
- Fuse, 24F (5A)
- Fuse, 70A (1-1/3 amperes)
- Fuse, 70G (1/2 ampere)
- Fuse, 70H (3/4 ampere)
- Fuse, Bussman MDL-2 (2 amperes)
- Fuse, Bussman MDX-5 (5 amperes)
- Interrupter, KS-15900, L1

- Dial, 9CA (rotary dial)
  - Dial, 35Y3A (TOUCH-TONE dial)
  - Key, 636A
  - Lamp, 51A
  - Set, Hand, G15A-50.
- (e) **832- and 2832-Type Telephone Sets** —
- Refer to Section 503-701-110.
- (f) **833- and 2833-Type Telephone Sets** —
- Refer to Section 503-702-110.

## INSTALLING

**3.07** Use care when transporting and unpacking apparatus so as to prevent damage to components.

### A. 580-Type KSU

**Warning:** *The 580-type KSU weighs approximately 230 pounds excluding the plug-in units and requires extreme care in unpacking and handling to avoid personal injury or damage to the apparatus.*

**3.08** The lift-off cover should be removed and the hinged gate securely latched (closed) prior to moving or lifting the apparatus cabinet. **Accidental opening of the gate could result in personal injury and/or damage to the apparatus.**

**3.09** To install the 580-type KSU:

- (1) Place cabinet in selected location and level.
- (2) Remove lift-off cover.
- (3) **Secure cabinet to floor** using appropriate fasteners.
- (4) Unlatch gate and open it slowly while observing that the cabinet is securely attached to floor and does not move or tilt.

- (5) Close gate slowly while observing that wiring forms and cords do not pinch or bind.
- (6) Connect a 14-gauge ground wire from the LOC GRD terminal of the power units to an acceptable local ground as a circuit ground. If a 3-wire grounded receptacle is not available, **a frame ground** (No. 14 gauge wire) **must** be connected from the case of the power units to an acceptable local ground.

**Caution:** *Do not strap the circuit ground to the frame or case of the power units. The susceptibility of surge damage to semiconductor components used in 400-series KTUs requires that grounding procedures be followed. Properly grounded installations will minimize service failures that can result from surge voltages or differences between dissimilar grounds.*

- (7) Terminate CO/PBX or private lines on connecting block 7, column A, terminals 23 through 50. See Fig. 14.
- (8) Terminate station cables. Cut down the A50B connector cables on connecting blocks 6 and 7, 8 and 9, 10 and 11, 12 and 13, or 14 and 15 as shown in Fig. 15. The intercom code assigned to each column is shown at the top of the blocks in Fig. 15. **A direct cable run to any station may not exceed 667 feet of 24-gauge cable.**
- (9) Place or remove option straps (if required) and connect optional apparatus (such as selector consoles, loudspeakers, etc).
- (10) Install power cord. **Do not connect to ac source at this time.**
- (11) Close and latch gate.
- (12) Dress and attach all connector cables and inside wires, connected to the KSU, in a neat manner. Clean up and properly dispose of all scrap wire.
- (13) Install KTUs necessary to provide required services. See Fig. 3 for KTU connector arrangement.

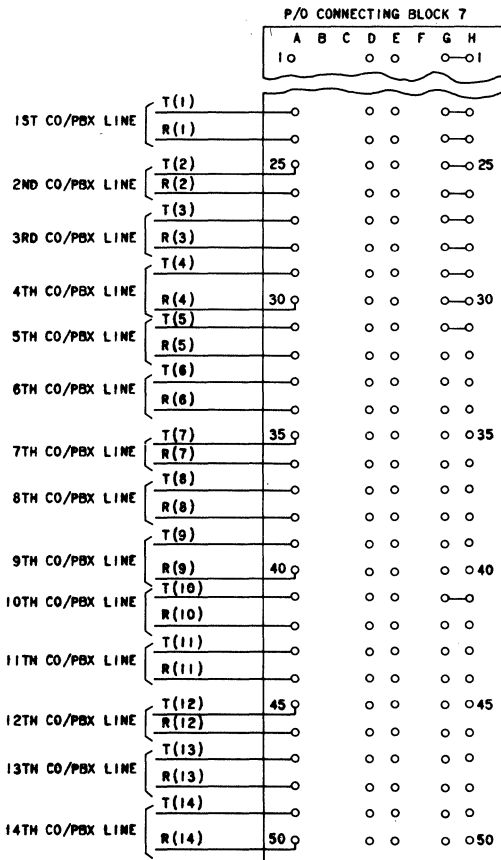


Fig. 14—Connections for Incoming CO/PBX Lines

### B. Satellite Wiring Plan

**3.10** The 14A System is designed for "home run" (direct) cabling from each telephone set to the KSU. Where it is more practical to serve a group of stations from a secondary location, a "satellite" wiring plan can be used. ♦The satellite wiring plan is a connecting block arrangement for station terminations served by connecting cables from the KSU. **No more than 17 stations can be served from a satellite location.**♦

**3.11** ♦Cabling is required between the KSU and the satellite location to provide the following leads:

- Those leads common to all stations, such as T, R, and A of the CO/PBX lines, T and R of the intercoms, etc. Only one appearance of these leads is required at the satellite.
- Six leads for *each* station code working from the satellite location. These are the VS, CO, SB, ±10V, ET, and ER leads.
- Additional leads required to cover A1, lamp, and lamp ground restrictions. These restrictions limit the voltage drop in the lamp loop to less than 2 volts and require a low resistance A to A1 lead.

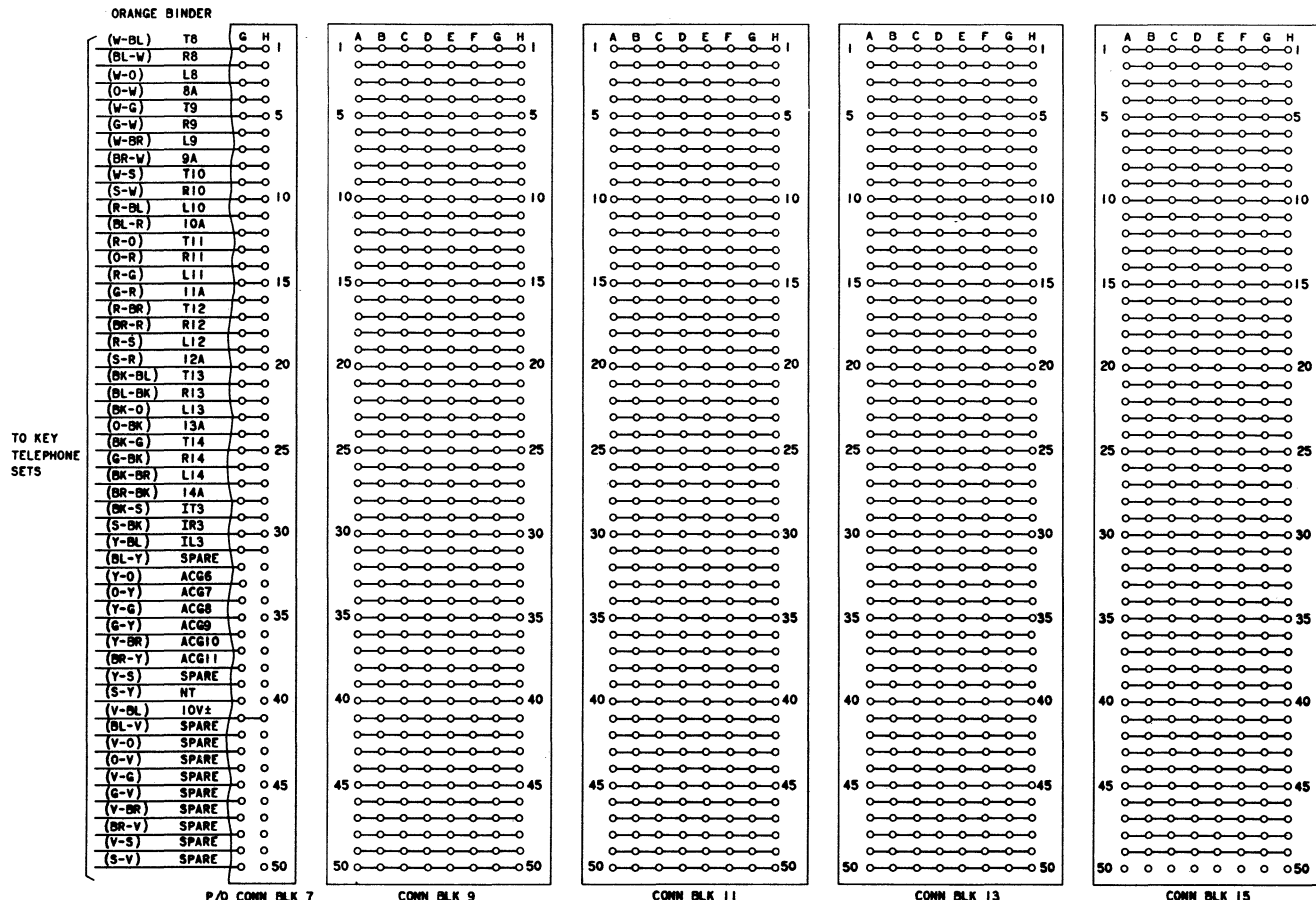
**3.12** Two methods are covered for providing the proper amounts of terminations and leads at a satellite location. One method employs prewired 14A1-type terminal blocks. The second uses standard 66-type connecting blocks and a nomograph which help to determine the number of extra lamp and lamp ground leads required. Both methods take into consideration that the lamp leads are distributed in the KSU as follows:

- (a) Lamp leads for the line status lamp in the KSU and station codes 0 and 7 through 15 are wired directly from the 400-type KTU.
- (b) Lamp leads for codes 16 through 39 are wired from the 453B (lamp driver) KTU.

***A station code grouping arrangement should be used where possible when satelliting. A satellite consisting of stations in the 0 and 7 through 15 (group A) or of stations 16 through 39 (group B) is the best arrangement.*** If stations from both groups must be intermixed in a satellite location, the lamp and lamp ground leads must be independently considered, whether using the 14A1-type terminal blocks or the standard blocks and the nomograph.

**3.13** All satellite wiring arrangements should limit the total distance from the KSU to the satellite **plus** from the satellite to the station to 667 feet.♦





\* STATION CODE 0 IS DEDICATED TO THE ATTENDANT STATION.  
 † THESE SIX LEADS MUST BE RUN SEPARATELY FOR EACH STATION (7-34) WHEN A SATELLITE WIRING ARRANGEMENT IS USED.

Fig. 15—Station Connections (Sheet 2)

**C. Satellite Plan Using 14A1-Type Terminal Blocks**

**3.14** The 14A1-type terminal blocks consist of a 66-type connecting block factory-wired to KS-connectors. Connector cables are used from the connectors to the KSU—the station telephone set cables being fed from the satellite are terminated on the 66-type connecting block. Each 14A1-type terminal block will accommodate eight 25-pair station cables. One 14A1-100 terminal block is required for the first binder of each eight satellite stations, and one 14A1-75 is required for the second binders. Station codes assigned to group A and group B can be intermixed; or, if enough stations are fed from the satellite, group A stations can be bunched on one set of terminal blocks and group B on another.

**3.15** If stations from groups A and B are to be intermixed on the same block, the station cables must be terminated on an assigned column and the B bridging clips properly positioned as shown in Fig. 16. Station cables are terminated on the 66-type connecting block following the even-count color code.♦

**3.16** ♦Connections between the terminal blocks and the KSU are made using connector cables plugged into the connectors on the blocks. The raw ends of the connector cables are terminated in the KSU as shown in Fig. 17 and 18. The terminations are made on the rows and columns of the KSU connecting blocks that would normally contain the station cables.♦

**3.17** ♦For the purpose of illustration, assume a satellite made up of station codes 7, 10, 14, 16, 20, 23, 30, and 33. One 14A1-100 terminal block will be required for the first binder of the station cables and one 14A1-75 for the second binder. Three stations (7, 10, 14) are in lamp group A and five stations (16, 20, 23, 30, 33) are in lamp group B, requiring terminations and the placing of the bridging clips for a 3/5 combination as shown in Fig. 16. The station cables are terminated so that the three stations of group A appear on columns A, B, and C (codes 7, 10, 14, respectively), and the five stations of group B are on columns D, E, F, G, and H (codes 16, 20, 23, 30, 33, respectively) as shown in Fig. 19.♦

**3.18** ♦Connector cables are plugged into the connectors of the terminal blocks and routed to the KSU. The cables are terminated in the

KSU as shown in Fig. 17 and 18. For this example, cable No. 1 from the 14A1-100 is terminated where the cable for the station appearing on column H of the terminal block (code 33) would be terminated if home-run, that is, block 14, column B. Cable No. 2 provides the additional lamp and lamp ground leads plus the individual code leads for the stations on columns G and A of the 14A1-100 (codes 30 and 7), so it is terminated on block 12, column G, and block 6, column H. In addition, the four A1 leads can be obtained on any of the spare terminations of the satellite stations. Cables 3 and 4 are terminated in a like manner on the designated blocks and columns. The three cables from the 14A1-75 are also terminated in the KSU on the blocks and columns shown in Fig. 19 and provide access to the second binder leads plus the additional lamp and lamp ground leads.♦

**D. Satellite Plan Using Nomograph**

**3.19** The same basic rules apply for satellites using standard 66-type connecting blocks as with the 14A1-type terminal blocks. Sufficient conductors must be run from the KSU to the satellite to provide a one-time appearance of all common station leads, individual code leads, and enough L and LG multiples (see 3.12).

**3.20** The number of additional conductors required per L and LG lead is determined using the nomograph shown in Fig. 20. To use the nomograph, it is necessary to know three items:

- (a) The distance from the KSU to the satellite location
- (b) Number of stations to work from the satellite
- (c) Distance from satellite location to furthest station working from satellite.

By plotting the values on the proper scales and connecting them, the required number of additional conductors required per L and LG lead can be determined. The three required values are plotted on scales A, B, and E, respectively, on Fig. 20. The number of additional leads required per L and LG lead will be found on scale D. Scales C1 and C2 are used only to establish reference points.♦

**3.21** ♦To illustrate the use of the nomograph, assume a satellite location is 400 feet from the KSU, eight stations are to be fed from the



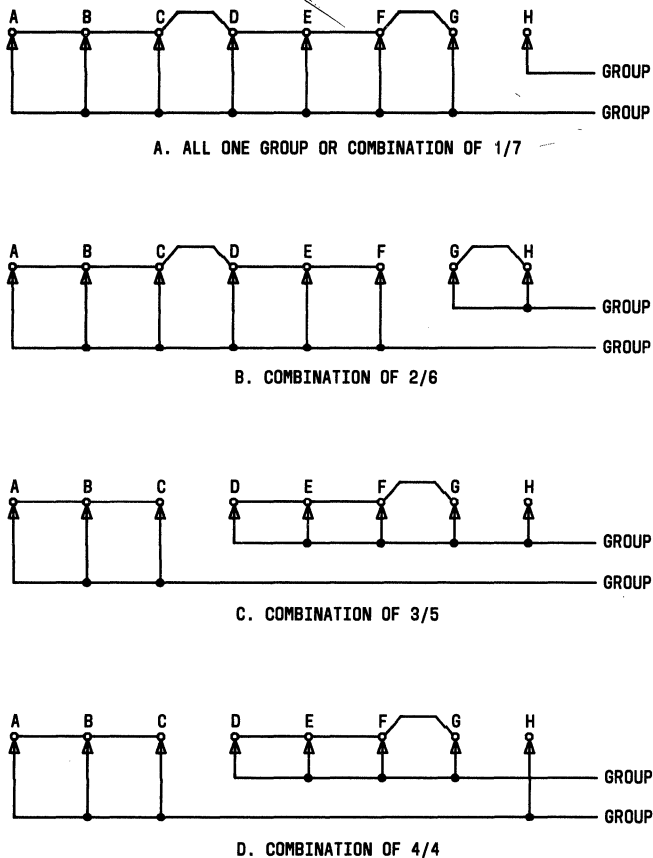
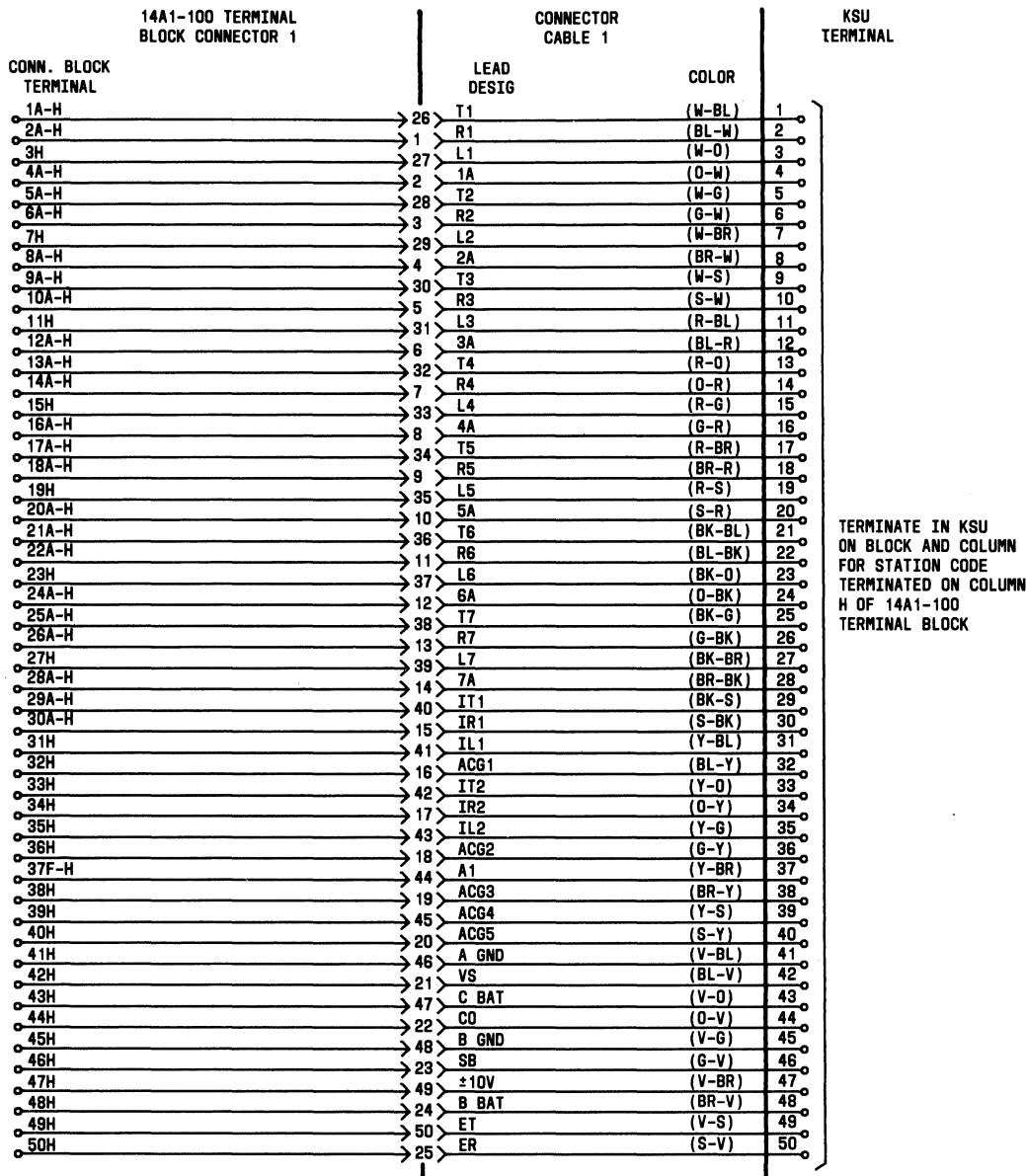


Fig. 16—Terminal Assignments and Bridging Clip Locations—14A1-Type Terminal Blocks

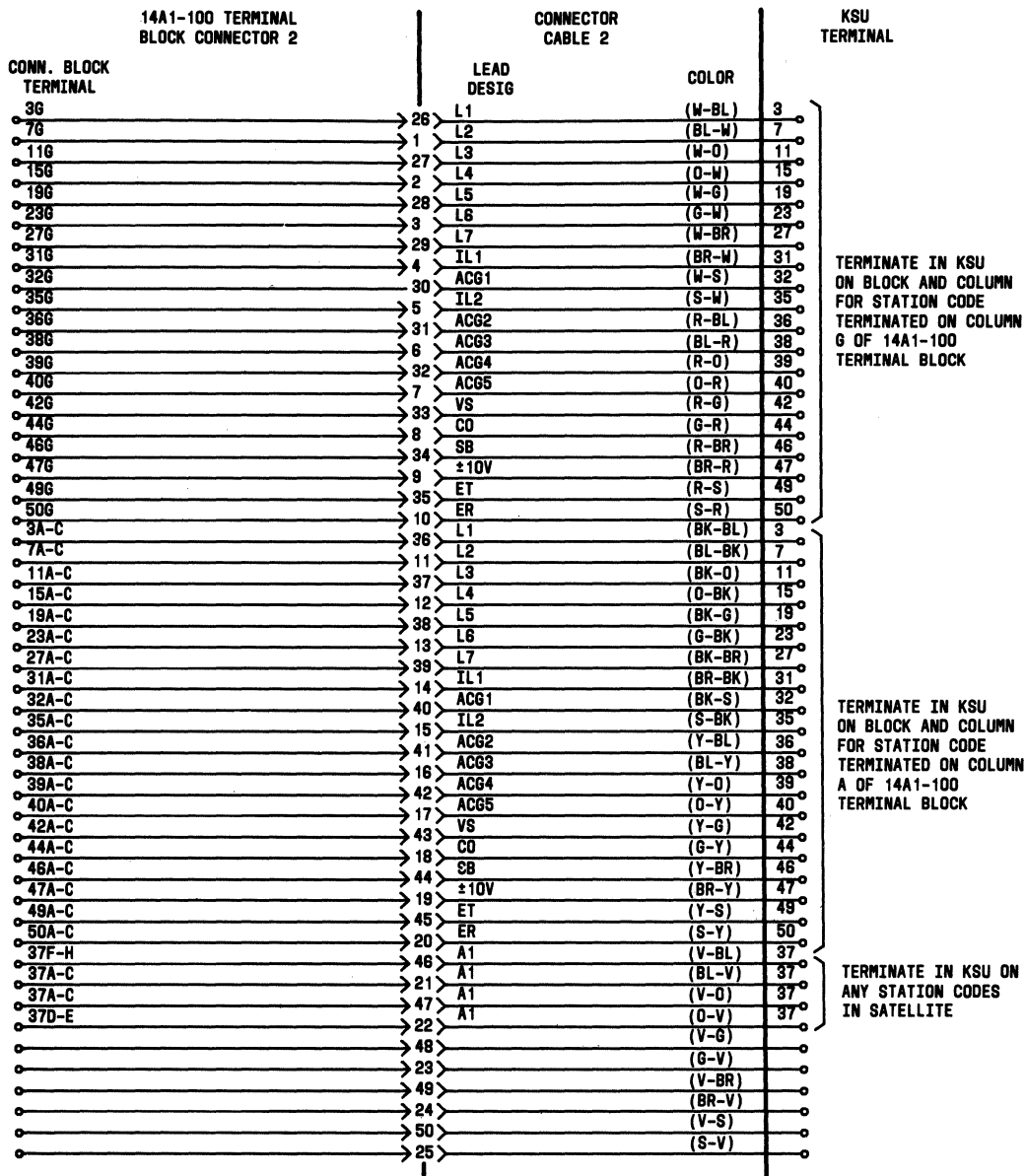
satellite, and the farthest station is 175 feet from the satellite. These figures are used as an example shown on Fig. 20 and are shown as dotted lines. To determine the number of extra leads required, use the nomograph as follows:

- (1) Locate the distance from the KSU to the satellite on scale A (400 feet).
- (2) Locate number of stations served by satellite on scale B (8 stations).
- (3) Using a straight edge, connect the points on A and B and extend the line until it crosses scale C1.
- (4) Note the point at which the line crosses C1 (approximately 33); find the same point on C2 and mark.
- (5) Locate the distance from the satellite to the furthest station (175 feet) on scale E.
- (6) Using a straight edge, connect points on C2 and E.
- (7) The point where the line from C2 to E crosses scale D indicates the number of additional conductors required (6 in the example) for each L and LG lead.



TERMINATE IN KSU  
ON BLOCK AND COLUMN  
FOR STATION CODE  
TERMINATED ON COLUMN  
H OF 14A1-100  
TERMINAL BLOCK

Fig. 17—Connections for 14A1-100 Terminal Block (Sheet 1 of 4)



TERMINATE IN KSU  
ON BLOCK AND COLUMN  
FOR STATION CODE  
TERMINATED ON COLUMN  
G OF 14A1-100  
TERMINAL BLOCK

TERMINATE IN KSU  
ON BLOCK AND COLUMN  
FOR STATION CODE  
TERMINATED ON COLUMN  
A OF 14A1-100  
TERMINAL BLOCK

TERMINATE IN KSU ON  
ANY STATION CODES  
IN SATELLITE

Fig. 17—Connections for 14A1-100 Terminal Block (Sheet 2 of 4)

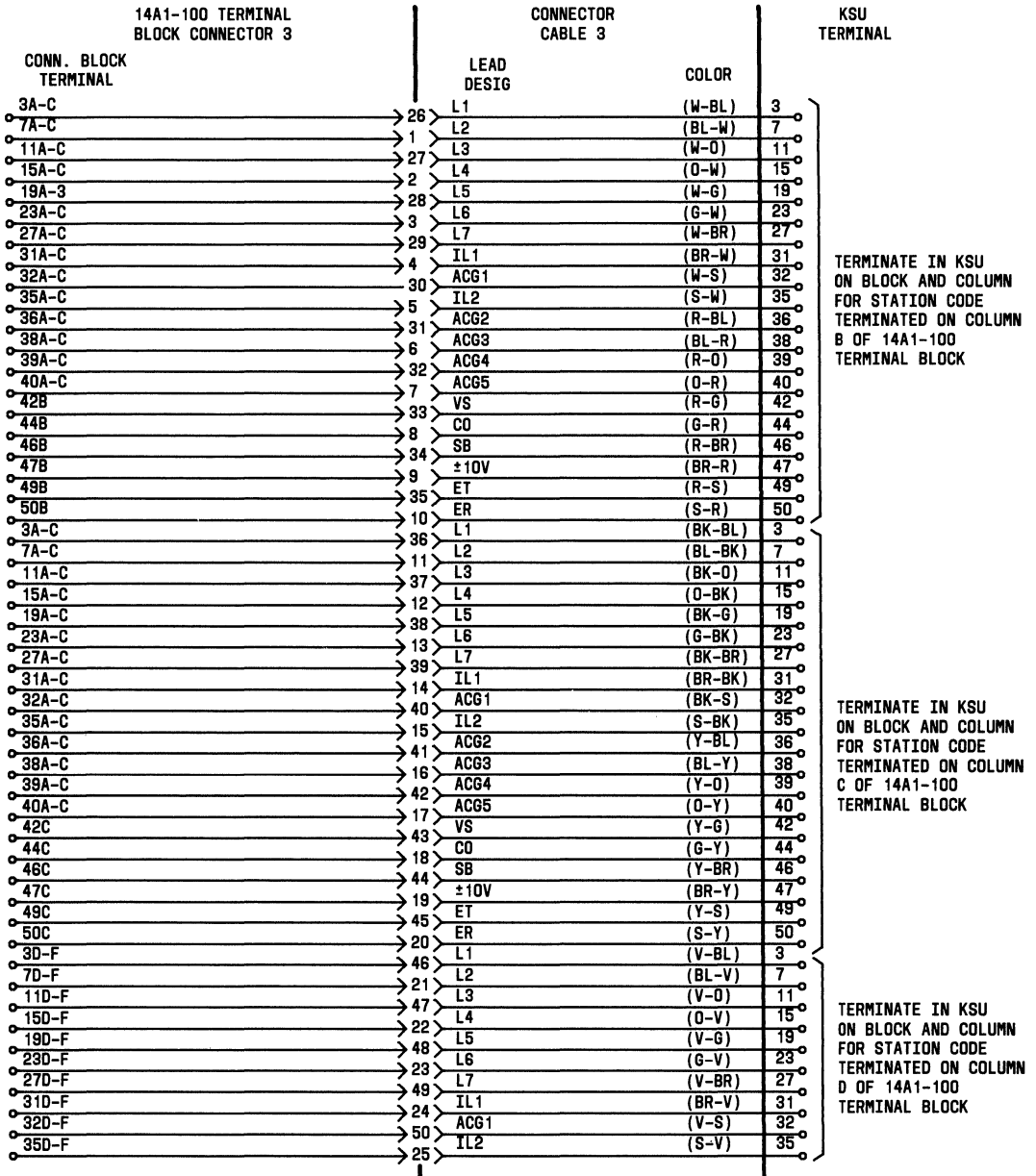


Fig. 17—Connections for 14A1-100 Terminal Block (Sheet 3 of 4)

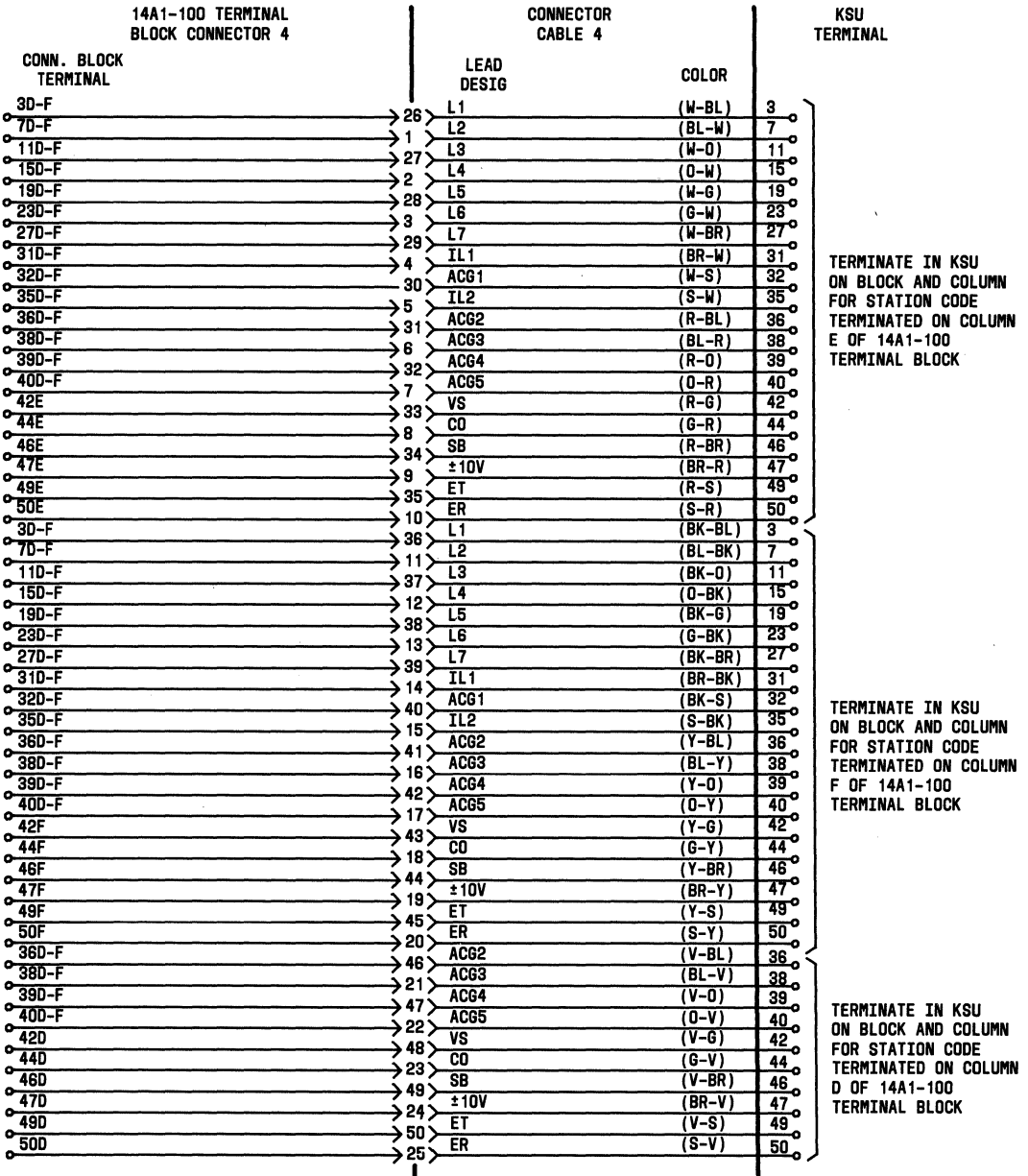
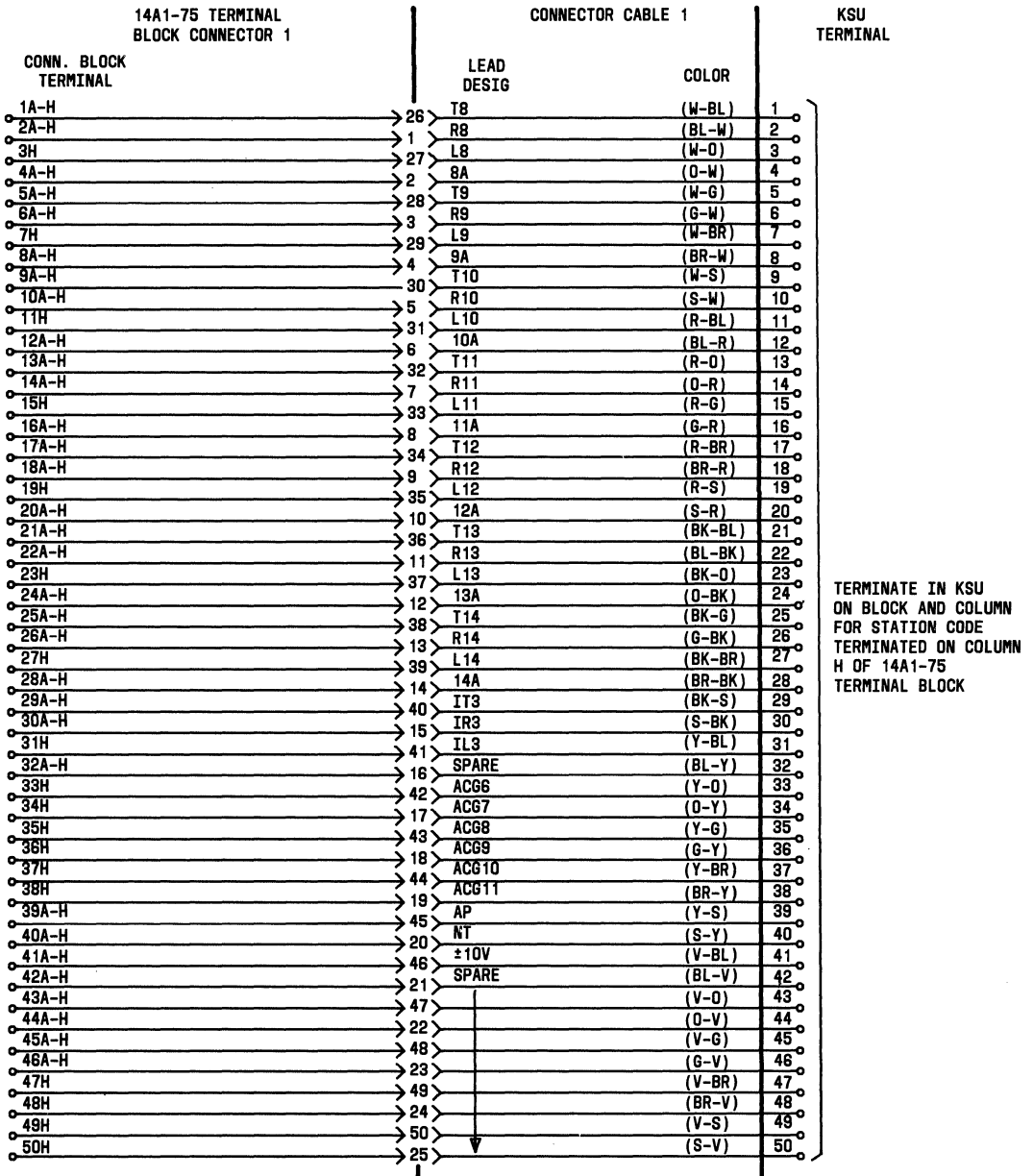


Fig. 17—Connections for 14A1-100 Terminal Block (Sheet 4 of 4)



TERMINATE IN KSU ON BLOCK AND COLUMN FOR STATION CODE TERMINATED ON COLUMN H OF 14A1-75 TERMINAL BLOCK

Fig. 18—Connections for 14A1-75 Terminal Block (Sheet 1 of 3)

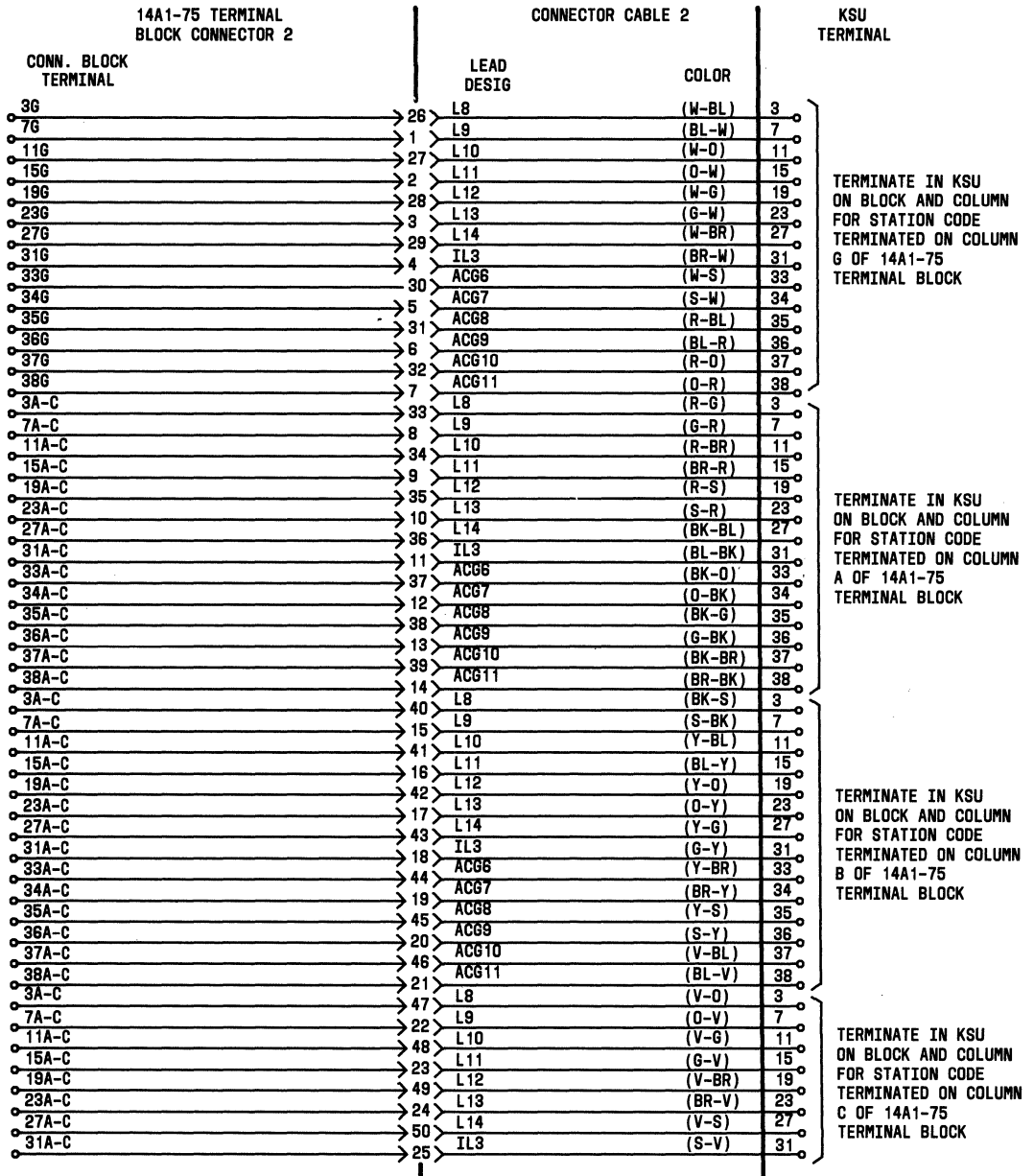


Fig. 18—Connections for 14A1-75 Terminal Block (Sheet 2 of 3)

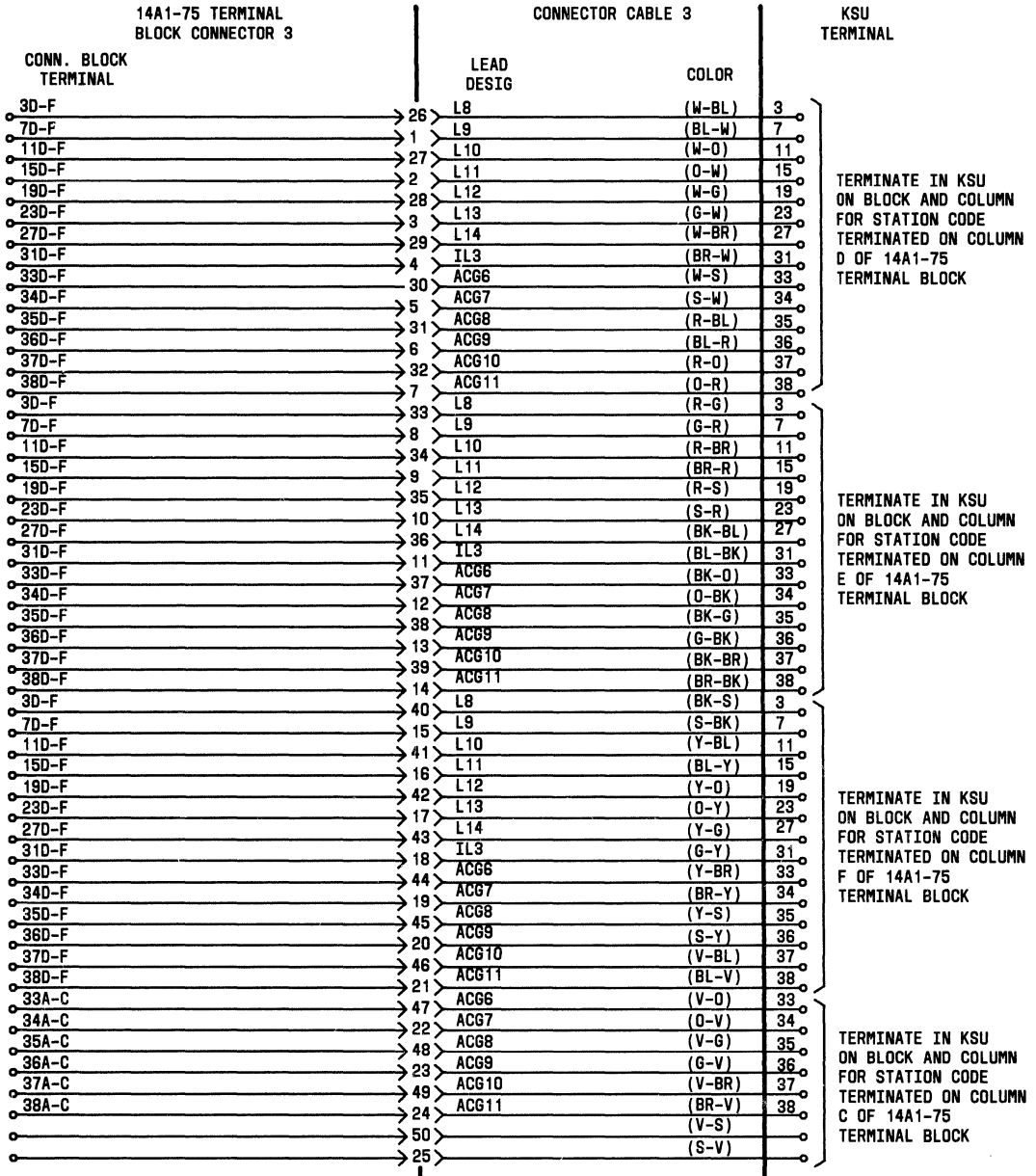


Fig. 18—Connections for 14A1-75 Terminal Block (Sheet 3 of 3)



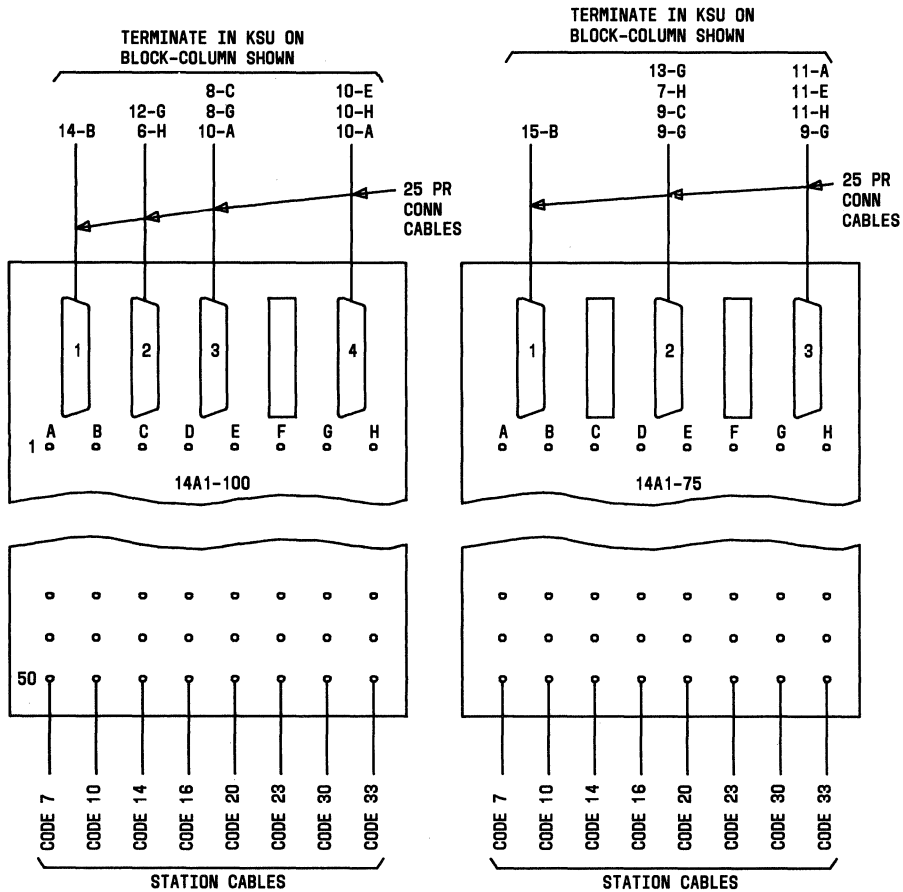


Fig. 19—Example of Satellite Wiring Using 14A1-Type Terminal Blocks

3.22 If stations from both lamp groups must be intermixed in a satellite location, the L and LG leads from group A and group B must be brought to the satellite location independently and the station codes wired to their proper group. For instance, station code 14 should be wired to group A and station code 26 to group B if they are involved on the same satellite location.

3.23 To maintain a low resistance A lead, where a satellite is more than 200 feet from the KSU, add four additional (24-gauge) cable conductors (five total conductors) for the A1 lead. Additional

cable conductors are not required for satellites located less than 200 feet from the KSU.

3.24 Once the total number of terminations is determined, the proper number of 66-type connecting blocks can be provided at the satellite and sufficient conductors run to the KSU. All terminations should be fully identified to aid in future rearrangements or repair visits.

E. Telephone Sets

3.25 Install telephone sets at desired locations. Install any telephone set options at this

A. DISTANCE FROM KSU TO SATELLITE

C. REFERENCE SCALES

E. DISTANCE FROM SATELLITE TO FARTHEST STATION

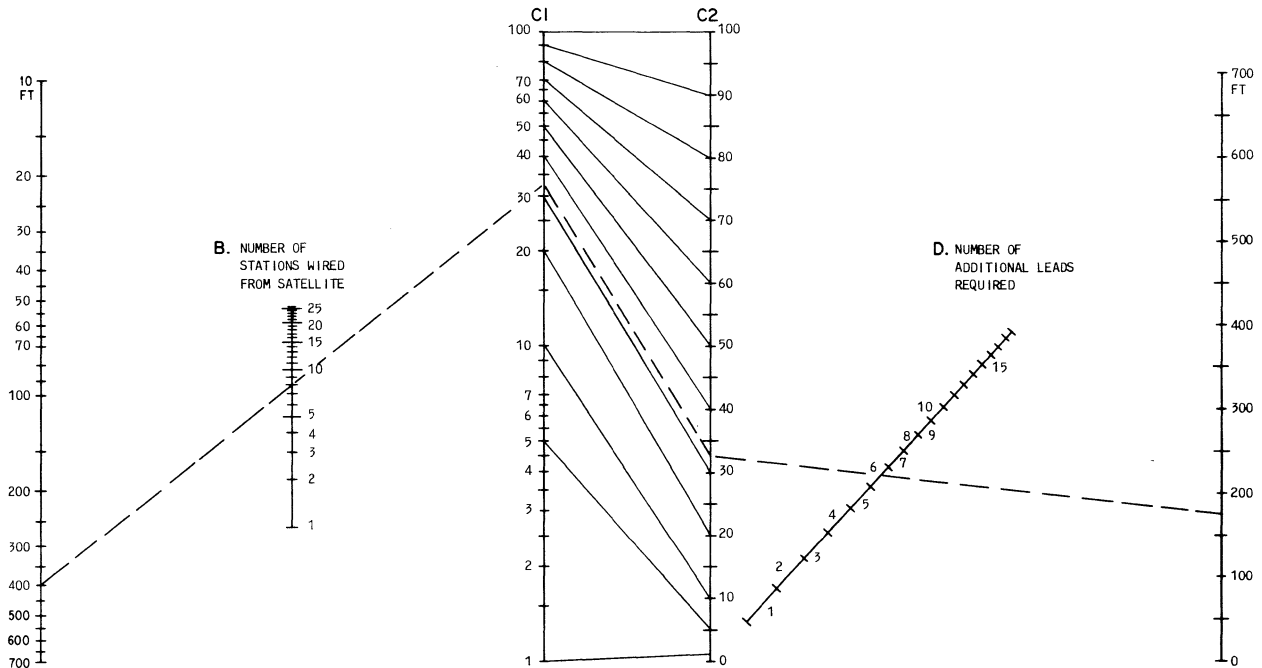


Fig. 20—Satellite Nomograph

time. Refer to Section 503-702-110 for schematics and additional information on the 833- and 2833-type telephone sets or Section 503-603-120 for the 575- and 2575-type telephone sets.

**3.26** When 832- and 2832-type telephone sets are used with the 580-type KSU, refer to Section 518-450-103.

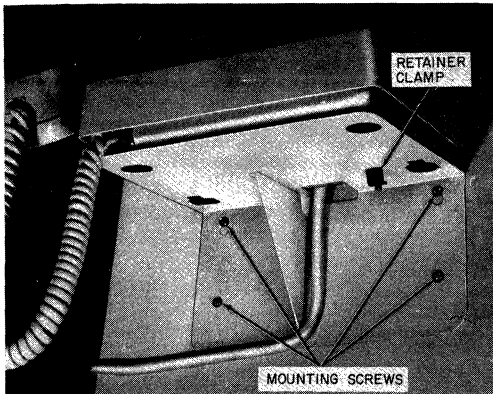
**3.27** Table C may be used as a quick reference for features of the COM KEY telephone sets.

**3.28** Where it is desirable to wall-mount an 833 or 2833 desk-type telephone set, install a D-180656 kit of parts. The kit of parts (Fig. 21) consists of a mounting shelf and a telephone set retaining clamp. Install the mounting shelf using appropriate fasteners for the surface on which it is to be mounted. Insert the telephone set mounting cord down through the opening at the rear of the shelf. Insert the retaining clamp (screw down) through the slot of the shelf, up into the base of the telephone set. Check that the pads on the telephone set base fit in the slots in the shelf and tighten the retaining clamp until the telephone set is held firmly in place.

TABLE C

TELEPHONE SET FEATURES

FEATURE	STATUS	833A(MD) 2833A(MD)	833B/2833B(MD) 833BM/2833BM 833DM/2833DM	833C/2833C(MD) 833CM/2833CM 833EM/2833EM
RECALL	Factory-provided	•	•	•
	Factory-connected	•	•	•
	Field-provided			
	Field-connected			
PRIVACY CIRCUIT	Factory-provided		•	
	Factory-connected		•	
	Field-provided	•		•
	Field-connected	•		•
PRIVACY RELEASE	Factory-provided	•	•	
	Factory-connected		•	
	Field-provided			
	Field-connected	•		
RING TRANSFER	Factory-provided			•
	Factory-connected			
	Field-provided			
	Field-connected			•



**Fig. 21—Shelf for Wall Mounting COM KEY Telephone Set (D-180656 Kit of Parts)**

**3.29** The 833DM, 833EM, 2833DM, or 2833EM telephone sets can also be installed at wall-mounted stations. Install as follows:

- (1) Place 833A-50 adapter supplied with set in position on mounting surface and mark location of mounting screw holes. Adapter should be positioned with slots at bottom.
- (2) Drill holes and place two fasteners for keyhole slots in top left and right corners.
- (3) Remove faceplate and housing from telephone set, if in place.
- (4) If connector cable will be brought into the rear of the set, route cable through slot in bottom of adapter and fasten adapter to wall using keyhole slots plus a third screw through bottom tab of adapter. Coil slack in mounting cord so that it can be stored in adapter, plug connector cable into the mounting cord, and mount set on adapter using keyhole slots and rivets in base pan.
- (5) If mounting cord is to run down wall, feed cord through slot in adapter, and fasten adapter to wall using keyhole slots and screw in bottom tab. Mount set on adapter.
- (6) Fasten bottom of set to adapter using base pan retaining clip and self-tapping screw.

- (7) Replace housing and faceplate.

#### **4. FEATURES (IDENTIFICATION, OPERATION, CONNECTIONS, AND TESTING)**

##### **BASIC FEATURES**

##### **A. Automatic Button Restoration (ABR)**

**4.01** Automatic button restoration is a feature of the 833- and 2833-type telephone sets. When the handset is placed on-hook, all depressed buttons automatically return to the nonoperated position. The ABR feature prevents inadvertent intrusion on calls that may be in progress and insures that multiple buttons will not be left depressed on an idle set causing an undesired conference.

**4.02** The intercom-only telephone sets, 575AM-50 and 2575AM-50, do not have ABR.

**4.03** The 833- and 2833-type telephone sets are operated the same as other sets except when flashing the switchhook. When switchhook flashing, the line button(s) associated with the line(s) being used must be held depressed while the switchhook is momentarily operated. For this reason, the RECALL button should be used for flashing.

**4.04** Automatic button restoration is a mechanical function of the telephone set, no wiring is required, and field adjustment of the mechanism is not recommended.

##### **B. Common Audible**

**4.05** Common audible is derived through diodes located on connecting block 2 (Fig. 5). As factory-wired, there is a diode for each CO/PBX line connected to a common audible terminal. A factory-provided strap (on the installer's side of connecting block 1) connects the common audible terminal to station code 0. With this arrangement, whenever there is an incoming call on any of the CO/PBX lines, the attendant station receives **tone ringing**. A flashing line lamp identifies the calling line.

**4.06** The common audible signal can be changed to a station, or stations other than or in

addition to the attendant station. To change the common audible ringing, on connecting block 1:

- (1) Remove the factory-provided strap between terminals H19 and C1.
- (2) Run a (continuous) strap from the common audible terminal, H19, to the CO/PBX ring terminal(s), in column C or column G, associated with the station(s) selected for common audible ringing (see Fig. 4).

**Note:** *No more than 10 stations, including the attendant station, can be wired for common audible ringing in systems using a 580-type KSU manufactured after July 1, 1975, or modified as indicated by an asterisk (\*) stamped adjacent to the code on the KSU backplate. Systems manufactured prior to that date must be modified per Fig. 81 to increase the number of stations wired for common audible from one to ten.*

**4.07** A CO/PBX line can be removed from the common audible group by removing the corresponding common audible diode. The common audible diodes are located on connecting block 2 (Fig. 5). When a CO/PBX line is removed from the common audible ringing arrangement:

- The CO/PBX line must be connected to ring a selected station(s) via a CO ringing arrangement.
- The ringing cannot be transferred through the ring transfer arrangement.

### C. Multiline Conferencing

**4.08** Multiline conferencing is a feature of the telephone sets used in the system. Since there is no amplification involved, this type conferencing is limited. **When lines are conferenced, using this manner of conferencing, distant stations may have trouble hearing each other and transmission is not guaranteed.**

**4.09** Conferencing is accomplished by simultaneously depressing the CO/PBX line buttons of the lines to be conferenced.



**Intercom and CO/PBX lines cannot be conferenced together.**

**4.10** All lines that are conferenced together may be put on hold simultaneously by depressing the HOLD button.

**4.11** To make a call during a conference:

- (1) Depress HOLD button—all buttons restored; conferenced parties cannot hear each other.
- (2) Select an idle line and depress line button.
- (3) Dial call.
- (4) If it is desired to add this call to the conference, hold this CO/PBX line button down and simultaneously depress the conferenced CO/PBX line buttons.
- (5) To reenter conference, simultaneously depress the CO/PBX line buttons of the lines conferenced.

**4.12** If it is desired to add another line to a conference, hold the line buttons of the conferenced lines down and depress the line button of the CO/PBX line to be added to the conference.

**4.13** To prevent disconnecting one of the participants when setting up a conference, ensure that the conferenced CO/PBX line buttons are held down while adding another station.

**Remember:** The system may be disabled if multiple buttons are depressed at an idle station.

**4.14** Conferencing is a mechanical function of the telephone set and requires no wiring.

### D. Pickup, Hold, and Illumination

**4.15** The system provides pickup on CO/PBX and intercom lines and hold on CO/PBX lines. Lamps provide the following information: steady lamps are for line busy, flashing lamps for incoming calls, and winking lamps for lines on hold.

**4.16** The CO/PBX and intercom lines appear on the same buttons at all stations. By observing

the lamps associated with the CO/PBX and intercom line buttons, the station user can readily determine the status of each line. Any station user can pick up any idle line or place any CO/PBX line on hold. Lamp and hold functions are provided by the 400-type KTU.

### E. 3-Path Intercom

#### 4.17 The intercom circuit has three talking paths.

A path is selected by depressing one of the three intercom buttons on the telephone set. There is no privacy on any path and any station may enter into an existing call.

4.18 When it is desirable for a station to pick up only the three intercom lines and not have access to the CO/PBX lines, a 575AM-50 or a 2575AM-50 telephone set can be used. Both sets are connected to the 580-type KSU by an A25B connector cable. See Fig. 22 for connections.

4.19 The selector, used to select and alert the called stations, is shared among the three intercom paths. The alerting signal at the called station is a tone burst followed by a voice signal (message) from the calling station. The lamp functions on the intercom lines are as follows: When the selector has seized a path, the lamp associated with the seized path will flash on all telephone sets. The flashing lamp indicates which line should be answered by the called station. When the called station answers, the intercom line lamp changes from flash to steady. When the intercom path is idle, the associated lamp is dark.

4.20 To place an intercom call:

- (1) Select an idle intercom path and depress the associated intercom line button.
- (2) Lift telephone handset.

**Note:** If a lamp is flashing on another intercom path, other stations should not attempt intercom calls until the selector is released (and lamp goes steady or dark). While the selector is seized by another station, no dial tone is heard.

- (3) Dial selected station—tone burst signals called station.

(4) Calling station may make announcement or wait for called station to answer. When called party depresses intercom line button and goes off hook, intercom lamp will go steady.

4.21 Intercom is factory-wired, requiring the 424B or C, 444-type, 454B, and 456B KTUs. See Fig. 3 for connector locations. The intercom code of a station is determined by the column on connecting blocks 6 and 7, 8 and 9, 10 and 11, 12 and 13, or 14 and 15, on which the station connector cable is terminated. See Fig. 15.

### F. Tone and Voice Signaling

4.22 All stations in the 14A System are alerted by a distinctive tone signal. CO/PBX ringing is a frequency-shifting tone (900 and 1100 Hz) provided by the 455A KTU. Intercom ringing is a single tone (500 Hz) provided by the 456B KTU. In the event a station is simultaneously signaled by an incoming CO/PBX call and an intercom call, the intercom signal is given preference.

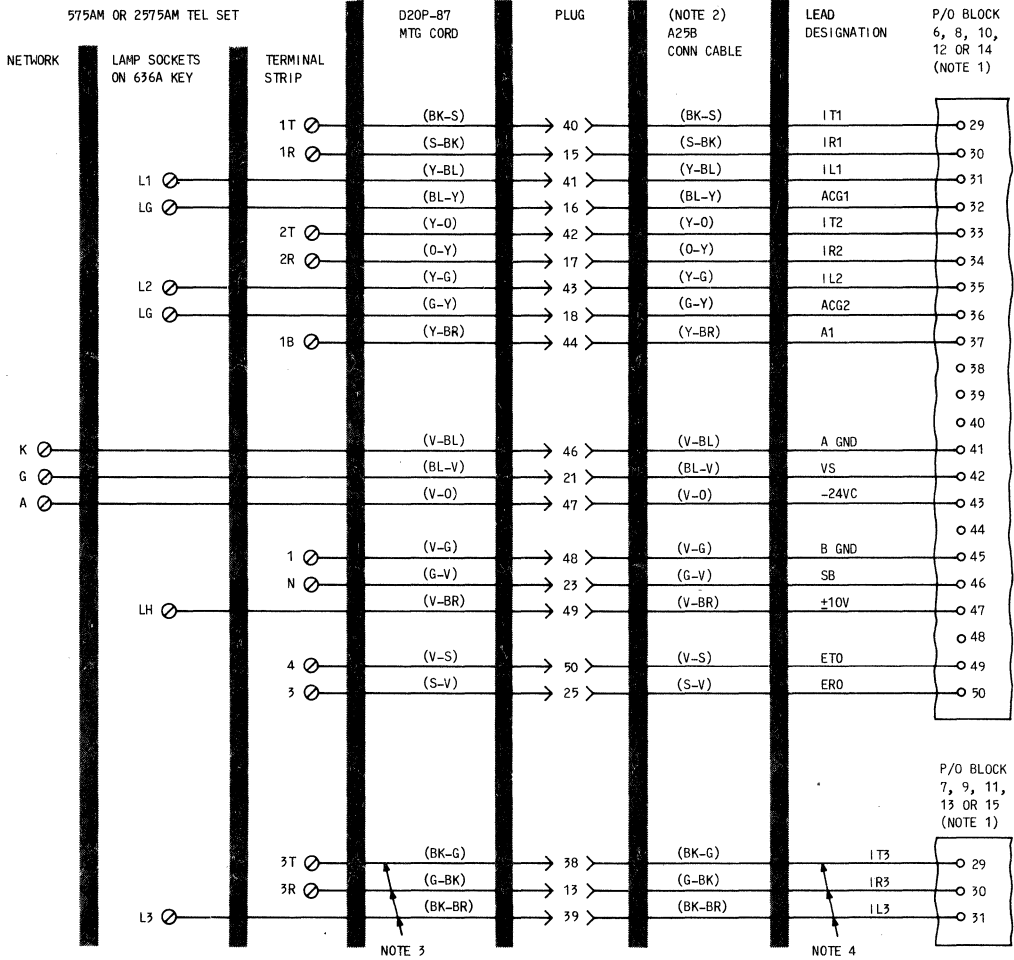
4.23 Voice signaling is the announcement that can be made on an intercom call after a station has been alerted by the tone signal. As soon as the alerting tone has been heard, the calling party can make an announcement which will be heard over the loudspeaker at the called station. After making an announcement, the calling party may terminate the call or wait for the called station to answer.

### G. Recall

4.24 Recall provides the same function as switchhook flash without restoring the line buttons. Recall is accomplished by momentarily depressing the RECALL button on the telephone set. Depressing the RECALL button opens the ring side of the line(s) in the telephone set. The RECALL button is designated by an amber cap.

**Caution:** When CO/PBX lines are conferenced and the RECALL button is depressed, the conferenced lines may be disconnected.

4.25 All 833- and 2833-type telephone sets are equipped with a RECALL button.



NOTES:

1. TERMINATE CONNECTOR CABLE FOR INTERCOM ONLY STATION ON SAME BLOCK(S) AND COLUMN AS 833- OR 2833-TYPE SETS.
2. LEADS SHOWN ARE ONLY ONES REQUIRED. BALANCE OF CONNECTOR CABLE CAN BE TERMINATED EXCEPT WHEN 3RD IC PATH IS REQUIRED.
3. THE BK-G, G-BK AND BK-BR LEADS ARE INSULATED AND STORED IN THE TEL SET. IF THE 3RD INTERCOM PATH IS PROVIDED THESE LEADS MUST BE TERMINATED AS SHOWN.
4. TERMINATE LEADS ONLY WHEN 3RD INTERCOM PATH IS PROVIDED.

Fig. 22—Connections for Intercom-Only Telephone Sets

## H. Ring Transfer

**4.26** Ring transfer switches the common audible CO/PBX ringing from the attendant station (code 0) to an alternate station or stations in the 14A System. A CO/PBX line that has been removed from the common audible group cannot have its incoming ring transferred via the ring transfer arrangement. Ring transfer can be wired for fixed station or for flexible station transfer. With fixed station ring transfer, incoming calls are transferred to a specific station or group of stations as fixed by an option strap in the KSU. For information on flexible ring transfer, refer to **OPTIONAL FEATURES**.

**4.27** To operate ring transfer wired for fixed station transfer, depress the RING TR (ring transfer) button on the attendant telephone set (locking it down). To transfer ringing back to the attendant station, depress the RING TR button again which releases it. While the RING TR button is depressed, the lamp under it is lit (steady).

**4.28** Attendant stations which are to control ring transfer must be equipped with an 833CM, 833EM, 2833CM, or 2833EM telephone set which is factory-equipped with a ring transfer button. However, the ring transfer button is not factory-connected and must be connected in the field. To connect the ring transfer button, open the telephone set, move the O-BK lead from terminal 7 to terminal 11, and move the O-V mounting cord lead from terminal 1 to terminal 23 on the telephone set terminal board (see Fig. 23).

**Note:** First production models of the 833C (MD) and 2833C (MD) telephone sets had the ring transfer button factory-connected.

**4.29** For fixed station ring transfer, in the KSU, run a strap from the RT terminal (column H, terminal 21) on connecting block 1 to station(s) code terminal(s) (in column C or column G) selected for ring transfer. For example, Fig. 23 shows station 12 connected for fixed ring transfer. When more than one station is to be connected for ring transfer, run a continuous strap from the RT terminal to all station code terminals of the stations selected for ring transfer. No more than ten stations can be wired to ring on ring transfer.

**4.30** To test fixed ring transfer:

- (1) Depress the RING TR button at the attendant station, locking it down—lamp under button lights (steady).
- (2) Select an idle CO/PBX line, depress line button, lift handset, and dial another CO/PBX line—station selected for ring transfer rings (tone burst is heard).
- (3) Depress RING TR button on the attendant station, releasing it—lamp under button goes off. Tone ringing is heard at attendant station.
- (4) Replace handset.¶

### OPTIONAL FEATURES

#### A. Station Line Ringing

**4.31** The station line ringing feature permits a station not wired for common audible to receive the ringing on a selected CO/PBX line. Any combination of stations may be connected for ringing on a one line-per station basis.

**Remember:** The station line ringing and common audible ringing is tone ringing.

**4.32** Terminals representing each CO/PBX line are located on connecting block 1, rows 22 and 23 (see Fig. 4). To connect a station for station line ringing, on connecting block 1 select the terminal in column C or column G associated with the station to ring. Then determine the terminal in row 22 or row 23 associated with the CO/PBX line selected for ringing. Next, run a strap, RC( ) lead, from the CO ring terminal to the station code terminal. Fig. 24 illustrates station 18, plus the attendant, connected to ring on line 5 and station 31 to ring on line 10.

**4.33** To remove the CO/PBX lines from the common audible group, remove the common audible diode as described in 4.07.

#### B. External Signaling Circuit

**4.34** When external signaling devices (such as bells, gongs, chimes, lights, or buzzers) are to be connected to the 14A System, a 22A-49 apparatus unit must be provided. The 22A-49 apparatus unit is externally mounted, and connections



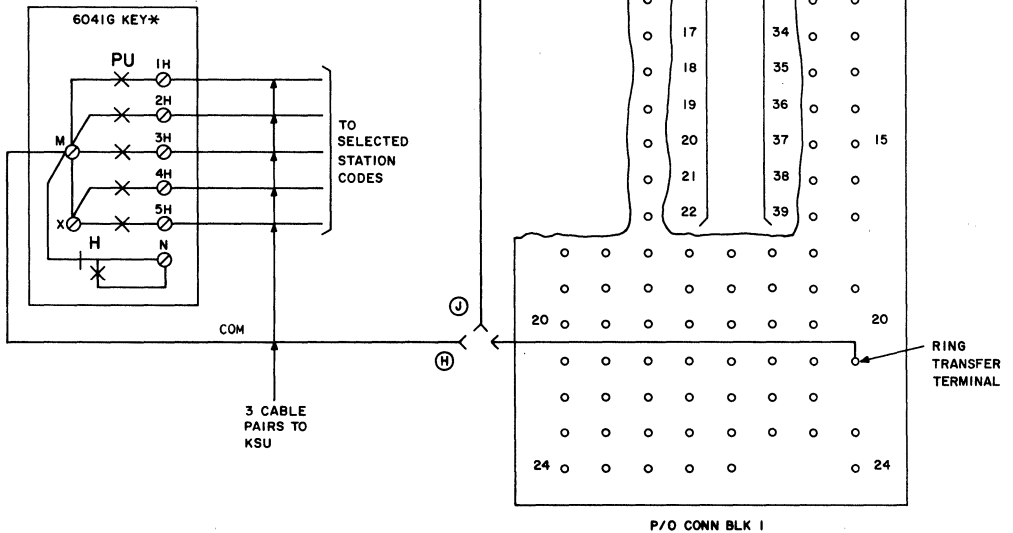
**SECTION 518-450-102**

CONNECTIONS TO ACTIVATE RING TRANSFER BUTTON IN 833CM, 833EM, 2833CM AND 2833EM TELEPHONE SETS

LEAD	COLOR	MOVE LEAD IN TEL SET	
		FROM TERM.	TO TERM.
RT KEY	O-BK	7	11
MTG CORD	O-V	1	23

\* REFER TO SECTION 512-210-103 FOR ORDERING INFORMATION ON 6041G - KEYS

- OPTIONS:
- (J) FIXED STATION RING TRANSFER. ANY STATION MAY BE SELECTED FOR RING TRANSFER. TRANSFER TO STATION 12 IS SHOWN HERE.
  - (H) FLEXIBLE STATION RING TRANSFER. ANY ONE OF UP TO FIVE STATIONS MAY BE SELECTED FOR RING TRANSFER THROUGH 6041G - KEY



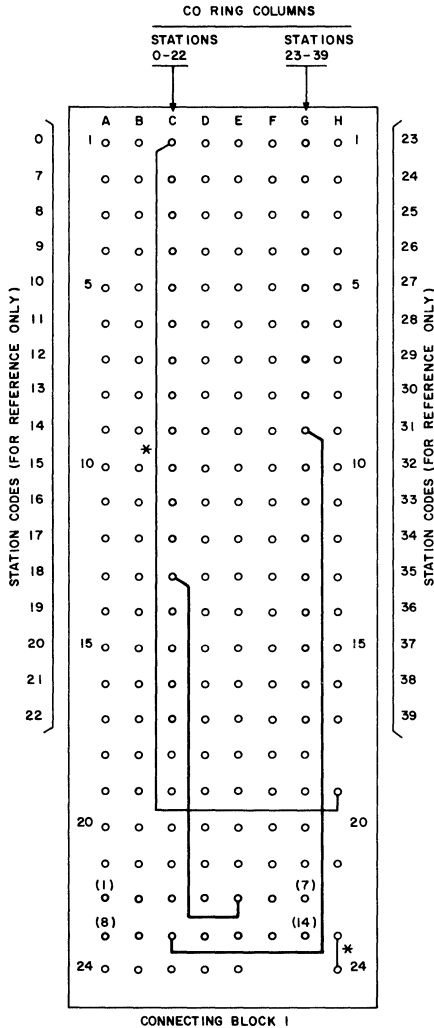
**Fig. 23—Connections for Ring Transfer**

are made to the KSU with inside wire. In addition, an external power supply must be provided to operate the signaling devices. The 22A-49 apparatus unit may be used to activate signaling devices that are operated by an open circuit (through a relay

break contact) or that are operated by a circuit closure (through a relay make contact).

**Caution: The 22A-49 apparatus unit contains a nonadjustable, mercury-wetted**

*sealed contact relay and must be mounted in a vertical upright position.*



- NOTES:
1. NUMBERS IN PARENTHESIS ( ) REPRESENT THE 14 CO/PBX LINES.
  2. CONNECTIONS AS SHOWN CAUSE STATION 18 TO RING ON LINE 5 AND STATION 31 TO RING ON LINE 10.
  3. RUN CONTINUOUS STRAP.
  4. WHERE IT IS NECESSARY TO "STACK" LEADS ON A TERMINAL USE 183B2 ADAPTERS.
- \* FACTORY PROVIDED STRAP ON INSTALLERS SIDE OF BLOCK.

**Fig. 24—Connections for Station Line Ringing**

**4.35** The 22A-49 apparatus unit is used to activate external signaling devices connected for:

- Station codes (see Fig. 25)
- Common audible (see Fig. 26)
- Station line ringing (see Fig. 26)
- Ring transfer (see Fig. 26).

**4.36** One 22A-49 apparatus unit is required for each station code or each CO/PBX line equipped with an external signaling device. The maximum resistance of each lead between the KSU and the 22A-49 apparatus unit is 25 ohms.

**4.37** The KS-16301 type auxiliary signals are recommended as external signaling devices for use with the 14A System. See Fig. 27 for connections. Refer to Section 463-110-100 for identification, installation, operation, maintenance, and ordering information on the KS-16301 type signals.

**4.38** The external power supply used to operate the signaling devices must be properly fused and have the capacity to adequately power the signaling devices. The ac power receptacle should meet requirements per 3.02. Information found in Sections 167-416-201, 167-440-201, or 167-446-101 may be used as a guide toward selecting an appropriate power supply. Do not use a power supply that exceeds the contact rating of the 22A-49 apparatus unit which is 130 volts, 1.5 amps, 25 volt/amps.

**C. Preset Conference on Intercom**

**4.39** The preset conference feature allows five stations to be signaled simultaneously by dialing station code 39. When preset conference is provided, by dialing code 39, any station can establish a conference with the stations that have been connected for preset conference. The station capacity of the 14A System is reduced to 33 stations when preset conference is provided, as code 39 is forfeited for use as a station code. Where a station is connected for preset conference and station line ringing, the signaling of the preset conference takes precedence over station line ringing.

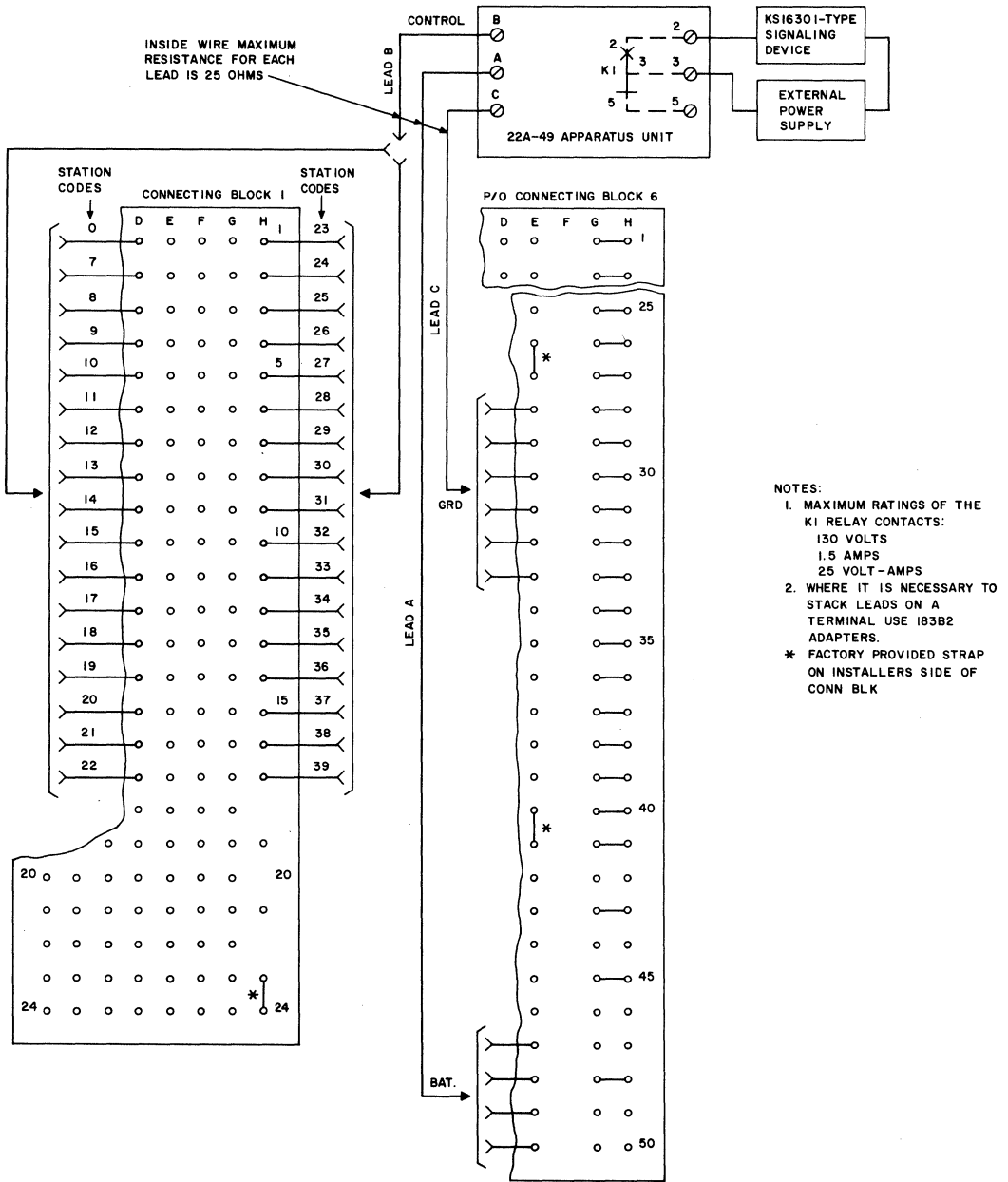
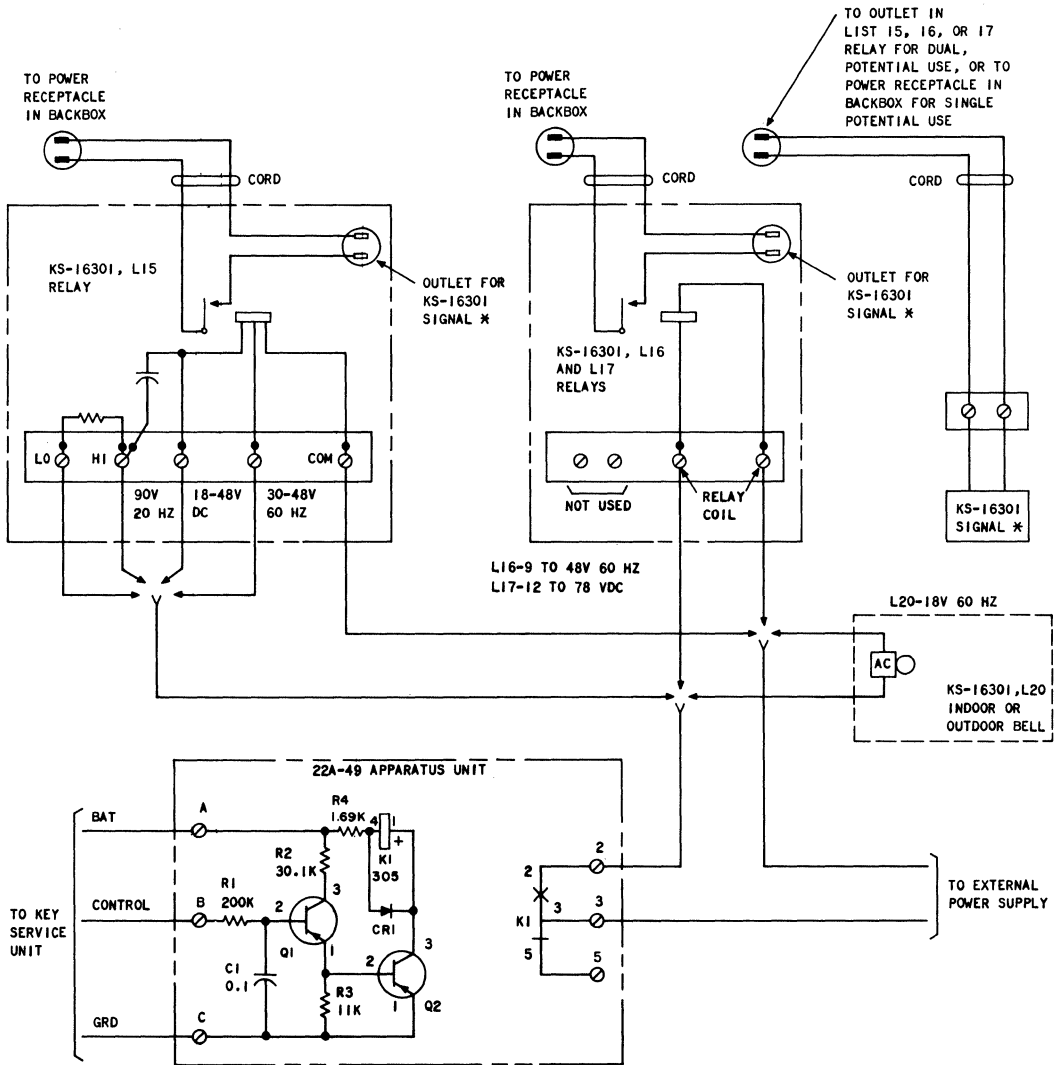


Fig. 25—Station Code Connections for External Signaling Circuit (22A-49 Apparatus Unit)





\* LIST 1, 2, 3, 4, OR 5

NOTE:  
THE 22A-49 APPARATUS UNIT MUST  
BE MOUNTED IN A VERTICAL UPRIGHT  
POSITION.

Fig. 27—Connections for 22A-49 Apparatus Unit and KS-16301 Type Signals

**4.40** Any station may originate a preset conference call but only those stations wired for preset conference will be alerted. An attendant may use DSS code 39 if the attendant station is equipped with the optional DSS console. To use preset conference:

- (1) Select idle intercom path and depress associated button.
- (2) Lift handset.
- (3) Dial code 39 (attendant may use DSS code 39 on DSS console)—tone burst signals all stations wired for preset conference.
- (4) All preset conference stations will receive announcement simultaneously.
- (5) Called stations must depress intercom line button and go off-hook to hold conference or talk to each other.

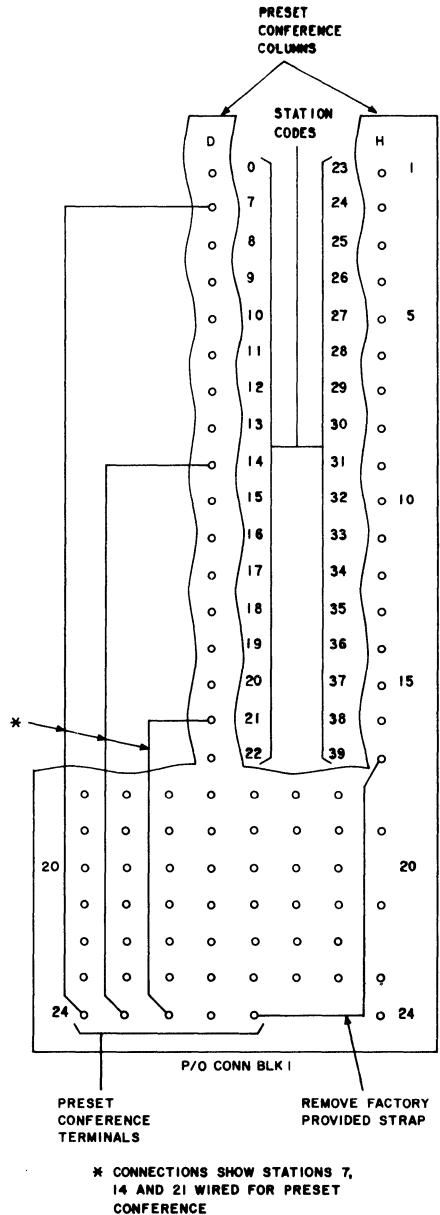
**4.41** Connections for preset conference are made as follows:

- (1) Locate the preset conference terminals, row 24, on connecting block 1 (Fig. 28).
- (2) Locate the station code terminals, column D or H, on connecting block 1, and identify the terminals associated with the stations to be connected for preset conference (Fig. 28).
- (3) Remove the factory-provided strap between terminals E24 and H17.
- (4) Strap the terminals in the preset conference row to the desired station terminals in column D or H (Fig. 28).
- (5) Test the preset conference arrangement by having code 39 dialed from a nonconference station and verifying that all conferenced stations are signaled.

**Note:** The preset conference diodes are located on connecting block 2 between rows 9 and 12 (Fig. 5).

**D. Music-On-Hold**

**4.42** The music-on-hold feature transmits music (from a customer-provided music source) to



**Fig. 28—Connections for Preset Conference on Intercom**

calling or called parties on CO/PBX lines that are placed on hold.

**4.43** ♦ Music-on-hold is provided on CO/PBX lines by a 33A voice coupler and two 451-type KTUs (580A KSU only) or two 498A KTUs equipped with 116A1 CMs (580B KSU only). The music is supplied from a customer-provided source. The customer-provided music source must have an output impedance low enough to drive an 8-ohm load without distortion. The music source must also be adjustable so the listening level of the music-on-hold may be adjusted. The output of the customer-provided music source must furnish ac coupling only, thus blocking all direct current to the input terminals of the 33A voice coupler.



*The customer-provided music source should be able to deliver up to 1 watt into an 8-ohm load. The 33A voice coupler will accept input from any customer-provided apparatus that does not operate the fuses in the voice coupler. The customer should contact the local Telephone Company Business Office or the Marketing Representative to obtain a copy of the Technical Reference covering this interface specification. If a service call is caused by a malfunction of the customer-provided equipment, billing should be made in accordance with Section 660-101-312.*

**4.44** Connections for music-on-hold are made as follows:

- (a) Install 451-type or 498A KTUs in connectors J27 and J29. See Fig. 3 for location.

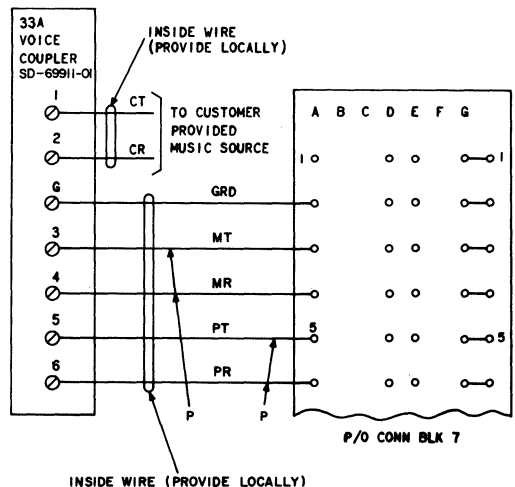
**Note:** Each 451-type KTU will provide music-on-hold for seven CO/PBX lines. Each 498A KTU will provide music-on-hold for four CO lines. When used in a 580-type KSU, the 498A KTU should be equipped with a 116A1 CM which increases the capacity to seven lines. To install the 116A1 CM, remove the screw in the standoff on the 498A KTU, plug the CM into the KTU, and replace the screw to secure the CM.

(b) Install 33A voice coupler (Fig. 11) as follows:

- (1) Remove cover from voice coupler.

**Caution:** *Ensure that 35P fuses are installed with the springs at the bottom. If fuses are improperly installed, operated fuses may cause damage to customer's amplifier.*

- (2) Mount voice coupler externally to the KSU (wherever customer desires).
- (3) Connect voice coupler to 580-type KSU as shown in Fig. 29.
- (4) Have customer connect voice coupler to his music source as shown in Fig. 29.



**Fig. 29—Connections for 33A Voice Coupler**

- (5) Replace cover on voice coupler.
- (c) Adjustment procedures for music-on-hold are as follows:
- (1) Turn potentiometer on 33A voice coupler to full counterclockwise position.

- (2) From any station, select a CO/PBX line, (eg, line 1) and dial a second CO/PBX line (eg, line 2).
- (3) Leaving the handset off-hook at the first station, at a second 14A station, answer the incoming call and place call on HOLD.
- (4) Return to the first station and have customer adjust his music source to a comfortable listening level while listening at the first station.
- (5) Disconnect call making sure handsets are on-hook and all buttons are restored to the unoperated position.♦
- (5) At the KSU, terminate one conductor (common lead) on the RT terminal (column H, terminal 21) of connecting block 1.
- (6) Terminate the remaining conductors on the terminals of connecting block 1, column C or column G, corresponding to the codes of the stations selected for ring transfer (see Fig. 23).
- (7) Install designation strip on the 6041G key. Designate the HOLD button as RELEASE and label the remaining buttons, according to the stations they connect, for ring transfer.

**Remember:** Incoming ringing on the CO/PBX lines that have been removed from the common audible group cannot be transferred via the ring transfer arrangement.

#### E. ♦Flexible♦ Ring Transfer

**4.45** The flexible ring transfer arrangement utilizes a 6041G key to permit any one of up to five stations or groups of stations to be selected for ring transfer of incoming CO/PBX calls.

**4.46** To operate flexible ring transfer, depress button on the 6041G key associated with the station or stations to receive incoming CO/PBX calls. Then depress the RING TR button on the attendant station (locking it down). While the RING TR button on the attendant station is depressed, the lamp under it is lit (steady). To transfer ringing back to the attendant station, depress the RING TR button again (which releases it) and operate the HOLD button on the 6041G key.

**4.47** To install flexible ring transfer:

- (1) Install a 6041G key at the attendant station.
- (2) Provide three cable pairs or six 24-gauge conductors between the 6041G key and the KSU.
- (3) Connect one conductor (common lead) to terminal M of the 6041G key (see Fig. 23 or 30).
- (4) Terminate the remaining conductors on terminals 1H, 2H, 3H, 4H, and 5H of the 6041G key, as required.

**4.48** To test flexible ring transfer:

- (1) Depress a button on the 6041G key.
- (2) Depress the RING TR button at the attendant station, locking it down—lamp under button lights (steady).
- (3) Select an idle CO/PBX line, depress line button, lift handset and dial another CO/PBX line—station associated with the depressed button of the 6041G key rings (tone burst is heard).
- (4) While CO/PBX line is ringing, depress other buttons on the 6041G key, making sure the station associated with each button rings.
- (5) Depress RING TR button on the attendant station, releasing it—lamp under button goes off and tone ringing is heard at attendant station.
- (6) Depress the RELEASE button on the 6041G key and replace handset.

**Note:** The lamps associated with the buttons of the 6041G key do not light.



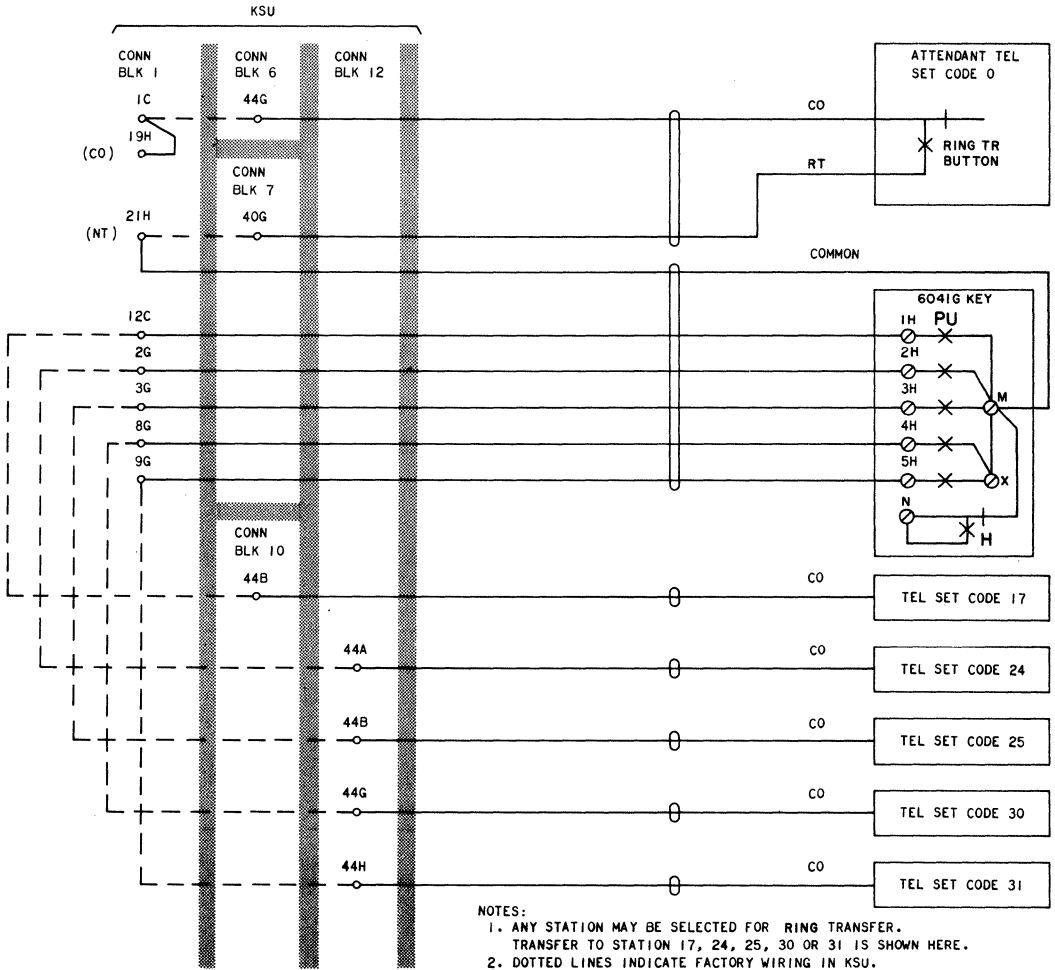


Fig. 30—Example of Connections for Flexible Station Ring Transfer

**F. Loudspeaker Paging and Background Music**

**Paging**

4.49 In the 14A System paging may be:

(a) Connected to as many as 21 loudspeakers, using indoor and outdoor speakers

(b) Provided in three separate zones or areas using as many as seven indoor and/or outdoor speakers for each zone

(c) Connected to a customer's paging system

(d) Connected to a separate paging system provided by the telephone company.

**4.50** A paging system should be loud enough to be heard but not loud enough to annoy anyone located near the speakers. The number and locations of speakers are influenced mainly by the environment in which the speakers will be located. Fig. 31 shows several examples of speaker placement. Refer to Section 981-251-100 for information on loudspeaker paging systems. It may be necessary to experiment, on site, to achieve the desired results.

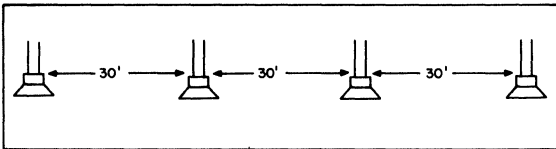
**Caution: Avoid placing loudspeakers directly in front of or close to stations that will utilize the paging system. An undesirable oscillation (squeal) can result from such speaker placement. A separation of 60 feet between**

**telephone sets and loudspeakers is recommended.**

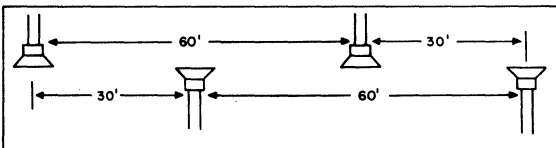
**4.51** Paging may be activated by dialing an intercom code for each zone, by dialing an intercom code for two zones, or by dialing an intercom code for all zones or various combination of zones (see Table D). Intercom codes 4, 5, and 6 are used for paging, and straps must be placed on connecting block 3 to connect the codes. The diodes associated with the zone paging arrangement are located on connecting block 3 (see Fig. 6).

**4.52** Connections for paging are made as follows:

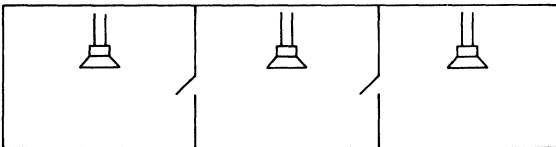
- (1) Install 457C KTUs (one for each zone or one for each seven speakers) in connectors



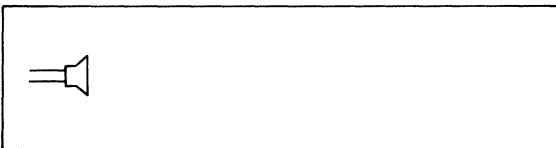
EXAMPLE A - SPEAKERS LOCATED ON ONE WALL OF ROOM (NOTES 1, 2 AND 3)



EXAMPLE B - SPEAKERS LOCATED ON OPPOSITE WALLS OF ROOM (NOTES 1 AND 2)



EXAMPLE C - SPEAKERS LOCATED IN INDIVIDUAL ROOMS (NOTES 1, 2 AND 4)



EXAMPLE D - OUTSIDE SPEAKER (HORN) LOCATION (NOTES 2 AND 5)

NOTES:

1. EXAMPLES A, B AND C ARE FOR QUIET OR OFFICE TYPE ENVIRONMENTS, LESS THAN 65DB SOUND PRESSURE LEVEL (SPL). ALL SPEAKERS SHOULD BE LOCATED AT LEAST 60 FEET FROM ANY STATION USED FOR PAGING.
2. SPEAKER WIRING SHOULD BE RUN SEPARATELY, NOT PART OF A VOICE CABLE. QUAD CABLE SHOULD BE USED WITH BOTH PAIRS CONNECTED. SPEAKERS SHOULD BE HUNG AS CLOSE TO THE CEILING AS POSSIBLE. MAXIMUM SPEAKER DISTANCE FROM THE KSU IS 320 FEET USING QUAD WIRE.
3. SPEAKERS REACH A DEPTH OF 30 FT. IF ROOM IS OVER 30 FT. WIDE, FACING SPEAKERS SHOULD BE USED.
4. ONE SPEAKER WILL SERVE A ROOM UP TO 25 FT. BY 25 FT.
5. ONE SPEAKER (HORN) MOUNTED 20 FT. ABOVE GROUND LEVEL WILL COVER AN AREA APPROXIMATELY 80 FT. BY 100 FT. IF THE HORN IS MOUNTED LESS THAN 20 FT. ABOVE GROUND LEVEL, TWO HORNS MUST BE USED. HORNS SHOULD NOT BE MOUNTED LESS THAN 15 FT. ABOVE GROUND LEVEL. IF MORE THAN ONE HORN IS USED, THEY SHOULD BE MOUNTED VERTICALLY, RATHER THAN SIDE-BY-SIDE.

Fig. 31—Example of Paging Speaker Locations

**TABLE D**  
**CODE CONNECTIONS FOR**  
**ZONE PAGING**

TO ACTIVATE AMPLIFIER	WITH CODE	CONN BLOCK 3	
		STRAP	
		FROM TERM.	TO TERM.
1st 457C KTU in Connector J28	4	4B	13A
	5	8B	13B
	6	12B	13C
2nd 457C KTU in Connector J30	4	4D	14A
	5	8D	14B
	6	12D	14C
3rd 457C KTU in Connector J32	4	4F	15A
	5	8F	15B
	6	12F	15C

J28, J30, and J32 in the KSU. See Fig. 3 for connector locations.

- (2) Where background music is provided, install the 33A voice coupler according to 4.44(b).
- (3) Install loudspeakers and connect them to the KSU using quad inside wire with both pairs connected (see Fig. 32). To stack leads on the connecting block terminals, use 183B2 adapters. Speaker wiring should be run separately and should not be part of a voice cable. Speakers, connected with 24-gauge quad inside wire (having both pairs connected), may be located a **maximum of 320 feet** from the KSU.

**Note:** If the customer does not have music-on-hold but does have background music, turn the potentiometer of the 33A voice coupler fully clockwise. Have the customer adjust his music to the desired level.

**4.53** The **KS-21880,L1** (Fig. 12) or the K8 loudspeaker is an indoor speaker. It is

wall-mounted or may be mounted over an outlet box. A mounting clip is furnished with the speaker. Indoor speakers should be hung as close to the ceiling as possible. To mount the speaker (see Fig. 12), screw mounting clip to wall or outlet box, slip speaker baffle over mounting clip and pull speaker down until it is firmly held by the mounting clip. Speaker volume is controlled by a potentiometer (with screwdriver adjustment slot) located in the bottom of the speaker. Adjust speaker volume after speaker is mounted.



**Speaker volume will be affected by changes in room content. The addition of furniture, fixtures, draperies, carpeting or wall covering may necessitate increasing speaker volume.**

**4.54** The KS-21939,L2 loudspeaker is applicable to locations with adverse weather conditions or where a horn-type speaker is required. The loudspeaker is also provided with a volume control. The loudspeaker is installed using the three holes in the swivel base assembly. A KS-21939,L3 loudspeaker is also available which is equipped with an adapter for mounting on 1/2-inch pipe.



**Where outdoor speakers (KS-21939,L2) are installed in other buildings or on poles, racks or other structures, the speaker leads must be protected according to station protection practices. See Section 460-100-400.**

**4.55** A customer-owned and maintained (COAM) paging system, or a separate telephone company-provided paging system, is connected to the 14A System through a 20A-49 apparatus unit (see Fig. 33). The 20A-49 apparatus unit is mounted externally to the KSU. Where zone paging is utilized, a separate 20A-49 apparatus unit is required for each zone.

- (a) Connect the 20A-49 apparatus unit as follows:
  - (1) Remove cover from the 20A-49 apparatus unit.
  - (2) Mount the 20A-49 apparatus unit within 200 feet of the KSU (wherever the customer desires).
  - (3) Connect the apparatus unit to the KSU as shown in Fig. 33. Wiring should be

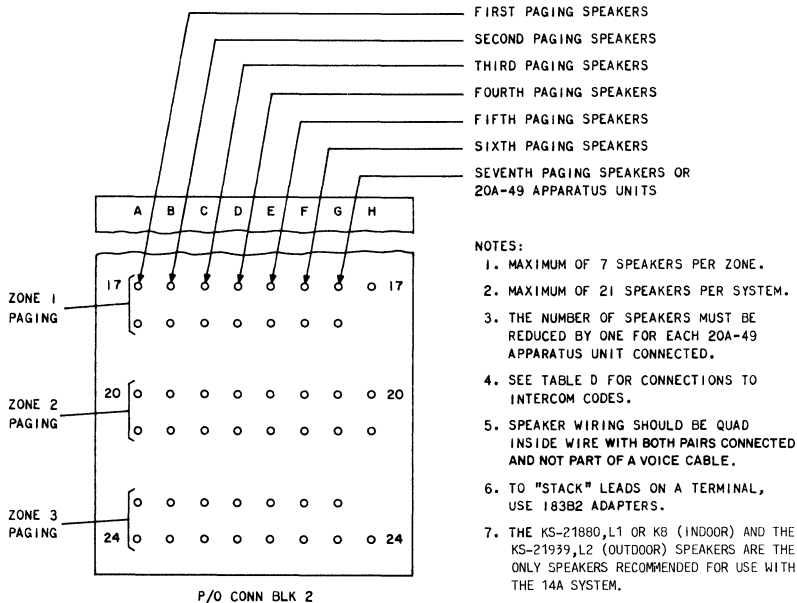


Fig. 32—Connections for Paging Speakers

run separately and not be a part of the voice cable.

- (4) Have customer connect his paging system to the 20A-49 apparatus unit, using shielded wire, as shown in Fig. 33.
  - (5) Replace cover on the apparatus unit.
- (b) Adjustment procedure for the 20A-49 apparatus unit is as follows:

- (1) Turn potentiometer to the full counterclockwise position.
- (2) Select an intercom line and dial the paging code associated with the apparatus unit.
- (3) Using normal voice level, make test announcements while turning the potentiometer clockwise until a voice level suitable for the customer's equipment is reached.

(4) Where necessary, adjust volume control of individual speakers, if equipped.

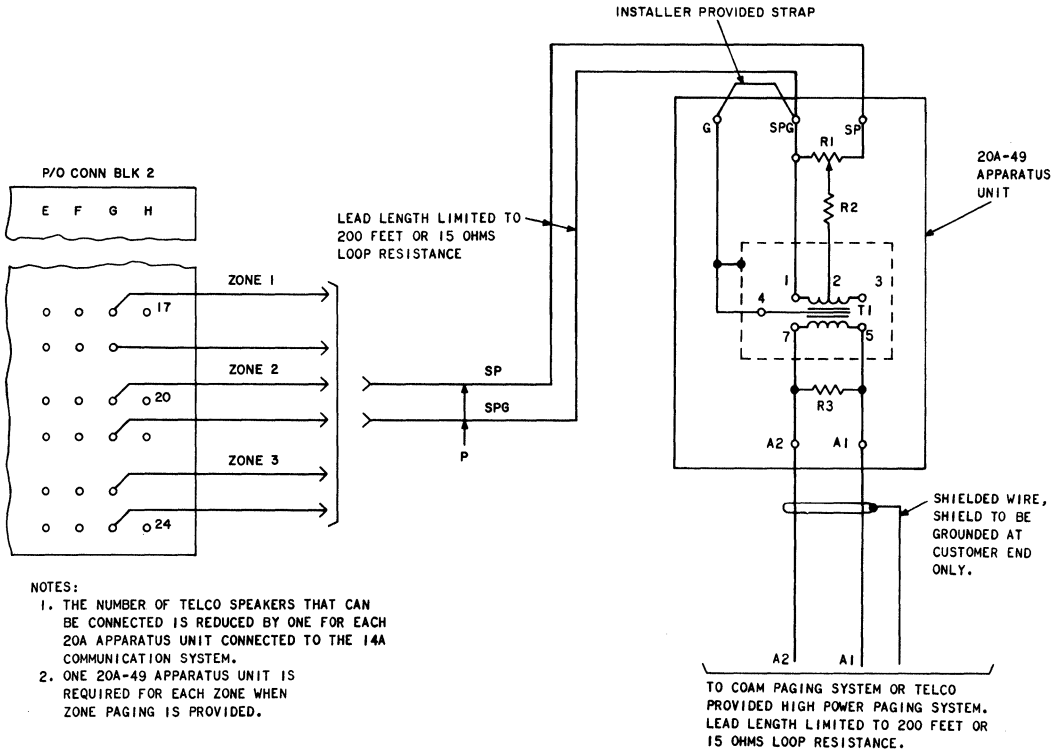
(5) Disconnect call.

**Note:** Where the customer's paging equipment has full control of the paging volume, turn the potentiometer of the 20A-49 apparatus unit to the full clockwise position.

(c) Where zone paging is provided, repeat the adjustment procedure for each zone.



**The 20A-49 apparatus unit provides a nominal 300-ohm output to a customer-owned paging system. It does not provide a means to activate the customer's equipment; therefore, the customer's equipment must be in the ON mode at all times. If a service call is caused by a malfunction of the customer-provided equipment, billing should be made in accordance with Section 660-101-312.**



NOTES:

1. THE NUMBER OF TELCO SPEAKERS THAT CAN BE CONNECTED IS REDUCED BY ONE FOR EACH 20A APPARATUS UNIT CONNECTED TO THE 14A COMMUNICATION SYSTEM.
2. ONE 20A-49 APPARATUS UNIT IS REQUIRED FOR EACH ZONE WHEN ZONE PAGING IS PROVIDED.

Fig. 33—Connections for 20A-49 Apparatus Unit

**Background Music**

4.56 When the paging system is not being used, a customer-provided music source may be used to provide background music over the paging speakers. For background music (or music-on-hold), a 33A voice coupler must be installed and connected between the KSU and the customer-provided music source (as described in 4.44). Music, from the customer's music source, is fed through the voice coupler to the 457C KTUs (amplifier circuits) and from the 457C KTUs to the paging speakers. When a paging code (code 4, 5, or 6) is dialed, the selector causes the amplifier circuit to switch to the paging mode, opening the music from the amplifier. On completion of the paging call, the amplifier circuit switches from the paging mode and restores the music to the amplifier and the paging speakers.

4.57 Alignment procedure for paging and background music is as follows:

- (1) Dial paging code(s).
- (2) While a test paging announcement is being made, adjust the potentiometer on each loudspeaker for desired speaker volume.
- (3) Disconnect paging call.
- (4) Have customer adjust the potentiometer on voice coupler for comfortable level of background music over paging system.
- (5) Inform customer, after alignment is complete, that if any changes are made in the gain of his music source, the background music and music-on-hold will be affected.

**Note:** If the customer has paging and music-on-hold but does not want background music, the potentiometer on the voice coupler should remain in the counterclockwise position.

**4.58** The alignment procedure for paging and background music with a COAM paging system will vary according to the type of equipment used by the customer. Where the customer-provided music source is connected directly to the paging system, the customer will make all adjustments. When the customer-provided music source is connected to the KSU through a 33A voice coupler, the following may be used as a guideline for alignment:

- (a) Where the customer has paging and music-on-hold but does not have background music, adjust the potentiometer on the 33A voice coupler fully counterclockwise and adjust the potentiometer on the 20A-49 apparatus unit to suit the customer's paging equipment.
- (b) Where the customer has paging and background music but does not have music-on-hold, adjust the potentiometer of the 33A voice coupler fully clockwise and adjust the potentiometer on the 20A-49 apparatus unit to suit the customer's paging equipment.

#### G. Power Failure Ringer

**4.59** Where power failure ringing is provided, a power failure ringer (E1C) must be installed near the telephone sets designated to answer incoming calls in the event of a power failure. Connections (Fig. 34) may be made by one of the following methods:

- (1) From telephone set terminals 20 and 21 to E1C ringer terminals 5 and 6 (using inside wire).
- (2) From A50B cable connector (using adapter) pins 25 and 50 to E1C ringer terminals 5 and 6 (using inside wire).
- (3) From connecting block 6, terminals 49 and 50, column H; or connecting blocks 8, 10, 12, or 14, columns A through H, rows 49 and 50 (see Fig. 8 for specific station code block and columns).

#### H. Power Failure Ringing

**4.60** Utilizing 452A KTUs and externally mounted E1C ringers, the power failure ringing feature provides an audible indication of incoming CO/PBX calls during a power failure. The tip and ring of each CO/PBX line is wired from the line side of the 400-type KTUs to line ringers through normally made contacts of relays in the 452A KTUs. The relays in the 452A KTUs are held operated (by B BAT) as long as the 29-type power supply in the KSU is energized. In the event the commercial power to the KSU is lost or the B battery fuse operates, the relays in the 452A KTUs release, cutting through the tip and ring of the CO/PBX lines to the ringers. Ringing from the CO or PBX will then activate the E1C ringer(s) to indicate an incoming call.

**4.61** The tip and ring of each CO/PBX line is brought out on connecting block 1, rows 18 (tip) and 19 (ring) for lines 1 through 7 and rows 20 (tip) and 21 (ring) for lines 8 through 14 (Fig. 34). To connect a CO/PBX line to a selected station, run a strap from the CO/PBX line terminals (in rows 18 and 19 or 20 and 21) to the station terminals in columns A (tip) and B (ring) for station codes 0 and 7 through 22, or columns E (tip) and F (ring) for station codes 23 through 39. For example, Fig. 34 shows CO/PBX line 1 connected to station code 7. An E1C ringer must be installed near the station connected for power failure ringing. See Fig. 34 for connections.

**4.62** Install 452A KTUs in connectors J31 (for lines 1 through 7) and J33 (for lines 8 through 14). See Fig. 3 for connector locations. Test the power failure ringing feature by placing a call to a CO/PBX line equipped for power failure ringing. Allow the line to ring and disconnect the commercial power from the KSU. Observe that the E1C ringer is activated by ringing supplied by the CO or PBX. Repeat test for all CO/PBX lines equipped for power failure ringing.

**Note:** If it is necessary to test the power failure ringing feature while the customer is using the 14A System, instead of disconnecting the commercial power from the KSU, remove fuse 12 from the 29-type power supply (see Table K).

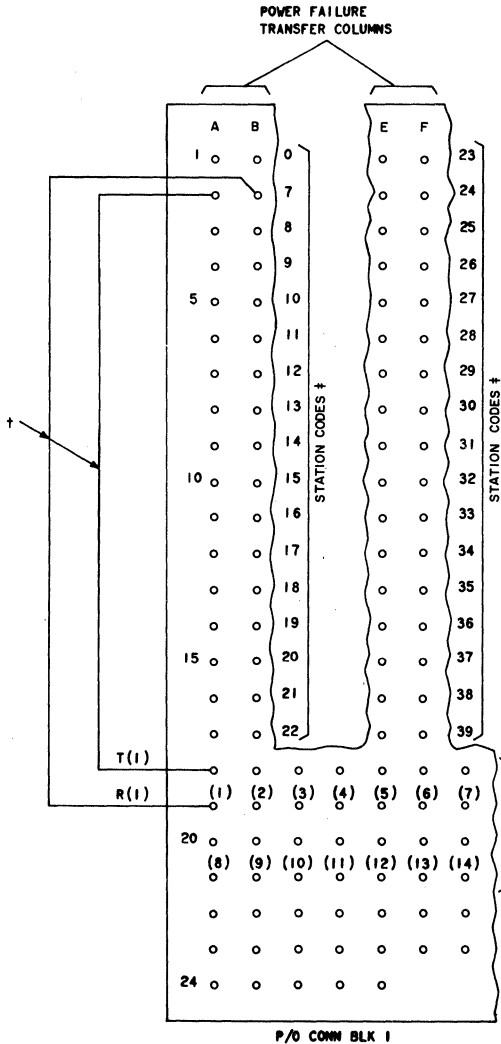


Fig. 34—Connections for Power Failure Ringing

- \* - NUMBERS SHOWN IN PARENTHESIS ( ) REPRESENT THE 14 INCOMING CO/PBX LINES. NUMBERS ARE FOR REFERENCE ONLY AND DO NOT APPEAR ON THE BLOCK.
- † - CONNECTIONS SHOWN PROVIDE POWER FAILURE IN THE STATION CABLE FOR STATION 7. FOR EACH STATION EQUIPPED WITH POWER FAILURE TRANSFER, AN EXTERNAL RINGER (EIC) MUST BE INSTALLED.
- ‡ - A GIVEN STATION MAY PICK UP ONLY ONE POWER FAILURE LINE.
- § - USE INSIDE WIRE FOR RINGER CONNECTIONS.

CONNECT POWER FAILURE RINGER (EIC) BY ONE OF THE FOLLOWING METHODS:

	FROM TEL SET TERMINAL	TO RINGER TERMINAL	LEAD DESIGNATION
1			
§	20	5	ER
	21	6	ET
2	FROM A50B CABLE CONNECTOR (USING ADAPTER)	TO RINGER TERMINAL	LEAD DESIGNATION
§	PIN 25	5	ER
	PIN 50	6	ET
3	FROM CONN BLK 6,8,10, 12 OR 14 IN KSU	TO RINGER TERMINAL	LEAD DESIGNATION
§	TERM 50	5	ER
	TERM 49	6	ET

POWER FAILURE TRANSFER TERMINALS \*

I. Privacy

4.63 Privacy prevents a station, so equipped, from bridging into a CO/PBX call. Privacy is a station feature and each station to be excluded (locked out) must be equipped with a privacy circuit board. The privacy circuit operates only when

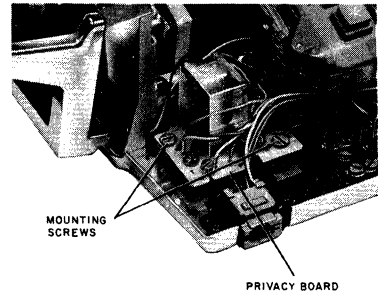
that telephone set attempts to bridge onto a busy CO/PBX line (line lamp lit steady).

4.64 The privacy circuit is *not* operational when a CO/PBX line is ringing, on hold, or not in use. The privacy circuit does not operate on the intercom paths.

**4.65** The privacy circuit monitors the "A" lead to determine the status of CO/PBX line. A ground or positive potential on the "A" lead indicates the line is busy and operates the privacy circuit. Any station equipped with a privacy circuit attempting to bridge in will be excluded. A negative potential on the "A" lead does not cause the privacy circuit to operate.

**4.66** A privacy circuit, D-180486 kit of parts, must be added to an 833A/2833A(MD), 833C/2833C(MD), 833CM/2833CM, or 833EM/2833EM telephone set used as a privacy station. The 833/2833B-, EM-, and DM-type telephone sets are wired at the factory with the privacy circuit operational. To install the D-180486 kit of parts:

- (1) Remove faceplate from telephone set.
- (2) Mount privacy circuit board on the two standoffs located at the left front of the telephone set base (Fig. 35).
- (3) Fasten circuit board to standoffs using mounting screws furnished with the telephone set.
- (4) Connect leads according to Table E.
- (5) Make sure all connections are tight and terminals are not crossed or shorted. Close telephone set.
- (6) Test the operation of the privacy circuit in the following manner:
  - (a) At station being tested, lift handset and depress a CO/PBX line button on an idle line—dial tone should be heard.
  - (b) Operate dial to break dial tone (unless station being tested is a restricted station).
  - (c) Replace handset.
  - (d) At a second station, lift handset, depress a CO/PBX line button on an idle line, and leave handset off-hook.
  - (e) At station being tested, lift handset and depress same CO/PBX line button as on the second station—dial tone should not be heard.



**Fig. 35—Privacy Circuit Board Mounted in Telephone**

- (f) Replace handset at both stations.
- (g) At station being tested, lift handset and depress an intercom line button on an idle intercom path—dial tone should be heard.
- (h) Operate dial to break dial tone.
- (i) Replace handset and make sure all line buttons are restored at station being tested and all other stations used during testing.
- (j) Test all stations equipped with a privacy circuit.

**4.67** To convert a privacy station to a nonprivacy station, it is necessary to open the telephone set and remove the O lead of the privacy circuit board from terminal 8 on the telephone set terminal board and insulate and store (Table F). The O lead of the privacy circuit board is the privacy circuit power lead.

**Note:** If privacy is being removed from the entire system, remove fuses 42 through 45 on the KSU power panel rather than rewiring each set. Stations 0 and 7 must still be rewired since the fuse for these stations also serves the DSS feature.

#### J. Privacy Release

**4.68** Privacy release is a feature which permits a station to allow another station equipped with a privacy circuit to bridge into a CO/PBX



TABLE E

**833A/2833A(MD), 833C/2833C(MD), 833CM/2833CM, AND 833EM/2833EM  
TELEPHONE SET CONNECTIONS FOR PRIVACY CIRCUIT  
(D-180486 KIT OF PARTS)**

TEL SET LEADS	PRIVACY BOARD LEADS	CONNECT TO TEL SET TERM.	MOVE LEAD	
			FROM TEL SET TERM.	TO PRIVACY BOARD TERM.
	O	8		
	BR	F on net.		
	S*	15		
	BK	12		
	BL	6		
R			13	P2
G-W			13	P1
Y			6	R1
O			F on net.	T

\* In the 833A and 2833A telephone sets only, store (S) lead under screw terminal S2 on privacy board when privacy release is provided.

TABLE F

**TELEPHONE SET CONNECTIONS TO  
DISABLE PRIVACY CIRCUIT**

COLOR	MOVE LEAD IN TEL SET	
	FROM TERM.	Insulate and Store
0	8	

call. When any station is off-hook with a CO/PBX line button depressed, all stations equipped with a privacy circuit will be locked out from that CO/PBX line. Only stations equipped with a privacy release (PRIV RLS) button can allow a privacy station to bridge into a CO/PBX call.

**4.69** To permit a privacy-equipped station to bridge into a CO/PBX call:

- (1) Depress (and hold down) the PRIV RLS button.
- (2) Observe that CO/PBX line lamp changes from steady to wink.

The CO/PBX line lamp changing from steady to wink is an indication for the privacy-equipped station to bridge into the call.

- (3) Observe that CO/PBX line lamp changes from wink to steady, which indicates privacy-equipped station has bridged into the call.

(4) Release the PRIV RLS button.

**4.70** To allow an additional privacy-equipped station to bridge into a CO/PBX call, both stations must depress their PRIV RLS buttons simultaneously. When the PRIV RLS buttons are depressed, the line lamp will change from steady to wink. As the third station bridges into the call, the line lamp will become steady. The PRIV RLS buttons are then released.

**4.71** The 833A/2833A(MD), 833B/2833B(MD), 833BM/2833BM, and 833DM/2833DM telephone sets have factory-provided privacy release buttons. The privacy release button in the 833A/2833A(MD) sets must be connected in the field (see Table G). The privacy release button in the 833B/2833B(MD), 833BM/2833BM, and 833DM/2833DM sets is factory-connected.

**4.72** Where privacy release is no longer desired, the privacy release button may be disabled by opening the telephone set and moving the O-BK lead of the privacy release button from telephone set terminal 10 to terminal 15 (see Table H).

#### K. Speakerphone

**4.73** Normal speakerphone service may be provided at all stations in the 14A System. Connect the speakerphones as follows.

(a) **3B Speakerphone:** Connect the D10R cord between the telephone set and the 55B control unit. Connect the 666B transmitter, 760A loudspeaker, and 2012B transformer to the 55B control unit. See Table I for connections. Plug 2012B transformer into ac receptacle. (Refer to Section 512-620-487 for illustrations and more detailed information on 3B speakerphone connections.)

(b) **4A Speakerphone:** Install 223A adapter within cord length (7 feet) of telephone set. Connect M16C cord to telephone set as shown in Table J. Plug loudspeaker, transmitter, and power cords into 223A adapter. Plug 85B1 power unit into ac receptacle. (Refer to Section 512-740-471 for illustrations and more detailed information on 4A speakerphone connections.)

**Note:** Speakerphone does not prevent normal operation of a telephone set.

**4.74** To originate a call using the 3B or 4A speakerphone:

- (1) Depress line button associated with an idle CO/PBX line.
- (2) Momentarily depress transmitter ON button. ON lamp lights and dial tone is heard through the loudspeaker.

**TABLE G**  
**833A/2833A TELEPHONE SET CONNECTIONS**  
**FOR PRIVACY RELEASE BUTTON**

LEAD COLOR	REMOVE LEAD FROM TEL SET TERMINAL	CONNECT LEAD TO	
		TEL SET TERMINAL	PRIVACY BOARD TERMINAL
BK*	15	2§	S2
S†	15		S2
BK-BL‡	27	15	
G-W‡	27	2§	S2

\* Tel set lead.

† If tel set has a privacy circuit and privacy release circuit is now being added.

‡ Leads from privacy release key.

§ If tel set does not have privacy circuit.

TABLE H

TELEPHONE SET CONNECTIONS TO  
DISABLE PRIVACY RELEASE BUTTON

COLOR	MOVE LEAD IN TEL SET	
	FROM TERM.	TO TERM.
O-BK	10	15

- (3) Dial number in normal manner.
- (4) When called party answers, transmitter and loudspeaker are used to carry on the conversation. Adjust volume level as desired.
- 4.75** To answer an incoming call using the 3B or 4A speakerphone:
- (1) When audible tone indicates an incoming call, depress CO/PBX button associated with flashing lamp; or when notified by the attendant of an incoming call, depress the CO/PBX line button associated with the line indicated.
  - (2) Momentarily depress the transmitter ON button (audible signal is silenced) which connects speakerphone to the line.
  - (3) Answer call using transmitter. Transmitter and loudspeaker are used to carry on the conversation. Adjust the volume level as desired.
- 4.76** To disable transmitter when it is not desirable to transmit conversation from the surrounding area to the distant station:
- (1) Depress transmitter ON button during entire period transmitter is to be disabled.
- Note:** With transmitter disabled, conversation will not be transmitted to the distant station; however, the distant party may be heard over the loudspeaker.
- (2) Release the ON button and system is restored to hands-free operation.
- 4.77** To transfer from handset to speakerphone operation:
- (1) Put CO/PBX line on hold.

- (2) Replace handset.
- (3) Turn speakerphone on.
- (4) Depress line button.

**4.78** To transfer from speakerphone to handset operation, lift handset and call is automatically transferred to handset. When it is desired to transfer back to speakerphone operation, refer to 4.77 to prevent disconnect.

**4.79** To terminate a call on speakerphone, momentarily depress the transmitter OFF button and **restore any depressed line buttons.**

**4.80** Use the RECALL button for flashing instead of the switchhook. It is necessary to hold line button depressed if switchhook is used for flashing in order to avoid dropping the line.

## L. Station Busy Console (7A1) With DSS

**4.81** After selecting an idle intercom line and depressing the appropriate button on the 7A1 console, an attendant may signal any station over the intercom or make announcements over the paging system. The console also provides the attendant with a visual indication of a busy station. Thirty-three buttons in the DSS field on the console correspond to the station codes (codes 7 through 39); three buttons are associated with paging, one button is arranged for recall, and three buttons are spare (Fig. 9).

**Note:** The schematic for the 7A1 selector console is located at the end of this section.

**4.82** Any station having the handset off-hook lights a lamp under the associated button on the 7A1/DSS console as a visual indication of a busy station. The operated switchhook contacts of a telephone set extend ground over an SB( ) lead, through the KSU, to the 7A1 console, thus lighting the lamp under the associated button in the DSS field.

**4.83** To perform DSS from the 7A1 console:

- (1) Lift handset on the associated telephone set.

**TABLE I**  
**3-TYPE SPEAKERPHONE CONNECTIONS**

LEAD DESIG	CORD COLORS			CONNECT LEADS FROM				CONNECT LEADS TO 55B CONTROL UNIT TERM. ‡
	DIOR	T7A	R2FK	TEL SET TERM.	TRMTR TERM.	LSPK TERM.	TRNSF TERM.	
P4 ¶¶	W-S			24				13
IR †								
P3 ¶¶	S-W			30				4
IT †								
T1	W-BL			25 †				1
				RR § ¶¶				
R1	BL-W			6				10
LK	W-BR			29				35
AG	BR-W			8				11
A1	W-G			10				2
	O-W			19 ¶				32
	W-O			**				23
LK	G-W*	BK-O			8			35
F1		G-Y			7			17
S		O-BK			5			18
A1		Y-O			6			19
M2		BK-S			3			16
P1		BL-R			2			8
M1		S-BK			1			7
SP2			G			††		20
SP1			R			††		29 § §
TF1							‡‡	27
TF2							‡‡	36

\* Insulate and store G-W lead.

† For TOUCH-TONE telephone set.

‡ Strap terminal 4 and 5 on control unit when used with TOUCH-TONE telephone sets.

§ Located on network.

¶ Also remove W-S lead from telephone set amplifier terminal 1 and connect it to terminal 19.

\*\* Connect W-O lead to terminal 1 on telephone set amplifier.

†† Loudspeaker terminals are not designated.

‡‡ Use inside wire. Transformer terminals are not designated.

§ § Connect lead to terminal 30 if a reduction in volume is desired.

¶¶ For rotary dial telephone set.

**Note:** Move O lead from tel set terminal 27 to terminal 22 when using tel sets equipped with new line switch.

TABLE J

## 4-TYPE SPEAKERPHONE CONNECTIONS

M16C CORD		TEL SET LEAD	REMOVE FROM AMPLIFIER TERM.	CONNECT TO	
LEAD DESIG	LEAD COLOR			TEL SET TERM.	AMPLIFIER TERM.
A1	W-BR			10	
AG	W-O			8	
R1	BL-W			6	
T1	W-BL			25*	
				RR‡ (on net.)	
IR*	G-W			24	
P4‡					
IT*	W-G			30	
P3‡					
LK	O-W			29	
		W-S	1	19‡	
	S-W			19‡	
	BL-R				1

\* TOUCH-TONE telephone sets.

† Rotary telephone sets.

‡ Spare terminal.

(2) Select idle intercom path and depress intercom button.

(3) On the 7A1 console, momentarily depress button on DSS field corresponding to intercom station code of desired station—tone burst signals called station.

(4) Announcement may now be made to called station (or line held until called station answers).

If second call is to be made or call is for another station, proceed as follows:

(1) Momentarily depress RECALL button on DSS console—dial tone will be returned.

(2) Momentarily depress button on DSS field corresponding to desired station—tone burst signals called station.

(3) Announcement may now be made to called station (or line held until called station answers).

**Note:** The selector may be repeatedly recalled (without losing the seized intercom path) by repeatedly depressing the RECALL button (on the DSS console) and a DSS button. If intercom call is answered at any point, caller must either hang up and start over or depress the RECALL button on the associated telephone set.

**4.84** To page from the 7A1/DSS console:

- (1) Lift handset on associated telephone set.
- (2) Select an idle intercom path and depress intercom button.
- (3) Select PAGE button on DSS console associated with zone to be paged.
- (4) Momentarily depress PAGE button—tone burst will be heard over paging system loudspeakers.

**Note:** Where zone paging is not provided, momentarily depress the button designated for paging.

- (5) Speak into handset transmitter to make announcement.
- (6) Replace handset.

**4.85** The A50B connector cable from the 7A1/DSS console is cut down on connecting blocks 6 and 7, column E, using standard cutdown. See Fig. 36 for connections. **The D0 to D1 (26E to 27E) and CG0 to CG1 (40E to 41E) straps on connecting block 6 must be removed when the console is installed and replaced if the console is removed.**

**M. Station Busy Console (7B1) With MW**

**4.86** By depressing the appropriate button on the 7B1 console, an attendant may light the lamp under the HOLD button of a station to indicate there is a message waiting for the station user. The console also provides the attendant with a visual indication of a busy station. Thirty-three buttons in the message waiting field on the console correspond to the station codes (7 through 39); seven buttons are not used (Fig. 10).

**Note:** The schematic for the 7B1 selector console is located at the end of this section.

**4.87** When a station is unattended and the station user is to be informed of a message, the attendant selects and depresses the button, on the message waiting console, associated with the user's station. The button on the console will lock down causing the lamp under the HOLD button of the station user's telephone set to light (steady). The lighted HOLD button alerts the station user to call the attendant. When the station user calls the attendant, the attendant conveys the message to the station user, then depresses the associated MW button on the console to restore it. When the associated button on the message waiting console is restored, the lamp under the HOLD button of the station user's telephone set is extinguished.

**4.88** The station busy feature of the 7B1/MW console is identical to the 7A1/DSS console features described in 4.82.

**4.89** The A50B connector cable from the message waiting console is cut down on connecting blocks 6 and 7, column D, using standard cutdown. See Fig. 37 for connections. The factory-provided straps on connecting block 6 (26E to 27E and 40E to 41E) must be in place when the 14A System is not equipped with a DSS console.

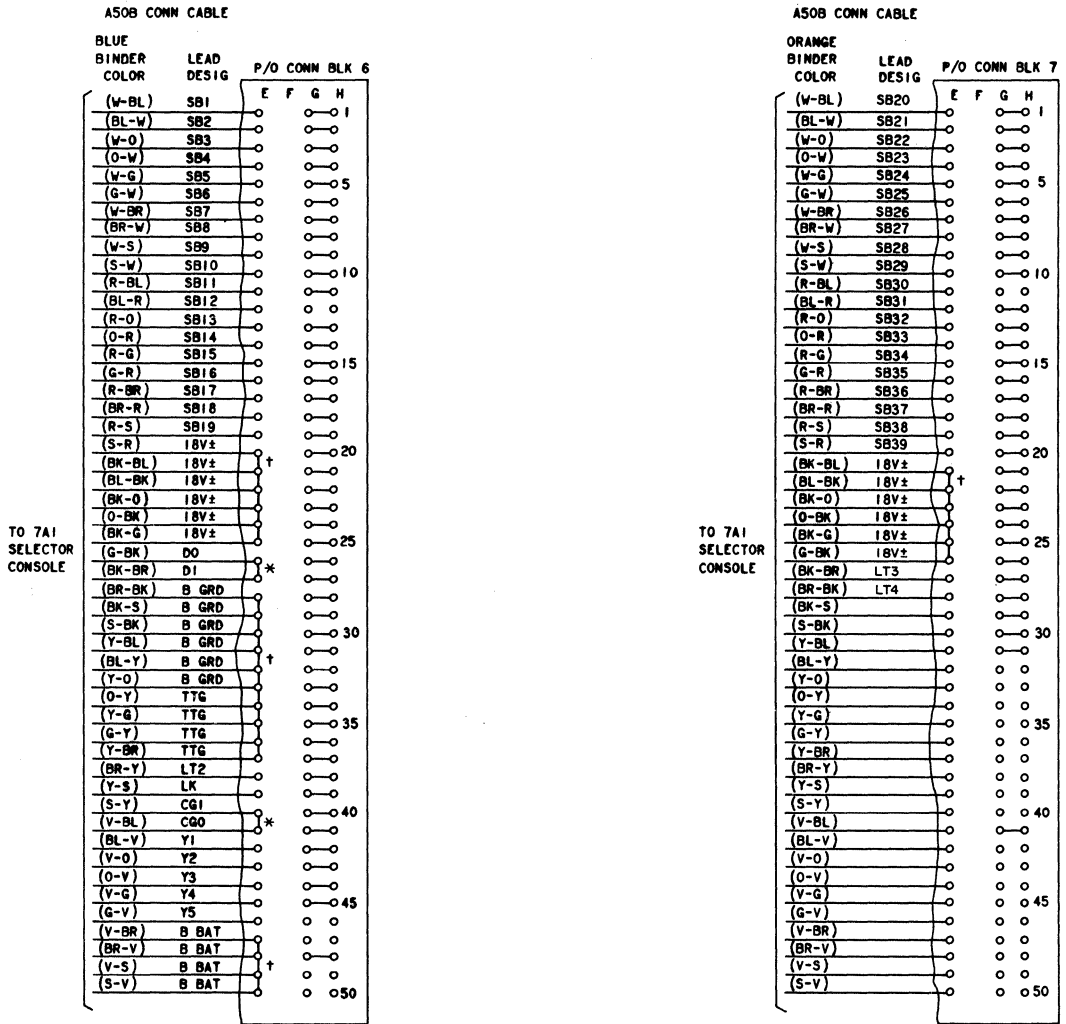
**Caution: Although all CO/PBX and intercom line buttons may be unoperated, a busy station indication is displayed at the 7A1/DSS or 7B1/MW console when a station handset is off-hook.**

**N. Multiple Consoles**

**4.90** The original design intent of the COM KEY 14 was for one selector console, either station busy or message waiting. Multiple consoles can be provided (up to a maximum of three of any combination); but additional power and, in some cases, additional terminations are required.

**Note:** When more than one MW console is installed, the MW signal can only be retired at the console originating the signal since the key must be physically released.

**4.91** The additional power is required because the  $\pm 18$ -volt supply in the KSU is capable of powering only one console. Each additional



\* FACTORY PROVIDED STRAPS MUST BE REMOVED WHEN CONSOLE IS CONNECTED. IF CONSOLE IS REMOVED, THE STRAPS MUST BE REPLACED.

† VERTICAL STRAPS ON BACK OF BLOCK

Fig. 36—Connections for 7A1 Selector Console (Station Busy Console With DSS)

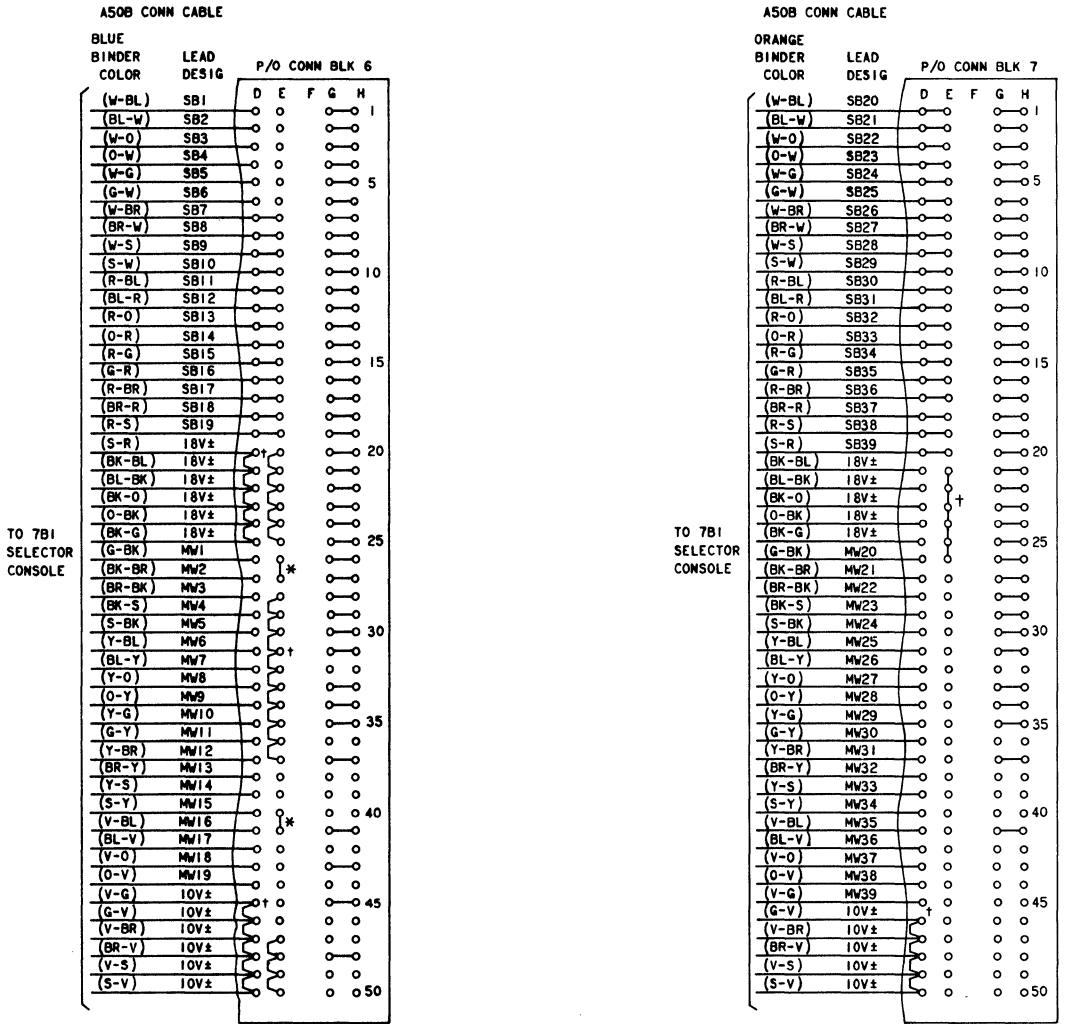


Fig. 37—Connections for 7B1 Selector Console (Station Busy Console With MW)



console will require  $\pm 18$  volts fused at 2 amperes. Use a separate 18-gauge wire for each  $\pm 18$ -volt lead required. In addition, the ground terminals of the 215C1 power unit should be strapped to the  $\pm 18$ -volt ground terminal of the KSU power unit. A 215C1 power unit fused for  $\pm 18$  volts can be used for three leads. Because of the method of terminating the console connector cables in multiples as shown in Fig. 38 through 44, power is wired on a per block basis rather than per console.

**4.92** The connections for multiple consoles are shown in Fig. 38 through 44. Since there are terminations for only one DSS and one MW console within the KSU, additional blocks which must be mounted external to the KSU are required when more than one console of either type is required. When 66M1-50 blocks are used, B bridging clips are used as straps for common leads. Where a second wire must be connected to a terminal, 183B2 adapters are used.

**4.93** In any installation requiring a DSS console, the factory-provided D0-D1 strap (26E to 27E) and the CG0-CG1 strap (40E to 41E) on block 1 of the KSU must be removed. If all DSS consoles are removed, the straps must be replaced. When more than one DSS console is required, the CG0-CG1 leads from the consoles must be wired in a series loop as shown in Fig. 40, 41, and 42.

**4.94** The 580A KSUs having a serial number of 14425 or higher and all 580B KSUs have been modified to permit mounting the 215C1 power unit on the bracket for the internal electrical outlet in the lower left corner of the KSU. The KSUs numbered between 8296 and 14424 can be modified by the addition of a D-180759 kit of parts. Installation instructions are included with the kit of parts. Where desired, or for KSUs numbered below 8296, a 215B1 power unit can be used for multiple consoles, but the unit must be mounted external to the KSU.†

#### O. Station Restriction

**4.95** Station restriction prevents a station from dialing on CO/PBX lines. Station restriction does not prevent dialing on intercom lines and has no effect on incoming calls.

**4.96** To restrict a station equipped with a rotary dial telephone set:

- (1) Install a 446F diode (or equivalent) between terminals RR and F on the telephone set network. Terminate the negative (cathode) lead of the diode on terminal F with the positive (anode) lead on terminal RR (arrow pointing toward terminal F).
- (2) Move **two red leads** from terminal 4 to terminal 22 on the telephone set terminal board.
- (3) Move **two green leads** from terminal 22 to terminal 4 on the telephone set terminal board.

**Caution:** Make sure bare leads of the diode do not come into contact with the case of the network, other network terminals, or other parts of the telephone set. Use insulating sleeving where required.

**4.97** To restrict a station equipped with a TOUCH-TONE dial telephone set:

- (1) Move **two red leads** from terminal 4 to terminal 22 on the telephone set terminal board.
- (2) Move **two green leads** from terminal 22 to terminal 4 on the telephone set terminal board.

**4.98** To test a restricted station:

- (1) Lift telephone handset.
- (2) Depress line button on an idle CO/PBX line—dial tone should be heard.
- (3) Dial the telephone number assigned to the CO/PBX line—dial tone should still be heard.
- (4) Operate switchhook—CO/PBX line button restores.
- (5) Depress line button on an idle intercom line—dial tone should be heard.
- (6) Dial an intercom station code—tone burst signals the called station.

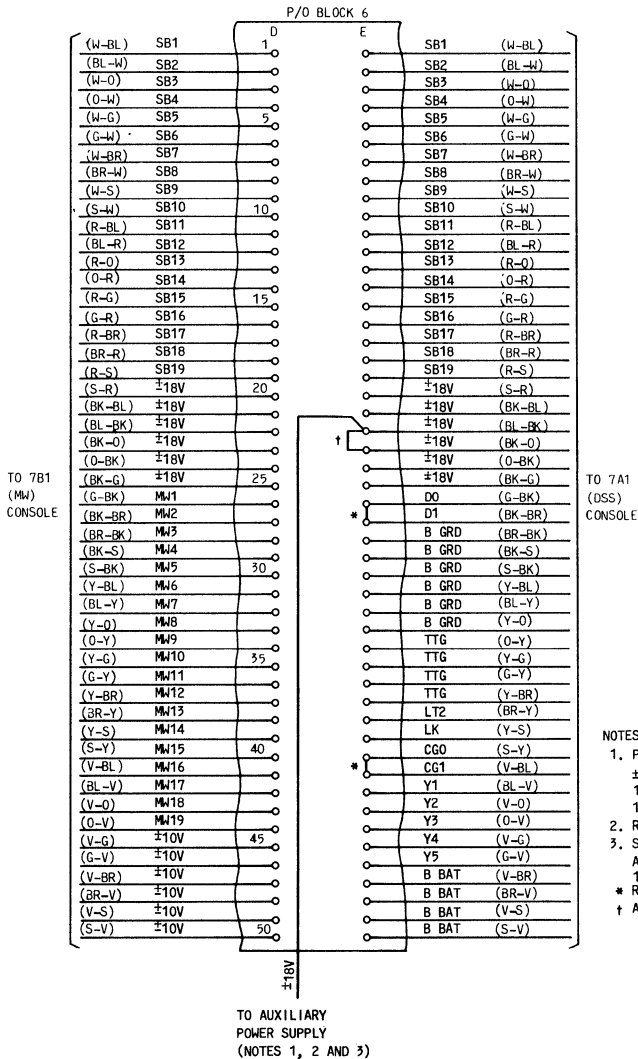


Fig. 38—Connections for One MW and One DSS Console (Sheet 1 of 2)

(7) Place handset on-hook—intercom line button restores.

**P. TOUCH-TONE Adapter**

4.99 Where TOUCH-TONE dial telephone sets are used with the 14A System, a 440A or

478B KTU (TOUCH-TONE adapter) is required. The 440A and 478B KTUs are the only TOUCH-TONE adapters usable in this system and are installed in connectors J21 and J22. See Fig. 3 for KTU location. The adapter is used to convert the multifrequency signals from the TOUCH-TONE telephone set dial to contact closures which supply

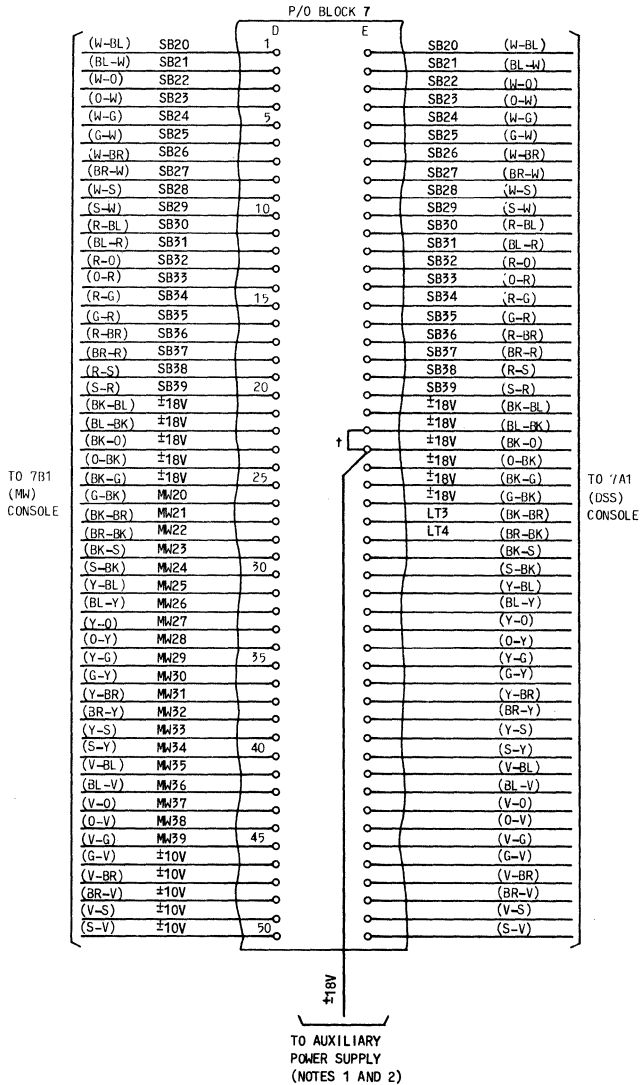


Fig. 38—Connections for One MW and One DSS Console (Sheet 2 of 2)

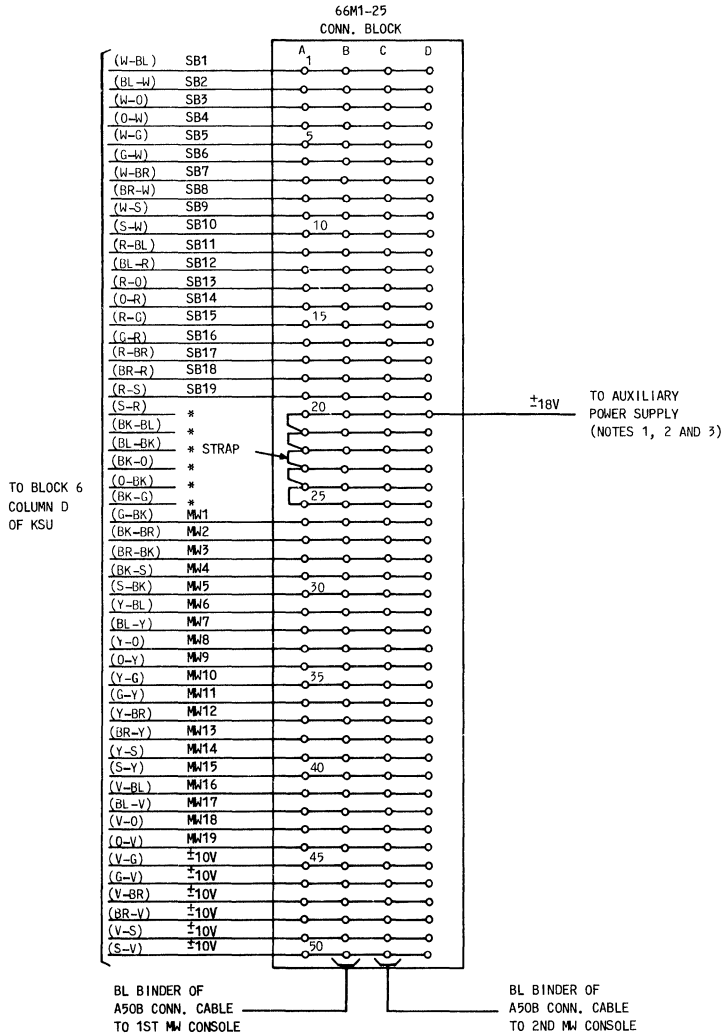


Fig. 39—Connections for Two MW Consoles (Sheet 1 of 2)

ground to the proper leads in the code selector circuit, 424C KTU. If the 580-type KSU has not been modified to provide A and B grounds for using the 478B KTU (serial number 6184 or higher), the kit of parts supplied with the 478B KTU must be installed. Instructions are packed with the KTU. If the KTU is equipped with the plug-type

option block, make sure the plug is inserted between B and C (Y option). If the KTU is equipped with a screw-type option, make sure the screw is in the option position.♦

4.100 *The factory-provided strap, RS1 to CG (terminal H23 to terminal H24),*

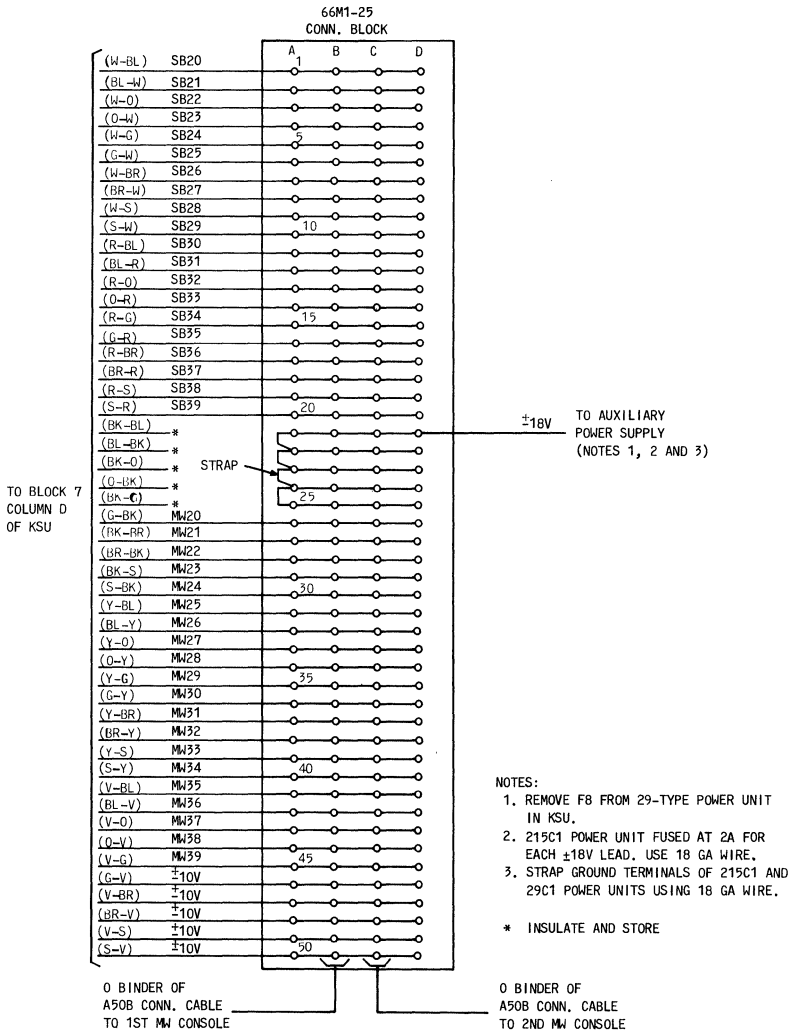


Fig. 39—Connections for Two MW Consoles (Sheet 2 of 2)

on connecting block 1, must be removed when TOUCH-TONE service is provided.

Q. Automatic, DC Signaling, Private Line Circuit

4.101 Private line service can be supplied in the 580B KSU only, and then

only if music-on-hold is not also being furnished. A circuit incompatibility exists between the private line circuit and the music-on-hold circuit. A 415A KTU is required for each private line circuit and is plugged into the KSU in place of one of the CO/PBX line circuits. Each private line installed will reduce the number of CO/PBX

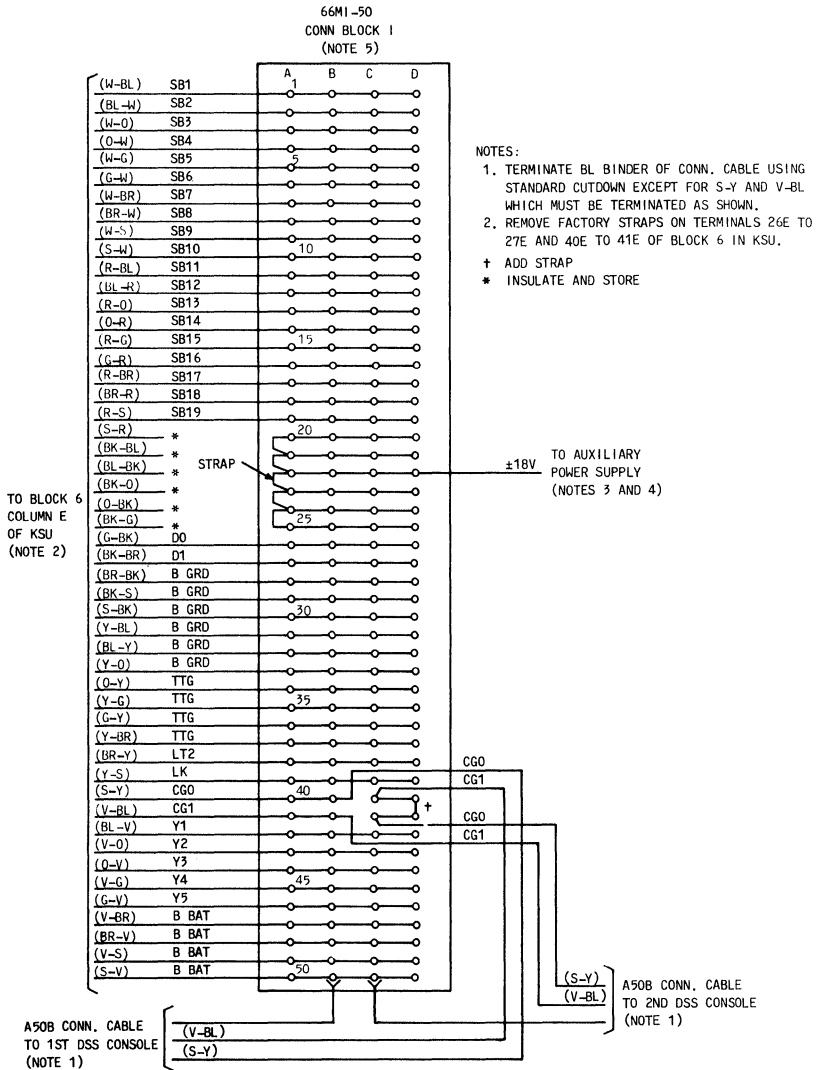
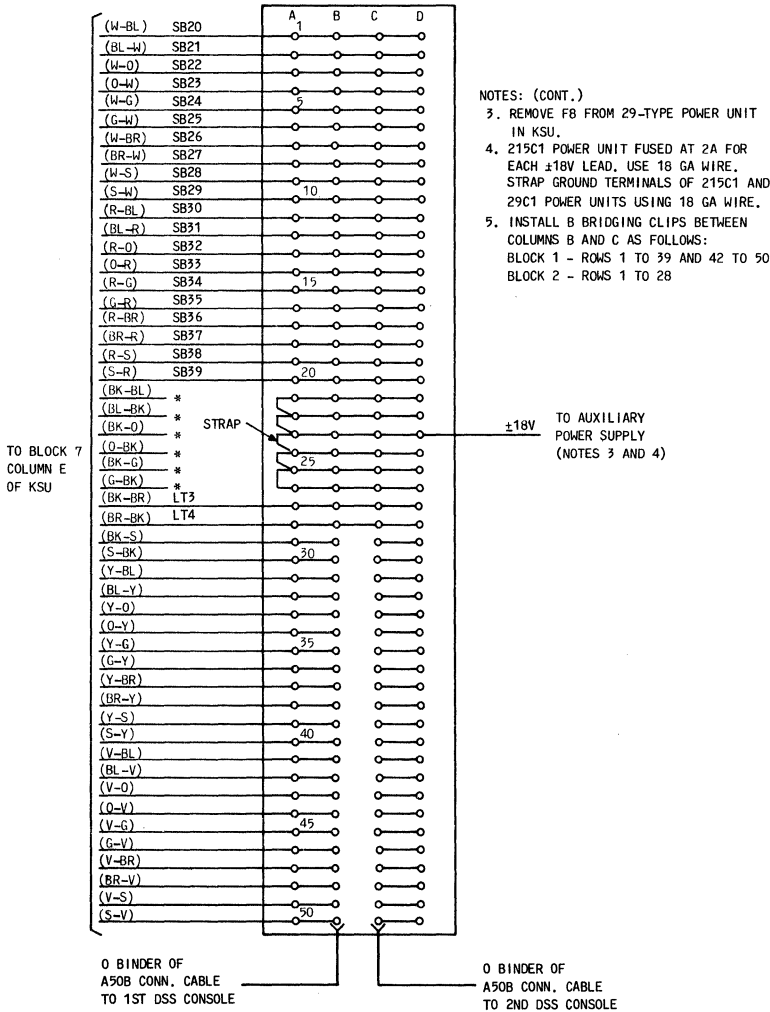


Fig. 40—Connections for Two DSS Consoles (Sheet 1 of 2)

66MI-50  
CONN. BLOCK 2  
(NOTE 5)



NOTES: (CONT.)

3. REMOVE F8 FROM 29-TYPE POWER UNIT IN KSU.
4. 215C1 POWER UNIT FUSED AT 2A FOR EACH ±18V LEAD, USE 18 GA WIRE. STRAP GROUND TERMINALS OF 215C1 AND 29C1 POWER UNITS USING 18 GA WIRE.
5. INSTALL B BRIDGING CLIPS BETWEEN COLUMNS B AND C AS FOLLOWS:  
BLOCK 1 - ROWS 1 TO 39 AND 42 TO 50  
BLOCK 2 - ROWS 1 TO 28

Fig. 40—Connections for Two DSS Consoles (Sheet 2 of 2)

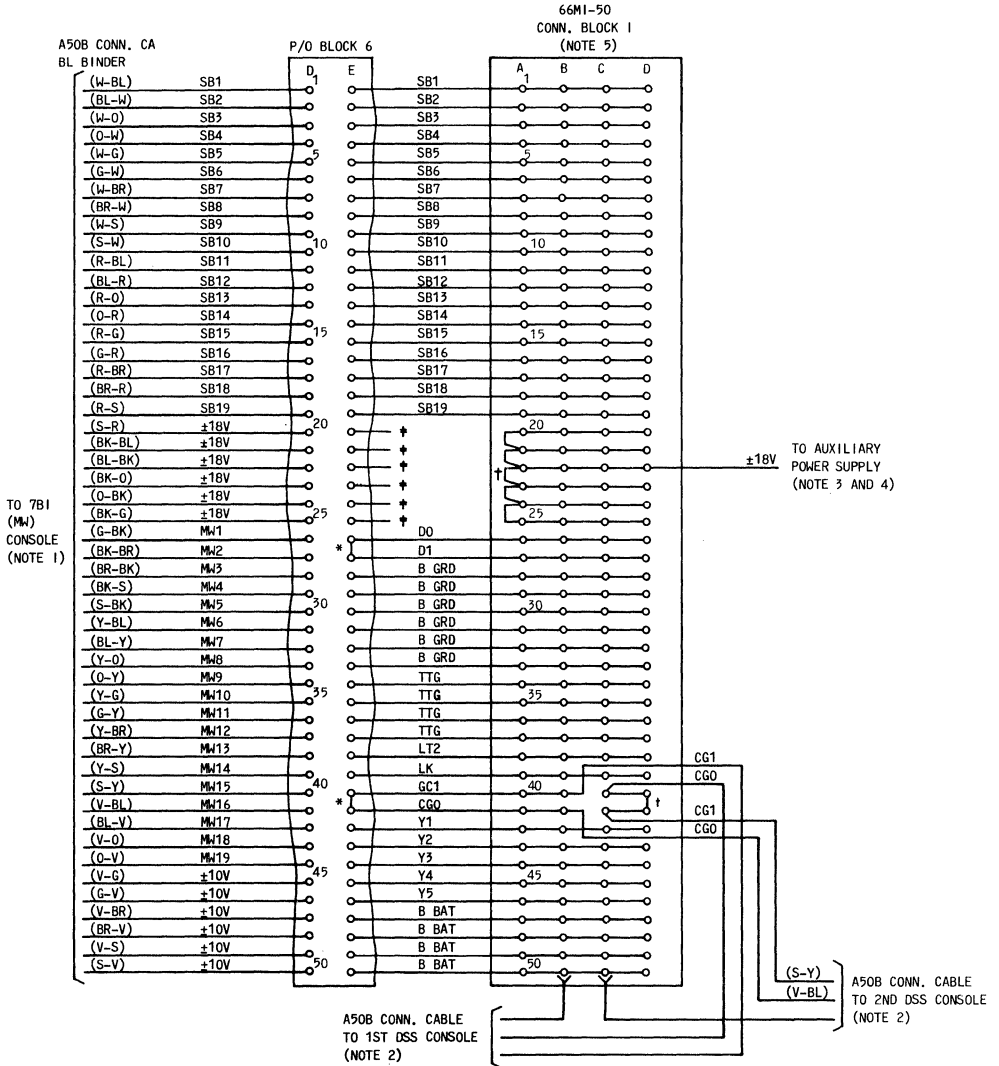


Fig. 41—Connections for One MW and Two DSS Consoles (Sheet 1 of 2)



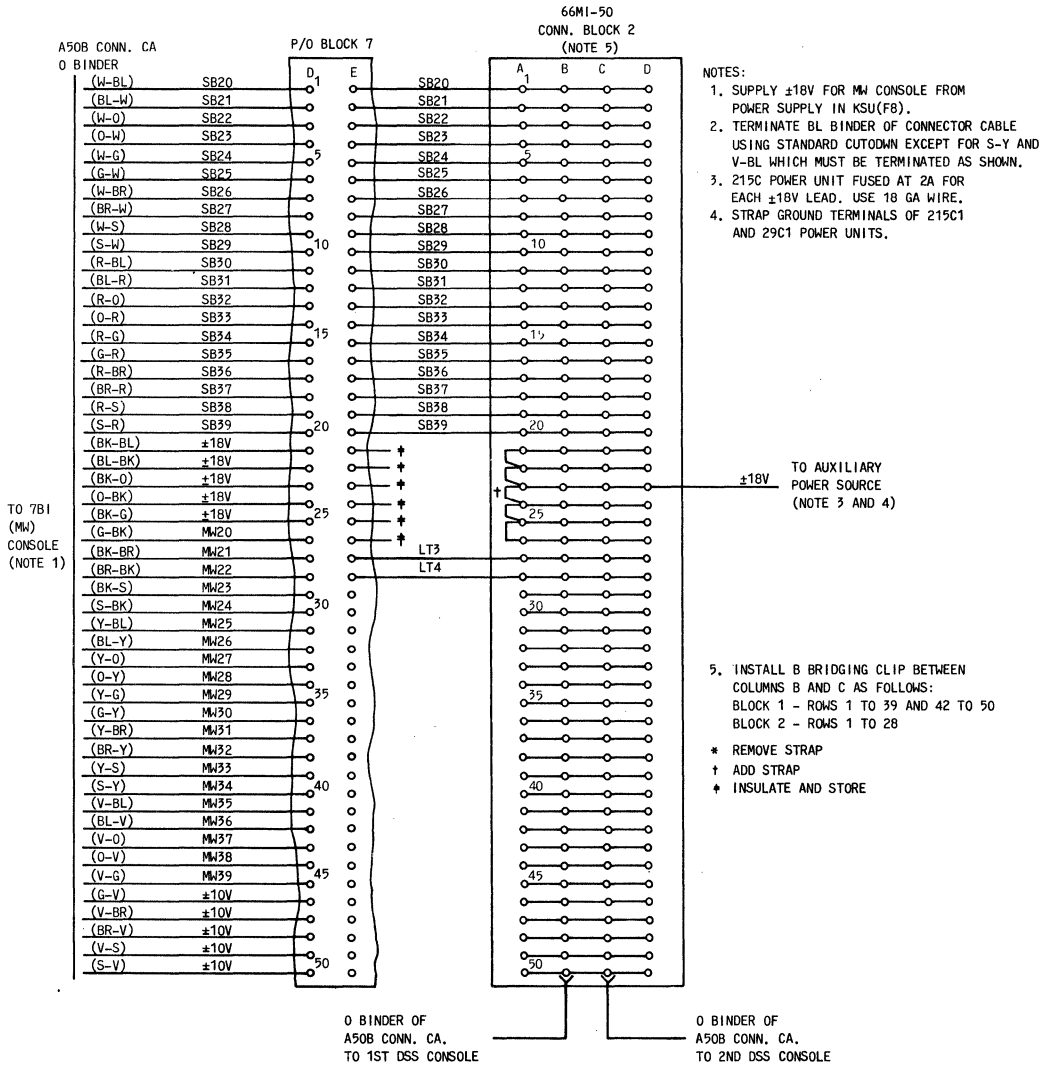


Fig. 41—Connections for One MW and Two DSS Consoles (Sheet 2 of 2)

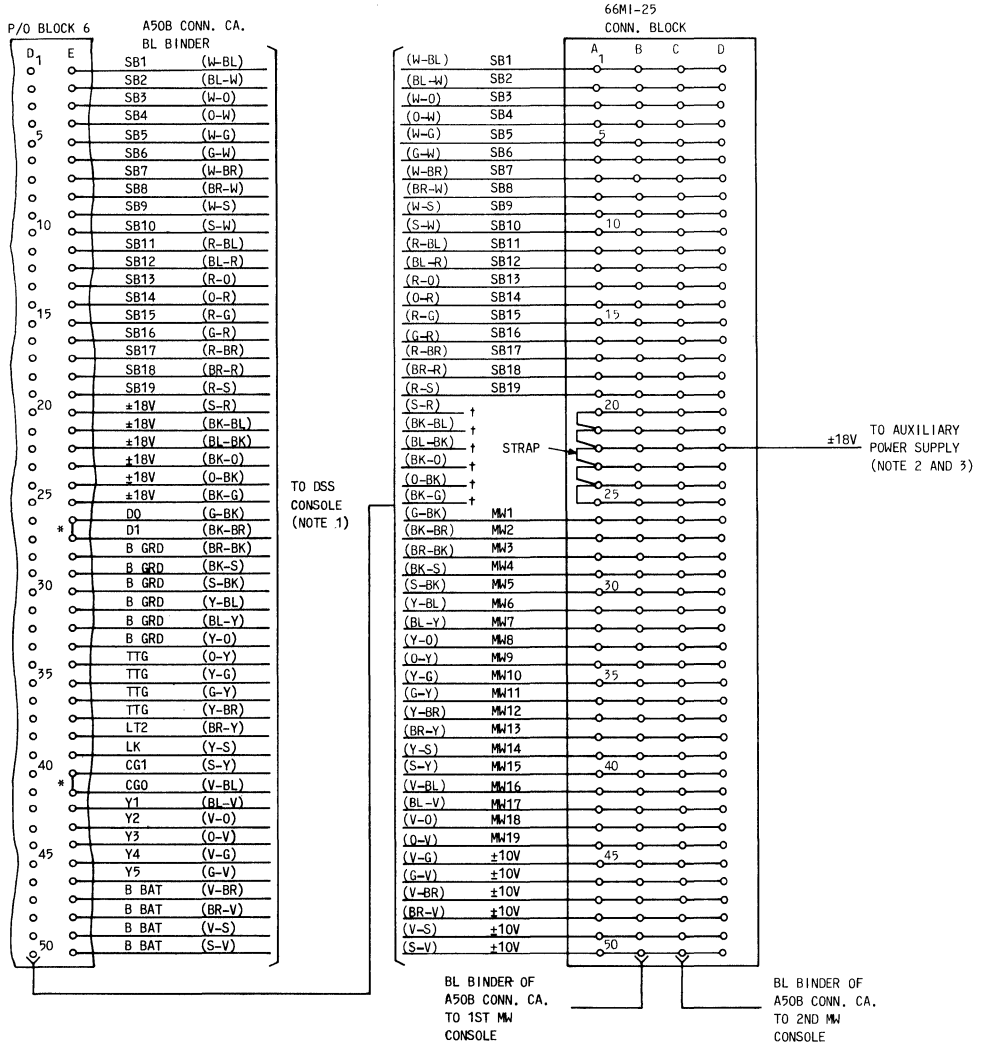


Fig. 42—Connections for One DSS and Two MW Consoles (Sheet 1 of 2)

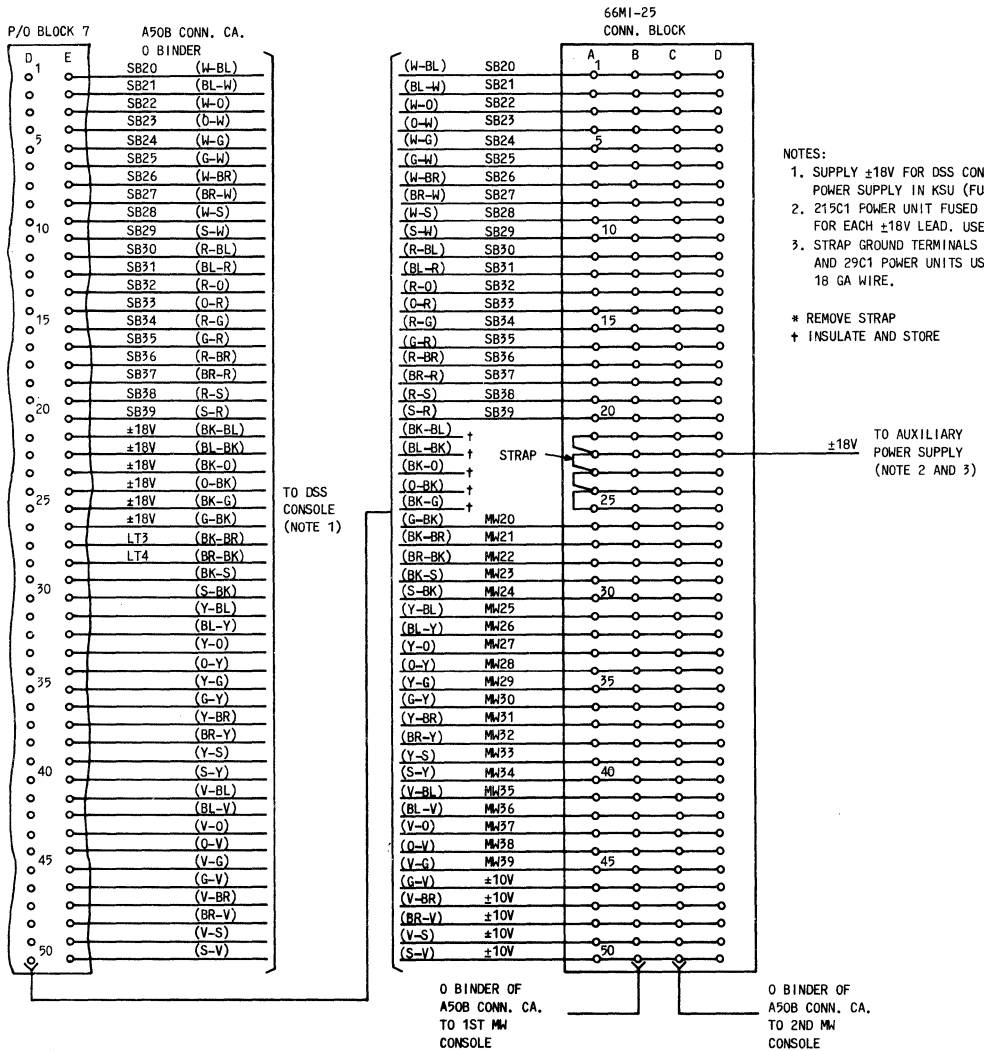


Fig. 42—Connections for One DSS and Two MW Consoles (Sheet 2 of 2)

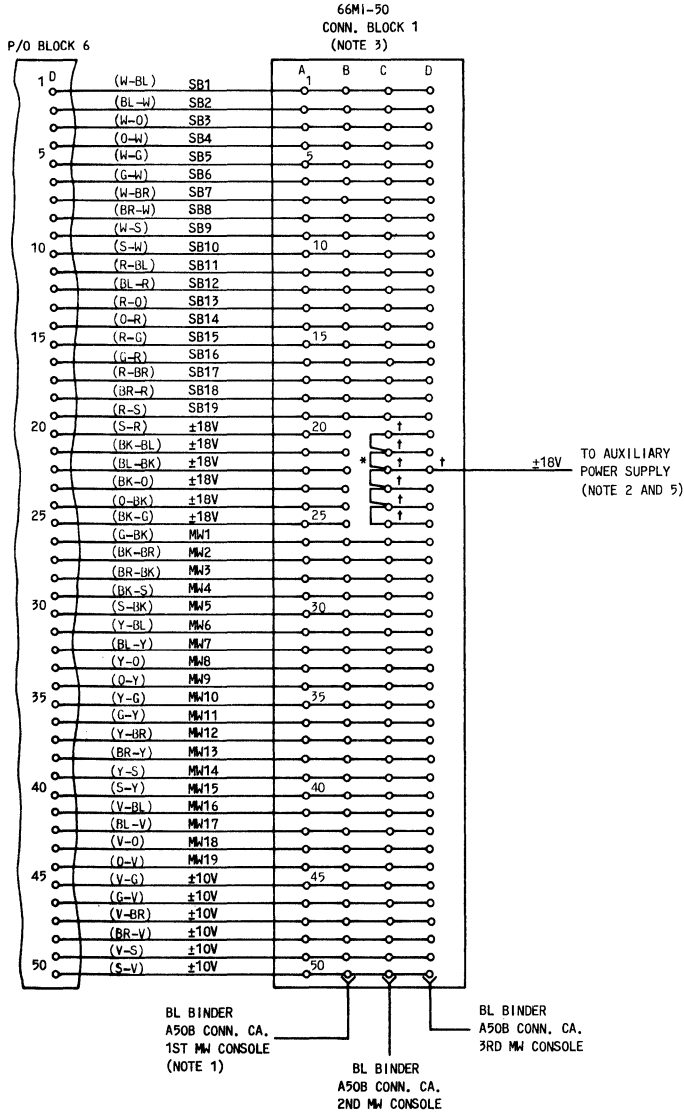


Fig. 43—Connections for Three MW Consoles (Sheet 1 of 2)

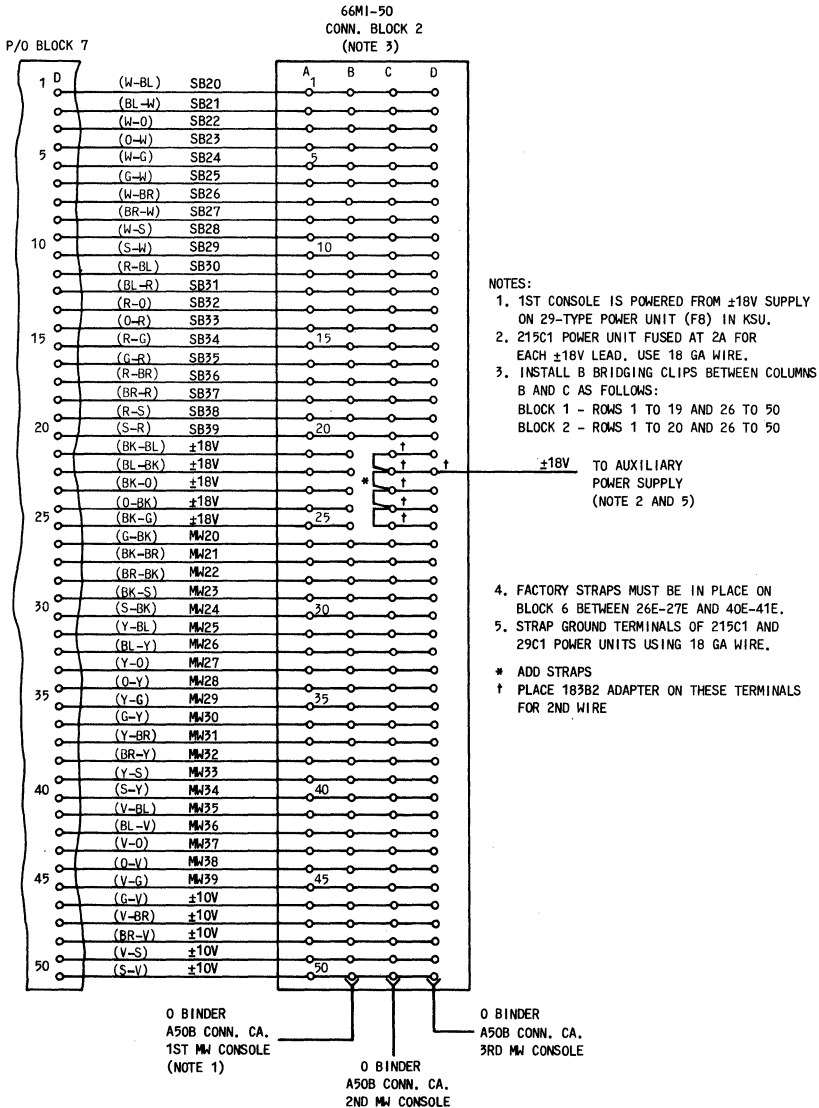


Fig. 43—Connections for Three MW Consoles (Sheet 2 of 2)

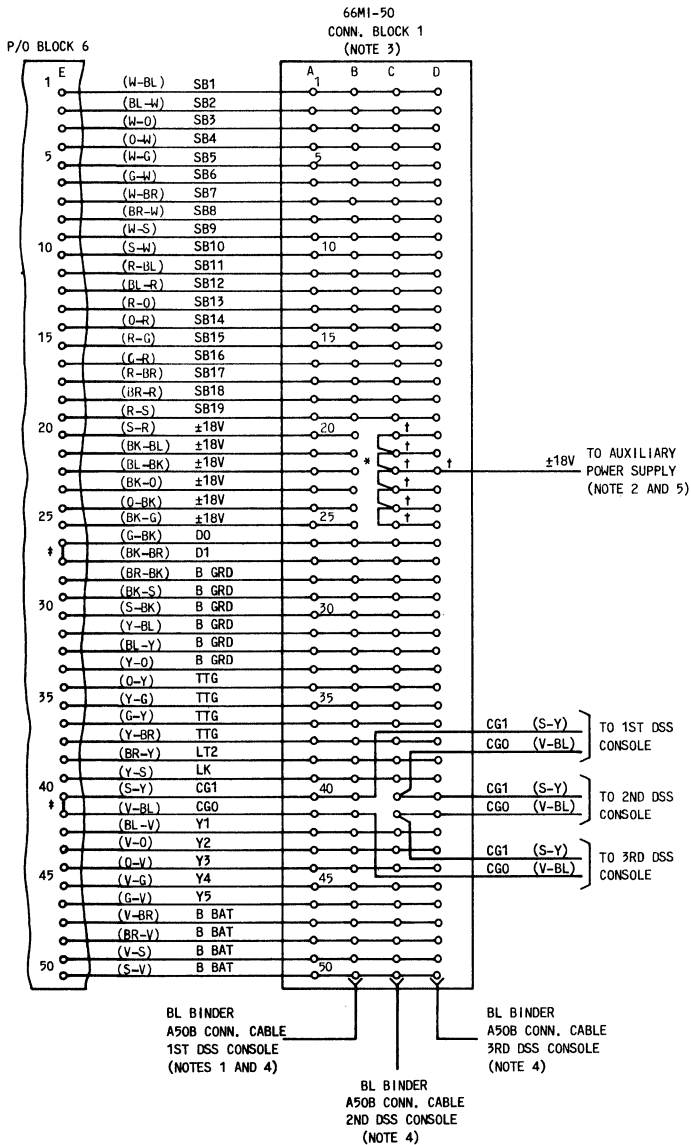


Fig. 44—Connections for Three DSS Consoles (Sheet 1 of 2)



lines by one. In addition, a 415A KTU or equivalent is required at the distant end.

**4.102** Install the 415A KTU in jacks 1 through 14 and connect tip and ring to the distant end to block 7 with the incoming CO/PBX lines (Fig. 14).

#### R. TOUCH-A-MATIC® Adjunct Dials

**4.103** Connections for adding the 870A1 or 2870A1 adjunct dials to 833- or 2833-type telephone sets can be found in Section 501-164-201.4

### 5. MECHANICAL MAINTENANCE

**5.01** Maintenance of the 14A Communication System is limited to normal station repairs (including cable and inside wire), wiring checks of the KSU, and replacement of defective components. Where a customer-owned and maintained (COAM) music source or a customer's paging system is connected to the 14A System, maintenance does not extend beyond the interface units (33A voice coupler and/or 20A-49 apparatus unit).

**5.02** Refer to Part 6 of this section for electrical maintenance information.

**5.03** When trouble is encountered, analyze the trouble to determine if the trouble can be localized to a particular area. For example, the trouble may be narrowed down to involve a circuit, CO/PBX line, console, feature, or telephone set.

#### 580-TYPE KSU

**5.04** Before considering the replacement of the 580-type KSU, the key telephone units, and the power units, perform the following:

- Fuses in place or not blown (Table K).
- Lamps properly seated and not burnt out.
- KTUs securely mounted in proper connectors with retainers and/or guide assemblies in place.
- Wiring on connecting blocks not loose, broken, or shorted.
- Frame ground is connected.

- Power cord is connected to a 3-wire grounded receptacle.

#### A. Key Telephone Units

- Securely placed in proper connector (Fig. 3).
- Proper option straps, if required, in place.
- Replace a suspected KTU with one known to be in good working order to determine whether trouble is in KTU or external to it.
- Should a replacement KTU not clear a trouble, the trouble is external and ***the original KTU should be returned to service.***
- No field maintenance is to be performed on KTUs.

#### B. Power Units

- Fuses in place and not blown
- Power cords connected properly and appropriate power taps connected
- Power present at the ac receptacle
- Circuit and frame grounds properly connected
- Proper auxiliary power supplied if multiple consoles are installed.

### CONSOLES

**5.05** Perform the following check before making a replacement on consoles:

- Mounting cord plugged into connector cable securely
- Lamps not burnt out
- Buttons operate freely
- Buttons on message waiting console (7B1) lock down and release properly.



TABLE K

## 580-TYPE KSU FUSE ARRANGEMENT

LOCATION	DESIG	FUSE AMP	TYPE	POTENTIAL	CIRCUIT	CODE
KSU Fuse Panel	F1	1-1/3	70A	10V ac	1st CO/PBX Line Lamps	0, 7-15
	F2					16-39
	F3				2nd CO/PBX Line Lamps	0, 7-15
	F4					16-39
	F5				3rd CO/PBX Line Lamps	0, 7-15
	F6					16-39
	F7				4th CO/PBX Line Lamps	0, 7-15
	F8					16-39
	F9				5th CO/PBX Line Lamps	0, 7-15
	F10					16-39
	F11				6th CO/PBX Line Lamps	0, 7-15
	F12					16-39
	F13				7th CO/PBX Line Lamps	0, 7-15
	F14					16-39
	F15				8th CO/PBX Line Lamps	0, 7-15
	F16					16-39
	F17				9th CO/PBX Line Lamps	0, 7-15
	F18					16-39
	F19				10th CO/PBX Line Lamps	0, 7-15
	F20					16-39
	F21				11th CO/PBX Line Lamps	0, 7-15
	F22					16-39
	F23				12th CO/PBX Line Lamps	0, 7-15
	F24					16-39
	F25				13th CO/PBX Line Lamps	0, 7-15
	F26					16-39

♦TABLE K (Contd)♦

## 580-TYPE KSU FUSE ARRANGEMENT

LOCATION	DESIG	FUSE AMP	TYPE	POTENTIAL	CIRCUIT	CODE	
KSU Fuse Panel	F27	1-1/3	70A	10V ac	14th CO/PBX Line Lamps	0, 7-15	
	F28					16-39	
KSU Power Panel	F29	1-1/3	70A	10V ac	1st Intercom Path Lamps	0, 7-23	
	F30					24-39	
	F31				2nd Intercom Path Lamps	0, 7-23	
	F32					24-39	
	F33				3rd Intercom Path Lamps	0, 7-23	
	F34					24-39	
	F35	See Note	See Note	-24V C BAT.	Telephone Set Amplifiers and Connector J26	0, 7	
	F36					8-15	
	F37					16-23	
	F38					24-31	
	F39					32-39	
	F40	Blank					
	F41	1/2	70G	-24V B BAT. (SIG)	Privacy and DSS	0, 7	
	F42					Privacy	8-15
	F43						16-23
	F44						24-31
	F45			32-39			
	F46			-24V B BAT. (SIG)	Paging Zone 1	(4)	
	F47				Paging Zone 2	(5)	
	F48				Paging Zone 3	(6)	
	F49 F50	Blank					
	F51						
	F52						

♦TABLE K (Contd)♦

## 580-TYPE KSU FUSE ARRANGEMENT

LOCATION	DESIG	FUSE AMP	TYPE	POTENTIAL	CIRCUIT	CODE
KSU Power Panel	F53 F54	Blank				
	F55 F56					
67-Type Power Unit	F1	3	24B	10V ac	CO Lamps Lines 9, 13	16-39
	F2				CO Lamps Lines 8, 11	16-39
	F3				CO Lamps Lines 10, 12	16-39
	F4				CO Lamps Lines 6, 14	16-39
	F5	5	24F		1st 7 CO Line Lamps	0, 7-15
	F6	2	24C		Sta MW & Attendant RT Lamp	
29-Type Power Unit	F1	3	24B	10V ac	Lamp Steady, IC Path 1, 2	
	F2				Lamp Steady, IC Path 3, IC Flash	
	F3				CO Lamps Lines 2, 4	16-39
	F4				CO Lamps Lines 3, 7	16-39
	F5				CO Lamps Lines 1, 5	16-39
	F6	5	24F		2nd 7 CO Line Lamps	0, 7-15
	F7	2	24C	10V ac	Interrupter Motor	
	F8			18V ac	Console Sta Busy Lamps	
	F9			-24V B BAT.	1st 7 CO/PBX Line Circuits	
	F10				2nd 7 CO/PBX Line Circuits	
	F11				Intercom B Battery	
	F12				Power Failure Transfer	
	F13				Privacy Circuits	
	F14				Paging	
	F15				-24V A	A Battery

Battery Symbol	Voltage Range
-24A	18-26
-24B	20-26
-24C	18-26

*Note:* On 580-type KSUs manufactured before June 25, 1975, fuses 35 to 39 were 1/2A (70G). Since that date, fuse 35 is 1-1/3A (70A) and fuses 36 to 39 are blank.

**EXTERNALLY MOUNTED UNITS**

**5.06** Do not replace any of the externally mounted units until a check has been made on the following:

**A. 33A Voice Coupler**

- Fuses not blown and properly positioned
- Connecting leads not part of a voice cable
- Connections not loose or broken.

**B. 20A-49 Apparatus Unit**

- Volume control not turned off
- Connecting leads not part of a voice cable
- Connections tight and leads not crossed
- Customer's connections made with shielded wire and grounded at customer's equipment only.

**C. 22A-49 Apparatus Unit**

- Unit fastened securely and mounted in a vertical position
- Battery and ground leads not reversed
- Connections tight and not shorted
- Associated external power supply properly connected and fuses not blown.

**D. Loudspeakers**

- Connections tight and both pairs of quad wire connected
- Volume control properly adjusted
- Speakers not located too far from KSU
- Speaker leads not part of a voice cable
- Speakers not positioned or located close enough to telephone sets to cause feedback.

**Note:** Other than fuse replacement, no field maintenance is to be performed on the externally mounted units.

**TELEPHONE SETS**

**5.07** Telephone sets should not be replaced until the following observations have been completed:

- Sets plugged in securely
- Volume control not turned off
- Lamps not burnt out
- Switchhook operates freely
- Line buttons operate freely and automatically restore when handset is placed on-hook (intercom-only telephone sets do not have ABR)
- Cords are not tangled or damaged.

**6. ELECTRICAL MAINTENANCE**

**6.01** Maintenance information is included as an aid in locating and clearing trouble in the 14A Communication System at the time of installation or on subsequent repair visits. Analysis of a trouble reported may be helpful in narrowing the search for the source of trouble. For instance, if a lamp does not light at a particular station or group of stations, the trouble is more likely in a telephone set or its wiring—if the lamp does not light at any station, the trouble is more likely in the KSU or the associated KTU.

**6.02** Maintenance information for the following circuits is provided:

- CO/PBX line circuits—400-type KTUs
- Station line ringing arrangements
- Intercom circuits—424C, 440A, 444A, 454B, 456B, and 478B KTUs
- Lamp driver circuit—453B KTU
- Lamp flash circuit
- Lamp wink circuit

- Message waiting circuit
- Music-On-Hold circuit—451-type KTU
- Loudspeaker paging and background music circuits
- Power distribution circuits:
  - 29-type power supply power distribution
  - 29-type power supply ground
  - 67-type power supply power distribution
  - 67-type power supply ground
- Power failure ringing circuit—452A KTU
- Preset conference on intercom circuit
- Station busy circuit—optional station busy consoles
- Tone ringing circuit.

**6.03** If analysis and/or testing indicates trouble in the KSU, the source can be further identified using the supplied information in the following sequence:

- (1) The description of each circuit and the purpose of the KTUs can be used to determine what units may be involved.
- (2) Once the involved circuit has been determined, use the sequence table which gives an operational procedure for testing the circuit and, where a failure is encountered, the most likely causes or KTUs that could cause the condition.
- (3) If the trouble is suspected in or isolated to a particular KTU, further aids are given in the form of a lead table and an input and output table. The lead table defines each lead, its function in the circuit, and its termination on the KTU and mating connector(s). The input and output table can be used to ensure that proper potentials are available at, or being supplied by, the KTU under any circuit conditions shown required in the Remarks column. ♦These potentials should be found on the KTU contacts and the connector terminals.♦ Only tests that can be made with a 1013A hand test set or equivalent have been included. Further tests

are possible but may require more sophisticated test equipment. If a KTU tests defective, replace it.

**Note:** No attempt should be made to repair or modify KTUs in the field. Replace defective KTUs with one known to be in working order. If replacing a KTU does not clear the trouble, ***the original unit should be put back in service.***

(4) If trouble is indicated in the factory wiring of the KSU, a point-to-point wiring schematic is furnished for each circuit. The distribution of all power in the KSU is also separately supplied in case it is found a particular potential is missing. Wiring color is not shown; however, connecting block, connector and power supply terminals are identified in detail. All factory wiring is shown as solid lines; dashed lines indicate wiring external to the KSU, installer placed leads, or leads shown in detail in other figures.

#### CO/PBX LINE CIRCUITS—400-TYPE KTU

**6.04** The 400-type KTU provides the control functions between one CO/PBX line and the telephone sets, including line pickup, hold, lamp and tone ringing control. The KTU also assures outgoing service during power failure. Option straps should be placed on the 400A, B, C, D, or G KTU when used with the 14A Communication System to provide short timeout (Z), lamp wink on hold (Y), and interrupted audible signal (W). ♦Options on the 400H should be CO/PBX line (T), interrupted line signal (W), and (S) or (R), depending on serving CO or PBX (see Fig. 93).♦

**6.05** ♦To aid in the maintenance of the CO/PBX line circuits in the 580-type KSU, refer to Tables L, M, and N for the 580A/B, Fig. 45 through 58 for the 580A, and Fig. 59 through 72 for the 580B.♦

#### STATION LINE RINGING ARRANGEMENTS

**6.06** Provision is made to program several arrangements involving ringing on the CO/PBX lines. These include:

- Common audible—as factory-wired, station 0 will receive all incoming CO/PBX calls (option K).

♦TABLE L♦

400-TYPE KTU LINE CIRCUIT

At station, depress associated line button and go off-hook.

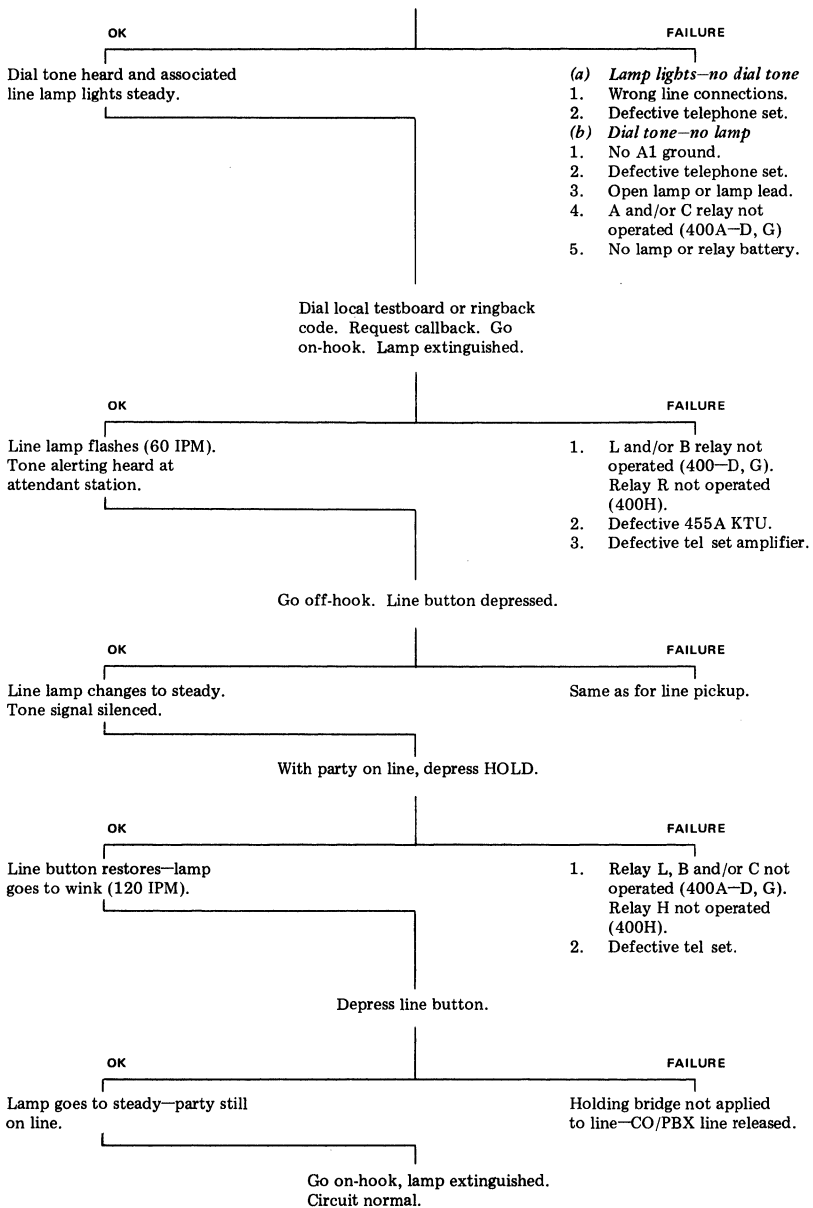


TABLE M  
LEAD TABLE—400-TYPE KTU

LEAD DESIG	FUNCTION	KTU/CONNECTOR AND PIN NUMBER
		J1—J14
A	A lead—primary control lead from telephone set. Status of A lead determines idle, off-hook, or hold indication.	16
L	Lamp lead—provides proper 10V ac signal to telephone set lamp and to lamp driver circuits (453B KTUs) to indicate line status.	8
R(CO)	Ring side of CO/PBX line <i>from</i> office.	9
R(STA)	Ring side of line—output <i>toward</i> station.	13
T(CO)	Tip side of CO/PBX line <i>from</i> office.	14
T(STA)	Tip side of line—output of KTU <i>toward</i> station.	12
RC	Ring control—tone signal control lead. Connects tone from generator to amplifier of telephone set as an audible signal.	1

- The common audible can be moved to a different station by replacing option K with a jumper from terminal 19H to the desired CO( ) lead on block 1.
- CO/PBX lines can ring at additional stations, in addition to or other than the attendant station, by connecting the RC leads to the CO leads (option S).
- Calls can be transferred from the attendant station to an alternate station(s) by adding option J (ring transfer) on block 1.

**Note:** In any of the arrangements, a maximum of 10 stations can be wired to ring on common audible on any of the lines. However, a station cannot ring on more than one line.

**6.07** Tables O, P, and Fig. 73 are provided as an aid for maintenance of the CO/PBX ringing arrangements.

**INTERCOM CIRCUITS—424C, 440A OR 478B, 444-TYPE, 454B, AND 456B KTUs**

**6.08** The intercom circuitry provides three separate paths for calls within the system with each path appearing on a button on the telephone sets. Basic intercom features are supplied by the following KTUs:

- 424C KTU—Selector circuit
- 444-Type KTU—Selector extender circuit
- 454B KTU—3-path access circuit
- 456B KTU—Voice and tone alerting circuit.

To provide the optional intercom features, the following additional units are required:

- 440A or 478B KTU—TOUCH-TONE adapter circuit
- 457C KTU—Paging amplifier circuit.

TABLE N  
INPUTS AND OUTPUTS — 400-TYPE KTU

TEST FROM (SEE NOTE)	TO	MON/TALK SWITCH	TEST FOR	REMARKS
INPUTS				
14	9	TALK	CO/PBX dial tone	
B BAT.	15		B Ground	
	6		MG — interrupter ground	
GROUND or 15	2	MON	LW — 10V± at 120 IPM	With interrupter running
	7		LF — 10V± at 60 IPM	
	4		10V steady	
	11		RN — interrupted tone ringer signal	
	17	TALK	B Battery	Interrupter running
OUTPUTS				
12	13	TALK	CO/PBX dial tone	
GROUND	8	MON	10V± steady	Ground pin 16
	1		Tone ringing signal	CO/PBX ringing on line

*Note:* Terminals shown in TEST FROM and TO columns appear on the KTU and the wiring side of the associated connector.

An additional optional feature, intercom preset conference, can be supplied by making wiring changes on connecting block 1.

*Note:* Condensed functional schematics of the KTUs are located at the end of this section.

#### A. Selector Circuit—424C KTU

**6.09** This circuit is the basic, selector-only 19-code rotary dial intercom circuit. Of the available codes, 0 is used as the attendant code; 1, 2, and 3 are the first digits of the 2-digit codes; 4, 5 and 6 are the paging codes; and 7 through 39 are assigned as station codes. The 424C KTU selects and alerts intercom station codes 0, 7, 8, and 9, or operates an associated 444-type KTU to select

and alert intercom stations, codes 1X, 2X, and 3X. Station selection can be by rotary dial, TOUCH-TONE or DSS console, if provided.

#### B. TOUCH-TONE Adapter Circuit—440A or 478B KTU

**6.10** The adapter circuit is used to convert the multifrequency signals from the station to contact closures which supply ground on the proper Y1-Y5 leads to the 424C selector. Operation of the proper counting relays in the selector alerts the designated station in the same manner as for a rotary dial call. The adapter also grounds the LK lead after the first digit of a 2-digit is dialed to remove dial tone. When the adapter is not in use, a path is completed through the H and L



relays for the CG0-CG1 lead, which operates the selector counting relays on rotary-dialed calls.

### C. Selector Extender Circuit—444-Type KTU

6.11 The extender circuit, in conjunction with the 19-code selector circuit (424C KTU), provides dial selection of up to 37 codes. This is accomplished by providing two more transfer digits with the selector extender circuit, in addition to the transfer digit in the selector circuit. The selector is designed so that any one of the three transfer digits (1, 2, or 3) will operate the transfer relays in the 424C KTU via the TD lead. The transferred output leads (RXX) of the 424C KTU become the input leads of the 444-type KTU. Depending on whether the 1, 2, or 3 transfer digit is dialed, the voice and tone signaling will appear on either the R1X leads, the R2X leads, or the R3X leads of the 444-type KTU. Single digit codes appear on the 424C KTU RX leads. Leads from the 444-type KTU also extend to the (optional) DSS console in order to operate the transfer relays when a station is selected from the console.

### D. 3-Path Access Circuit—454B KTU

6.12 The 454B KTU performs the following:

- Provides talking battery for the three intercom paths
- Controls all intercom lamp functions
- Provides the common control circuitry to connect the selector to one path at a time
- Provides a detect circuit to free the selector at the proper time if a second intercom call is waiting and connects the tone alert and TOUCH-TONE adapter (if provided) to the selected path
- Connects dial tone to the tip of the intercom path selected.

### E. Voice and Tone Alerting Circuit—456B KTU

6.13 The 456B KTU consists primarily of an oscillator circuit and a preamplifier circuit. The oscillator is designed to give a 1-second burst of tone as the alerting tone on intercom calls. The preamplifier is used for the voice signaling. A

voice input from the (optional) paging circuit is also furnished from this circuit.

6.14 Tables Q, R, S, T, U, V, W, and Fig. 74 are provided as an aid for maintenance of the intercom circuits.

### LAMP DRIVER CIRCUIT—453B KTU

6.15 The 453B KTUs are used to switch lamp current to the lamps of stations 16 through 39. Because of the number of lamp multiples (up to 34), the relay contacts of the 400-type line circuits alone are not adequate to switch all the lamp current. Each 453B KTU contains seven slave circuits that repeat lamp information, through high current capacity thyristors, to the telephone sets. Two 453B KTUs are used in the 14A System.

6.16 Tables X, Y, and Z are provided as an aid for maintenance of the lamp driver circuit. Refer to Fig. 45 through 72 (connector pin 8 of connectors 1 through 14) for further illustration of lamp circuitry.

### LAMP FLASH CIRCUIT

6.17 Fig. 75 is provided as an aid for maintenance of the lamp flash circuit.

### LAMP WINK CIRCUIT

6.18 Fig. 76 is provided as an aid for maintenance of the lamp wink circuit.

### MESSAGE WAITING CIRCUIT

6.19 Fig. 77 is provided to illustrate connections and KSU wiring for message waiting.

### MUSIC-ON-HOLD CIRCUIT—451-TYPE OR 498A KTU

6.20 The 451-type KTU contains seven identical circuits. Each circuit provides music-on-hold to one CO/PBX line circuit. Incoming music, provided by the customer, is connected to the 451-type KTU via a 33A voice coupler. The incoming music signal is impressed on all seven music-on-hold circuits in parallel as shown by the dashed lines (connectors J27 and J29) in Fig. 78. When the CO/PBX lines are in a talk condition, the outputs of the 451-type KTU are shorted by contacts in the associated line circuits. When the CO/PBX line is placed on hold, the output of the 451-type KTU

is impressed on the ring side of the CO/PBX line and can be heard by the held party. Two 451-type KTUs are used in the 14A System.

♦**Note:** The 400H KTU should not be used in a 580A KSU if music-on-hold is furnished. Any 400-type KTU can be used as the line circuit with or without music-on-hold in a 580B KSU.♦

**6.21** ♦On the 498A KTU, music is supplied to four CO lines. When the KTU is equipped with a 116A1 CM, this number is increased to seven. With the CO line in the talk condition, a normally open relay contact prevents the music from being heard. When the line is placed on hold, the 498A KTU or 116A1 CM recognizes the change on the A and L leads operating the relay associated with the line. Music is then applied to the T(Sta) and R(Sta) leads, through the line circuit to the held party.♦

**6.22** Tables AA, AB, AC, AD, AE, and Fig. 78, 79, 98, and 99 are provided as an aid for maintenance of the music-on-hold circuit.

#### LOUDSPEAKER PAGING AND BACKGROUND MUSIC CIRCUIT—457C KTU

**6.23** The paging circuit is enabled by dialing a paging code (digit 4, 5, or 6) on any of the idle intercom paths. This completes a circuit, via the SS lead, from the 456B KTU through the 424C KTU to the PC() lead of the 457C KTU(s). This applies the input on the PA lead from the 456B KTU to the amplifier(s) and opens the input of the COAM music source, if provided. Voice and tone inputs on the PA lead are then heard in the loudspeakers. Paging codes must be strapped on connecting block 3; see Table D for connections.

**6.24** Background music can be supplied over the paging speakers, when paging is not taking place, using the amplifier circuitry in the 457C KTU. The COAM music source is fed through a 33A voice coupler which acts as a combination interface and protective device. The level of the sound at the speakers involves interaction of the volume control settings at the music source, voice coupler, and the individual speakers.

**6.25** Tables AF, AG, AH, and Fig. 80 are provided as an aid for maintenance of the paging and background music circuit.

#### ♦AUTOMATIC, DC SIGNALING, PRIVATE LINE CIRCUIT

**6.26** *The 415A KTU can be used in the 580B KSU only.* The KTU provides a direct connection to a distant end station. Going off-hook (either end) automatically signals the distant end. At the 14A station, the signal will be the tone alerting signal. Calls are answered or originated by depressing the line pickup button associated with the private line. Lamp signals are the same as for a CO/PBX line.

**6.27** Tables AI, AJ, AK and Fig. 94 are provided as an aid for maintenance of the 415A KTU private line circuit.♦

#### POWER DISTRIBUTION CIRCUITS

**6.28** Power for the 14A System is supplied by two power supplies, a 29-type and a 67-type. Fig. 81 through 84 are provided as an aid for maintenance of the power system.

- Refer to Fig. 81 for the power distribution circuit for the 29-type power supply.
- Refer to Fig. 82 for the power ground circuit for the 29-type power supply.
- Refer to Fig. 83 for the power distribution circuit for the 67-type power supply.
- Refer to Fig. 84 for the power ground circuit for the 67-type power supply.

#### POWER FAILURE RINGING CIRCUIT—452A KTU

**6.29** The power failure ringing circuit provides for incoming audible signals on an optional basis in the event of loss of commercial power to the 580-type KSU. The tip and ring of each CO/PBX line is brought through normally closed contacts on the 452A KTU relays. These relays are operated (by battery from fuse 12 of the 29-type power supply) as long as commercial power is supplied to the KSU. If the commercial power is lost (or fuse 12 operates), the relays release, extending the lines to connecting block 1 where a cross-connect must be placed (Fig. 34). The cross-connection in turn extends the tip and ring to the (V-S) (S-V) pair of the desired station. An external (E1C) ringer must be connected to these leads at the telephone set or some other accessible point.

**6.30** Tables AL, AM, AN, and Fig. 85 are provided as an aid for maintenance of the power failure ringing circuit.

**PRESET CONFERENCE ON-INTERCOM CIRCUIT**

**6.31** Fig. 86 illustrates the diode arrangement, on connecting block 2, that makes up the preset conference circuit. Cross-connections to connect the stations selected for conferencing, option (T), are made on connecting block 1 (Fig. 27). The factory-placed strap, option (V), between 17H and 24E on connecting block 1 must be removed when preset conferencing is provided.

**STATION BUSY CIRCUIT (Optional Station Busy Console)**

**6.32** Fig. 87 is provided to illustrate connections and KSU wiring for station busy. When a station goes off-hook (with or without a CO/PBX

or intercom line button depressed), A1 ground is extended through the operated switchhook contacts of the telephone set and through the wiring of the KSU to light an associated lamp on the optional 7A1 or 7B1 console.

**tone RINGING CIRCUIT—455A KTU**

**6.33** The tone ringing on CO/PBX lines is furnished by the tone ringing signal generator, 455A KTU, located in connector J25. Inputs to the 455A KTU are A battery, pin 18, and A ground, pin 3. The 455A KTU has one output on pin 9 (RO lead) which consists of an alternate 900 Hz and 1107 Hz ac-dc signal. The dc output turns on the telephone set amplifier and the ac output is the audio signal.

**6.34** Fig. 88 is furnished as an aid in the maintenance of the tone ringing circuit.

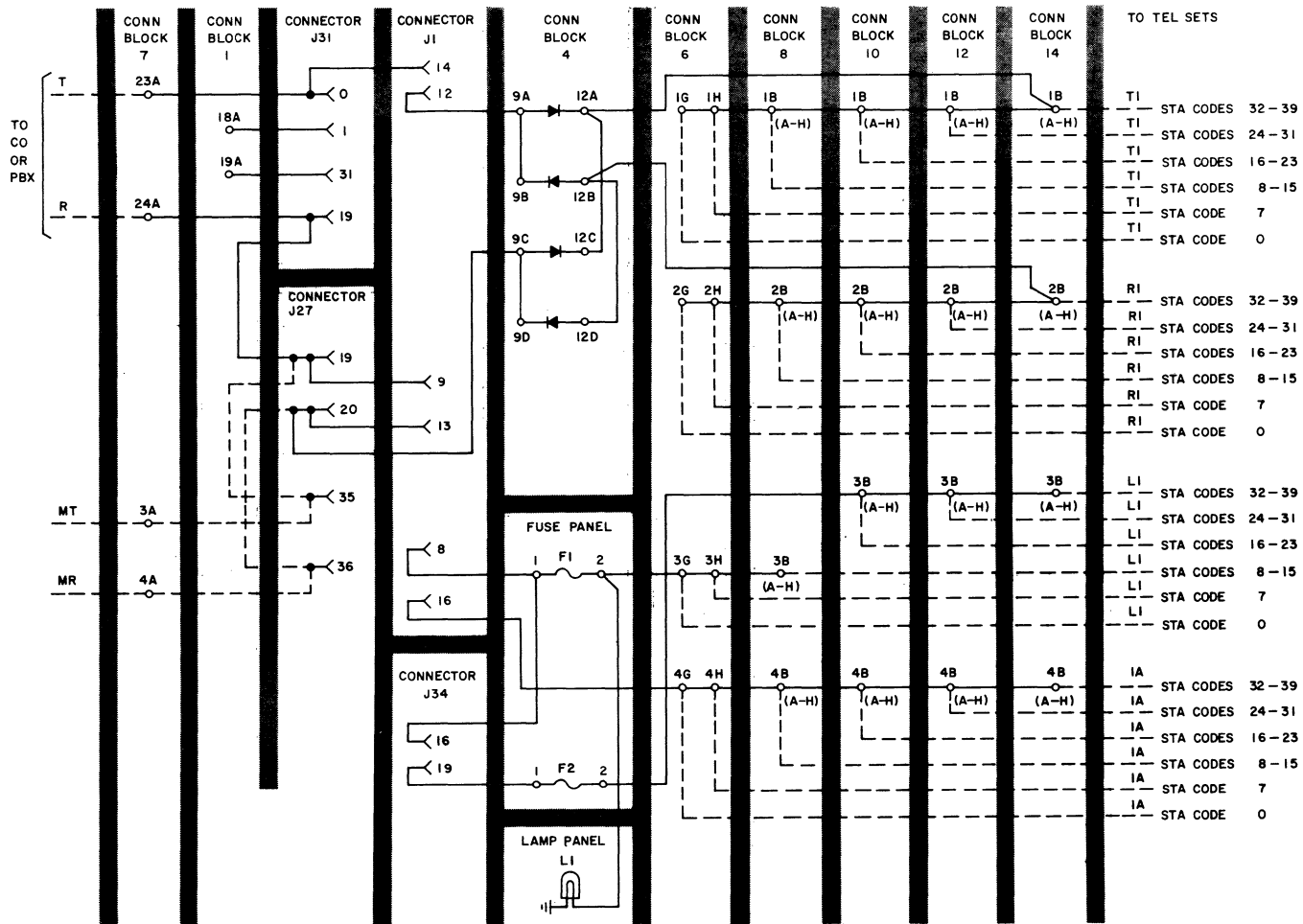


Fig. 45—CO/PBX Line Circuit 1—580A KSU

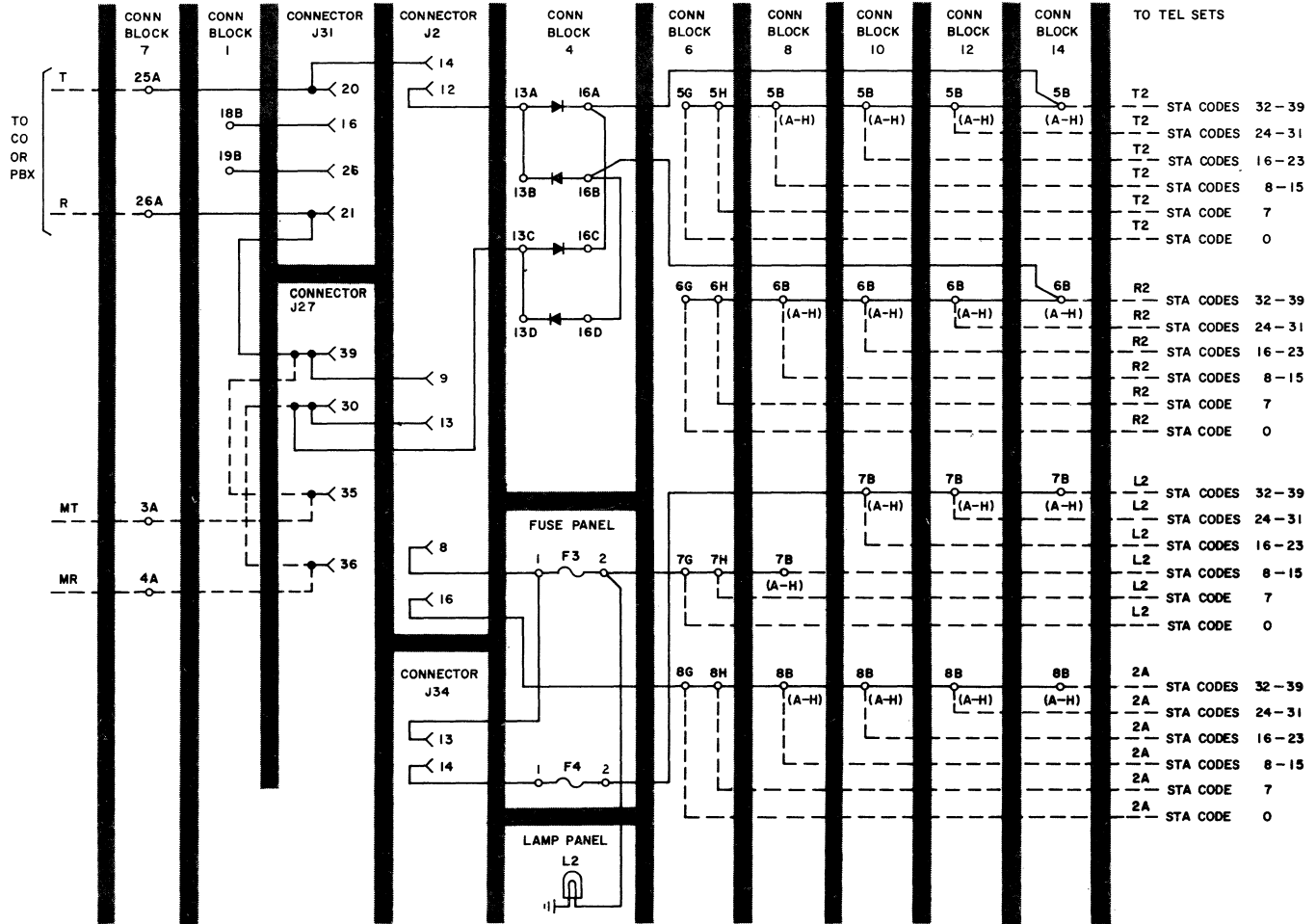


Fig. 46—CO/PBX Line Circuit 2—580A KSU

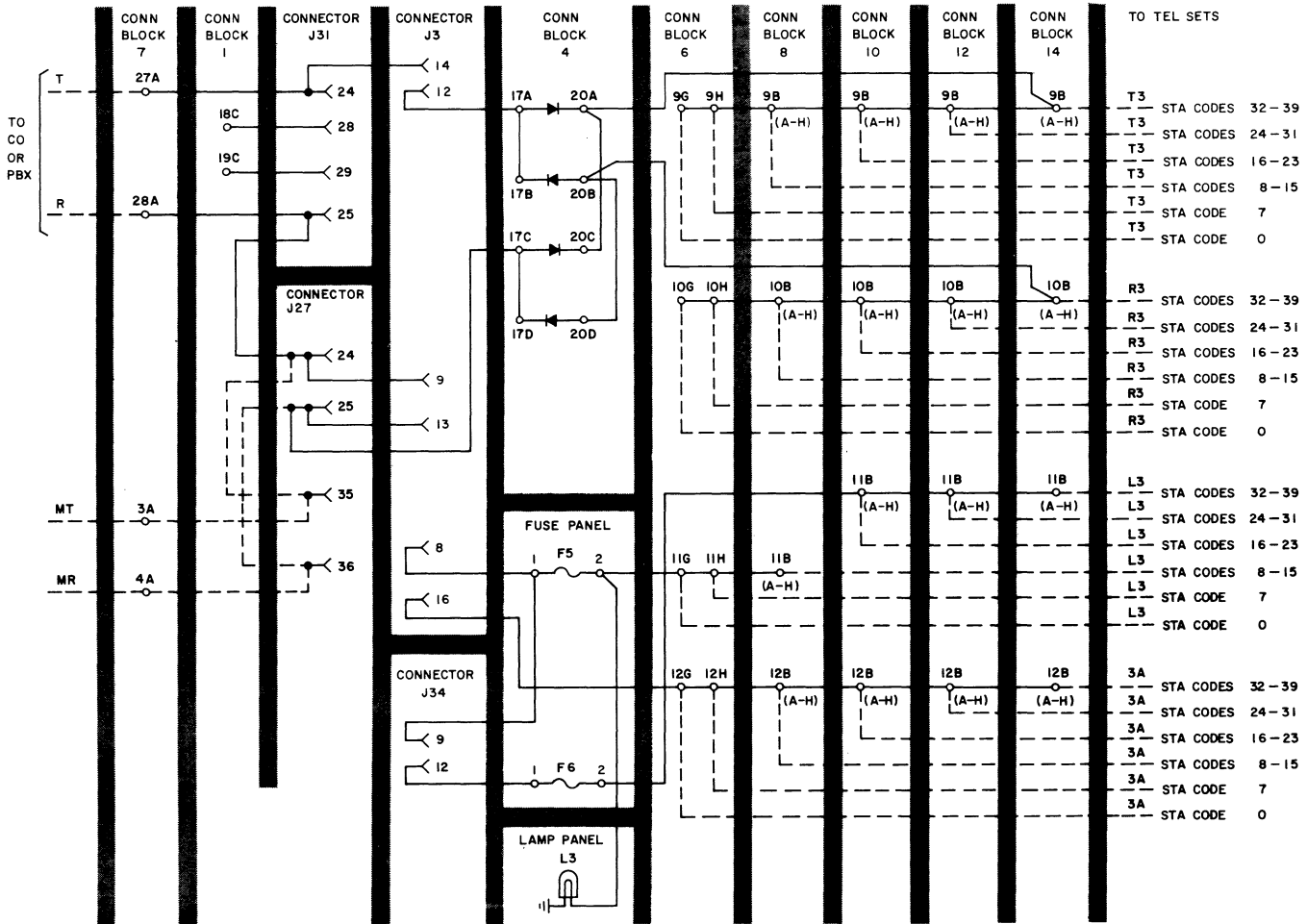


Fig. 47—CO/PBX Line Circuit 3—580A KSU

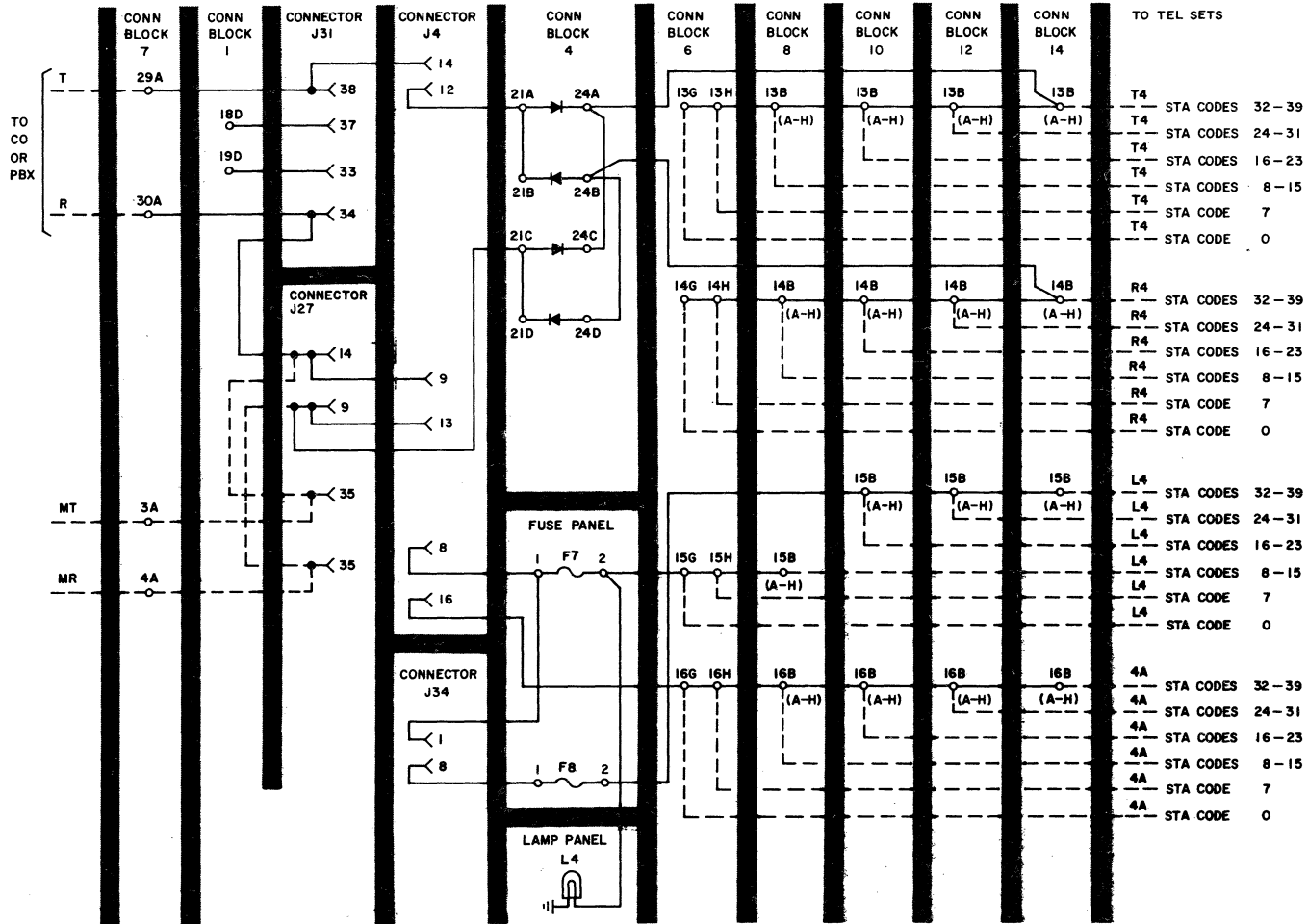


Fig. 48—CO/PBX Line Circuit 4—580A KSU





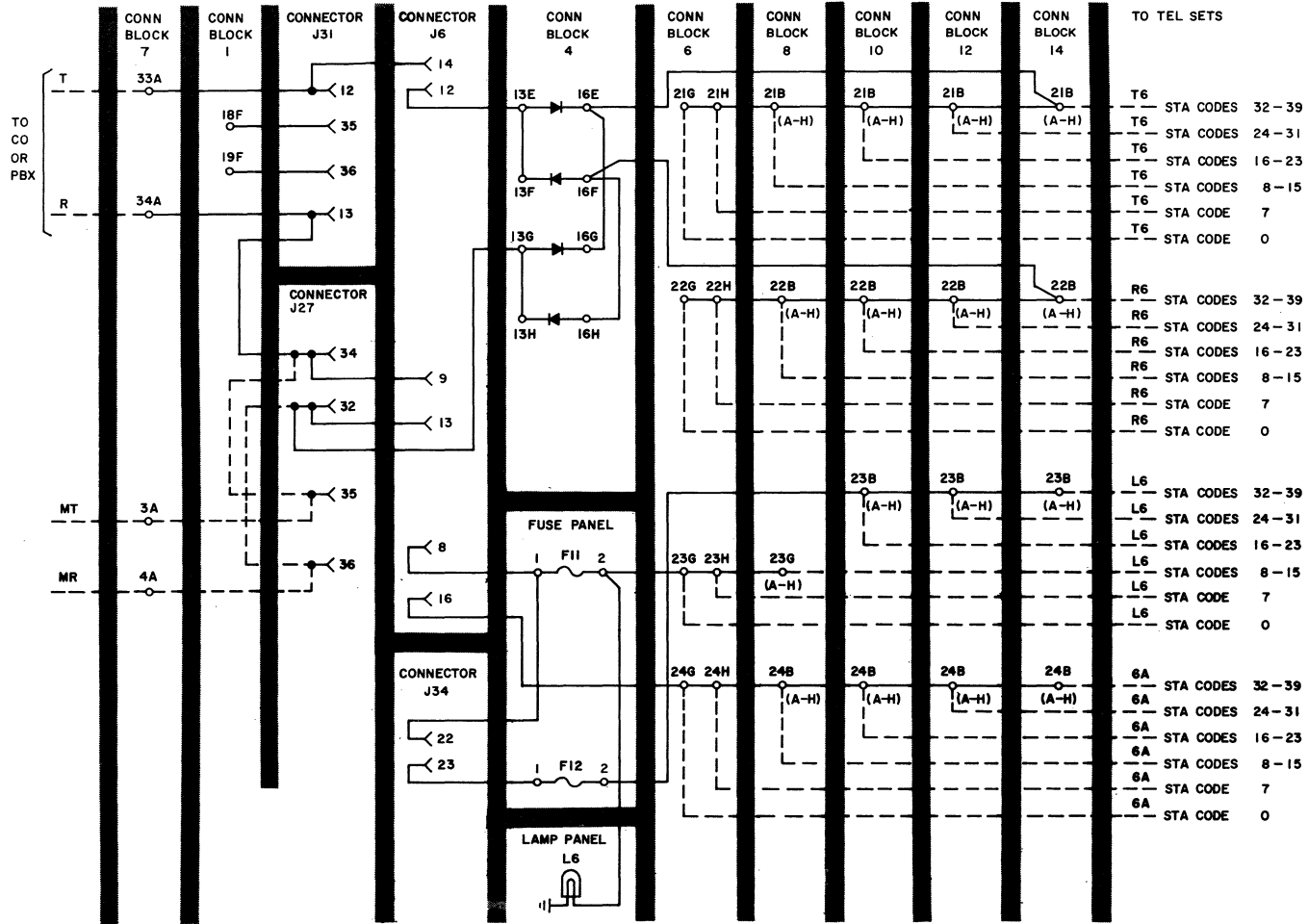


Fig. 50—CO/PBX Line Circuit 6—580A KSU



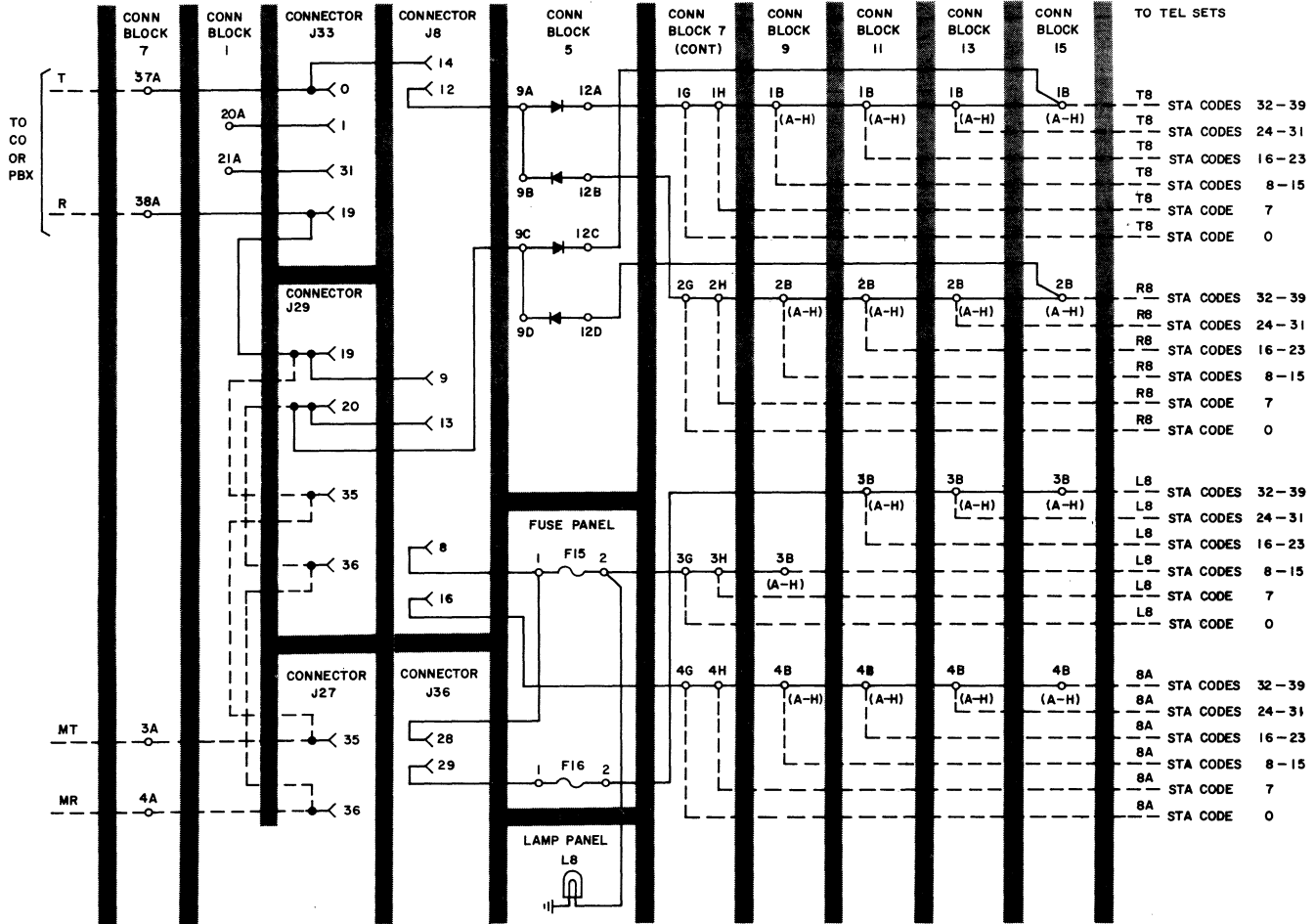


Fig. 52—CO/PBX Line Circuit 8—580A KSU

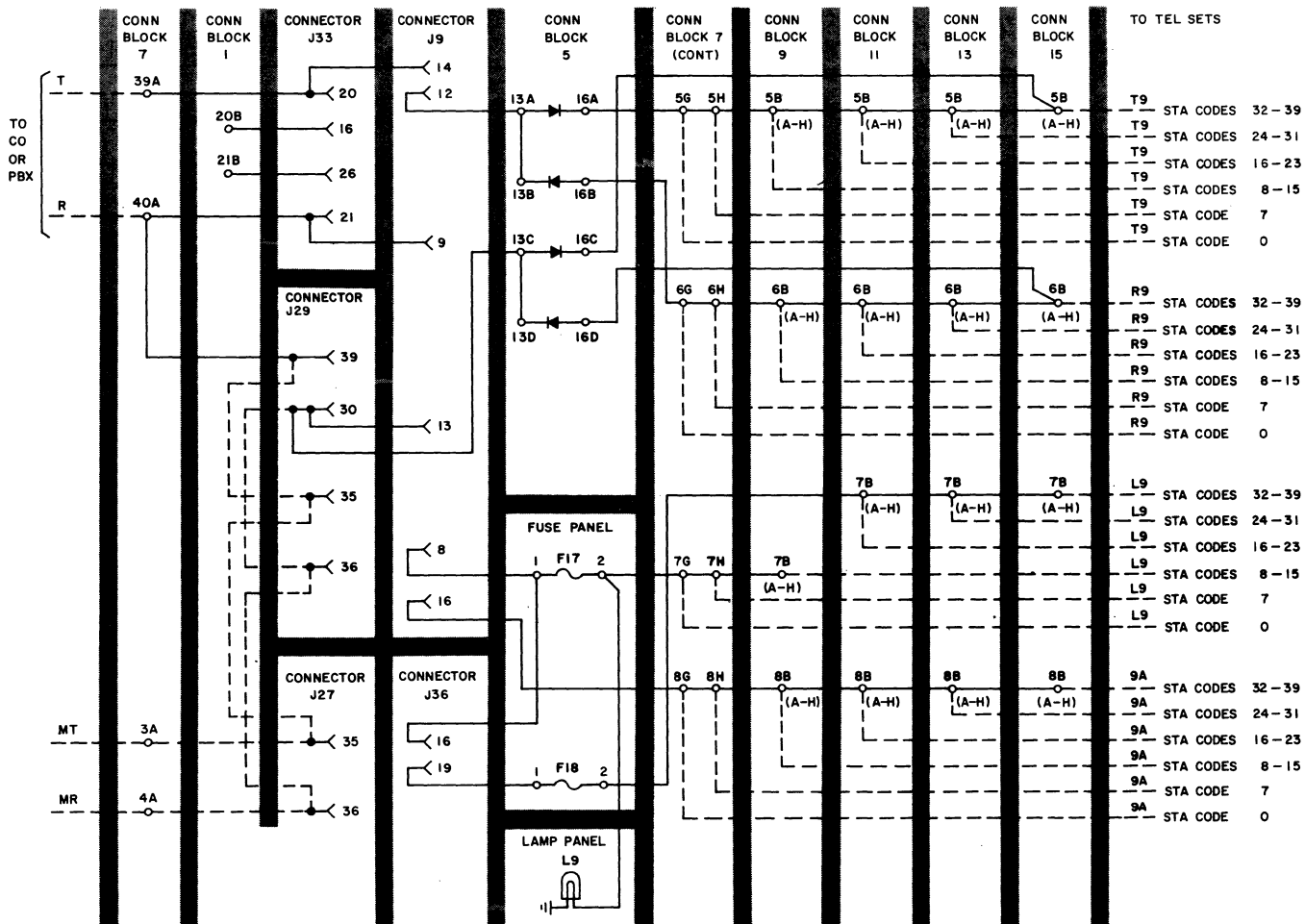


Fig. 53—CO/PBX Line Circuit 9—580A KSU

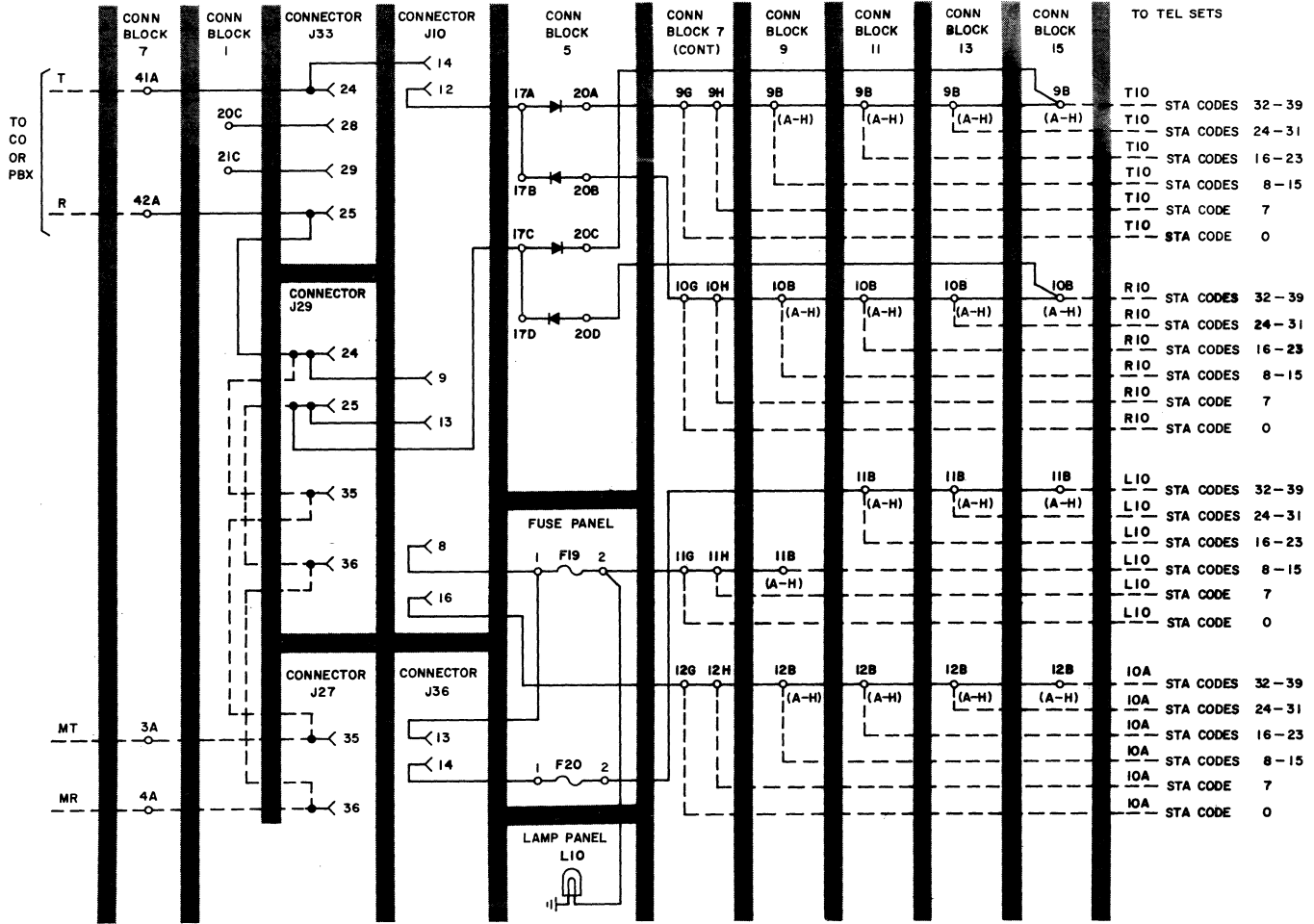


Fig. 54—CO/PBX Line Circuit 10—580A KSU

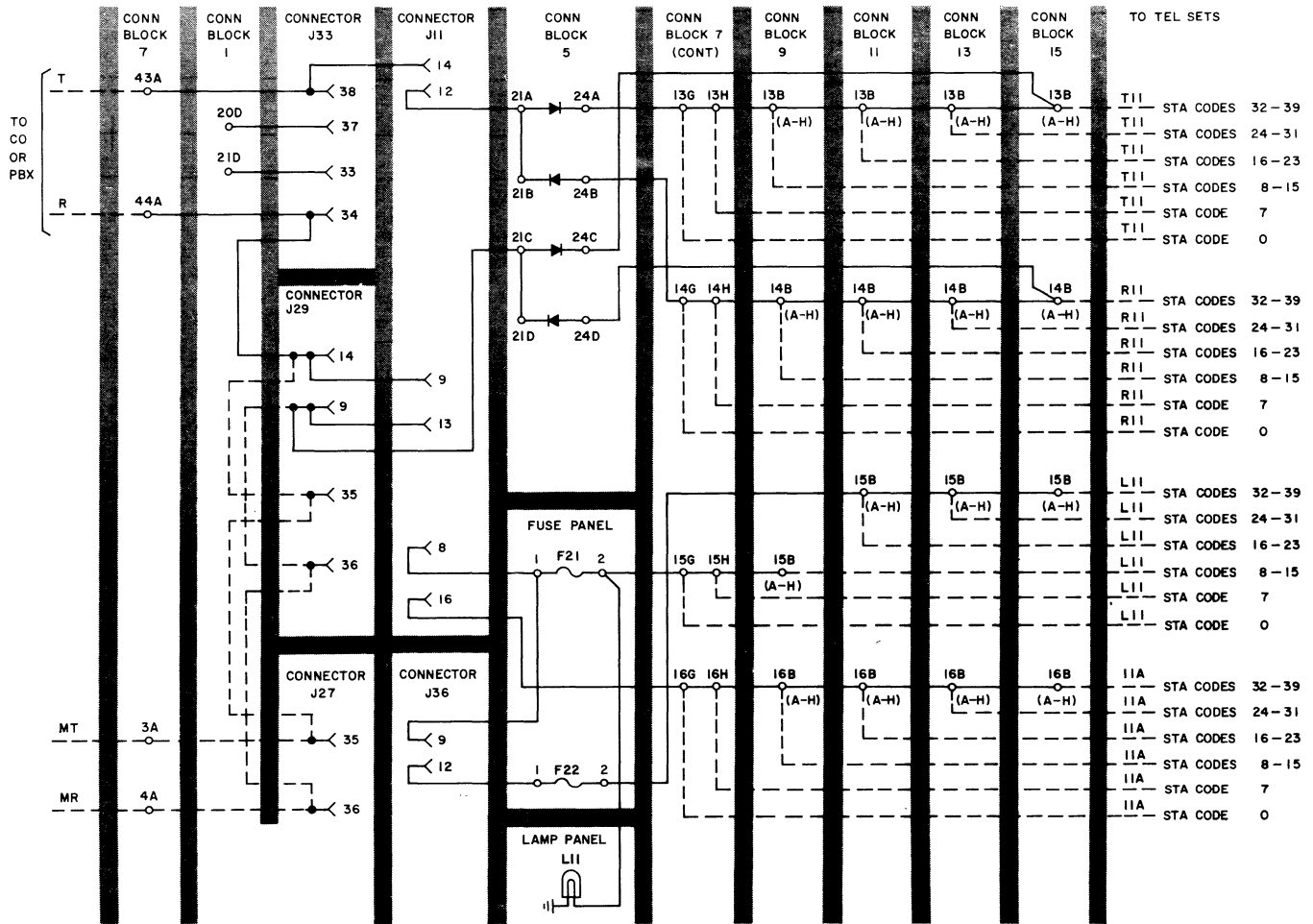


Fig. 55—CO/PBX Line Circuit 11—580A KSU

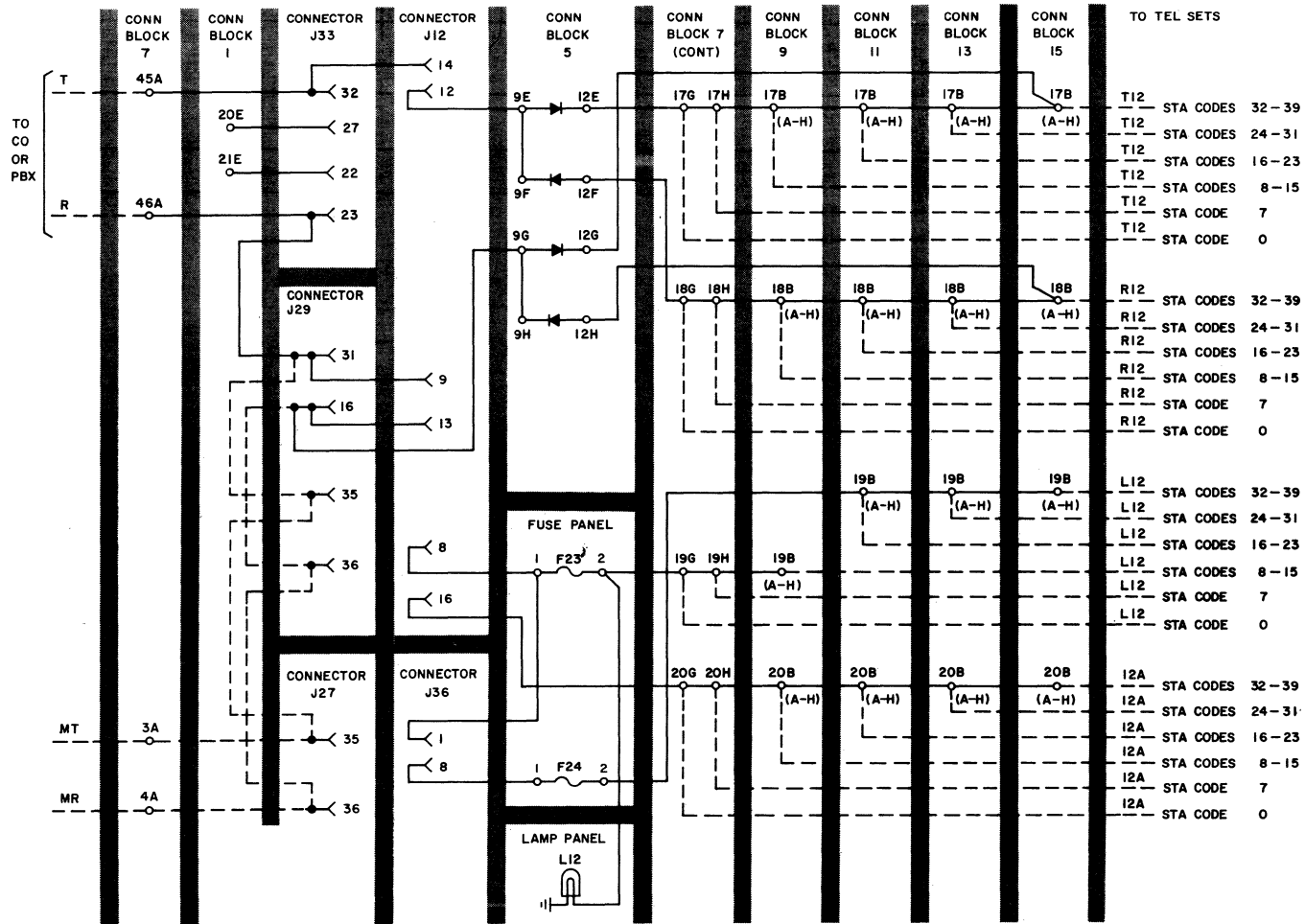


Fig. 56—CO/PBX Line Circuit 12—580A KSU





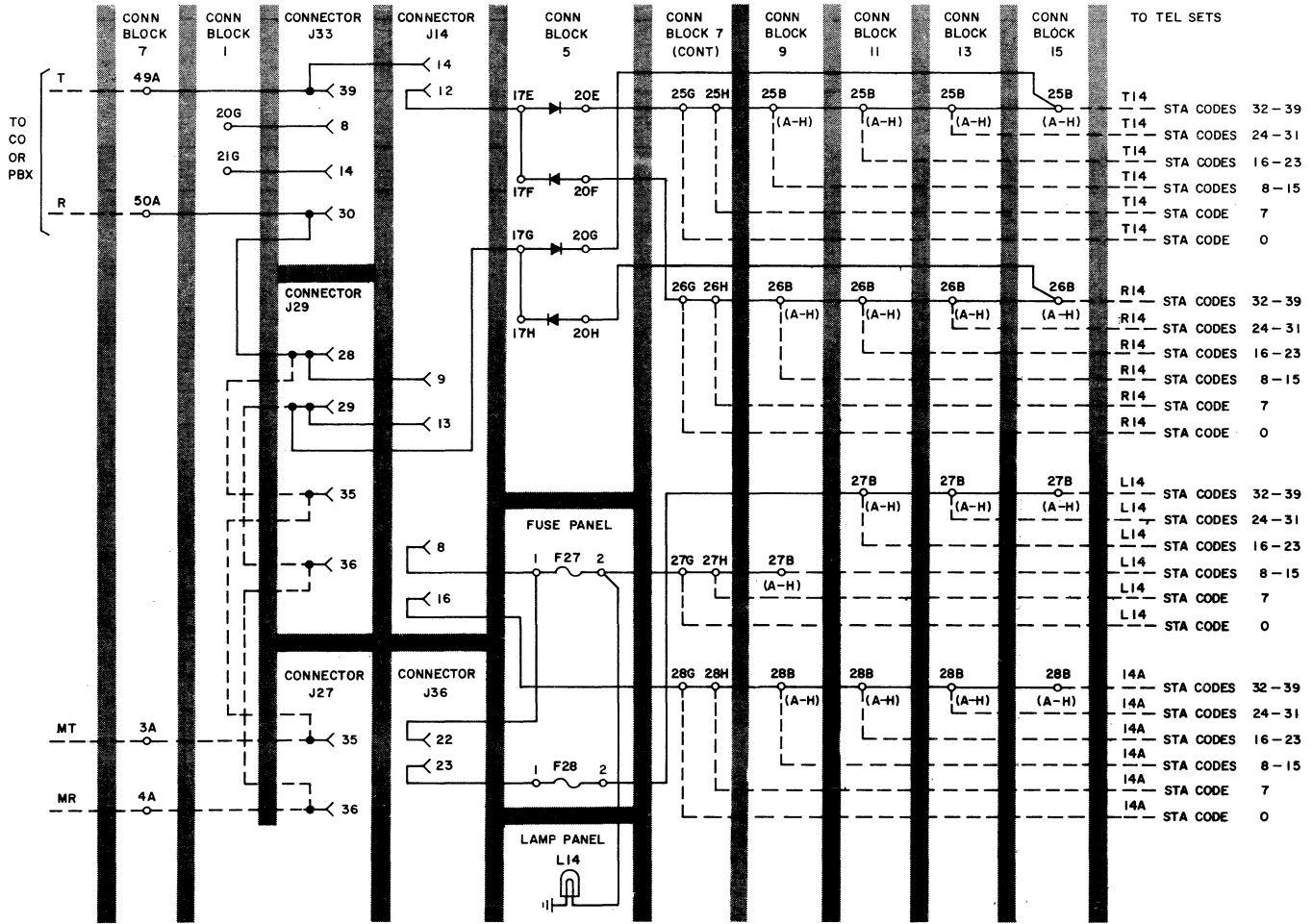


Fig. 58—CO/PBX Line Circuit 14—580A KSU

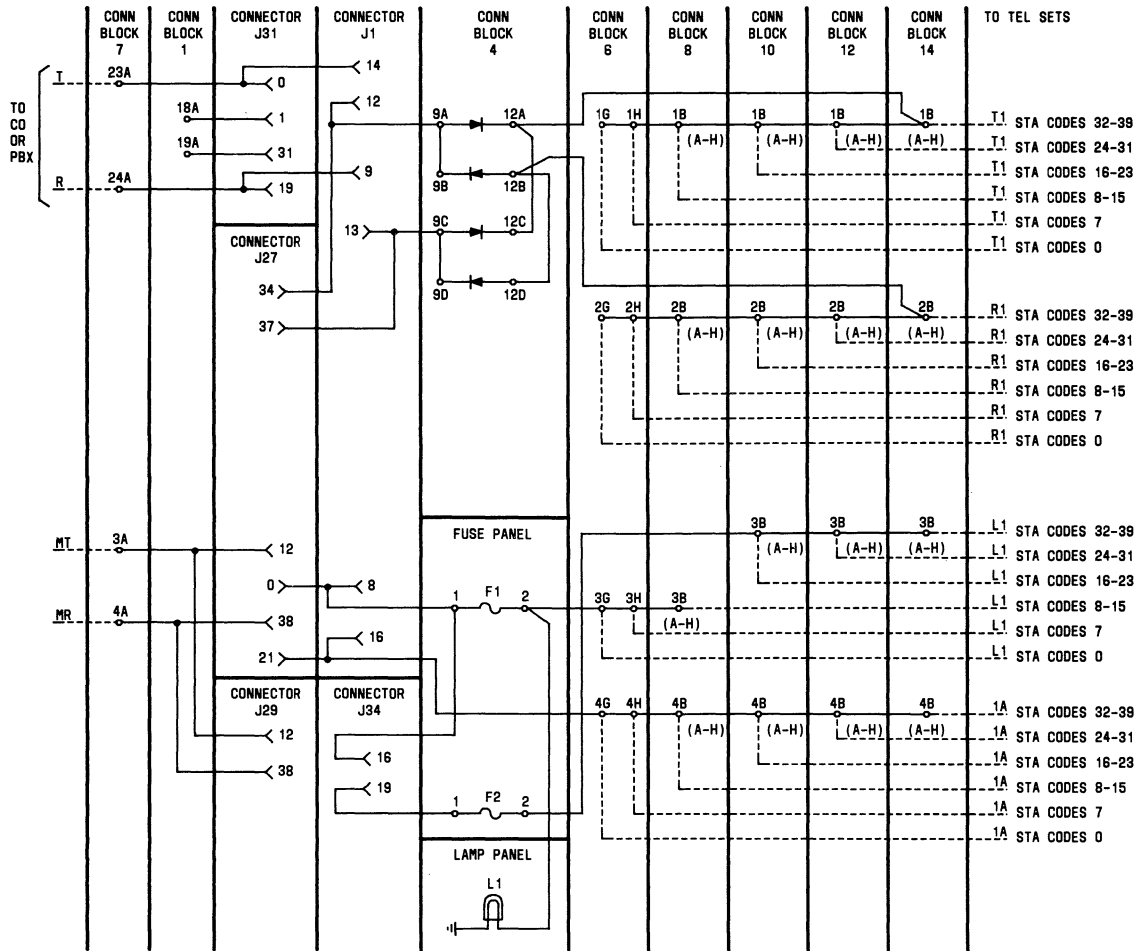


Fig. 59—CO/PBX Line Circuit 1—580B KSU

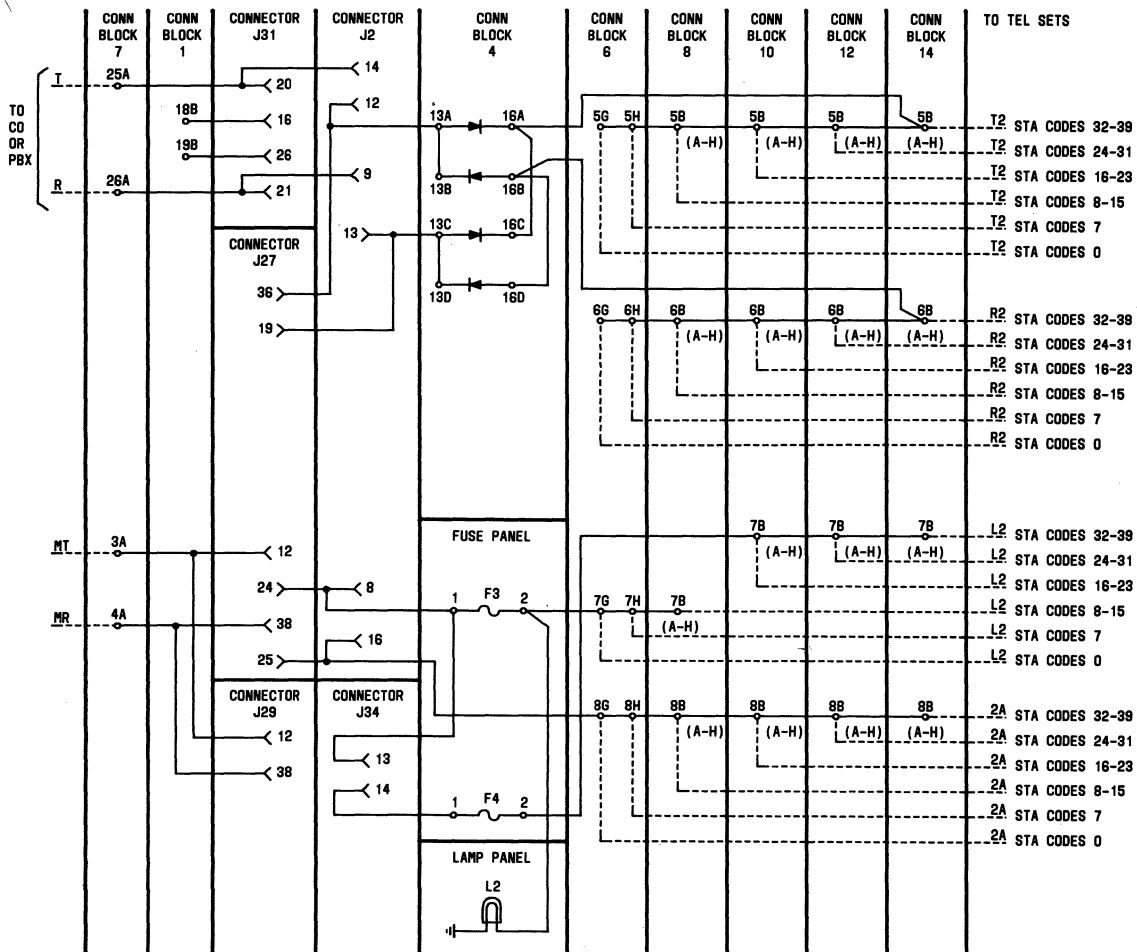


Fig. 60—CO/PBX Line Circuit 2—580B KSU

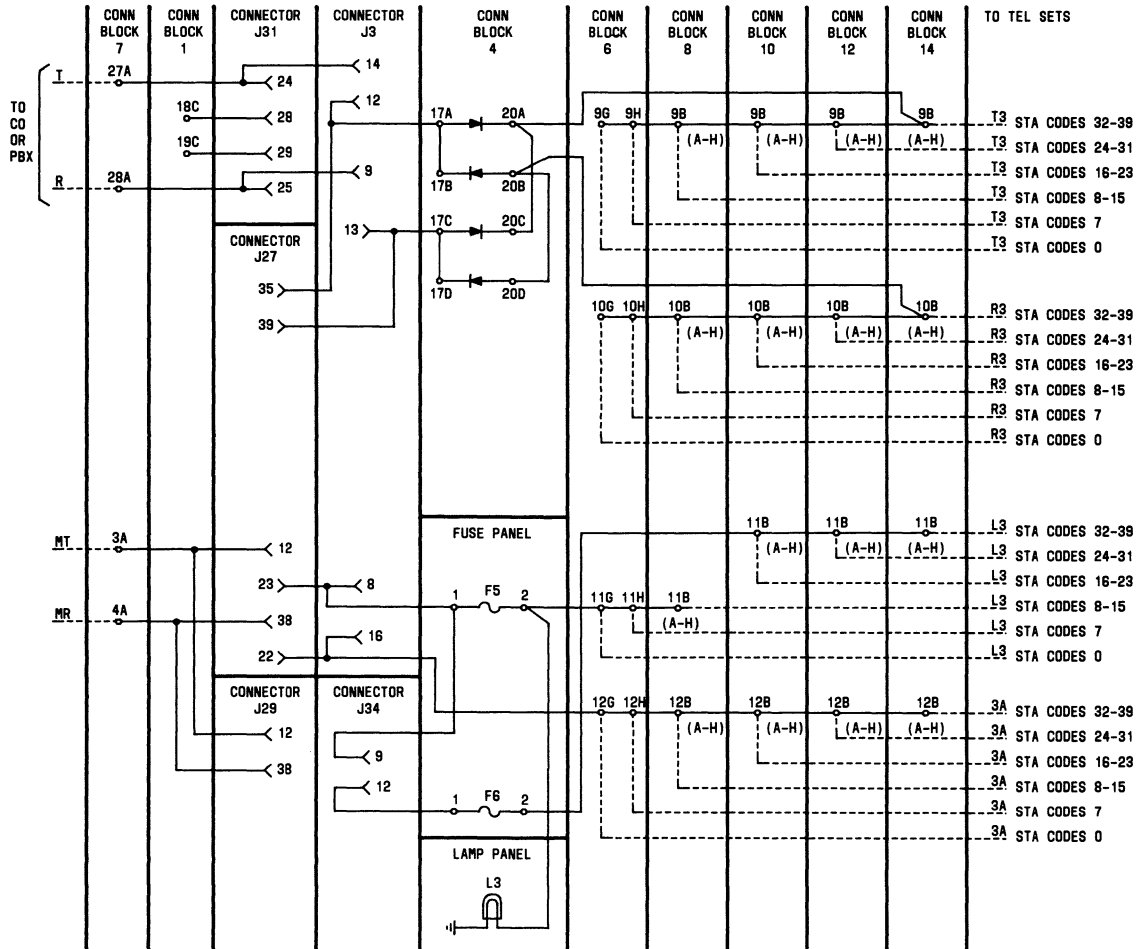


Fig. 61—CO/PBX Line Circuit 3—580B KSU

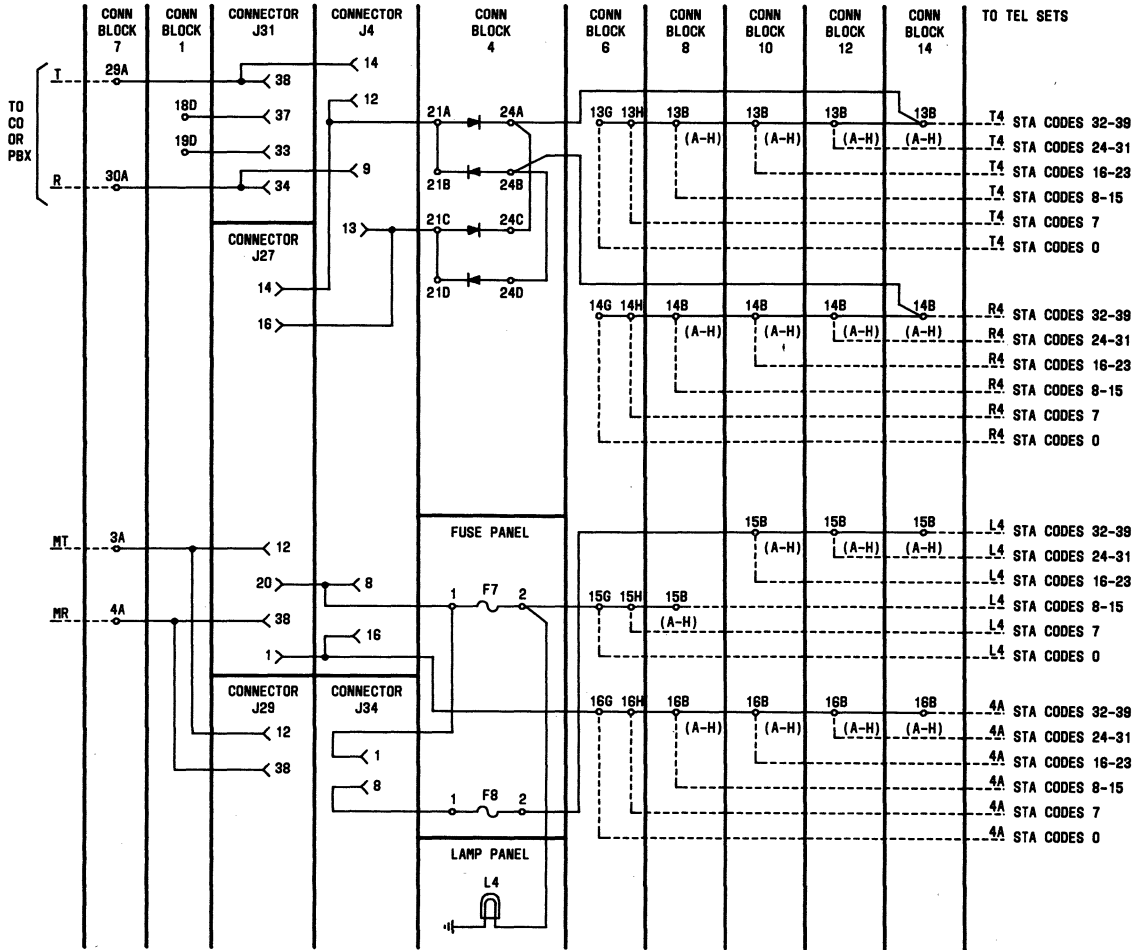


Fig. 62—CO/PBX Line Circuit 4—580B KSU



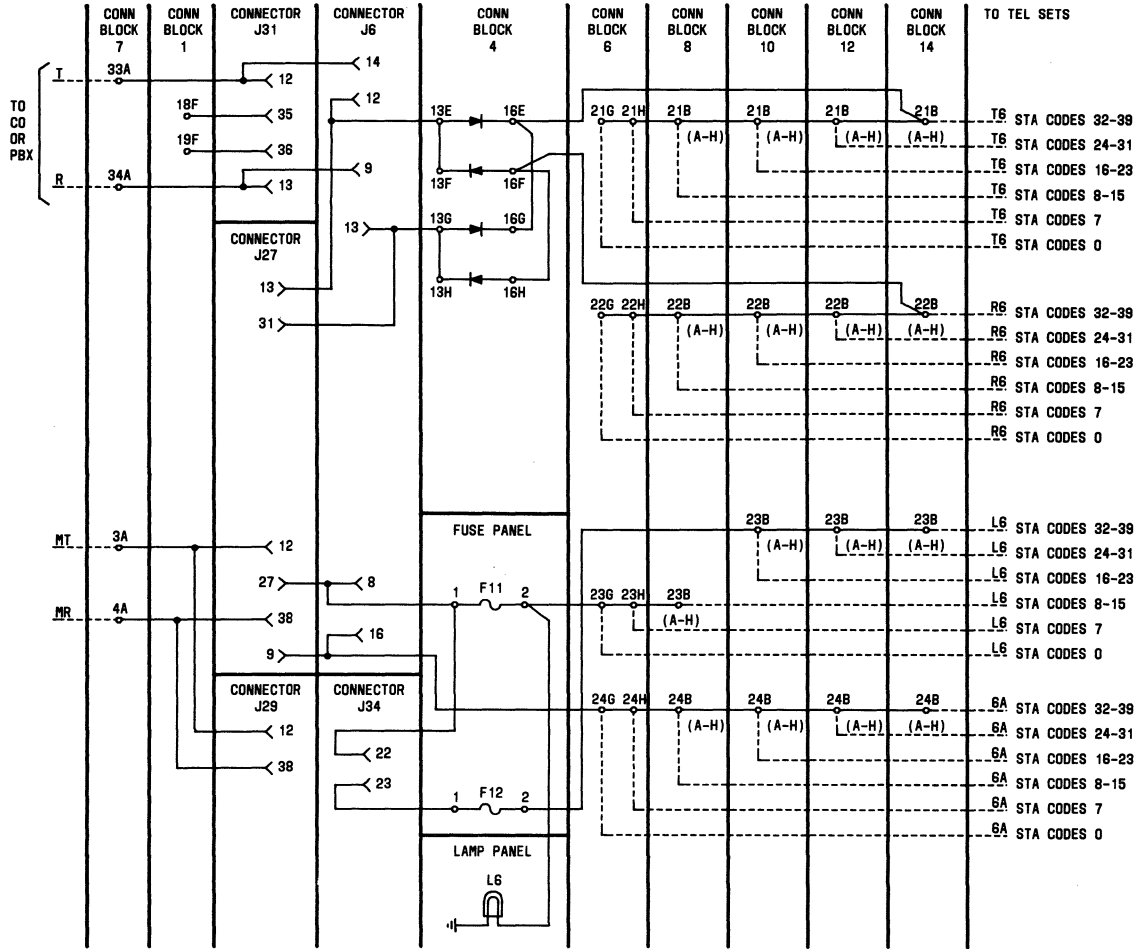


Fig. 64—CO/PBX Line Circuit 6—580B KSU





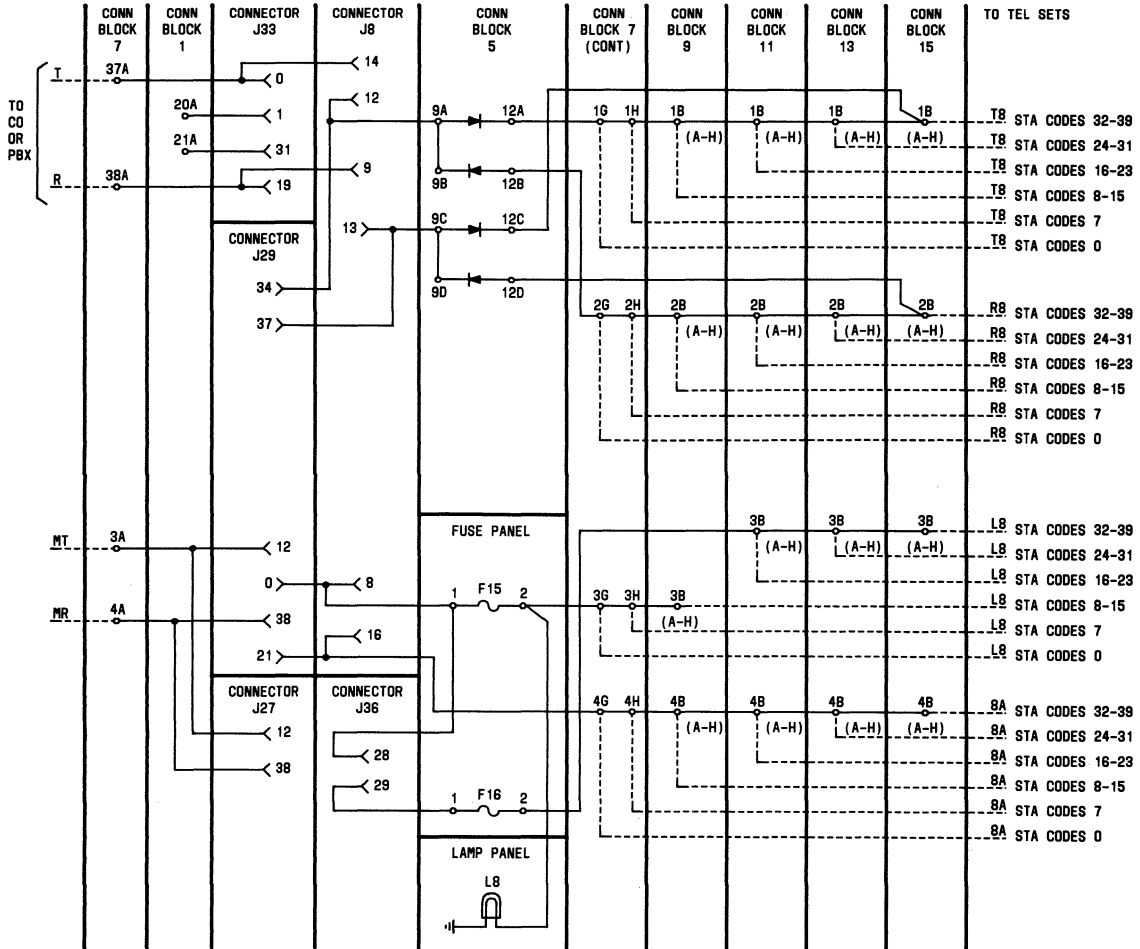


Fig. 66—CO/PBX Line Circuit 8—580B KSU

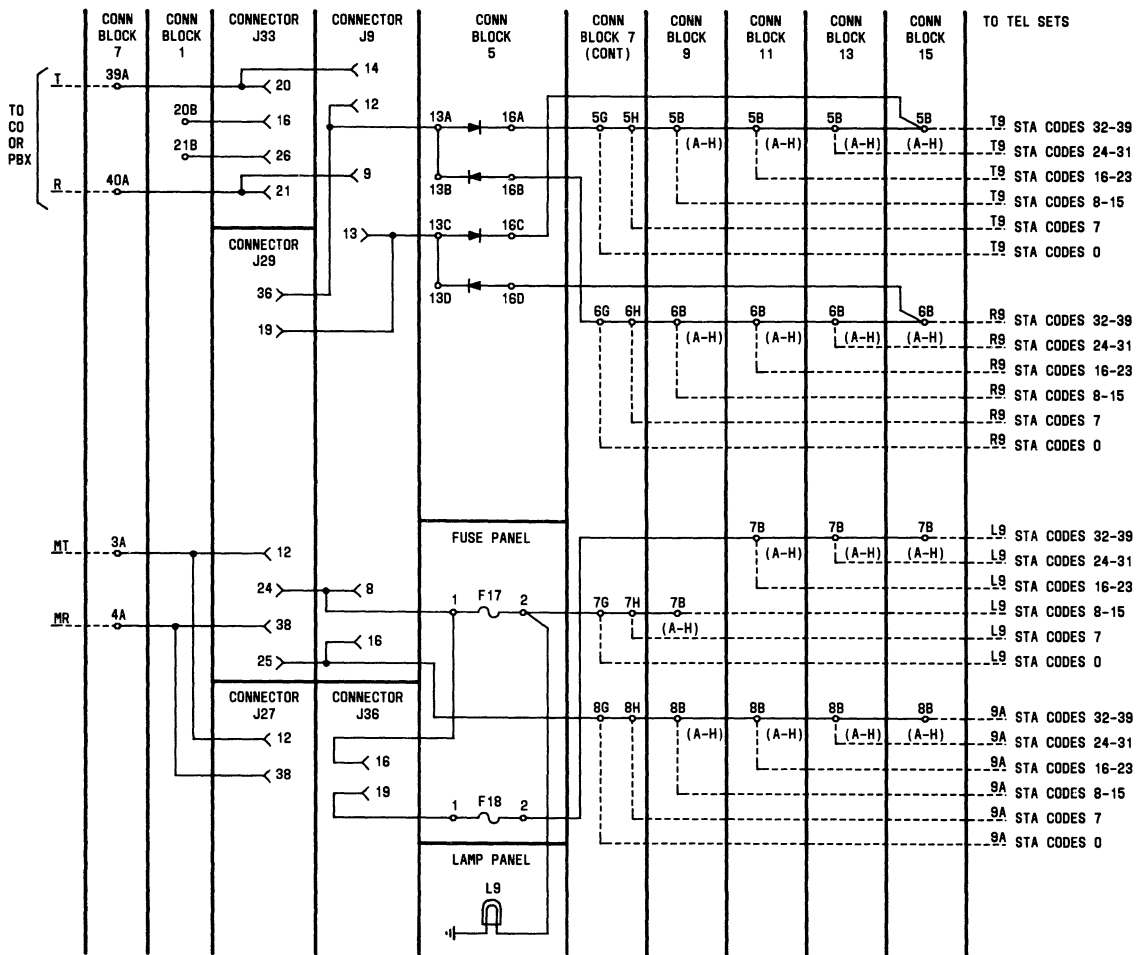


Fig. 67—CO/PBX Line Circuit 9—580B KSU

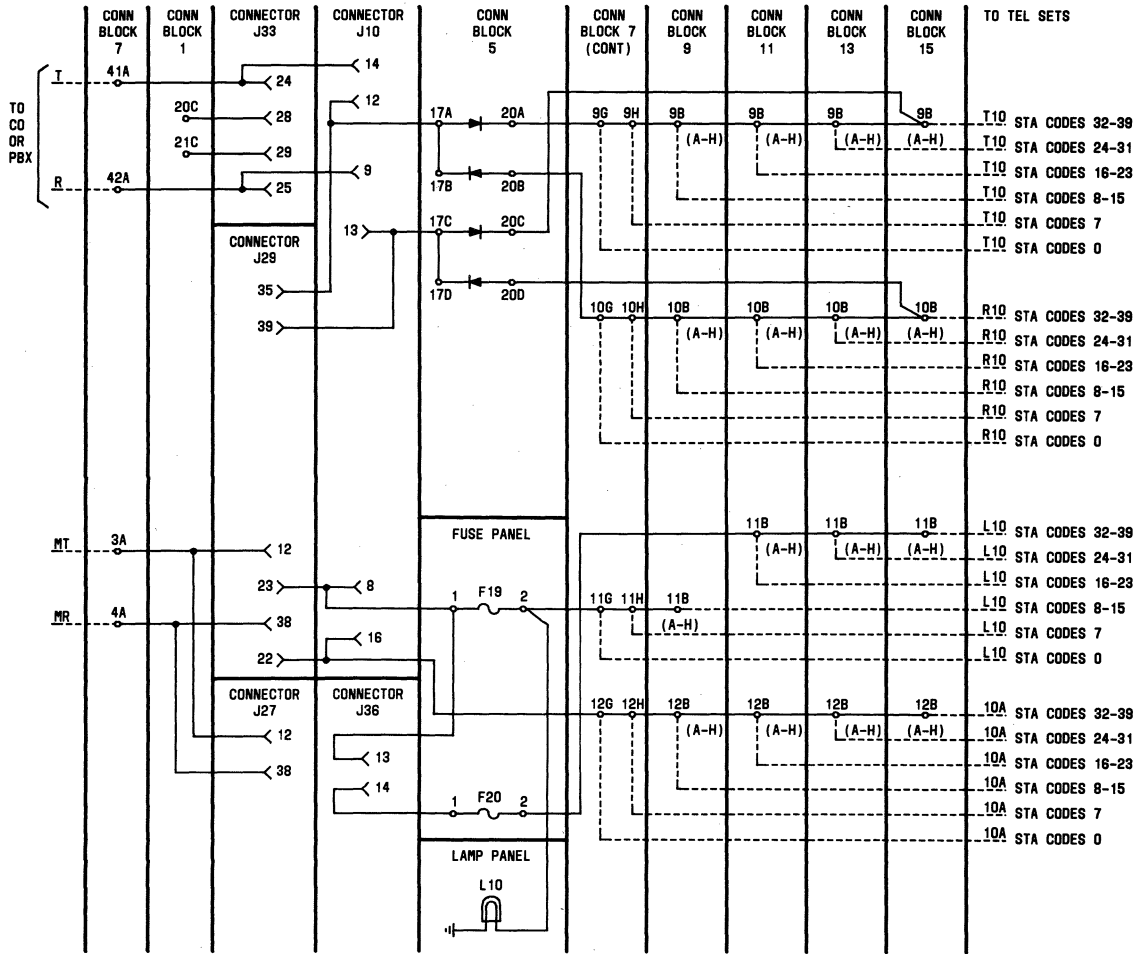


Fig. 68—CO/PBX Line Circuit 10—580B KSU

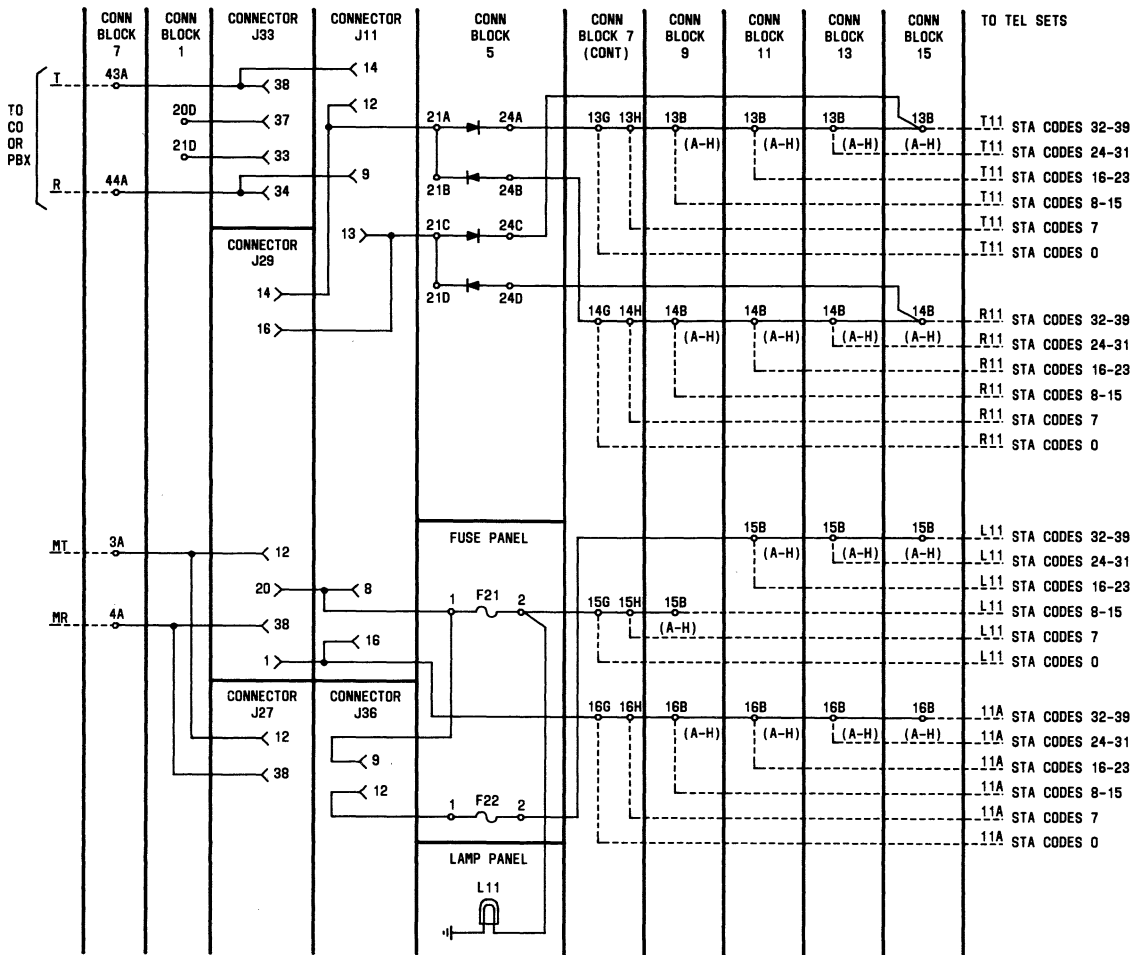


Fig. 69—CO/PBX Line Circuit 11—580B KSU

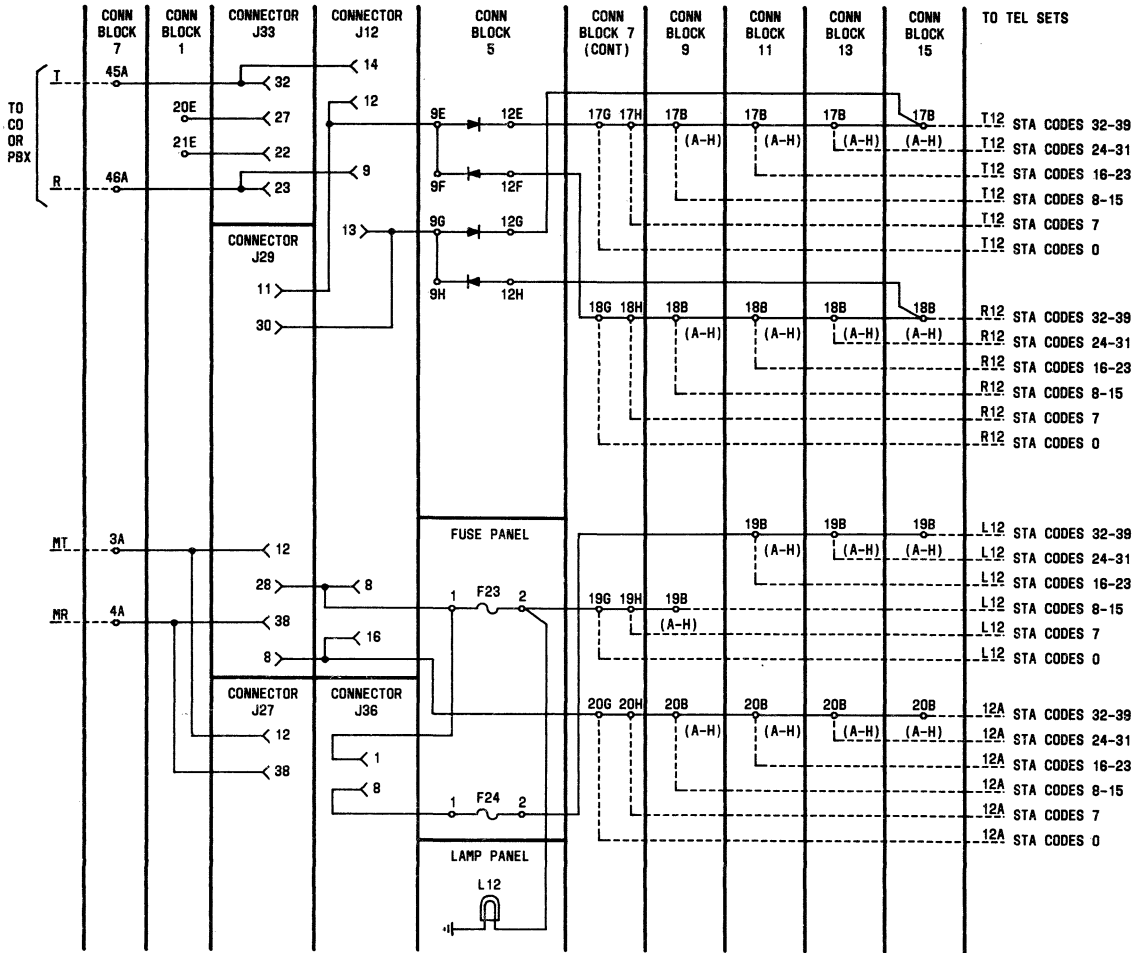


Fig. 70—CO/PBX Line Circuit 12—580B KSU

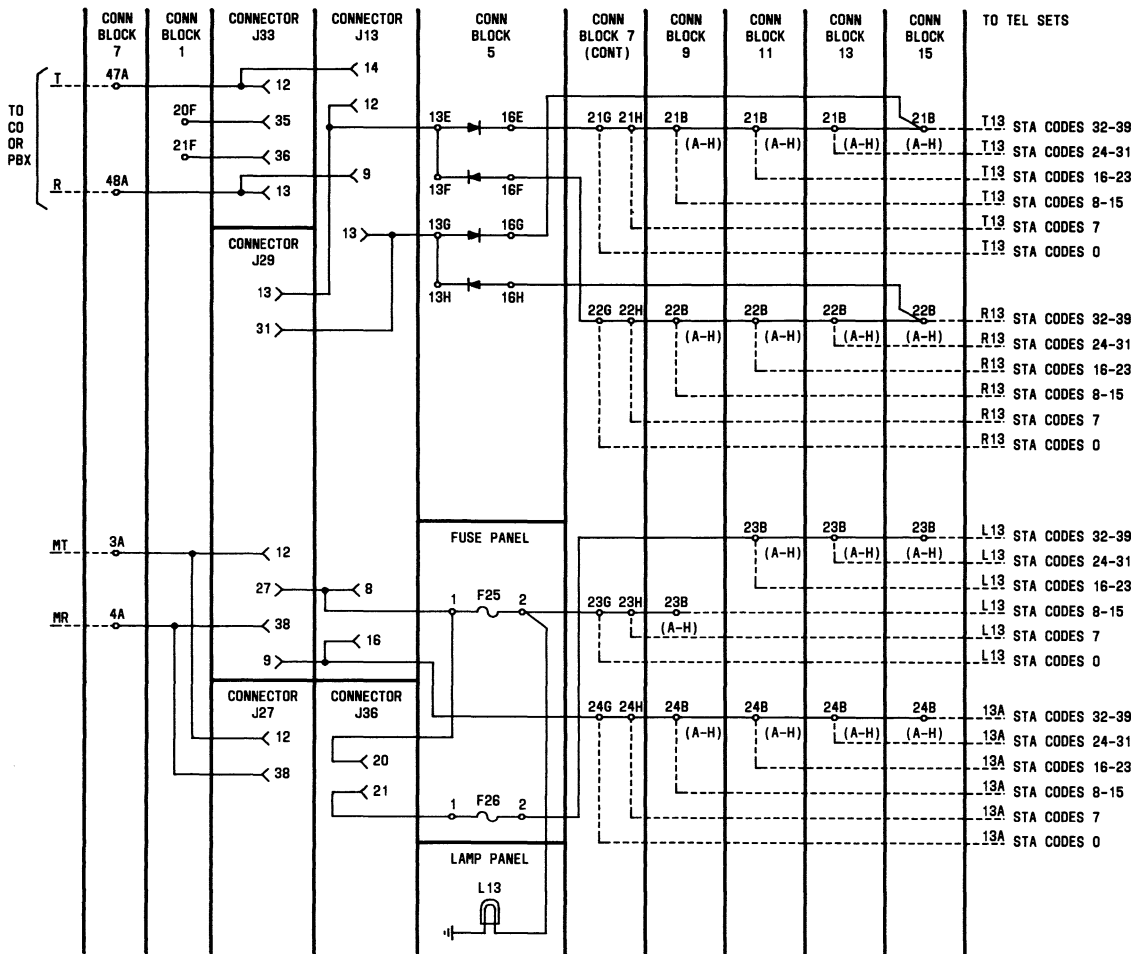


Fig. 71—CO/PBX Line Circuit 13—580B KSU

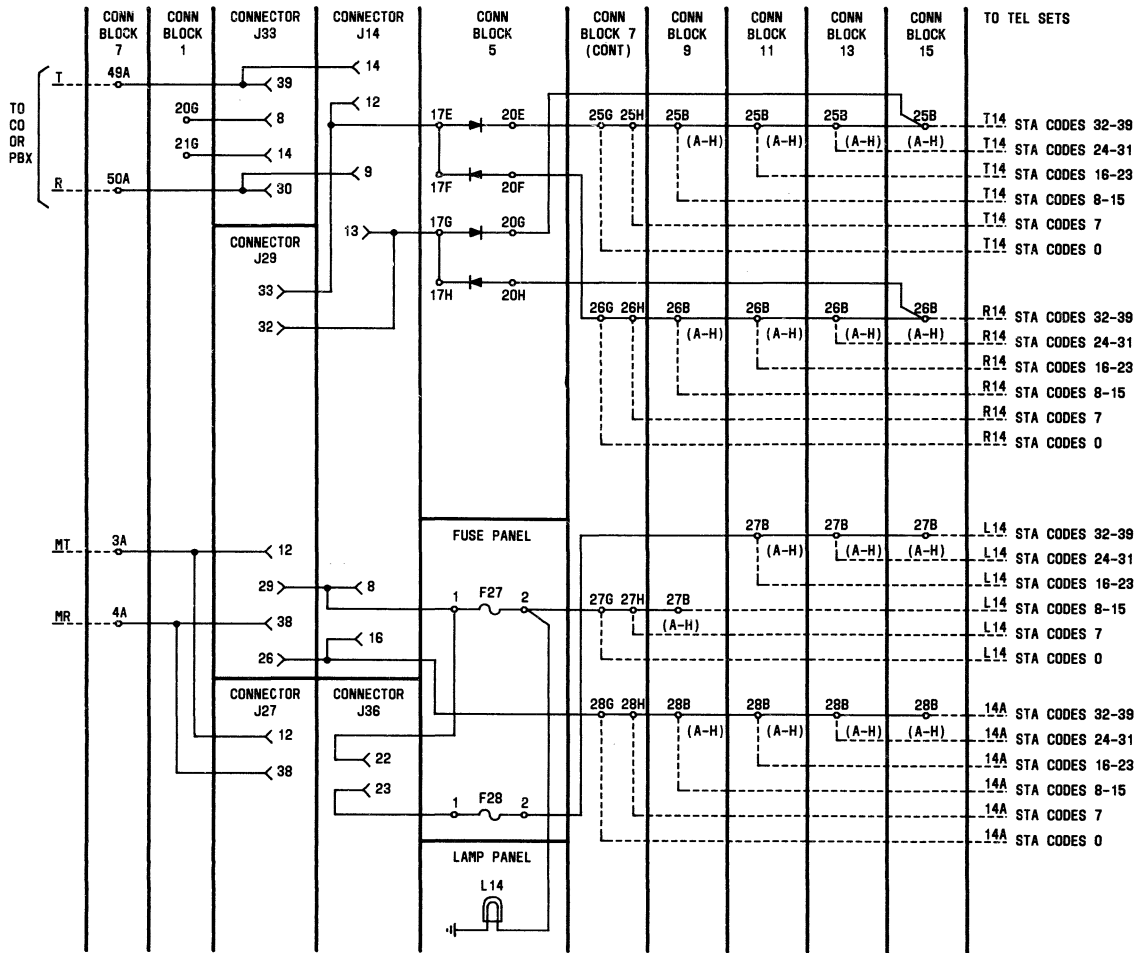
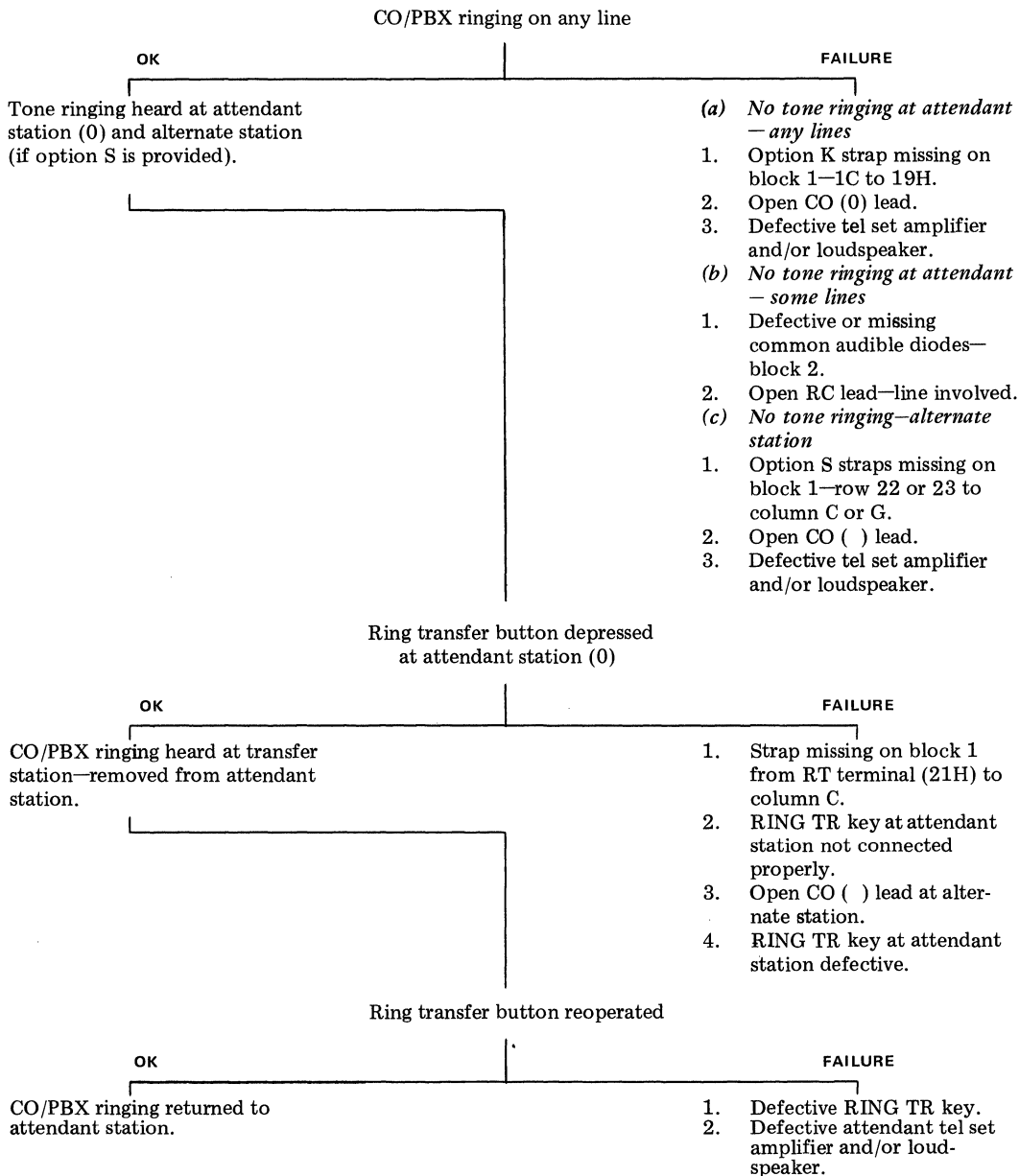


Fig. 72—CO/PBX Line Circuit 14—580B KSU

♦TABLE O♦

## CO/PBX LINE RINGING ARRANGEMENTS





◆TABLE P◆

LEAD TABLE — CO/PBX RINGING ARRANGEMENTS

LEAD DESIG	FUNCTION
CO( )	Central Office ringing lead — tone ringing is applied to this lead from RO lead of 455A KTU, interrupter, RN lead, 400-type KTU, RC( ) lead, common audible diodes, and cross-connect on block 1.
RT	Ring transfer — this lead transfers common audible ringing from CO (0) lead to designated station under control of RING TR button at attendant set and jumper at block 1 (option J).
RC( )	Ringing control — tone ringing output from 400-type KTU to common audible diodes on block 2.



TABLE Q  
INTERCOM (IC) CALL

Lift handset and depress button  
associated with idle IC path (lamp dark).

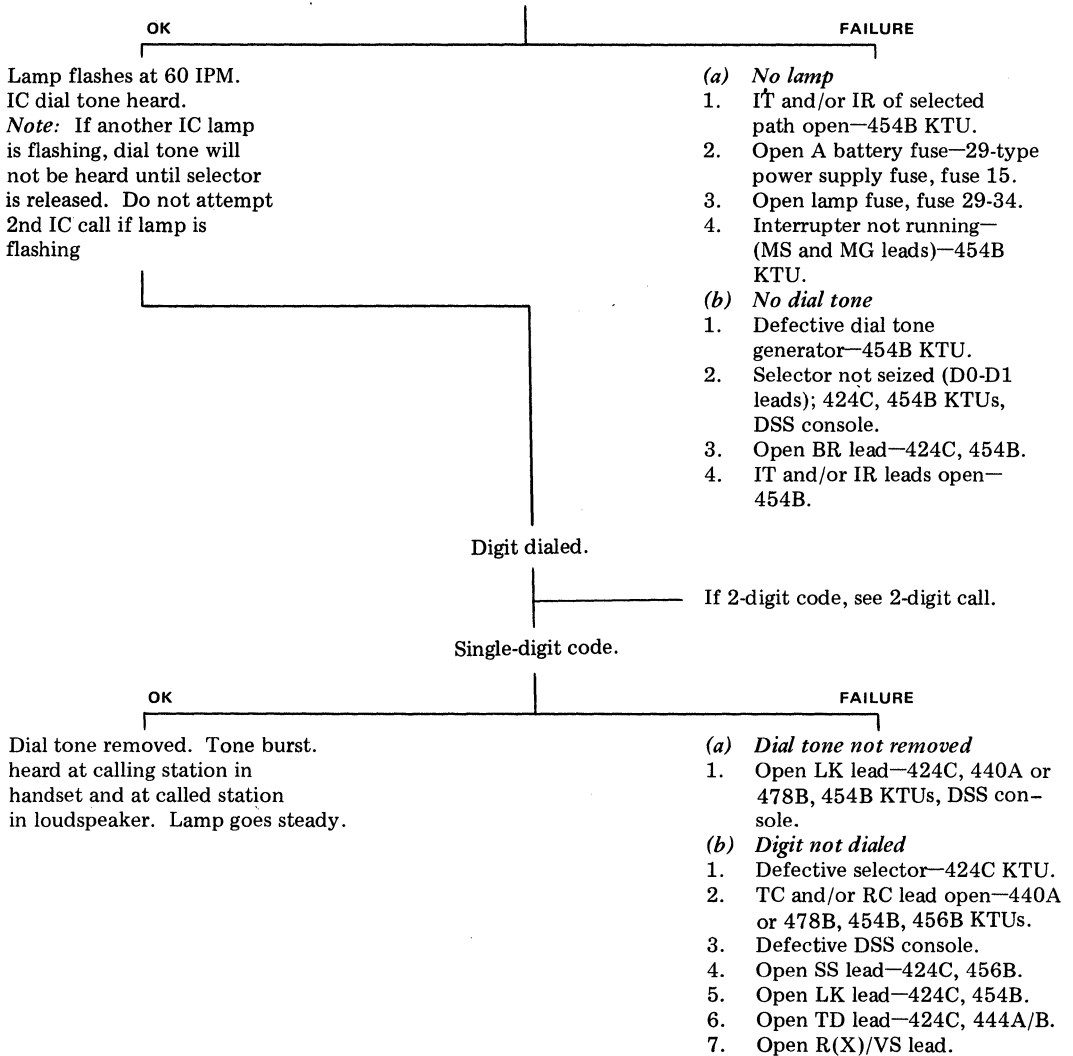


TABLE Q (Contd)

## INTERCOM (IC) CALL

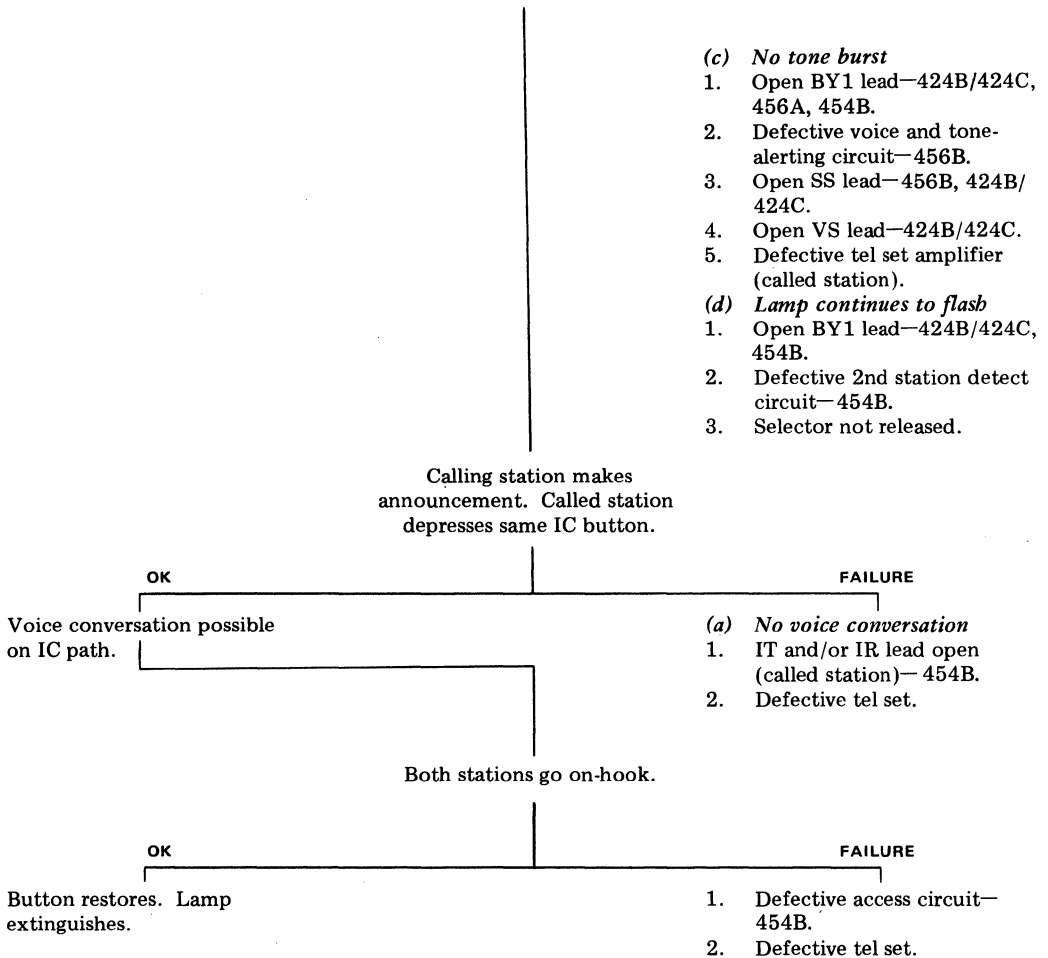


TABLE Q (Contd)

INTERCOM (IC) CALL

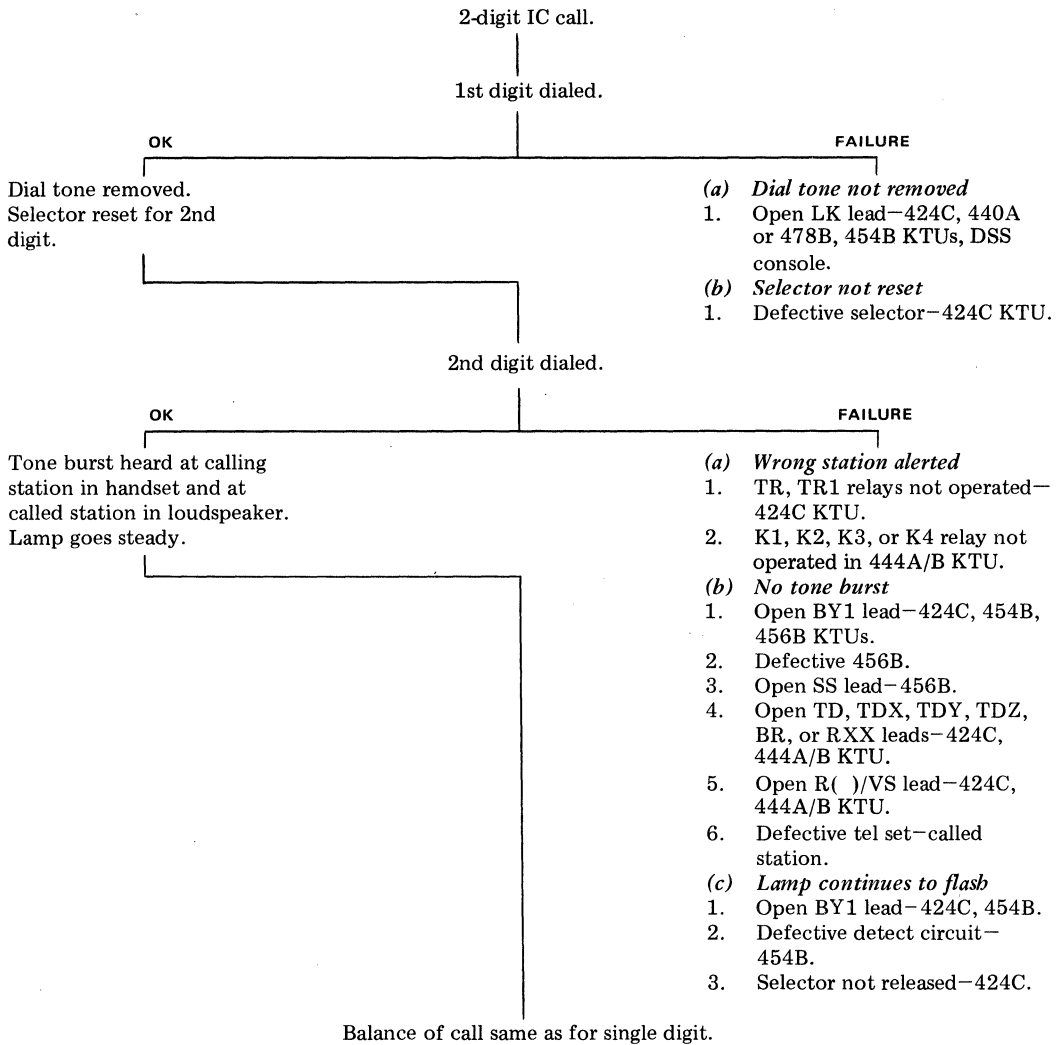


TABLE R

LEAD TABLE—INTERCOM CIRCUIT

LEAD DESIGN	FUNCTION	CONNECTOR AND PIN NUMBER
BR	Switched B Battery — when 424C is seized, this lead applies —24V B to 454B (to start intercom dial tone) and to 444-type (for the operation of the transfer digit relays).	J18-35 J20-35 J24-35
BY1	Busy Ground — applies ground after completion of dialing to enable the 2nd station detect circuit in the 454B and start intercom ringing in the 456B.	J18-19 J20-19 J26-19
CGO	Counter Ground — provides ground to counting relays (Y1-Y5) of 424C from RS1 lead (M option) or from 440A or 478B (N option) or from DSS console (Q option).	J18-21
CG1	Counter Ground — provides ground to counting relays of 424C, either by option strap or via DSS console (Q option) on non-TOUCH-TONE calls.	J22-21
DO	Dialing Output — seizure input for 424C by way of D1 lead (M option) or by way of DSS console (Q option).	J20-16
D1	Off-hook Detection — selector seizure output from 454B (M option) or to DO output of 454B via DSS console (Q option). If call is rotary dialed, D1 is also the dial pulse input from the 454B.	J18-16
ICF	Intercom Flash — interrupted 10V ac signal for intercom link lamps to indicate that an intercom link has seized the 424C (selector).	J16-7 J20-7
IL11	Intercom Lamp 1 — lamp lead for first intercom path; 10V ac is supplied from fuse 29 to station codes 0, 7-23, and to lamp 15 in lamp panel.	J20-8
IL12	Intercom Lamp 1 — lamp lead for first intercom path; 10V ac is supplied from fuse 30 to station codes 24-39.	J20-9
IL21	Intercom Lamp 2 — lamp lead for second intercom path; 10V ac is supplied from fuse 31 to station codes 0, 7-23, and to lamp 16 in lamp panel.	J19-16
IL22	Intercom Lamp 2 — lamp lead for second intercom path; 10V ac is supplied from fuse 32 to station codes 24-39.	J19-19
IL31	Intercom Lamp 3 — lamp lead for third intercom path; 10V ac is supplied from fuse 33 to station codes 0, 7-23, and to lamp 17 in lamp panel.	J19-8
IL32	Intercom Lamp 3 — lamp lead for third intercom path; 10V ac is supplied from fuse 34 to station codes 24-39.	J19-9

TABLE R (Contd)

## LEAD TABLE—INTERCOM CIRCUIT

LEAD DESIG	FUNCTION	CONNECTOR AND PIN NUMBER
IR1	Intercom Ring 1 — ring side of first intercom path.	J20-14
IR2	Intercom Ring 2 — ring side of second intercom path.	J20-0
IR3	Intercom Ring 3 — ring side of third intercom path.	J19-13
IT1	Intercom Tip 1 — tip side of first intercom path.	J20-34
IT2	Intercom Tip 2 — tip side of second intercom path.	J20-1
IT3	Intercom Tip 3 — tip side of third intercom path.	J19-14
LK	Dial Tone Disconnect — ground applied to this lead stops dial tone in the 454B after the first digit of an intercom code has been dialed.	J18-30 J20-30 J22-26
LTY	Transfer Lead Y — when 20s intercom code is selected from DSS console, DSS ground is applied to 444-type (TRY and TRY1 relays); then ground from the 444-type, via LT2 lead, is applied to the TR and TR1 relays of the 424C.	J23-39
LTZ	Transfer Lead Z — when 30s intercom code is selected from DSS console, DSS ground is applied to 444-type (TR Z and TR Z1 relays); then ground from 444-type, via LT2 lead, is applied to the TR and TR1 relays of the 424C.	J24-39
LT2	Transfer Lead 2 — when 10s intercom code is selected from DSS console, DSS ground is applied to the transfer relays, TR and TR1, of the 424C.	J17-39 J24-12
MG	Motor Ground — starts interrupter when this lead is shorted to MS lead through a contact closure of LB( ) relay in the 454B.	J16-3 J19-6
MS	Motor Start — starts interrupter when this lead is shorted to MG lead through A contact closure of LB( ) relay in the 454B.	J16-2 J19-5
PA	Paging Signal — output to paging amplifiers (457C KTUs).	J26-0 J28-16 J30-16 J32-16
PC1	Paging Code 1 — when the intercom code for zone one paging is dialed, —24V is applied to PC input of zone one paging amplifier (457C) enabling amplifier for paging.	J17-26
PC2	Paging Code 2 — when the intercom code for zone two paging is dialed, —24V is applied to PC input of zone two paging amplifier (457C) enabling amplifier for paging.	J17-20

TABLE R (Contd)

## LEAD TABLE—INTERCOM CIRCUIT

LEAD DESIG	FUNCTION	CONNECTOR AND PIN NUMBER
PC3	Paging Code 3 — when the intercom code for zone three paging is dialed, -24V is applied to PC input of zone three paging amplifier (457C) enabling amplifier for paging.	J17-21
RC	Calling Ring — common ring of intercom circuits to voice and tone-alerting circuit (456B), to access circuit (454B), and to TOUCH-TONE adapter circuit (440A/478B).	J20-13 J22-13 J26-9
RH	R Relay Hold — disables intercom ringing in 424C until dialing is complete by applying ground after intercom dialing starts.	J18-26 J20-26
RS1	Reset — provides ground for 424C selector timer; when TOUCH-TONE (N option) is provided, supplies ground via 440A/478B for counting relays in 424C.	J17-19 J18-38 J22-38
RX0	Station Ringing Lead — voice signal lead from 424C to 444-type for intercom codes 10, 20, or 30.	J17-14 J23-14
RX1	Station Ringing Lead — voice signal lead from 424C to 444-type for intercom codes 11, 21, or 31.	J17-8 J23-8
RX2	Station Ringing Lead — voice signal lead from 424C to 444-type for intercom codes 12, 22, or 32.	J17-22 J23-22
RX3	Station Ringing Lead — voice signal lead from 424C to 444-type for intercom codes 13, 23, or 33.	J17-24 J23-24
RX4	Station Ringing Lead — voice signal lead from 424C to 444-type for intercom codes 14, 24, or 34.	J17-27 J23-27
RX5	Station Ringing Lead — voice signal lead from 424C to 444-type for intercom codes 15, 25, or 35.	J17-0 J23-0
RX6	Station Ringing Lead — voice signal lead from 424C to 444-type for intercom codes 16, 26, or 36.	J17-1 J23-1
RX7	Station Ringing Lead — voice signal lead from 424C to 444-type for intercom codes 17, 27, or 37.	J17-33 J23-33
RX8	Station Ringing Lead — voice signal lead from 424C to 444-type for intercom codes 18, 28, or 38.	J17-31 J23-31
RX9	Station Ringing Lead — voice signal lead from 424C to 444-type for intercom codes 19, 29, or 39.	J17-9 J23-9



TABLE R (Contd)

## LEAD TABLE—INTERCOM CIRCUIT

LEAD DESIG	FUNCTION	CONNECTOR AND PIN NUMBER
R0	Station Ringing Lead — voice signal lead — code 0; VS0 lead to tel set.	J17-34
R7	Station Ringing Lead — voice signal lead — code 7; VS7 lead to tel set.	J17-32
R8	Station Ringing Lead — voice signal lead — code 8; VS8 lead to tel set.	J17-30
R9	Station Ringing Lead — voice signal lead — code 9; VS9 lead to tel set.	J17-29
R10	Station Ringing Lead — voice signal lead — code 10; VS10 lead to tel set.	J24-14
R11	Station Ringing Lead — voice signal lead — code 11; VS11 lead to tel set.	J24-8
R12	Station Ringing Lead — voice signal lead — code 12; VS12 lead to tel set.	J24-22
R13	Station Ringing Lead — voice signal lead — code 13; VS13 lead to tel set.	J24-24
R14	Station Ringing Lead — voice signal lead — code 14; VS14 lead to tel set.	J24-27
R15	Station Ringing Lead — voice signal lead — code 15; VS15 lead to tel set.	J24-0
R16	Station Ringing Lead — voice signal lead — code 16; VS16 lead to tel set.	J24-1
R17	Station Ringing Lead — voice signal lead — code 17; VS17 lead to tel set.	J24-33
R18	Station Ringing Lead — voice signal lead — code 18; VS18 lead to tel set.	J24-31
R19	Station Ringing Lead — voice signal lead — code 19; VS19 lead to tel set.	J24-9
R20	Station Ringing Lead — voice signal lead — code 20; VS20 lead to tel set.	J23-34
R21	Station Ringing Lead — voice signal lead — code 21; VS21 lead to tel set.	J23-28
R22	Station Ringing Lead — voice signal lead — code 22; VS22 lead to tel set.	J23-23
R23	Station Ringing Lead — voice signal lead — code 23; VS23 lead to tel set.	J23-25
R24	Station Ringing Lead — voice signal lead — code 24; VS24 lead to tel set.	J23-26
R25	Station Ringing Lead — voice signal lead — code 25; VS25 lead to tel set.	J23-20
R26	Station Ringing Lead — voice signal lead — code 26; VS26 lead to tel set.	J23-21
R27	Station Ringing Lead — voice signal lead — code 27; VS27 lead to tel set.	J23-32
R28	Station Ringing Lead — voice signal lead — code 28; VS28 lead to tel set.	J23-30
R29	Station Ringing Lead — voice signal lead — code 29; VS29 lead to tel set.	J23-29
R30	Station Ringing Lead — voice signal lead — code 30; VS30 lead to tel set.	J24-34

TABLE R (Contd)

## LEAD TABLE—INTERCOM CIRCUIT

LEAD DESIG	FUNCTION	CONNECTOR AND PIN NUMBER
R31	Station Ringing Lead — voice signal lead — code 31; VS31 lead to tel set.	J24-38
R32	Station Ringing Lead — voice signal lead — code 32; VS32 lead to tel set.	J24-23
R33	Station Ringing Lead — voice signal lead — code 33; VS33 lead to tel set.	J24-25
R34	Station Ringing Lead — voice signal lead — code 34; VS34 lead to tel set.	J24-26
R35	Station Ringing Lead — voice signal lead — code 35; VS35 lead to tel set.	J24-20
R36	Station Ringing Lead — voice signal lead — code 36; VS36 lead to tel set.	J24-21
R37	Station Ringing Lead — voice signal lead — code 37; VS37 lead to tel set.	J24-32
R38	Station Ringing Lead — voice signal lead — code 38; VS38 lead to tel set.	J24-30
R39	Station Ringing Lead — voice signal lead — code 39; VS39 lead to tel set (V option) or preset conference code (T option).	J24-29
SS	Station Signaling Input — when dialing is complete, this lead carries the tone burst from the 456B to the selector (424C) where it is applied to the R( )/VS( ) lead of stations 7, 8, 9, and 0, or is extended to the selector extender circuit (444-type) via a RX( ) lead where it is applied to R( )/VS( ) lead station 10 through station 39.	J18-14 J26-1
TC	Calling Tip — common tip of intercom paths to voice and tone-alerting circuit and TOUCH-TONE adapter.	J20-12 J22-12 J26-8
TD	Transfer Digit — resets selector (424C) when a transfer digit of a 2-digit intercom code is dialed.	J17-16 J23-16
TDX	Transfer Digit X — resets selector (424C) when a 1 transfer digit is dialed (codes 10 through 19).	J17-28 J24-36
TDY	Transfer Digit Y — resets selector (424C) when a 2 transfer digit is dialed (codes 20 through 29).	J17-23 J23-36
TDZ	Transfer Digit Z — resets selector (424C) when a 3 transfer digit is dialed (codes 30 through 39).	J17-25 J24-16
TTG	TOUCH-TONE Ground — supplies ground to control adapter (440A/478B) when selector is seized (N option) or provides ground to DSS console selector relays (Q option).	J18-39 J22-36
VS( )	Station Ringing — same as R( ) leads, see R0 and R7 through R39.	

TABLE R (Contd)

## LEAD TABLE—INTERCOM CIRCUIT

LEAD DESIG	FUNCTION	CONNECTOR AND PIN NUMBER
Y1	Selector Counter Relay No. 1 Ground — permits 440A/478B to apply ground to Y1 (counting relay No. 1) in 424C on TOUCH-TONE dialed intercom calls (N option) or permits DSS console to apply ground to Y1 relay in 424C on DSS calls.	J18-25 J22-14
Y2	Selector Counter Relay No. 2 Ground — same as above except for Y2 relay.	J18-24 J22-30
Y3	Selector Counter Relay No. 3 Ground — same as above except for Y3 relay.	J18-22 J22-29
Y4	Selector Counter Relay No. 4 Ground — same as above except for Y4 relay.	J17-36 J22-32
Y5	Selector Counter Relay No. 5 Ground — same as above except for Y5 relay.	J17-37 J22-23

♦ TABLE S ♦

## INPUTS AND OUTPUTS — 424C KTU

TEST FROM (SEE NOTE)	TO	MON/TALK SWITCH	TEST FOR	REMARKS
INPUTS				
GROUND	J18-17	TALK	B Battery	
B BAT.	J17-15	TALK	B Ground	
OUTPUTS				
GROUND	VS leads	MON	1 sec. tone burst on VS lead of station tested. See Fig. 97 for VS lead assignment.	Tone burst heard after dialing proper digit(s)
B BAT.	J18-19	TALK	Ground — BY1 lead	Dialing complete — 1- or 2-digit code
	J18-30		Ground — LK lead	After dialing 1st digit, dial tone should be removed
	J18-39		Ground — TTG lead	Selector seized
GROUND	J18-35		B BAT. — BR lead	Selector seized

*Note:* Terminals shown in TEST FROM and TO columns appear on the KTU and the wiring side of the associated connector.

TABLE T

## INPUTS AND OUTPUTS—440A/478B KTUs

TEST FROM (SEE NOTE)	TO	MON/TALK SWITCH	TEST FOR	REMARKS
INPUTS				
GROUND	J22-18	TALK	A Battery	
B BAT.	J21-3 J22-3	TALK	A Ground	Required for 478B KTU only
	J21-15 J22-15	TALK	B Ground	Required for 478B KTU only
J22-12	J22-13	MON	Multifrequency signals	Either IC path seized — any dial button depressed
OUTPUTS				
B BAT.	J22-26	TALK	B Ground— LK lead	1st digit of 2-digit code dialed
	J22-36		B Ground— TTG	Selector seized

*Note:* Terminals shown in TEST FROM and TO columns appear on the KTU and the wiring side of the associated connector.

TABLE U

## INPUTS AND OUTPUTS—444-TYPE KTU

TEST FROM (SEE NOTE)	TO	MON/TALK SWITCH	TEST FOR	REMARKS
INPUTS				
B BAT.	J23-15	TALK	B Ground	Any intercom path seized
GROUND	J23-39		K1 and K2 relays operate	
GROUND	J24-39		K3 and K4 relays operate	
OUTPUTS				
B BAT.	J23-16	TALK	B Ground	Dial a 10s digit
B BAT.	J24-12		Ground	Apply ground to J23-39

*Note:* Terminals shown in TEST FROM and TO columns appear on the KTU and the wiring side of the associated connector.

**TABLE V**  
**INPUTS AND OUTPUTS—454B KTU**

TEST FROM (SEE NOTE)	TO	MON/TALK SWITCH	TEST FOR	REMARKS	
<b>INPUTS</b>					
GROUND	J19-18	TALK	A BAT. — intercom talk battery		
	J19-17		B BAT. — intercom relay battery		
	J20-4	MON	10V± steady lamp voltage — paths 1 and 2		
	J19-4		10V± steady lamp voltage — path 3		
	J20-35	TALK	B Battery		Selector seized
	J20-7	MON	10V± at 60 IPM — lamp flash		Interrupter running
J19-17	J19-3	TALK	A Ground		
	J19-15		B Ground		
	J19-6		Ground — MG lead		
<b>OUTPUTS</b>					
J20-14	J20-34	TALK	Talk Battery — path 1	Selector seized	
J20-0	J20-1		Talk Battery — path 2		
J19-13	J19-14		Talk Battery — path 3		
GROUND	J20-8	MON	10V± at 60 IPM	Intercom path 1 seized	
	J20-9			Intercom path 2 seized	
	J19-16				
	J19-19			Intercom path 3 seized	
	J19-8				
	J19-9				
J20-12	J20-13	TALK	Talk BAT. — TC and RC leads	Any path seized	

*Note:* Terminals shown in TEST FROM and TO columns appear on the KTU and the wiring side of the associated connector.

**TABLE W**  
**INPUTS AND OUTPUTS—456B KTU**

TEST FROM (SEE NOTE)	TO	MON/TALK SWITCH	TEST FOR	REMARKS
<b>INPUTS</b>				
GROUND	J26-18	TALK	A Battery	
J26-18	J26-3		A Ground	
J26-8	J26-9		Talk Battery from 454B KTU — TC and RC leads	Any intercom path seized
J26-18	J26-19		Ground — from 424C KTU (BY1 lead) after dialing is completed on any path	
<b>OUTPUTS</b>				
J26-8	J26-9	MON	Tone burst after dialing	Any code dialed — any path
GROUND	J26-1		Tone burst after dialing	Any code dialed — any path
	J26-0		Voice conversation on intercom paging calls	Dial paging code — tone burst and voice should be heard

*Note:* Terminals shown in **TEST FROM** and **TO** columns appear on the KTU and the wiring side of the associated connector.

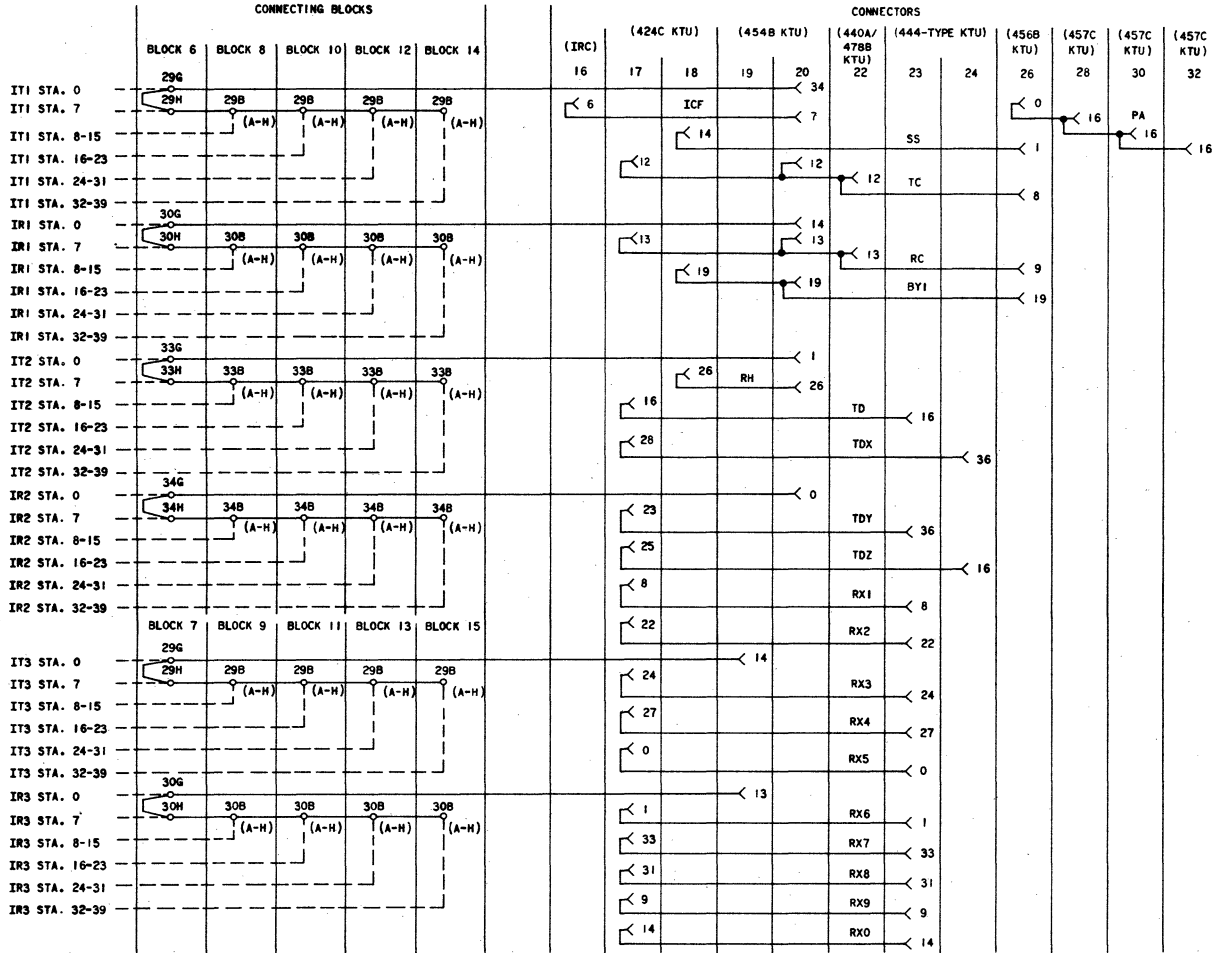


Fig. 74—Intercom Circuit (Sheet 1 of 4)

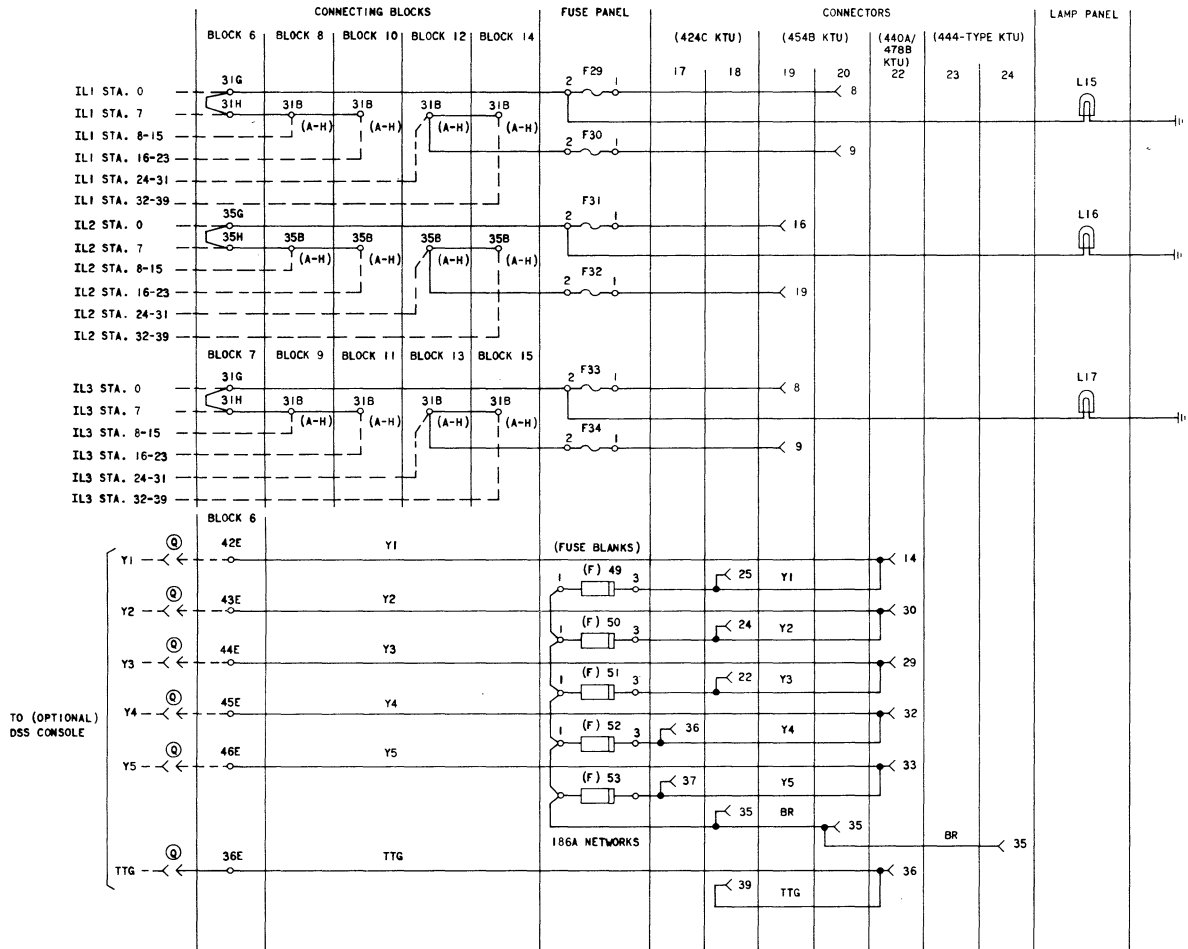


Fig. 74—Intercom Circuit (Sheet 2 of 4)



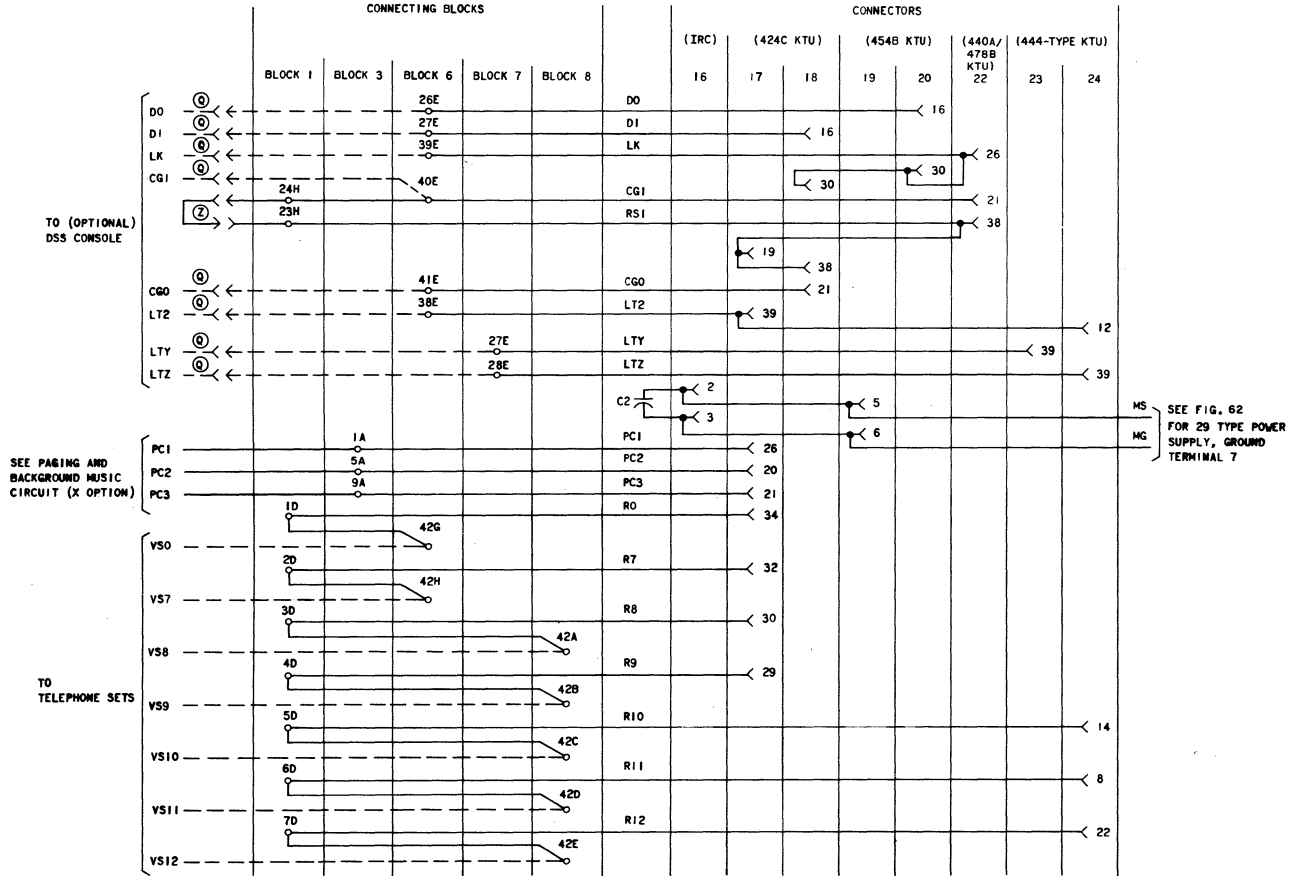


Fig. 74—Intercom Circuit (Sheet 3 of 4)

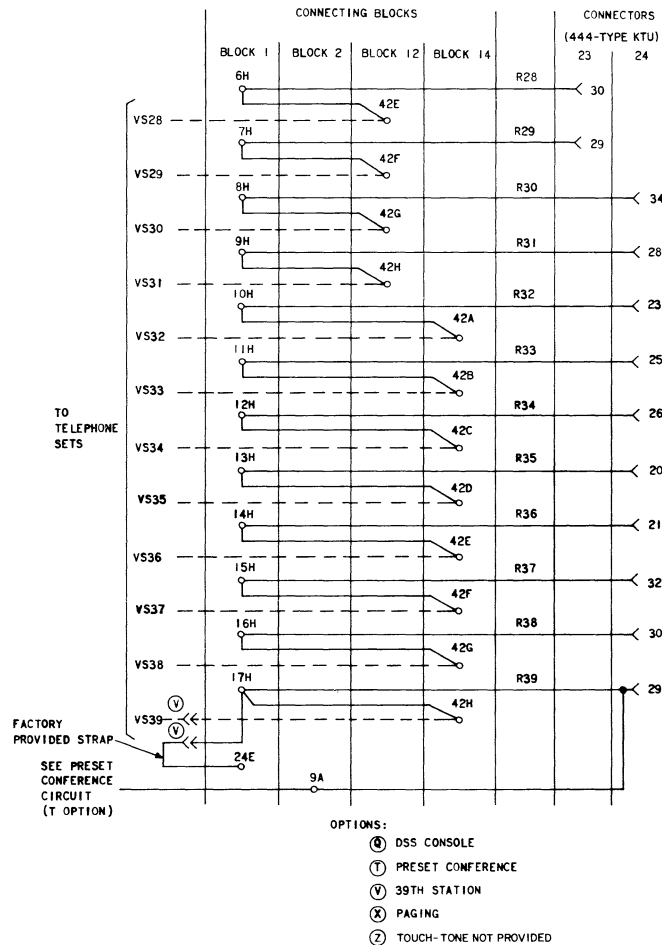
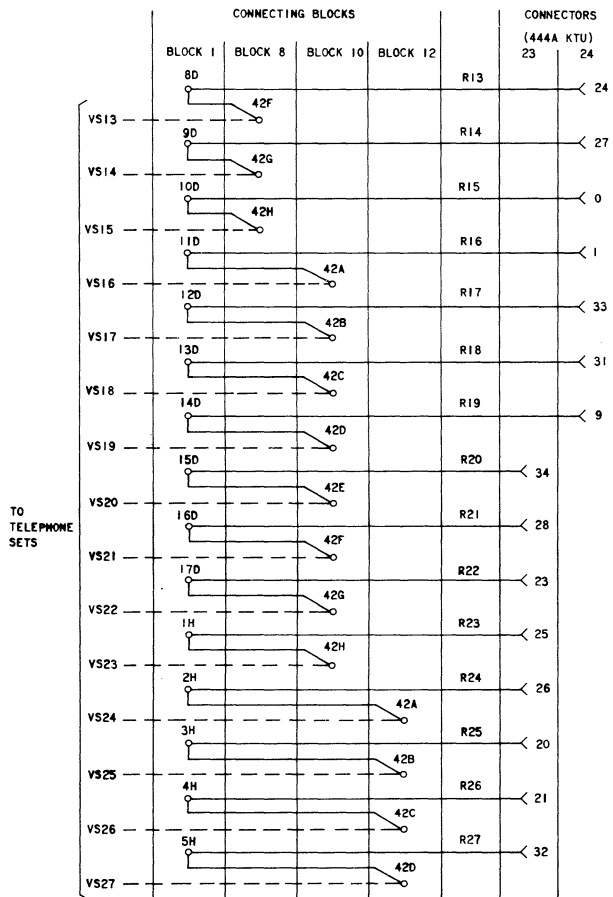


Fig. 74—Intercom Circuit (Sheet 4 of 4)

TABLE X

LAMP DRIVER CIRCUIT

- (a) CO/PBX ringing
- (b) Station off hook, CO/PBX line button depressed
- (c) CO/PBX line on hold

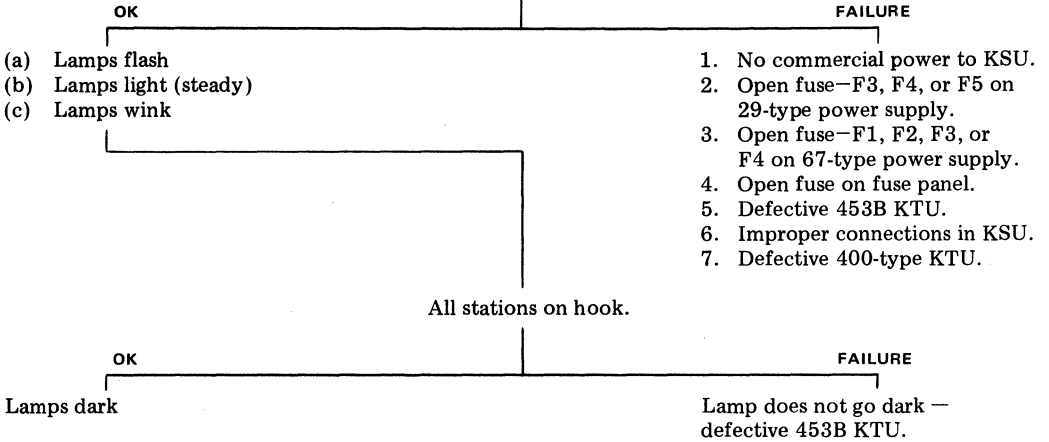


TABLE Y

LEAD TABLE-453B KTU

LEAD DESIG	FUNCTION	CONNECTOR AND PIN NUMBER
DL1	Lamp lead, driver side — CO/PBX line 1	J34-19
DL2	Lamp lead, driver side — CO/PBX line 2	J34-14
DL3	Lamp lead, driver side — CO/PBX line 3	J34-12
DL4	Lamp lead, driver side — CO/PBX line 4	J34-8
DL5	Lamp lead, driver side — CO/PBX line 5	J34-21
DL6	Lamp lead, driver side — CO/PBX line 6	J34-23
DL7	Lamp lead, driver side — CO/PBX line 7	J34-29
DL8	Lamp lead, driver side — CO/PBX line 8	J36-29
DL9	Lamp lead, driver side — CO/PBX line 9	J36-19
DL10	Lamp lead, driver side — CO/PBX line 10	J36-14
DL11	Lamp lead, driver side — CO/PBX line 11	J36-12
DL12	Lamp lead, driver side — CO/PBX line 12	J36-8
DL13	Lamp lead, driver side — CO/PBX line 13	J36-21
DL14	Lamp lead, driver side — CO/PBX line 14	J36-23
L1	Lamp lead, line side — CO/PBX line 1	J1-8 J34-16
L2	Lamp lead, line side — CO/PBX line 2	J2-8 J34-13
L3	Lamp lead, line side — CO/PBX line 3	J3-8 J34-9
L4	Lamp lead, line side — CO/PBX line 4	J4-8 J34-1
L5	Lamp lead, line side — CO/PBX line 5	J5-8 J34-20
L6	Lamp lead, line side — CO/PBX line 6	J6-8 J34-22
L7	Lamp lead, line side — CO/PBX line 7	J7-8 J34-28

TABLE Y (Contd)

LEAD TABLE—453B KTU

LEAD DESIG	FUNCTION	CONNECTOR AND PIN NUMBER
L8	Lamp lead, line side — CO/PBX line 8	J8-8 J36-28
L9	Lamp lead, line side — CO/PBX line 9	J9-8 J36-16
L10	Lamp lead, line side — CO/PBX line 10	J10-8 J36-13
L11	Lamp lead, line side — CO/PBX line 11	J11-8 J36-9
L12	Lamp lead, line side — CO/PBX line 12	J12-8 J36-1
L13	Lamp lead, line side — CO/PBX line 13	J13-8 J36-20
L14	Lamp lead, line side — CO/PBX line 14	J14-8 J36-22

TABLE Z  
 INPUTS AND OUTPUTS — 453B KTU

TEST FROM (SEE NOTE)	TO	MON/TALK SWITCH	TEST FOR	REMARKS
INPUTS				
GROUND		MON	10V± steady lamp voltage	Handset off-hook and CO/PBX line button depressed on:
	J34-16			Line 1
	J34-13			Line 2
	J34-9			Line 3
	J34-1			Line 4
	J34-20			Line 5
	J34-22			Line 6
	J34-28			Line 7
	J36-28			Line 8
	J36-16			Line 9
	J36-13			Line 10
	J36-9			Line 11
	J36-1			Line 12
	J36-20			Line 13
	J36-22		Line 14	
	J34-4		10V± interrupted lamp voltage	interrupter running
	J34-30			
	J34-31			
	J34-32			
	J36-4			
	J36-30			
	J36-31			
J36-32				

Note: (See end of table.)

TABLE Z (Contd)

## INPUTS AND OUTPUTS — 453B KTU

TEST FROM (SEE NOTE)	TO	MON/TALK SWITCH	TEST FOR	REMARKS
<b>OUTPUTS</b>				
GROUND		MON	10V± steady lamp voltage	Handset off-hook and CO/PBX line button depressed on:
	J34-19			Line 1
	J34-14			Line 2
	J34-12			Line 3
	J34-8			Line 4
	J34-21			Line 5
	J34-23			Line 6
	J34-29			Line 7
	J36-29			Line 8
	J36-19			Line 9
	J36-14			Line 10
	J36-12			Line 11
	J36-8			Line 12
	J36-21			Line 13
J36-23	Line 14			

*Note:* Terminals shown in TEST FROM and TO columns appear on the KTU and the wiring side of the associated connector.

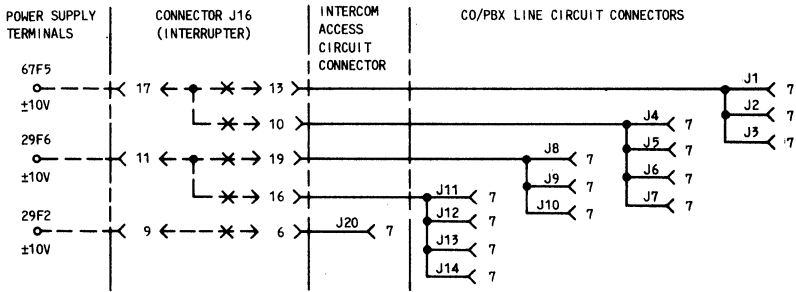


Fig. 75—Lamp Flash Circuit

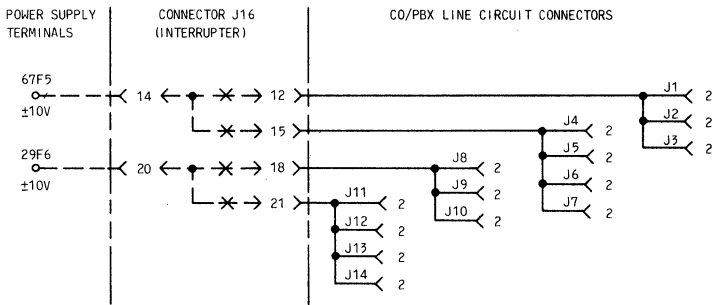


Fig. 76—Lamp Wink Circuit



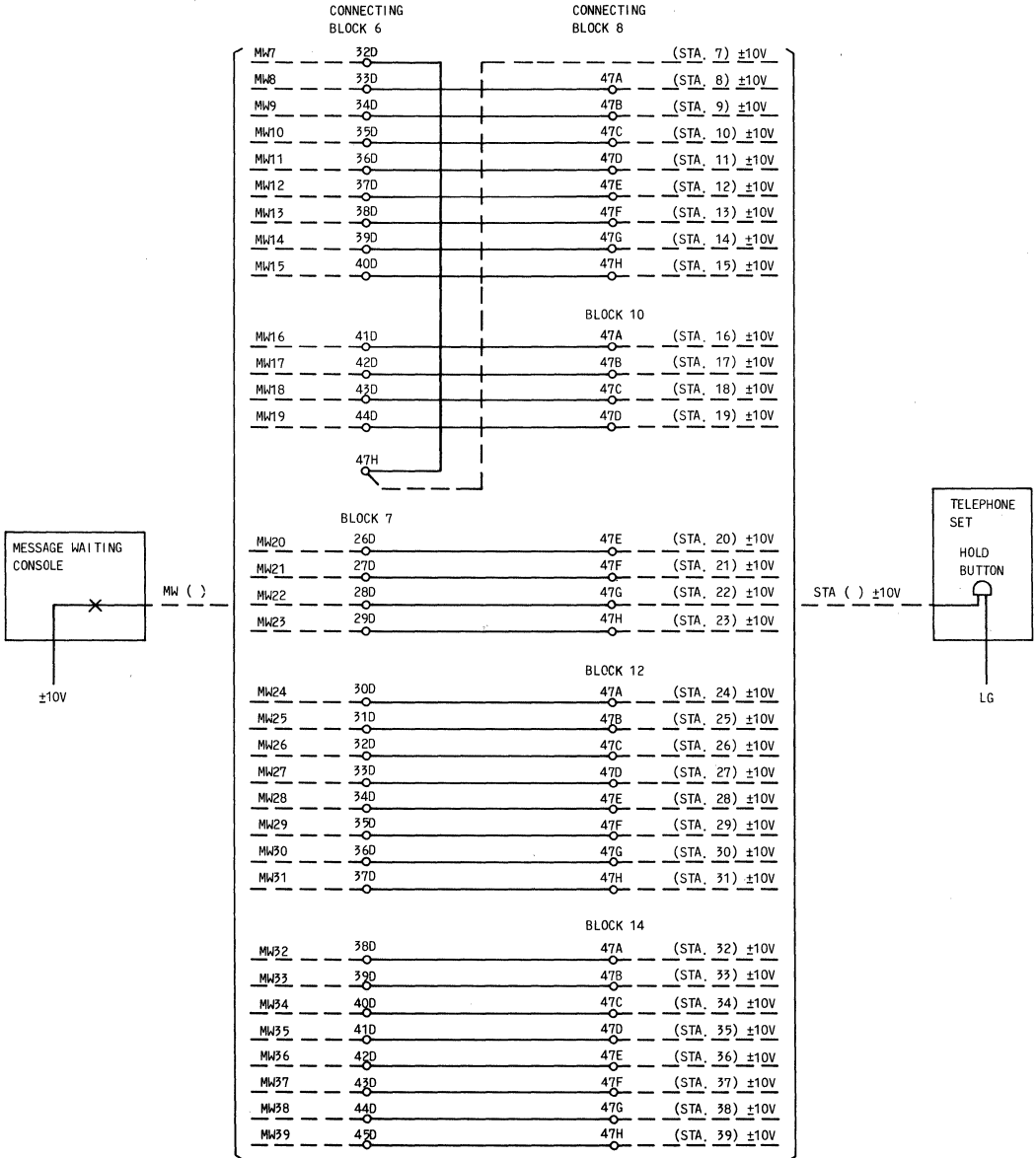


Fig. 77—Message Waiting Circuit

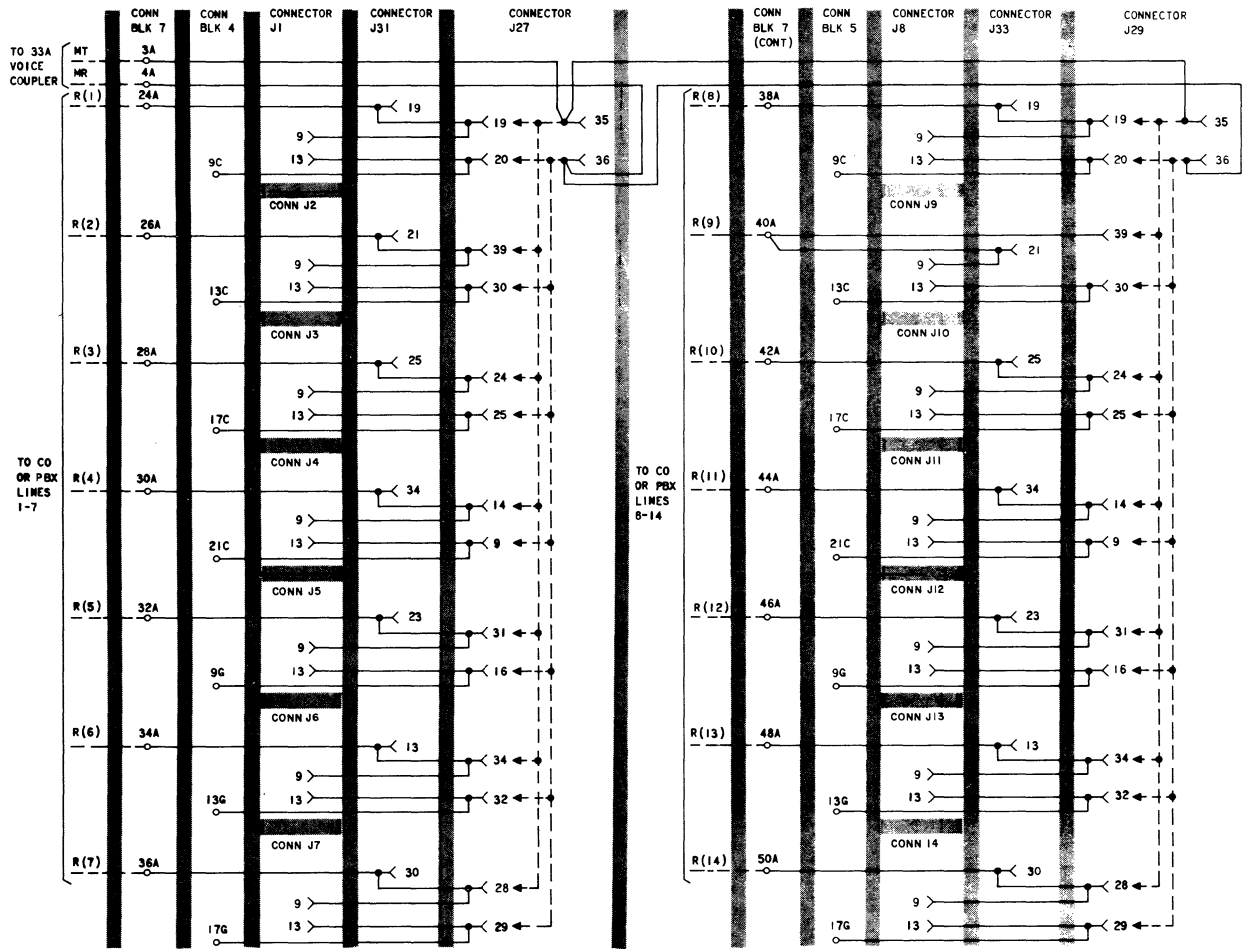


Fig. 78—Music-On-Hold Circuit—451-Type KTU in 580A KSU

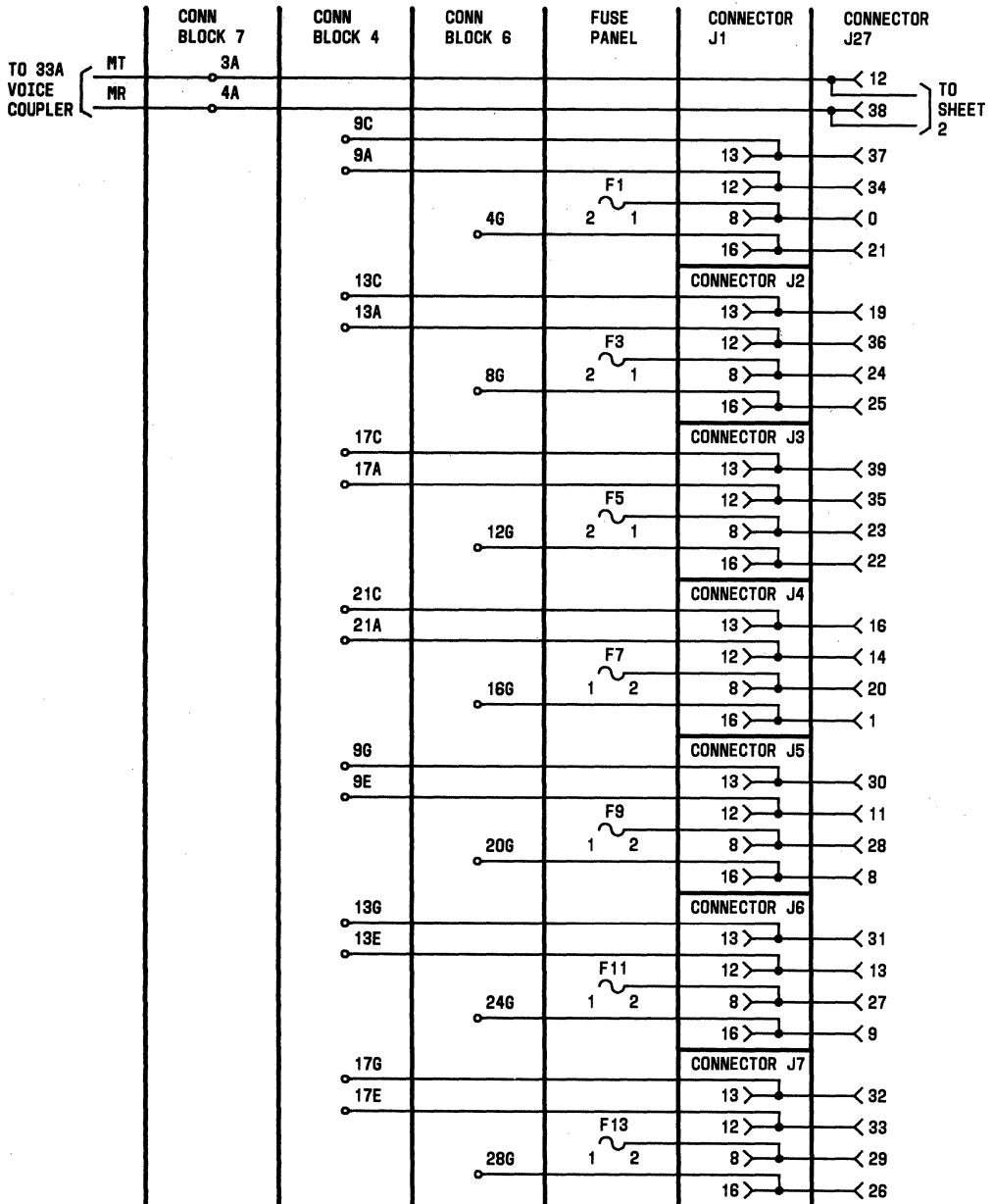


Fig. 79—Music-On-Hold Circuit—498A KTU in 580B KSU (Sheet 1 of 2)

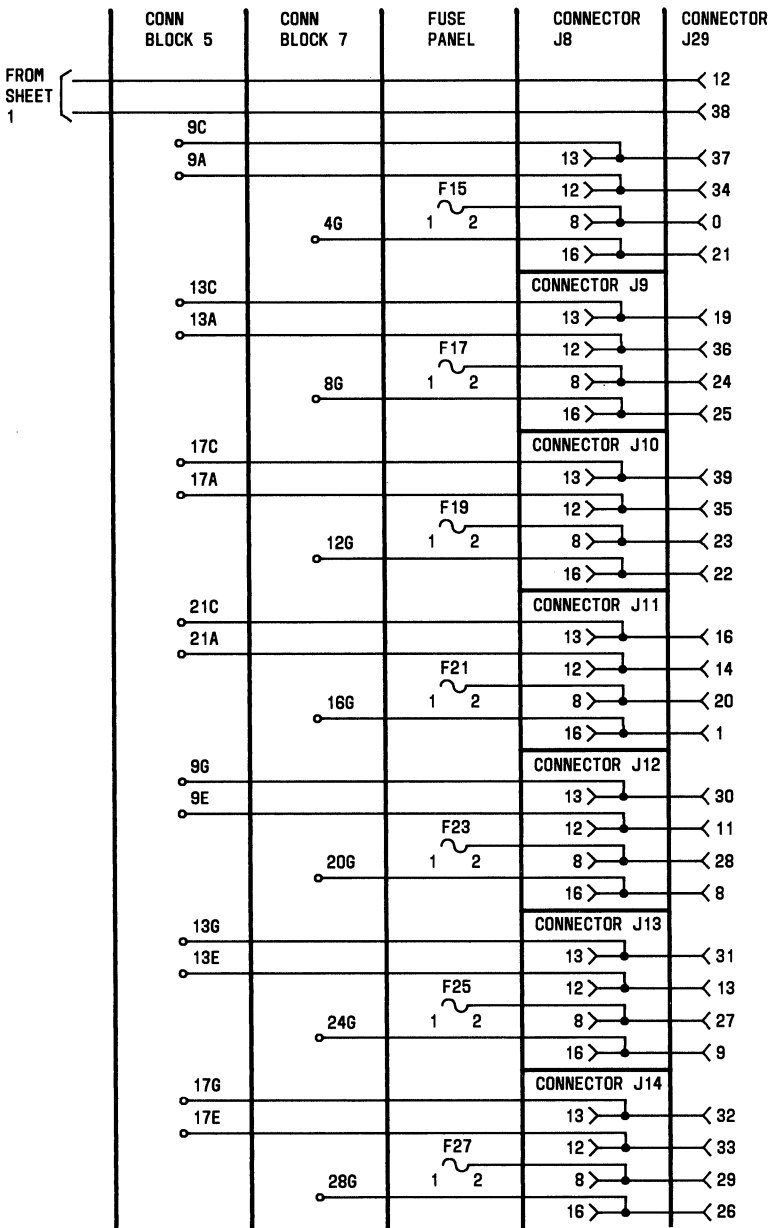


Fig. 79—Music-On-Hold Circuit—498A KTU in 580B KSU (Sheet 2 of 2)

## ♦ TABLE AA ♦

## MUSIC ON HOLD

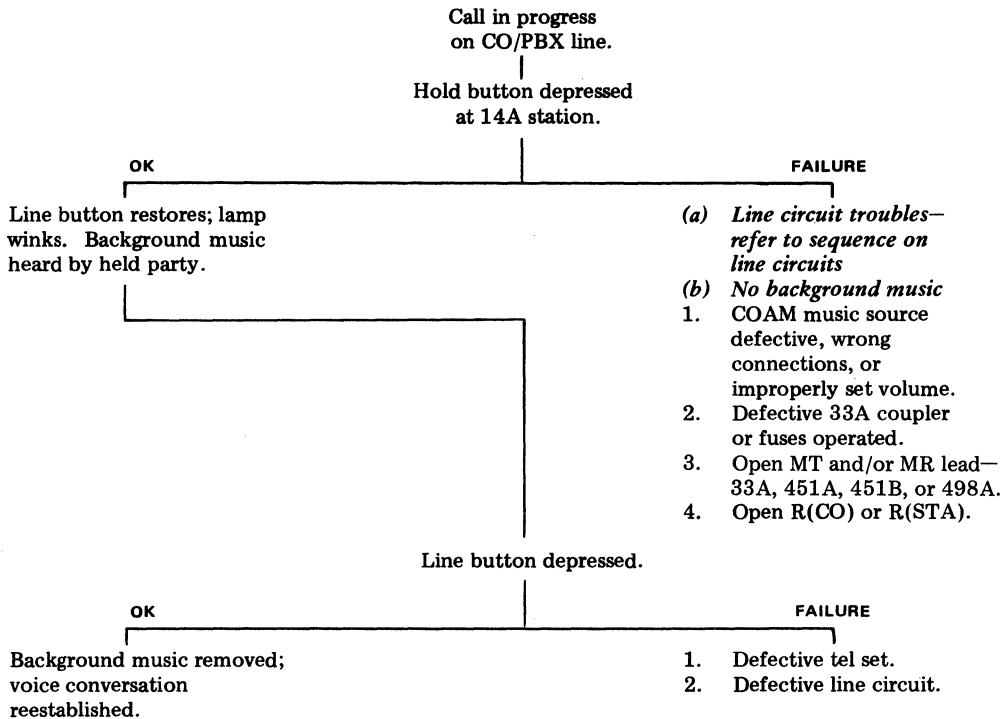


TABLE AB  
LEAD TABLE—451-TYPE KTUs

LEAD DESIG	FUNCTION	CONNECTOR AND PIN NUMBER
<b>FIRST 451-TYPE KTU</b>		
MT	Music tip — tip side of music source input— through 33A voice coupler	J27-35
MR	Music ring — ring side of music source input— through 33A voice coupler	J27-36
R (CO)	Ring (Central Office) — multiple of ring side of CO/PBX circuit	J27-19, 39, 24, 14, 31, 34, 28
R (STA)	Ring (Station) — multiple of ring side of line toward station	J27-20, 30, 25, 9, 16, 32, 29
<b>SECOND 451-TYPE KTU</b>		
MT	Music tip — tip side of music source input — through 33A voice coupler	J29-35
MR	Music ring — ring side of music source input — through 33A voice coupler	J29-36
R (CO)	Ring (Central Office) — multiple of ring side of CO/PBX circuit	J29-19, 39, 24, 14, 31, 34, 28
R (STA)	Ring (Station) — multiple of ring side of line toward station	J29-20, 30, 25, 9, 16, 32, 29

## ♦TABLE AC♦

## LEAD TABLE – 498A KTUs

LEAD DESIG	FUNCTION	CONNECTOR AND PIN NUMBER
<b>FIRST 498A KTU</b>		
MT	Music tip – tip side of music source input – through 33A voice coupler	J27-12
MR	Music ring – ring side of music source input – through 33A voice coupler	J27-38
R	Ring (station) – multiple of ring side of line toward station	J27-37, 19, 39, 16, 30, 31, 32
T	Tip (station) – multiple of tip side of line toward station	J27-34, 36, 35, 14, 11, 13, 33
A	A lead – multiple of A lead toward station	J27-21, 25, 22, 1, 8, 9, 26
L	Lamp lead – multiple of lamp lead toward station	J27-0, 24, 23, 20, 28, 27, 29,
<b>SECOND 498A KTU</b>		
M1	Music tip – tip side of music source input – multiplied from J27 through 33A voice coupler	J29-12
M2	Music ring – ring side of music source input – multiplied from J27 through 33A voice coupler	J29-38
R	Ring (station) – multiple of ring side of line toward station	J29-37, 19, 39, 16, 30, 31, 32
T	Tip (station) – multiple of tip side of line toward station	J29-34, 36, 35, 14, 11, 13, 33
A	A lead – multiple of A lead toward station	J29-21, 25, 22, 1, 8, 9, 26
L	Lamp lead – multiple of lamp lead toward station	J29-0, 24, 23, 20, 28, 27, 29

TABLE AD

## INPUTS AND OUTPUTS – 451-TYPE KTUs

TEST FROM (SEE NOTE)	TO	MON/TALK SWITCH	TEST FOR	REMARKS
<b>INPUTS – FIRST 451-TYPE KTU</b>				
J27-35	J27-36	MON	Music input	Music source connected
<b>OUTPUTS – FIRST 451-TYPE KTU</b>				
J27-19	J27-20	MON	Music output	CO/PBX line 1 on hold
J27-39	J27-30			CO/PBX line 2 on hold
J27-24	J27-25			CO/PBX line 3 on hold
J27-14	J27-9			CO/PBX line 4 on hold
J27-31	J27-16			CO/PBX line 5 on hold
J27-34	J27-32			CO/PBX line 6 on hold
J27-28	J27-29			CO/PBX line 7 on hold
<b>INPUTS – SECOND 451-TYPE KTU</b>				
J29-35	J29-36	MON	Music input	Music source connected
<b>OUTPUTS – SECOND 451-TYPE KTU</b>				
J29-19	J29-20	MON	Music output	CO/PBX line 8 on hold
J29-39	J29-30			CO/PBX line 9 on hold
J29-24	J29-25			CO/PBX line 10 on hold
J29-14	J29-9			CO/PBX line 11 on hold
J29-31	J29-16			CO/PBX line 12 on hold
J29-34	J29-32			CO/PBX line 13 on hold
J29-28	J29-29			CO/PBX line 14 on hold

*Note:* Terminals shown in TEST FROM and TO columns appear on KTU and the wiring side of the associated connector.



◆ TABLE AE ◆

## INPUTS AND OUTPUTS – 498A KTUs

TEST FROM (SEE NOTE)	TO	MON/TALK SWITCH	TEST FOR	REMARKS
INPUTS – FIRST 498A KTU				
J27-12	J27-33	MON	Music input	Music source connected
Ground	J27-17	TALK	B battery	
J27-17	J27-15		B ground	
J27-17	J27-6		MG ground	
OUTPUTS – FIRST 498A KTU				
J27-34	J27-37	MON	Music output	CO/PBX line 1 on hold
J27-36	J27-19			CO/PBX line 2 on hold
J27-35	J27-39			CO/PBX line 3 on hold
J27-14	J27-16			CO/PBX line 4 on hold
J27-11	J27-30			CO/PBX line 5 on hold*
J27-13	J27-31			CO/PBX line 6 on hold*
J27-33	J27-32			CO/PBX line 7 on hold*
INPUTS – SECOND 498A KTU				
J29-12	J29-38	MON	Music input	Music source connected
Ground	J29-17	TALK	B battery	
J29-17	J29-15		B ground	
J29-17	J29-6		MG ground	
OUTPUTS – SECOND 498A KTU				
J29-34	J29-37	MON	Music output	CO/PBX line 8 on hold
J29-36	J29-19			CO/PBX line 9 on hold
J29-35	J29-39			CO/PBX line 10 on hold
J29-14	J29-16			CO/PBX line 11 on hold
J29-11	J29-30			CO/PBX line 12 on hold*
J29-13	J29-31			CO/PBX line 13 on hold*
J29-33	J29-32			CO/PBX line 14 on hold*

*Note:* Terminals shown in TEST FROM and TO columns appear on the KTU and the wiring side of the associated connector.

\* These circuits are on the 116A1 CM.

TABLE AF  
LOUDSPEAKER PAGING

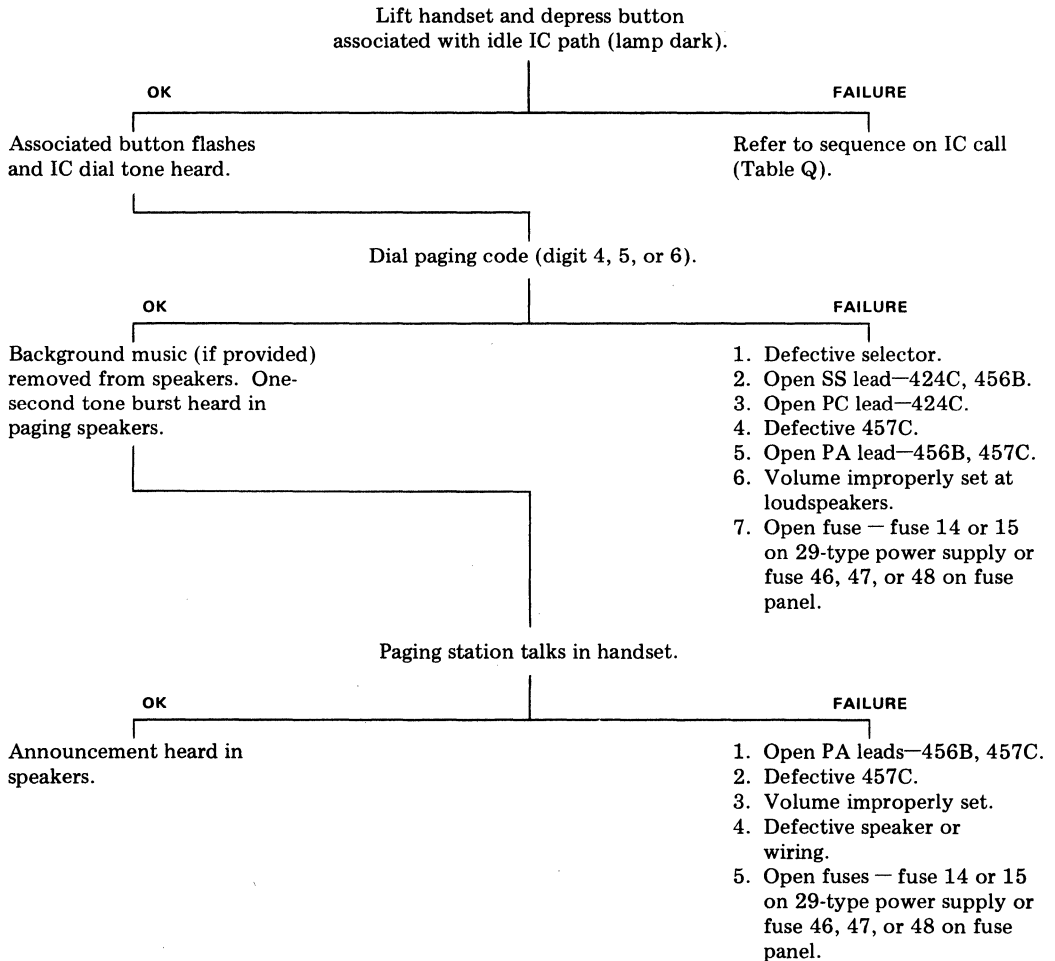


TABLE AG

LEAD TABLE – 457C KTUs

LEAD DESIG	FUNCTION	CONNECTOR AND PIN NUMBER
PA	Paging input — voice and tone alerting input from the 456B KTU	J28-16 J30-16 J32-16
PC	Paging code — when code 4, 5, or 6 is dialed, —24V is applied to this lead from 456B KTU to enable amplifier(s)	J28-19 J30-19 J32-19
PO	Paging amplifier output — outputs from paging amplifier to speakers	J28-0
SP		J30-0 J32-0
SPG	Paging speaker ground — ground return for paging loudspeakers	J28-15 J30-15 J32-15
PT	Tip from 33A voice coupler for background music	J28-8 J30-8 J32-8
PR	Ring from 33A voice coupler for background music	J28-9 J30-9 J32-9

**TABLE AH**  
**INPUTS AND OUTPUTS – 457C KTUs**

TEST FROM (SEE NOTE)	TO	MON/TALK SWITCH	TEST FOR	REMARKS
<b>INPUTS – FIRST 457C KTU</b>				
GROUND	J28-18	TALK	A Battery	
	J28-17		B Battery	
J28-17	J28-15		B Ground	
GROUND	J28-19		A Battery (PC lead)	
J28-8	J28-9	MON	Background music	If provided
<b>OUTPUTS – FIRST 457C KTU</b>				
GROUND	J28-0	MON	Voice and tone alerting	Code 4 dialed; voice input at calling station
<b>INPUTS – SECOND 457C KTU</b>				
GROUND	J30-18	TALK	A Battery	
	J30-17		B Battery	
J30-17	J30-15		B Ground	
GROUND	J30-19		A Battery (PC lead)	
J30-8	J30-9	MON	Background music	If provided
<b>OUTPUTS – SECOND 457C KTU</b>				
GROUND	J30-0	MON	Voice and tone alerting	Code 5 dialed; voice input at calling station
<b>INPUTS – THIRD 457C KTU</b>				
GROUND	J32-18	TALK	A Battery	
	J32-17		B Battery	
J32-17	J32-15		B Ground	
GROUND	J32-19		A Battery (PC lead)	
J32-8	J32-9	MON	Background music	If provided
<b>OUTPUTS – THIRD 457C KTU</b>				
GROUND	J32-0	MON	Voice and tone alerting	Code 6 dialed; voice input at calling station

*Note:* Terminals shown in TEST FROM and TO columns appear on the KTU and the wiring side of the associated connector.

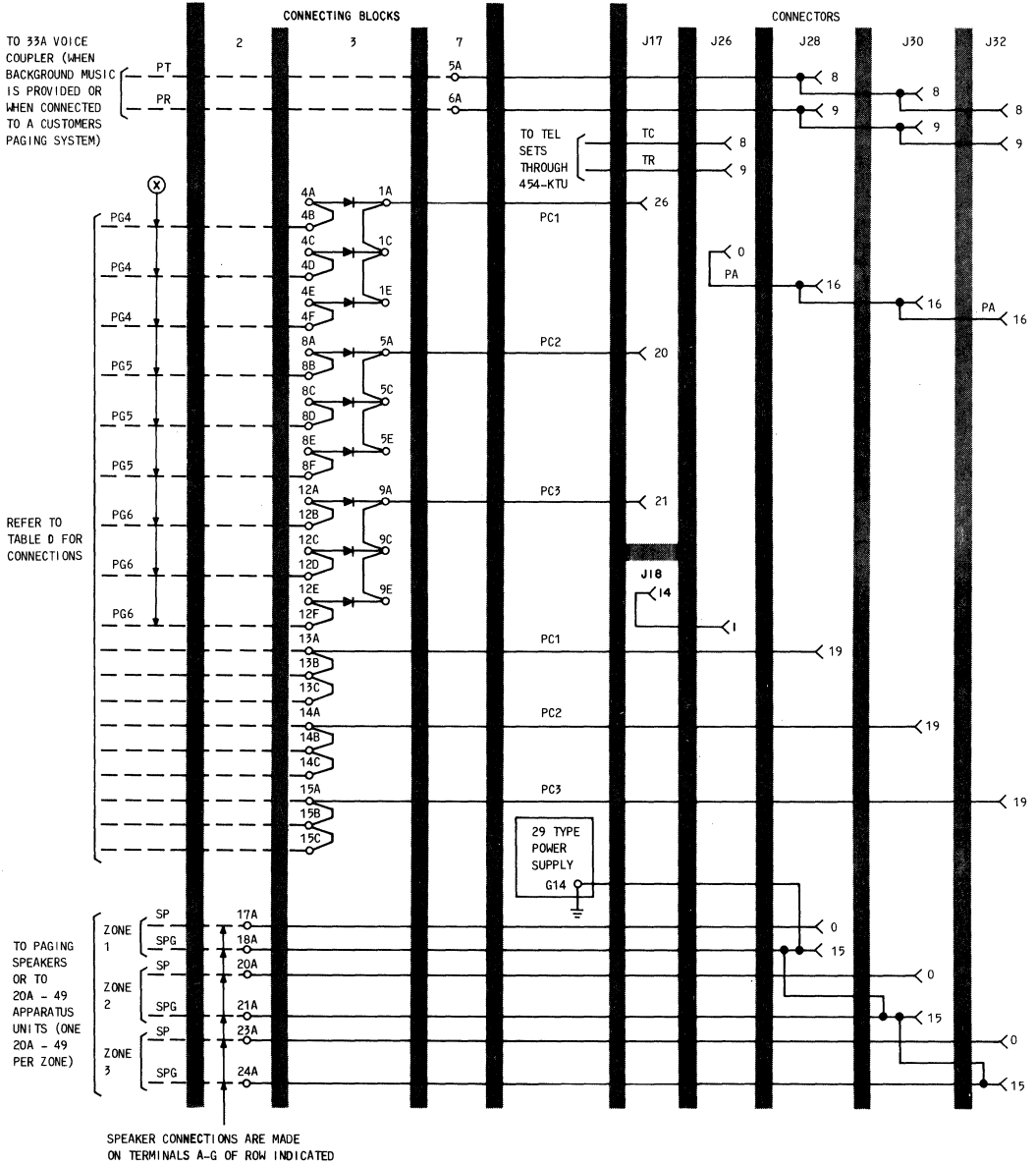


Fig. 80—Loudspeaker Paging and Background Music Circuit





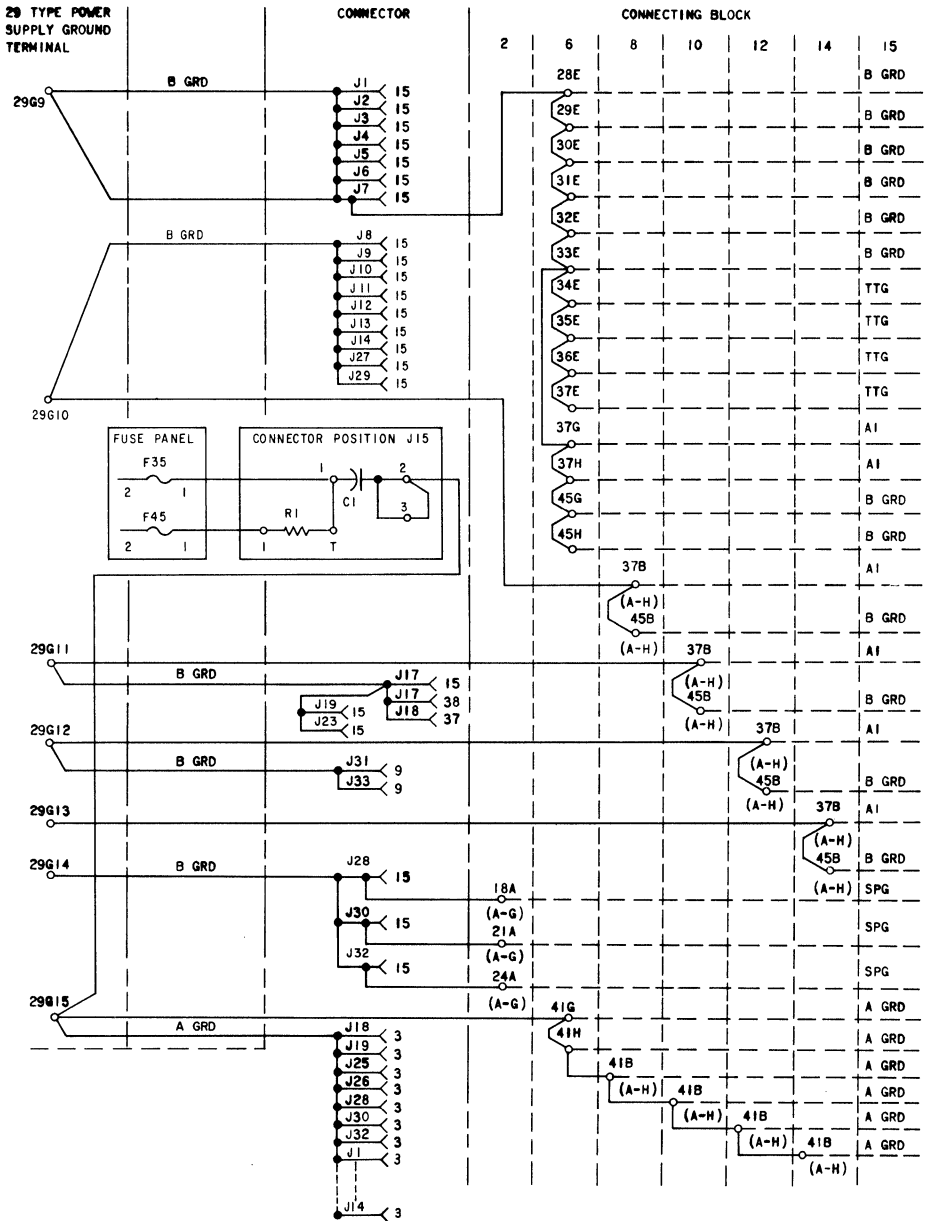


Fig. 82—Power Ground Circuit for 29-Type Power Supply (Sheet 2 of 2)



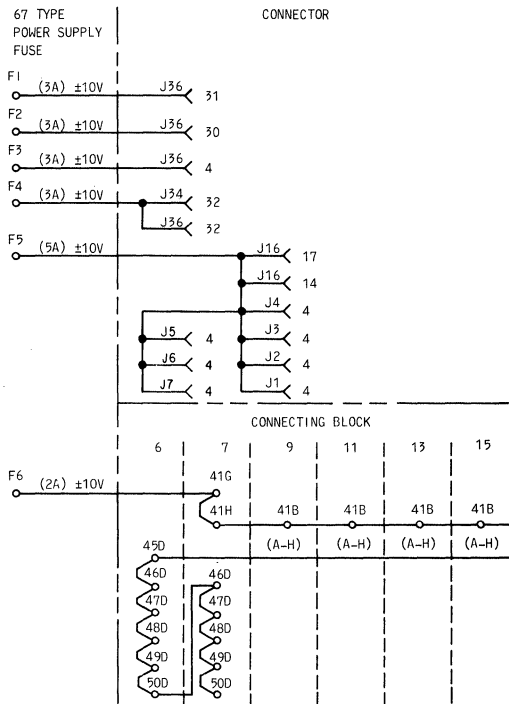


Fig. 83—Power Distribution Circuit for 67-Type Power Supply

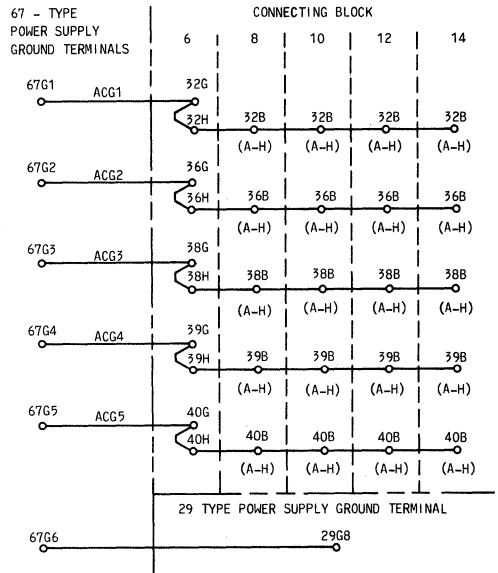
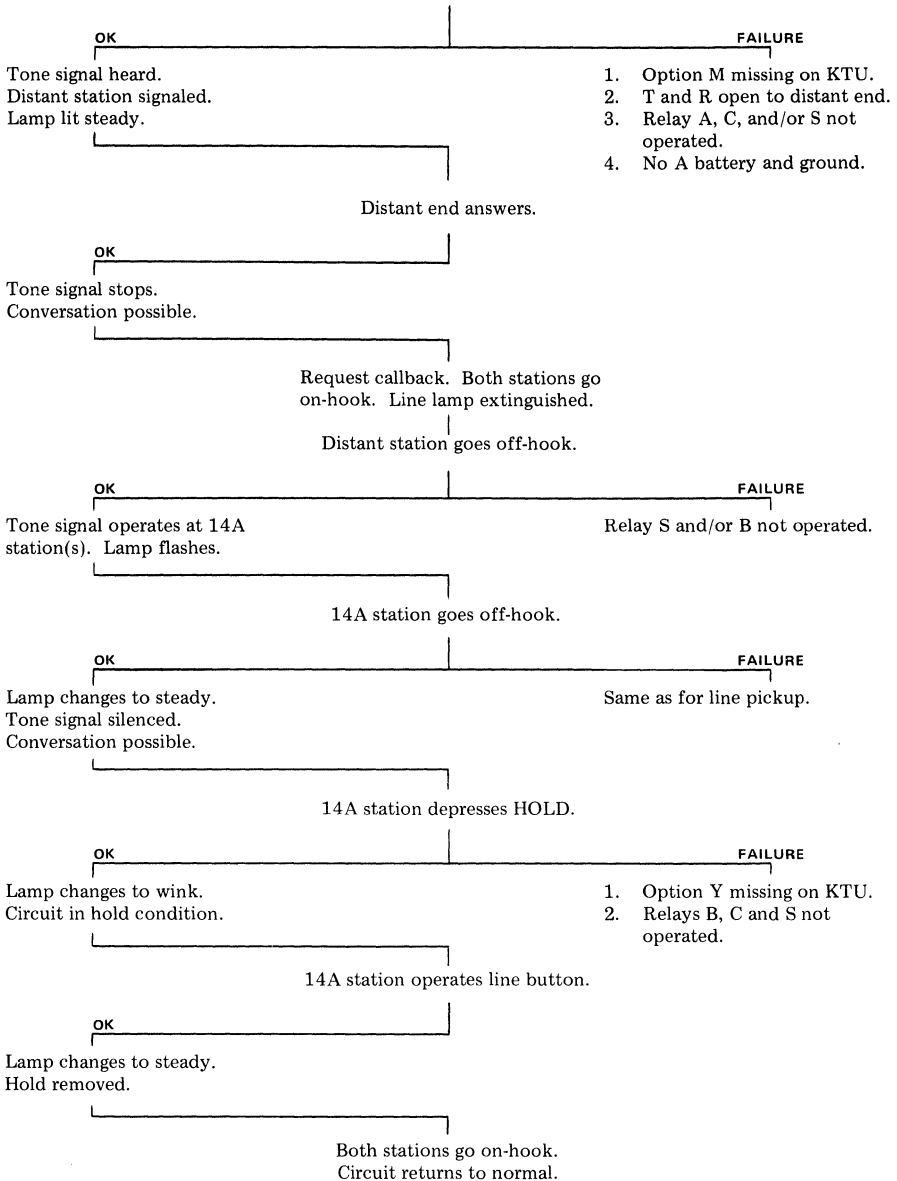


Fig. 84—Power Ground Circuit for 67-Type Power Supply

TABLE A1

PRIVATE LINE CIRCUIT

At 14A station, depress pickup button associated with private line.



♦TABLE AJ♦

LEAD TABLE – 415A KTU

LEAD DESIG	FUNCTION	CONNECTOR AND PIN NUMBER
		J1 – J14
A	A lead – primary control lead from telephone set	16
L	Lamp lead – provides proper 10Vac signal to telephone set lamps and lamp driver circuits to indicate line status	8
R(CO)	Ring side of private line from distant end	9
R(STA)	Ring side of line toward station	13
T(CO)	Tip side of private line from distant end	14
T(STA)	Tip side of line toward station	12
RC	Ring control – tone signal control lead. Connects tone from generator to amplifier of telephone set as an audible signal.	1

◆ TABLE AK ◆

## INPUTS AND OUTPUTS – 415A KTU

TEST FROM (SEE NOTE)	TO	MON/TALK SWITCH	TEST FOR	REMARKS
INPUTS				
14	9	TALK	Talk battery	Ground pin 16
17	15		B Ground	
	6		MG – interrupter ground	
GROUND or 15	2	MON	LW – 10V± at 120 IPM	With interrupter running
	7		LF – 10V± at 60 IPM	
	4		10V steady	
	11		RN – interrupted tone ringer signal	
	17	TALK	B Battery	
3	18	TALK	A Battery	
OUTPUTS				
12	13	TALK	Talk battery	
GROUND	8	MON	10V± steady	Ground pin 16
	1		Tone ringing signal	Distant station off-hook

*Note:* Terminals shown in TEST FROM and TO columns appear on the KTU and the wiring side of the associated connector.

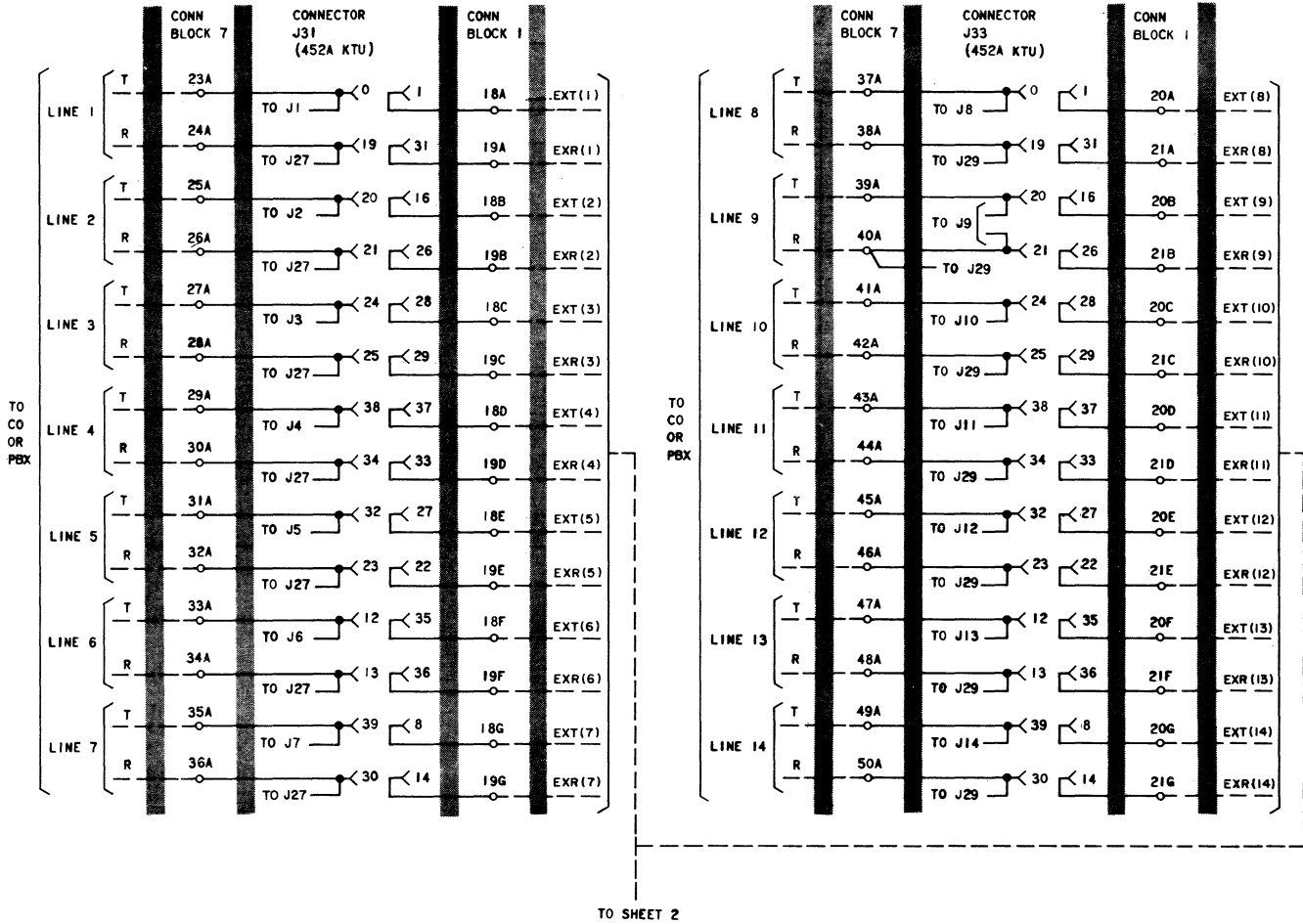


Fig. 85—Power Failure Ringing Circuit (Sheet 1 of 2)

FROM SHEET 1

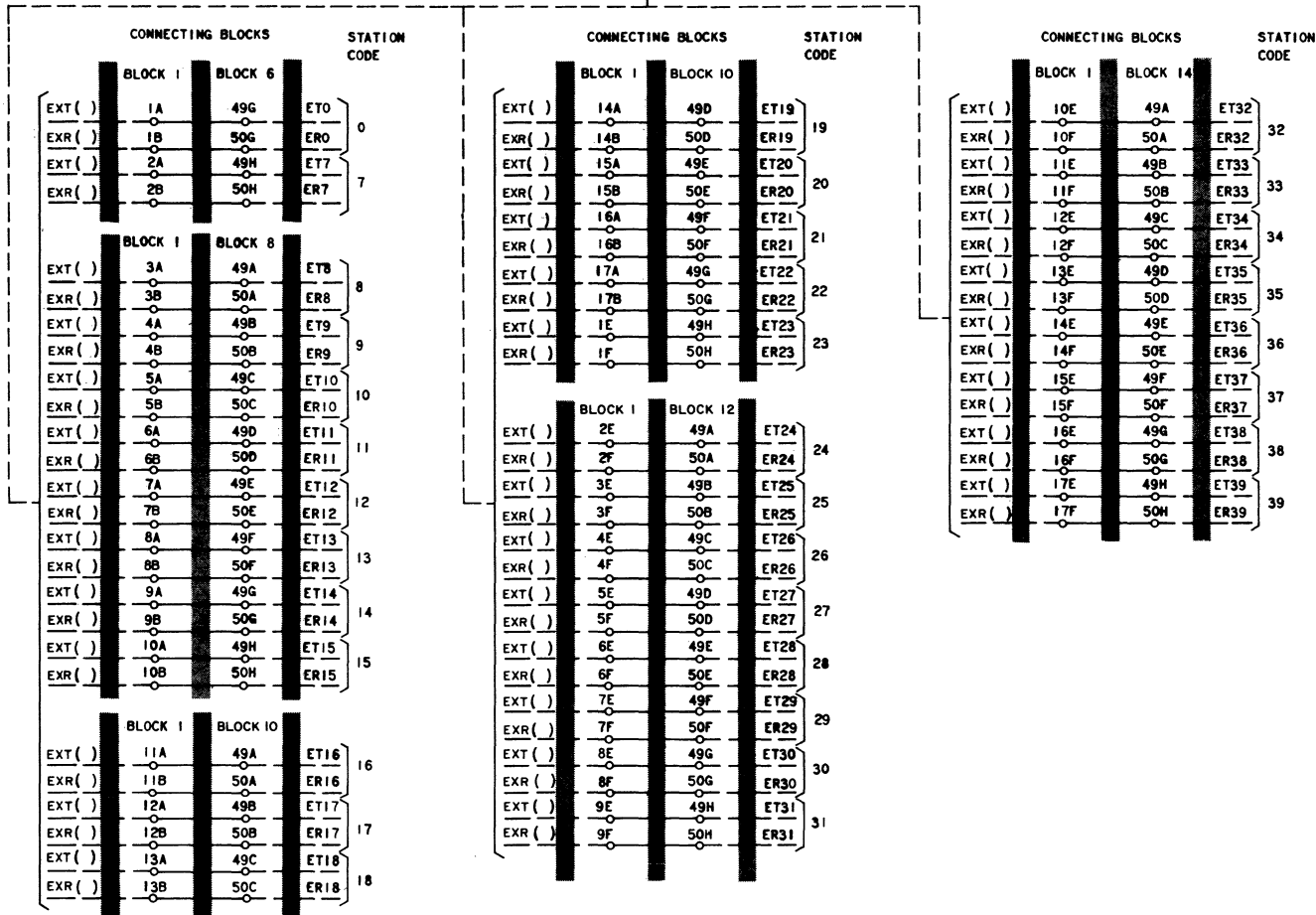


Fig. 85—Power Failure Ringing Circuit (Sheet 2 of 2)

TABLE AL  
POWER FAILURE RINGING CIRCUIT

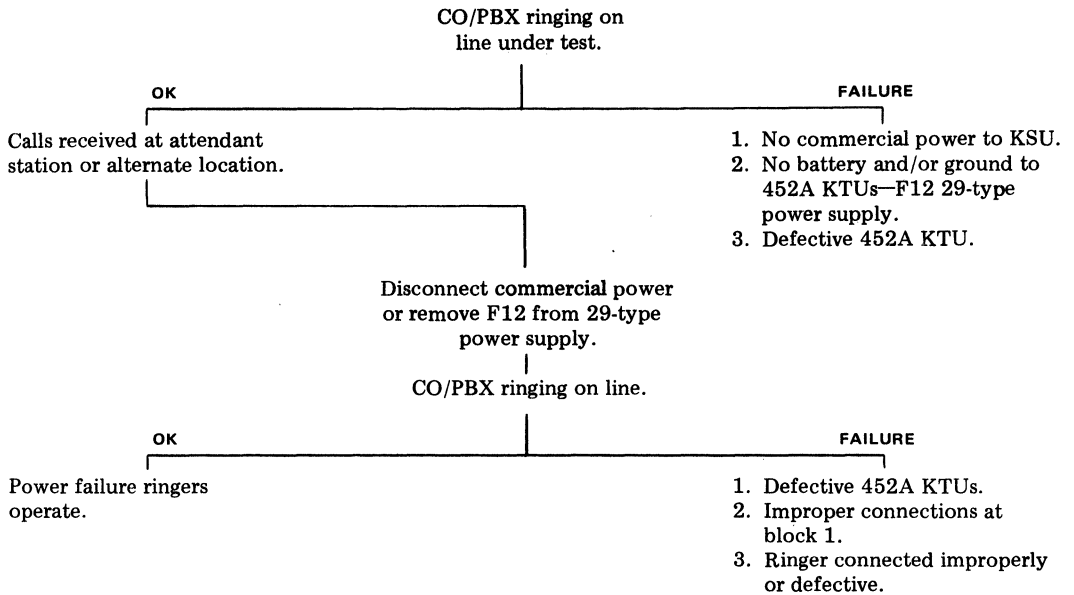


TABLE AM  
LEAD TABLE—452A KTUs

LEAD DESIG	FUNCTION	CONNECTOR AND PIN NUMBER
ET( )	Tip of extension ringer circuit from station (V-S)	
ER( )	Ring of extension ringer circuit from station (S-V)	
EXT( )	Tip side of audible circuit from first 452A KTU	J31-1, 16, 28, 37, 27, 35, 8
EXT( )	Tip side of audible circuit from second 452A KTU	J33-1, 16, 28, 37, 27, 35, 8
EXR( )	Ring side of audible circuit from first 452A KTU	J31-31, 26, 29, 33, 22, 36, 14
EXR( )	Ring side of audible circuit from second 452A KTU	J33-31, 26, 29, 33, 22, 36, 14
T(CO)	Tip side of CO/PBX line from CO — first 452A KTU	J31-0, 20, 24, 38, 32, 12, 39
T(CO)	Tip side of CO/PBX line from CO — second 452A KTU	J33-0, 20, 24, 38, 32, 12, 39
R(CO)	Ring side of CO/PBX line from CO — first 452A KTU	J31-19, 21, 25, 34, 23, 13, 30
R(CO)	Ring side of CO/PBX line from CO — second 452A KTU	J33-19, 21, 25, 34, 23, 13, 30



TABLE AN

## INPUTS AND OUTPUTS—452A KTUs

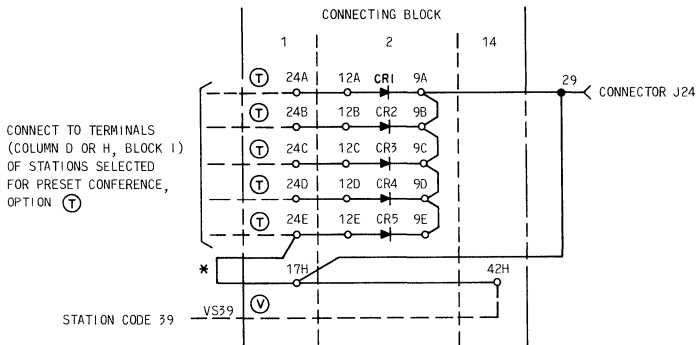
TEST FROM (SEE NOTE)	TO	MON/TALK SWITCH	TEST FOR	REMARKS
<b>INPUTS</b>				
GROUND	J31-17	TALK	B Battery	
	J33-17			
B BAT.	J31-9		B Ground	
	J33-9			
J31-0	J31-19	MON	CO/PBX ringing — line 1	
J31-20	J31-21		CO/PBX ringing — line 2	
J31-24	J31-25		CO/PBX ringing — line 3	
J31-38	J31-34		CO/PBX ringing — line 4	
J31-32	J31-23		CO/PBX ringing — line 5	
J31-12	J31-13		CO/PBX ringing — line 6	
J31-39	J31-30		CO/PBX ringing — line 7	
J33-0	J33-19		CO/PBX ringing — line 8	
J33-20	J33-21		CO/PBX ringing — line 9	
J33-24	J33-25		CO/PBX ringing — line 10	
J33-38	J33-34		CO/PBX ringing — line 11	
J33-32	J33-23		CO/PBX ringing — line 12	
J33-12	J33-13		CO/PBX ringing — line 13	
J33-39	J33-30		CO/PBX ringing — line 14	
<b>OUTPUTS</b>				
J31-1	J31-31	MON	CO/PBX ringing — line 1	CO/PBX ringing on lines and power disconnected from KSU
J31-16	J31-26		CO/PBX ringing — line 2	
J31-28	J31-29		CO/PBX ringing — line 3	
J31-37	J31-33		CO/PBX ringing — line 4	

TABLE AN (Contd)

INPUTS AND OUTPUTS—452A KTUs

TEST FROM (SEE NOTE)	TO	MON/TALK SWITCH	TEST FOR	REMARKS
<b>OUTPUTS</b>				
J31-27	J31-22	MON	CO/PBX ringing — line 5	CO/PBX ringing on line and power disconnected from KSU or fuse 12 removed from 29-type power supply
J31-35	J31-36		CO/PBX ringing — line 6	
J31-8	J31-14		CO/PBX ringing — line 7	
J33-1	J33-31		CO/PBX ringing — line 8	
J33-16	J33-26		CO/PBX ringing — line 9	
J33-28	J33-29		CO/PBX ringing — line 10	
J33-37	J33-33		CO/PBX ringing — line 11	
J33-27	J33-22		CO/PBX ringing — line 12	
J33-35	J33-36		CO/PBX ringing — line 13	
J33-8	J33-14		CO/PBX ringing — line 14	

*Note:* Terminals shown in TEST FROM and TO columns appear on the KTU and the wiring side of the associated connector.



- OPTIONS:
- (T) PRESET CONFERENCE
  - (V) 39TH STATION CODE
- \* FACTORY PROVIDED STRAP ON INSTALLERS SIDE OF CONNECTING BLOCK, OPTION (V). STRAP MUST BE REMOVED WHEN PRESET CONFERENCE IS PROVIDED.

Fig. 86—Preset Conference on Intercom Circuit

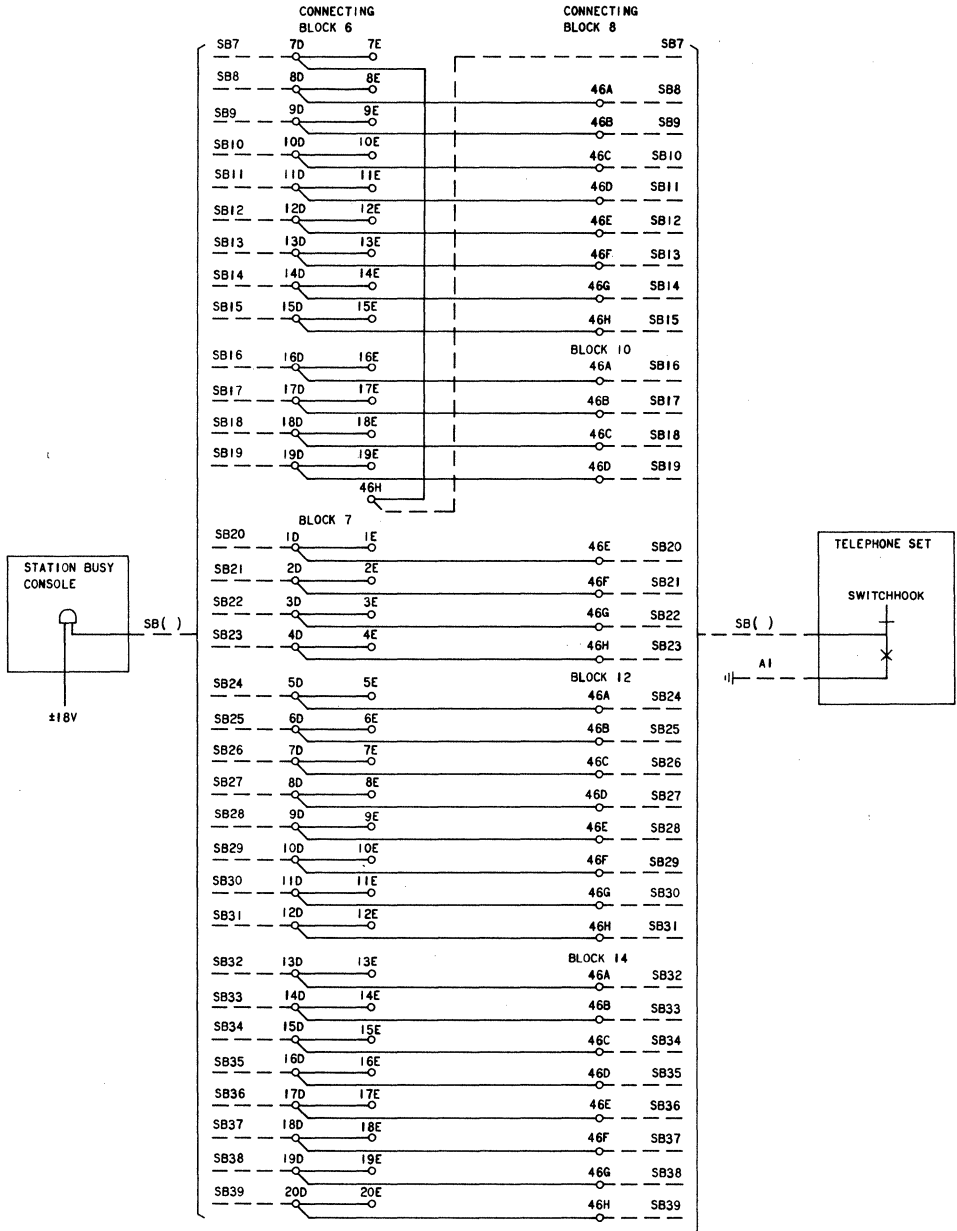


Fig. 87—Station Busy Circuit

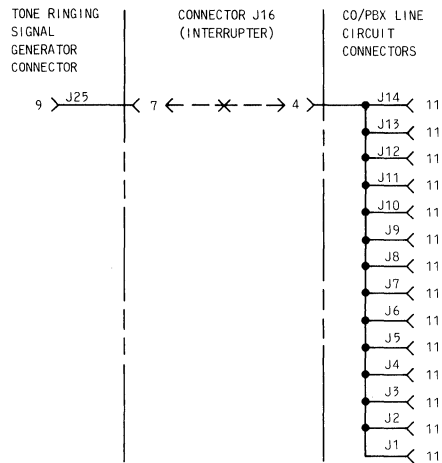


Fig. 88—Tone Ringing Circuit for CO/PBX Lines

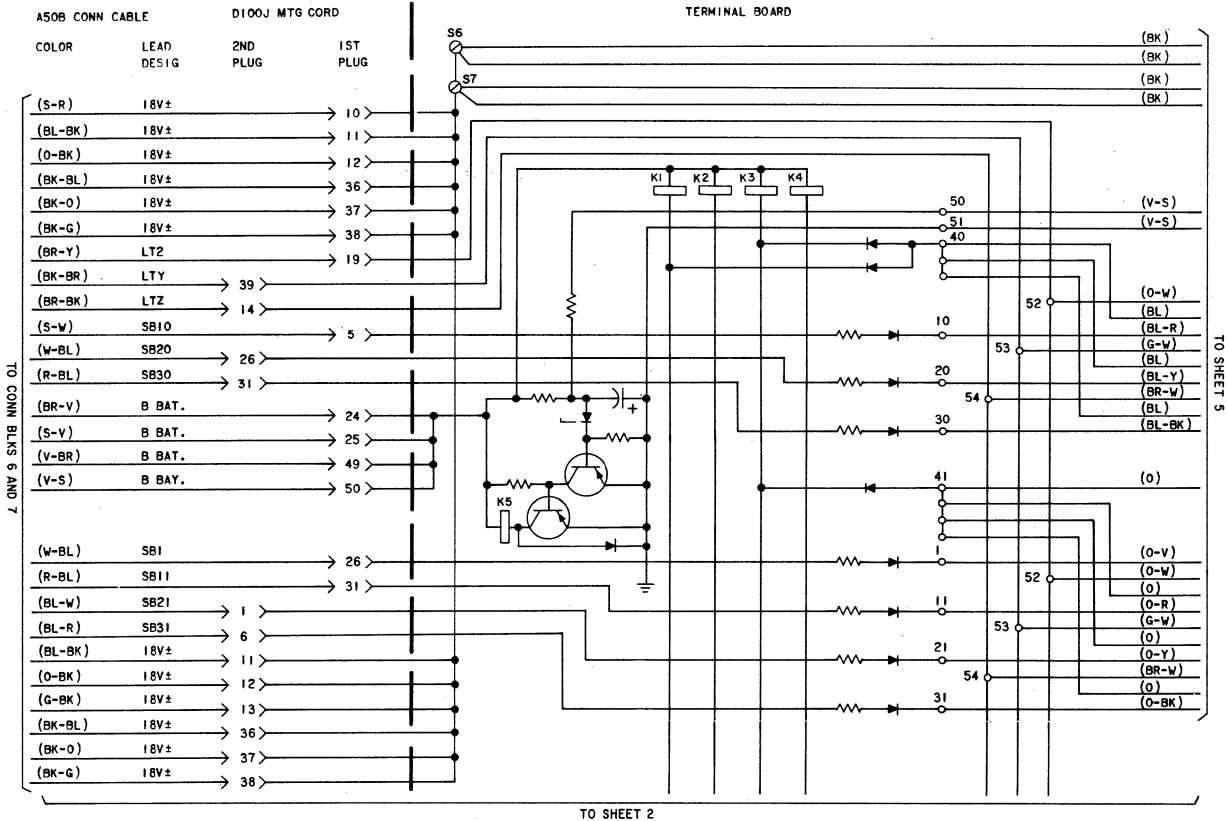


Fig. 89—Schematic of 7A1 Selector Console (DSS) (Sheet 1 of 8)

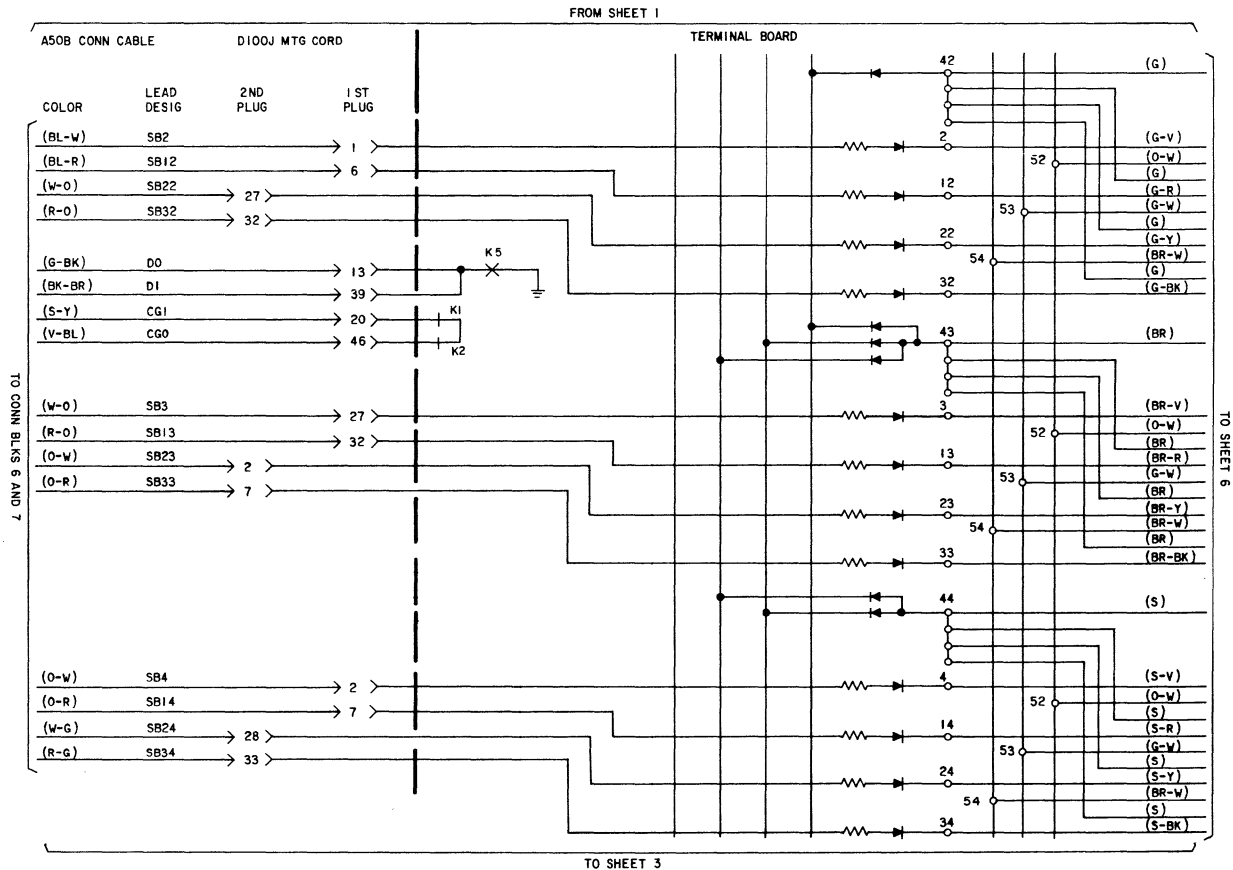


Fig. 89—Schematic of 7A1 Selector Console (DSS) (Sheet 2 of 8)

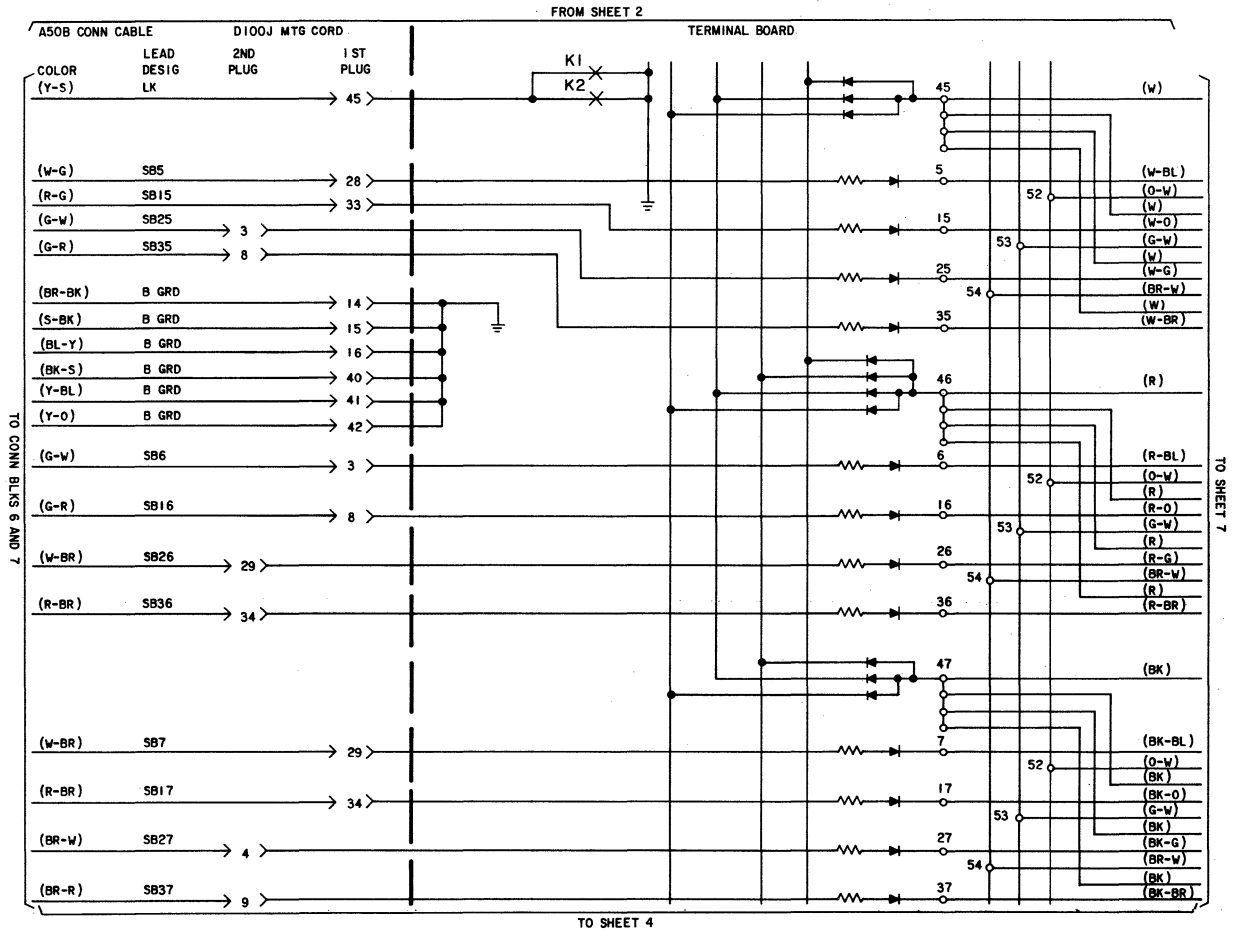


Fig. 89—Schematic of 7A1 Selector Console (DSS) (Sheet 3 of 8)

FROM SHEET 3

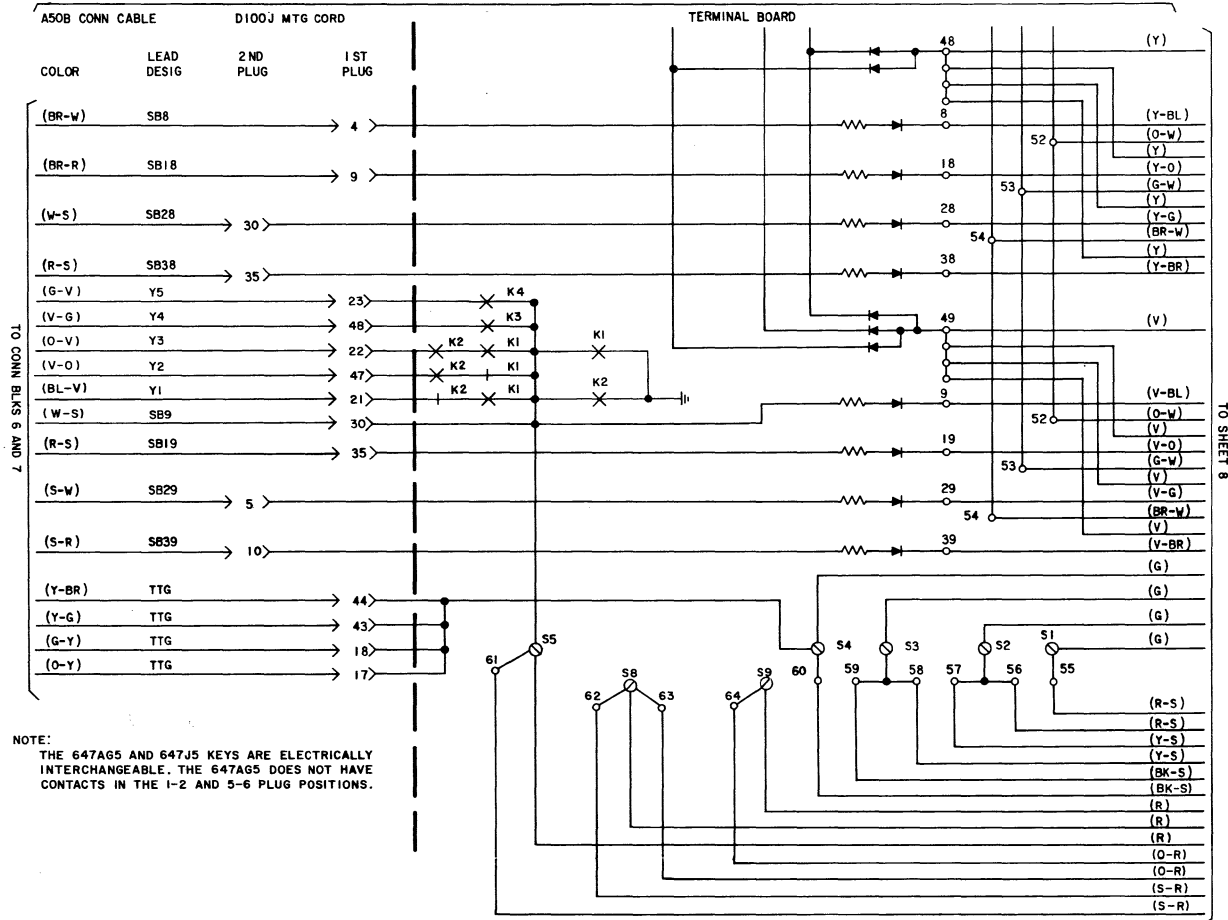


Fig. 89—Schematic of 7A1 Selector Console (DSS) (Sheet 4 of 8)



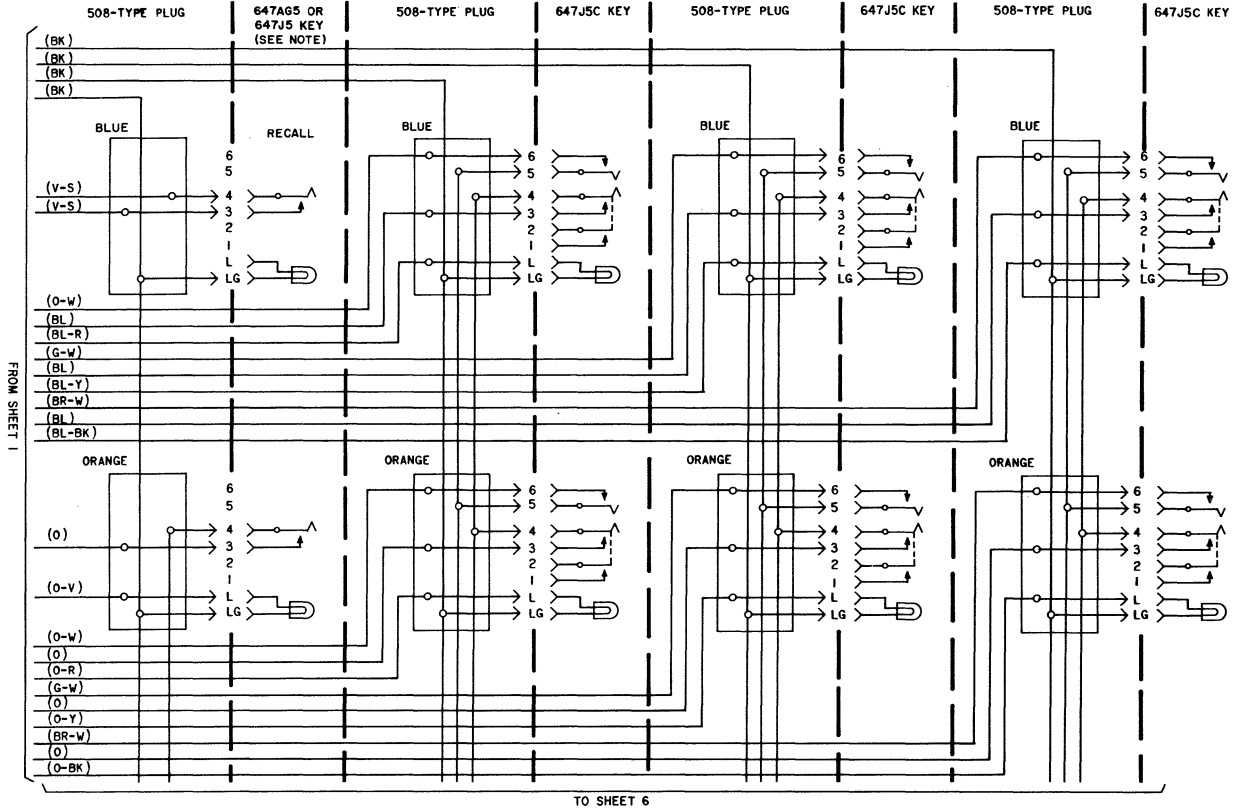


Fig. 89—Schematic of 7A1 Selector Console (DSS) (Sheet 5 of 8)

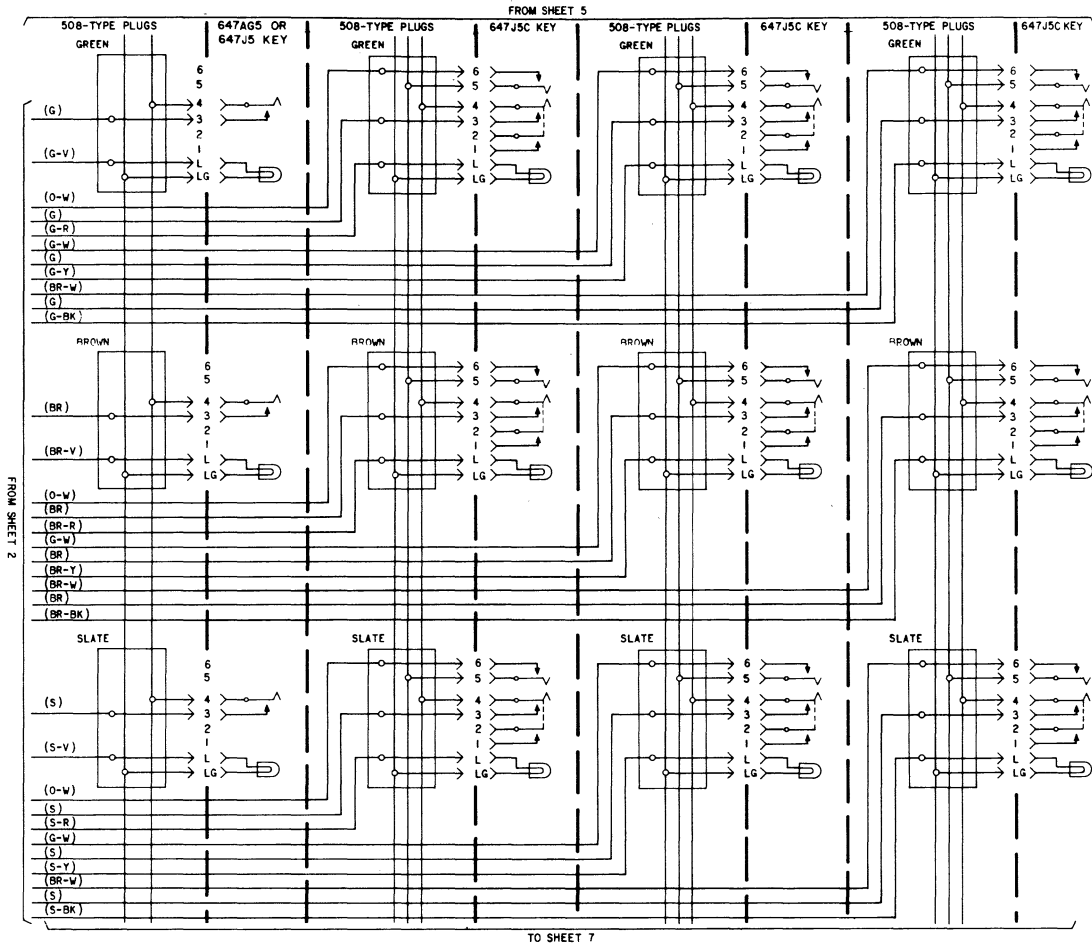


Fig. 89—Schematic of 7A1 Selector Console (DSS) (Sheet 6 of 8)

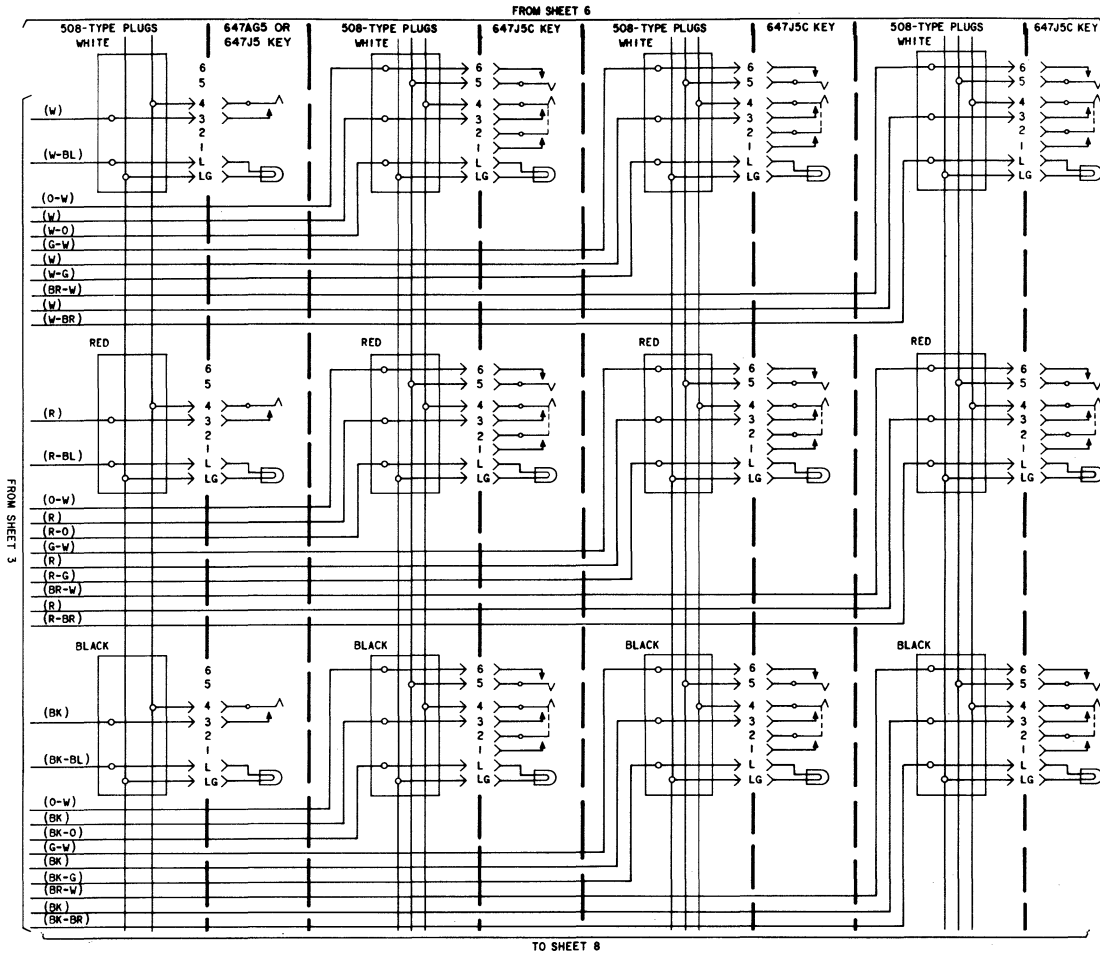


Fig. 89—Schematic of 7A1 Selector Console (DSS) (Sheet 7 of 8)

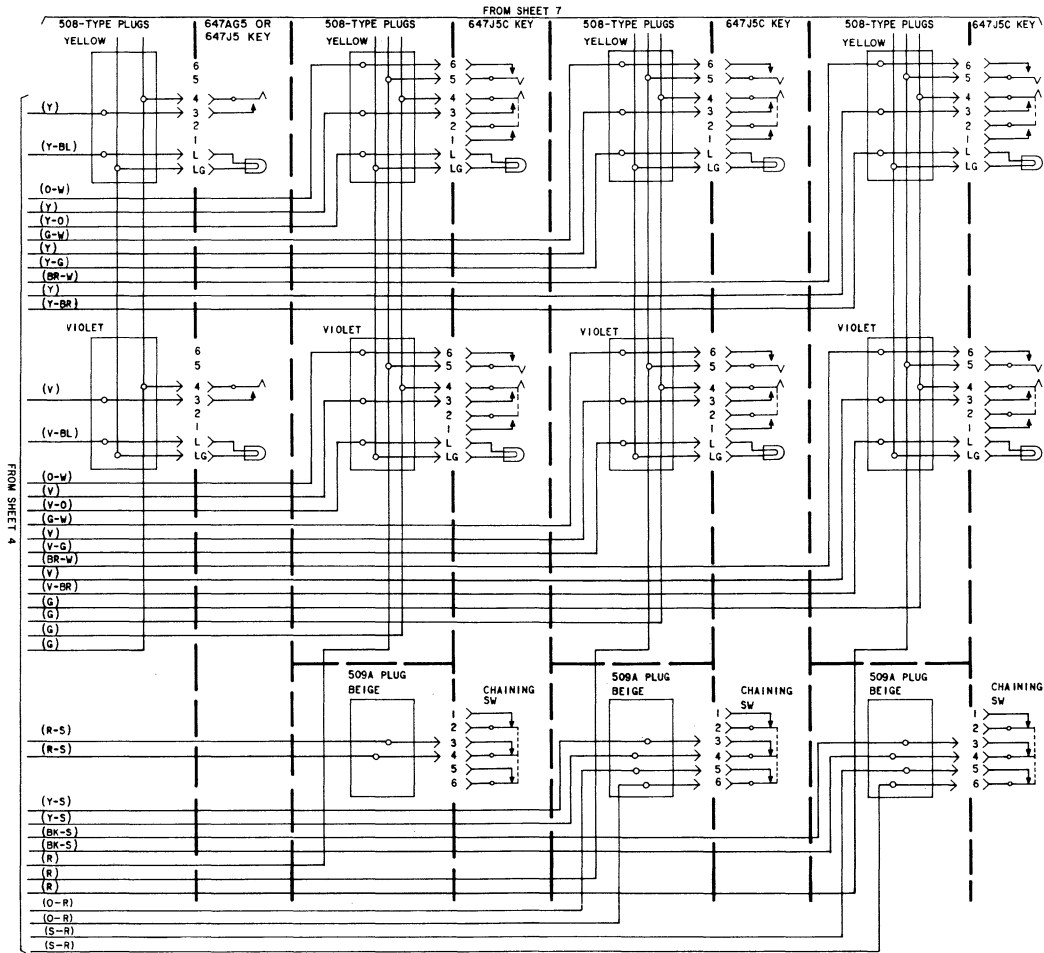


Fig. 89—Schematic of 7A1 Selector Console (DSS) (Sheet 8 of 8)

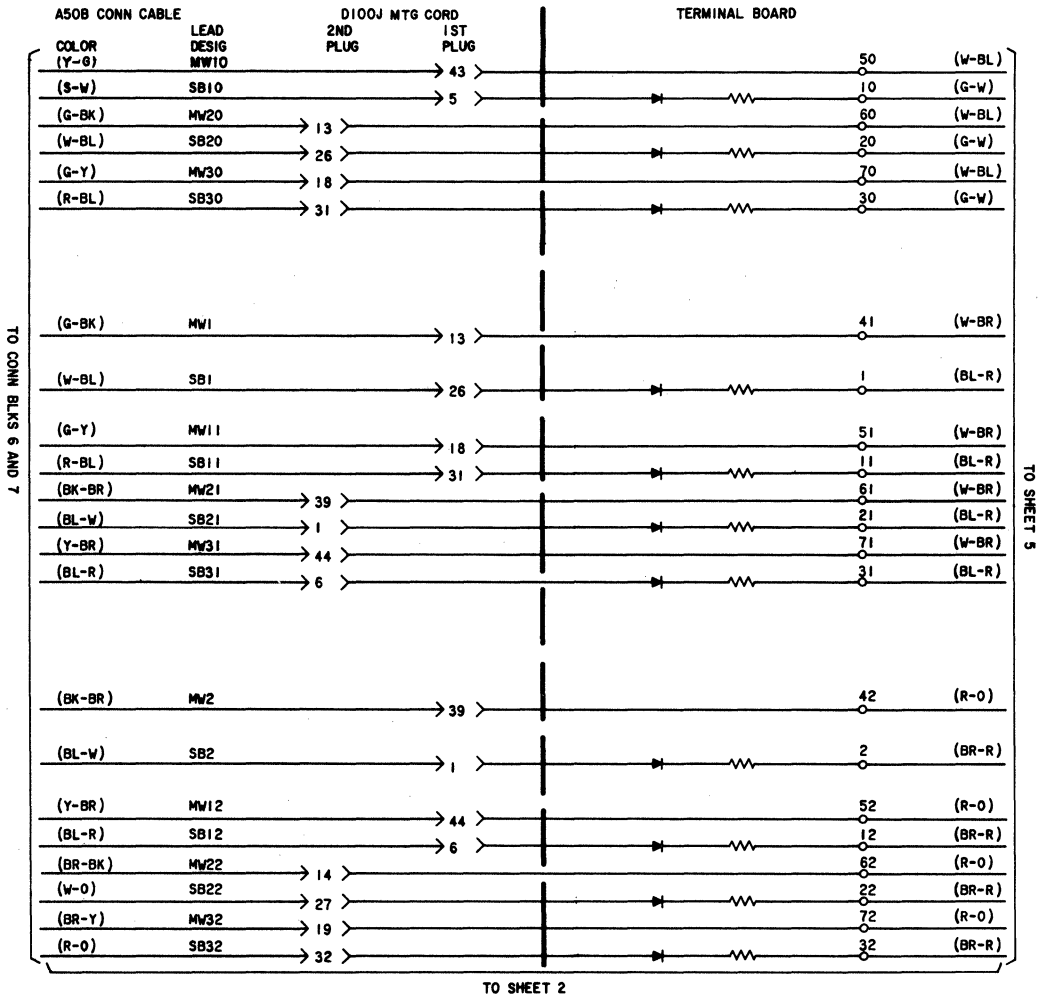


Fig. 90—Schematic of 7B1 Selector Console (Sheet 1 of 8)

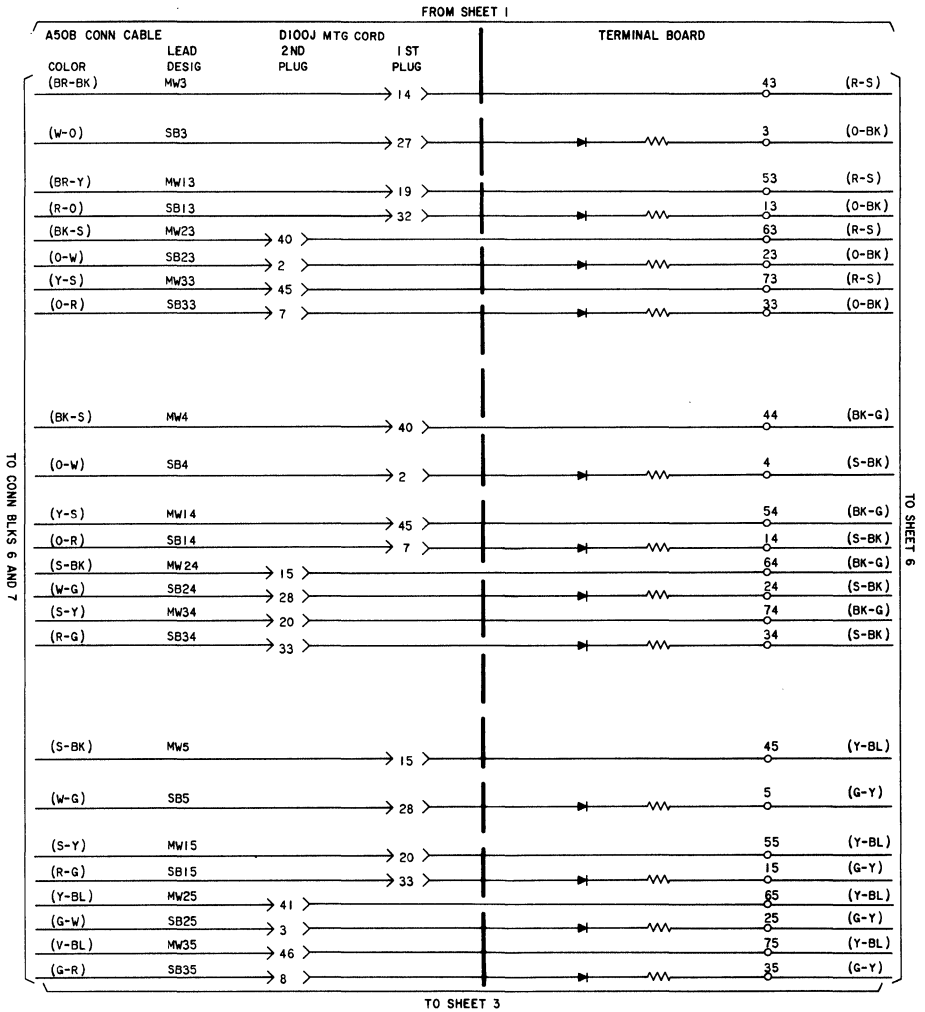


Fig. 90—Schematic of 7B1 Selector Console (Sheet 2 of 8)

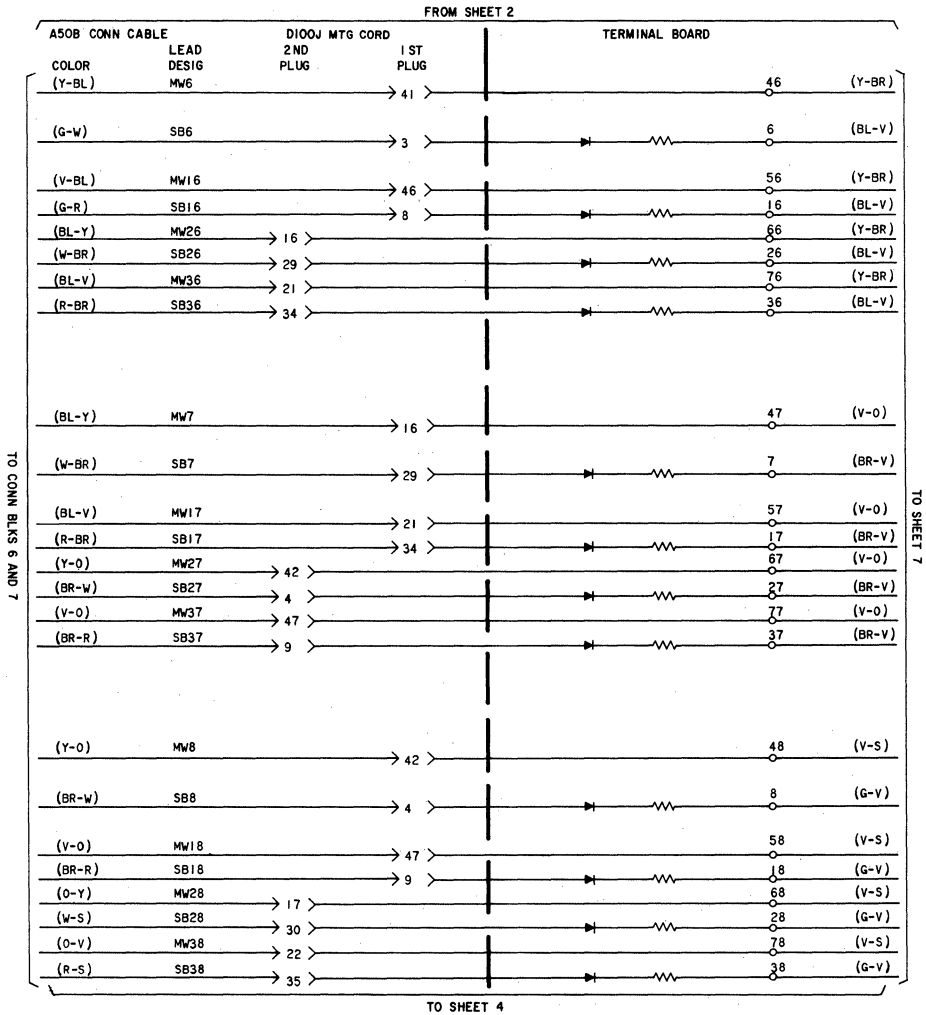


Fig. 90—Schematic of 7B1 Selector Console (Sheet 3 of 8)

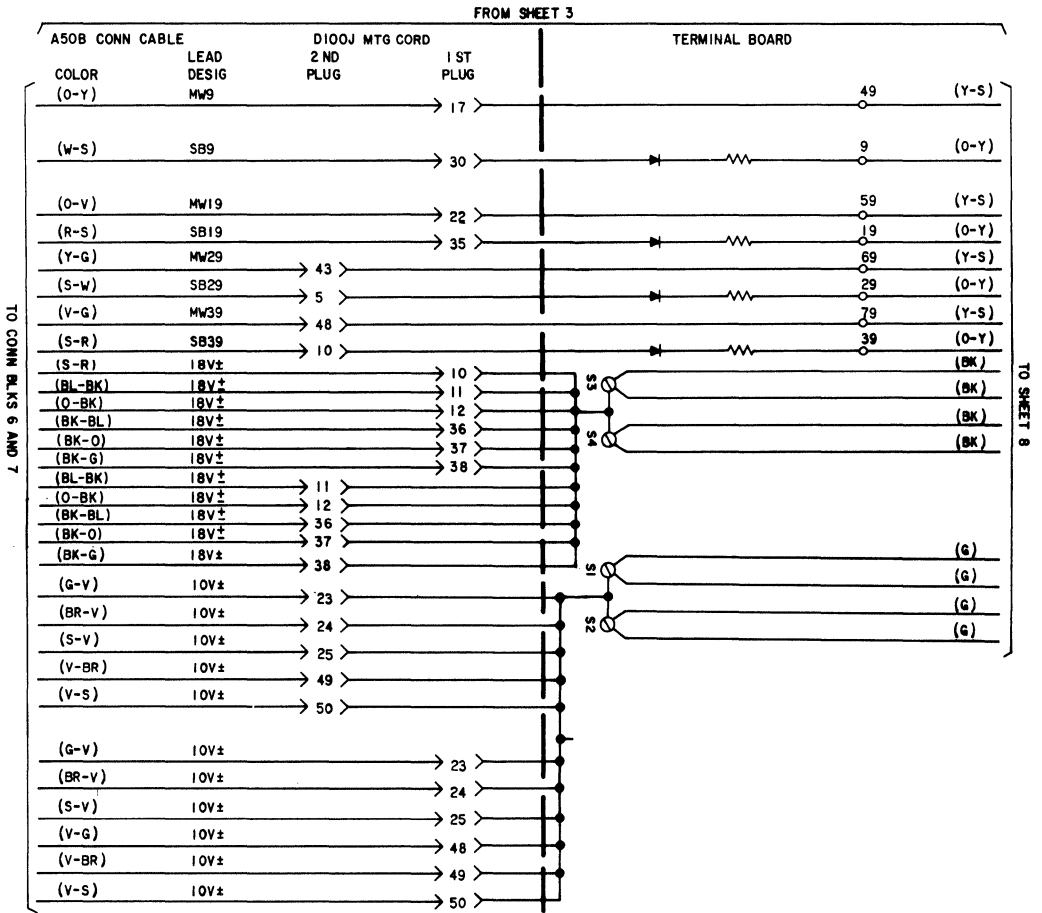


Fig. 90—Schematic of 7B1 Selector Console (Sheet 4 of 8)



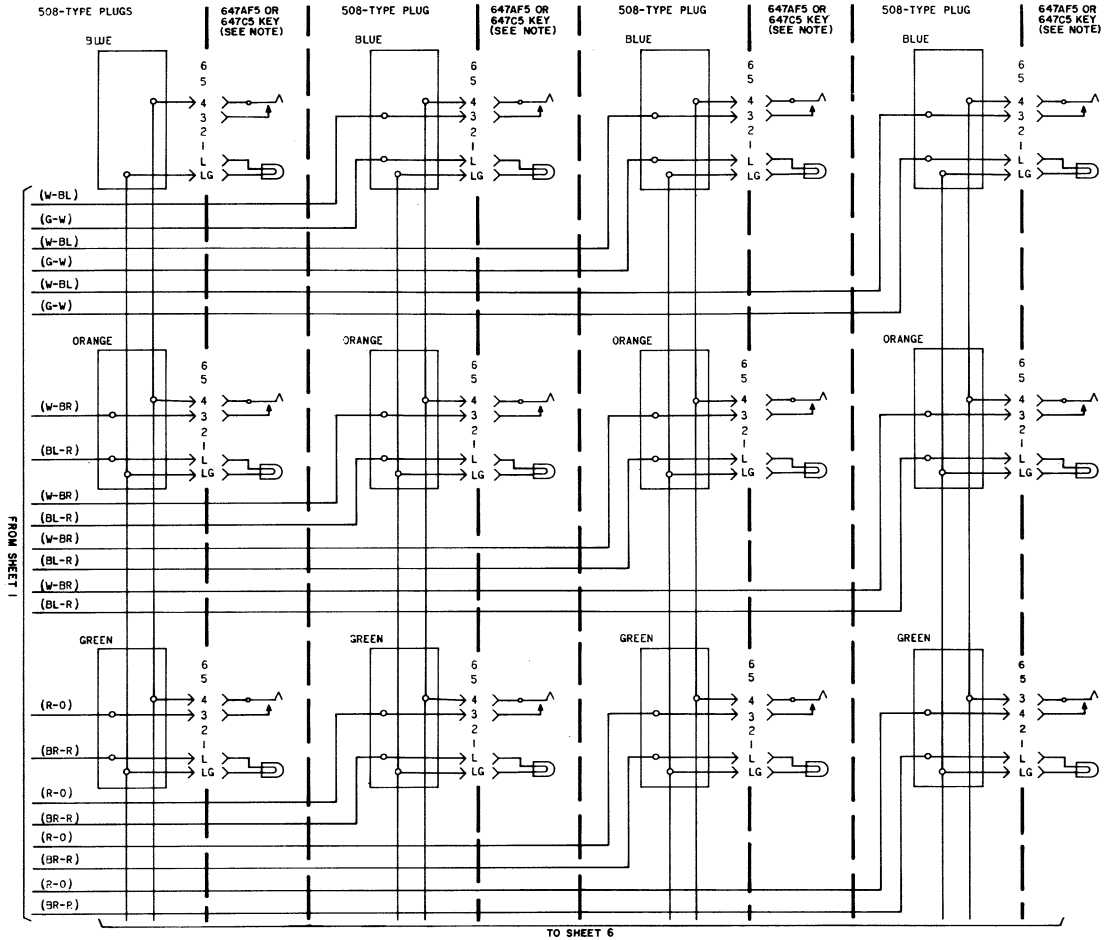


Fig. 90—Schematic of 7B1 Selector Console (Sheet 5 of 8)

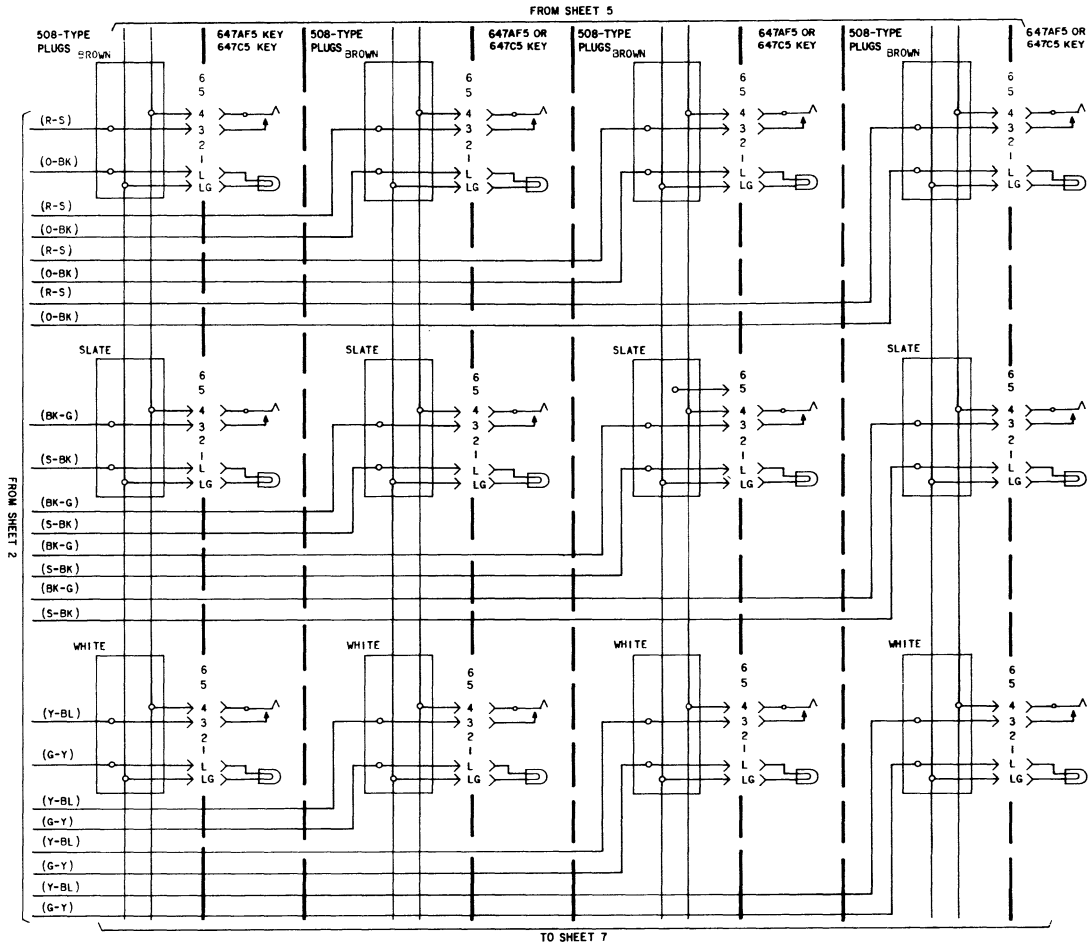


Fig. 90—Schematic of 7B1 Selector Console (Sheet 6 of 8)

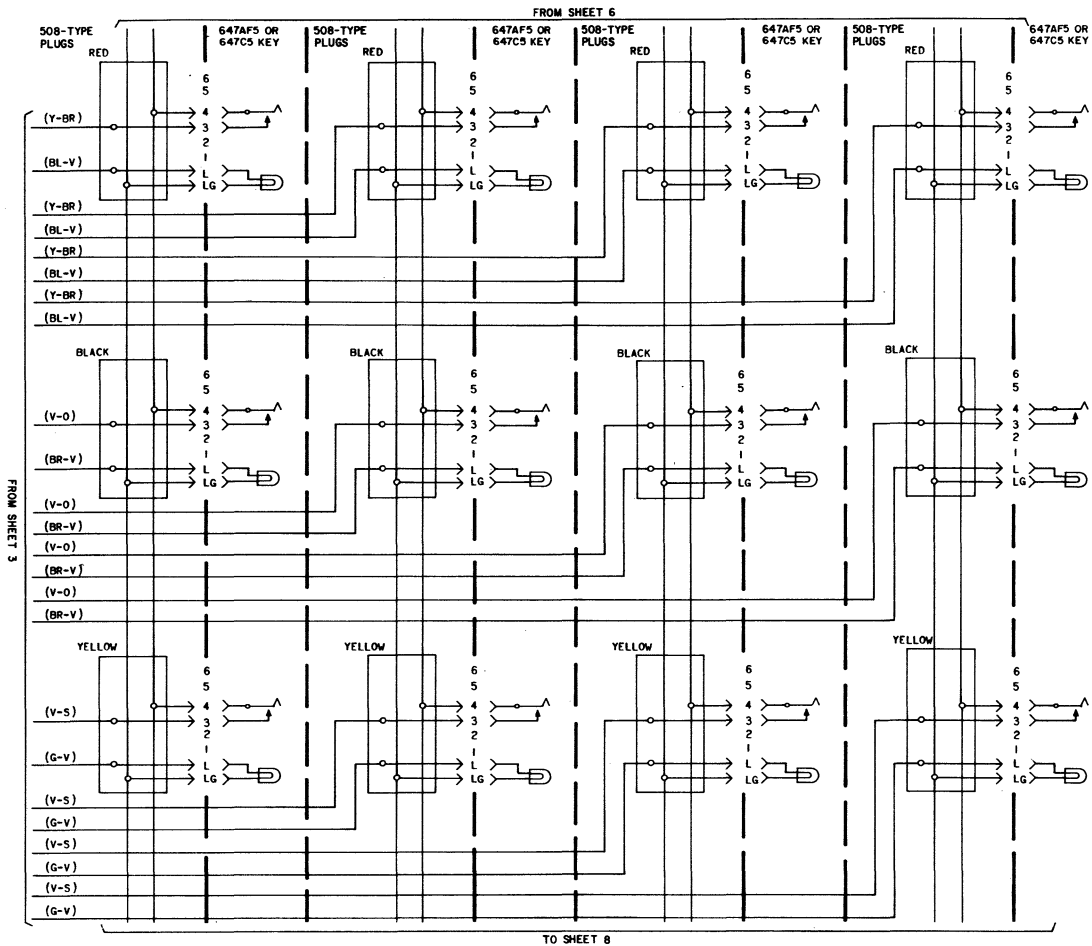
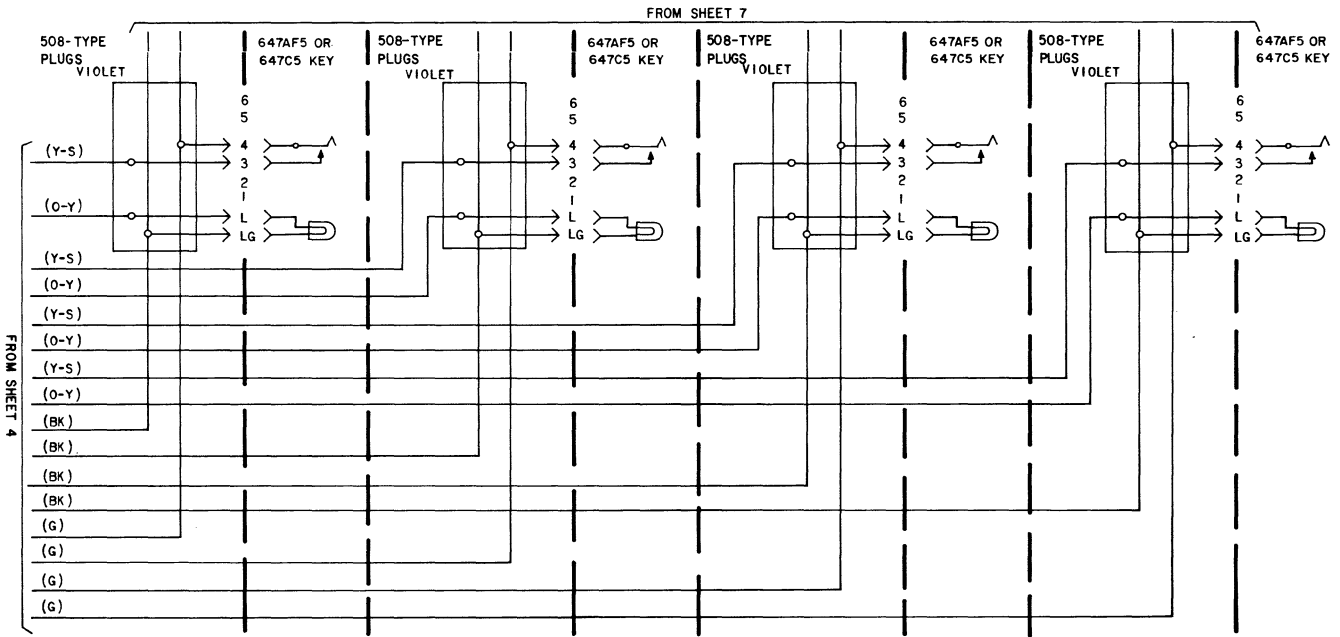


Fig. 90—Schematic of 7B1 Selector Console (Sheet 7 of 8)



NOTE:  
 THE 647AF5 AND 647C5 KEYS ARE ELECTRICALLY INTERCHANGEABLE.  
 THE 647AF5 DOES NOT HAVE CONTACTS IN THE 1-2 AND 5-6  
 PLUG POSITIONS.

Fig. 90—Schematic of 7B1 Selector Console (Sheet 8 of 8)



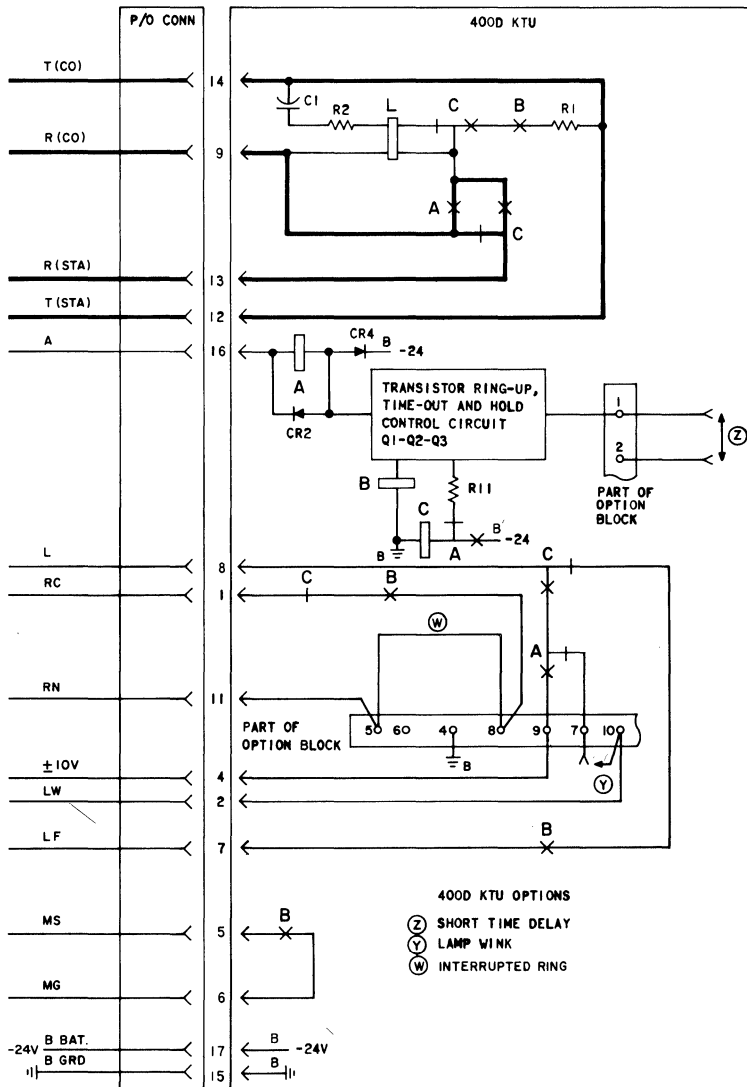


Fig. 91—Condensed Functional Schematic of 400D KTU (CO/PBX Line Circuit) (Sheet 2 of 2)

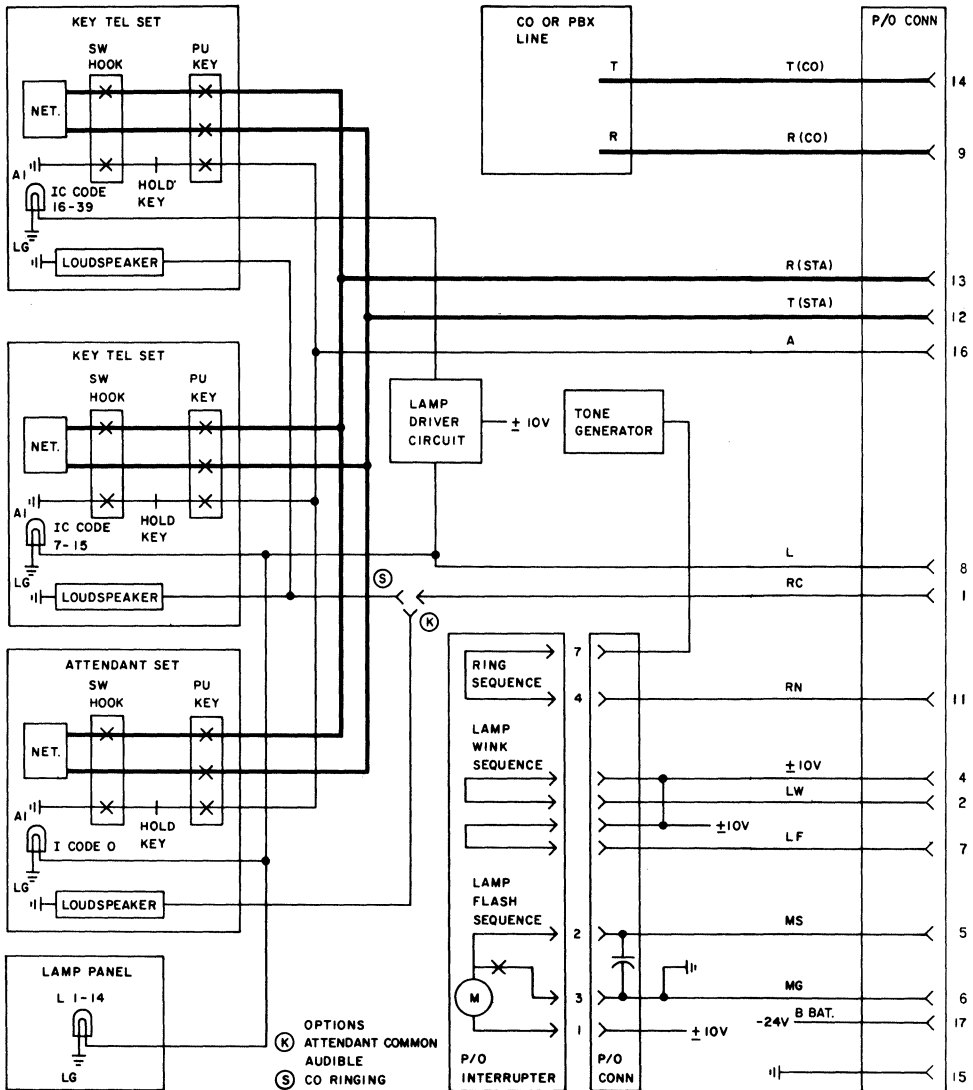


Fig. 92—Condensed Functional Schematic of 400G KTU (CO/PBX Line Circuit) (Sheet 1 of 2)

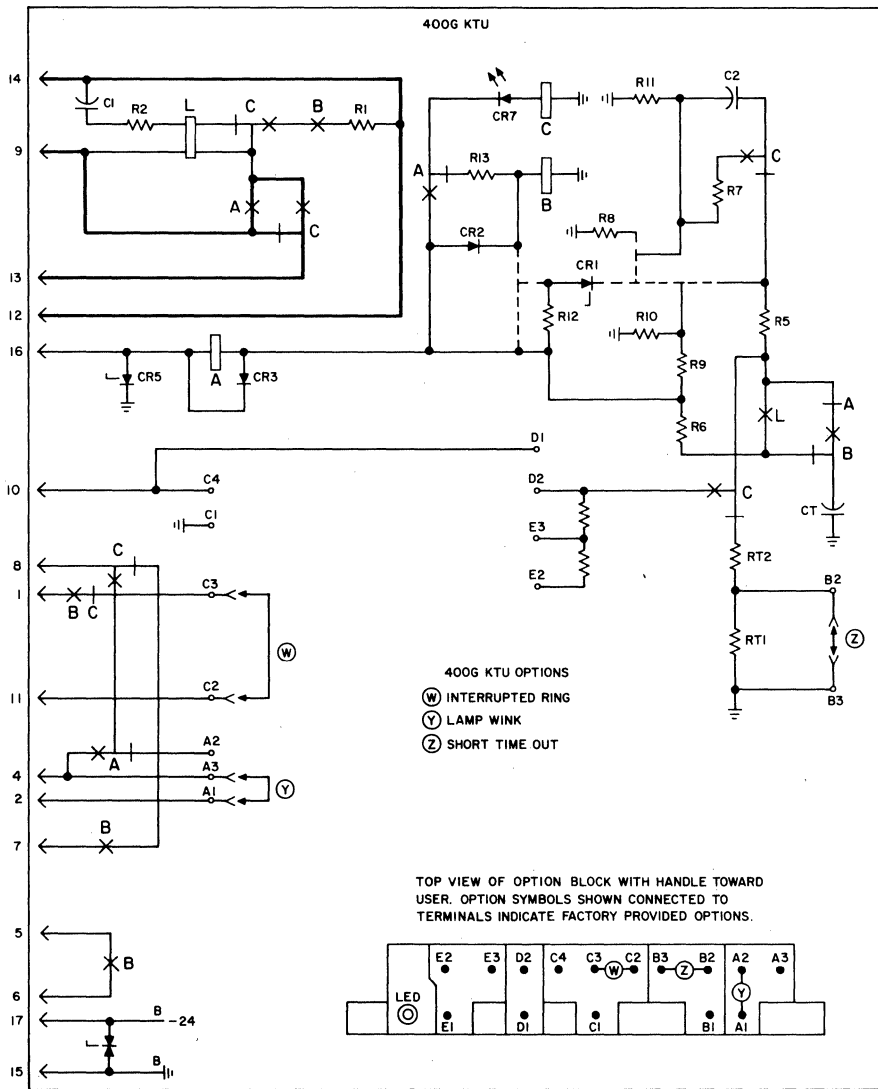


Fig. 92—Condensed Functional Schematic of 400G KTU (CO/PBX Line Circuit) (Sheet 2 of 2)



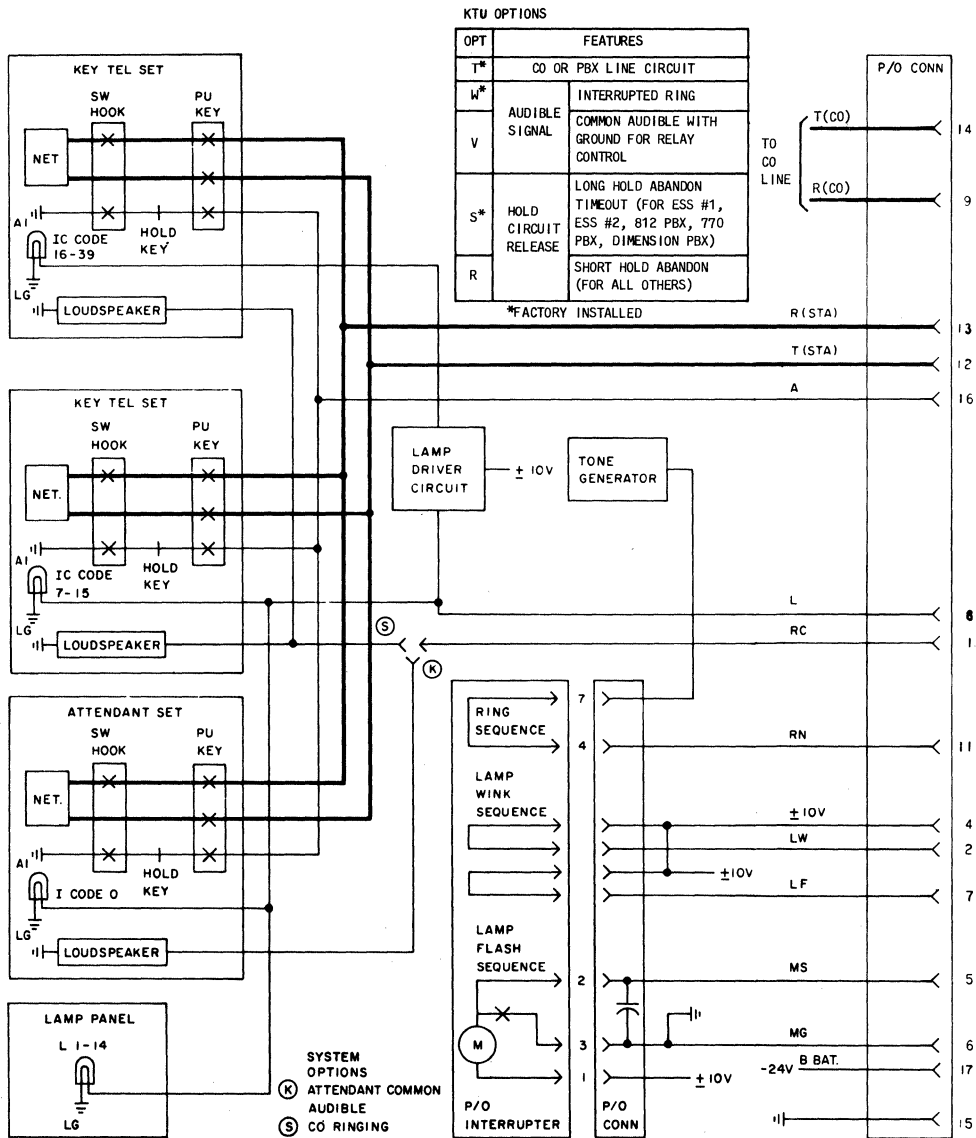


Fig. 93—Condensed Functional Schematic of 400H KTU (CO/PBX Line Circuit) (Sheet 1 of 2)

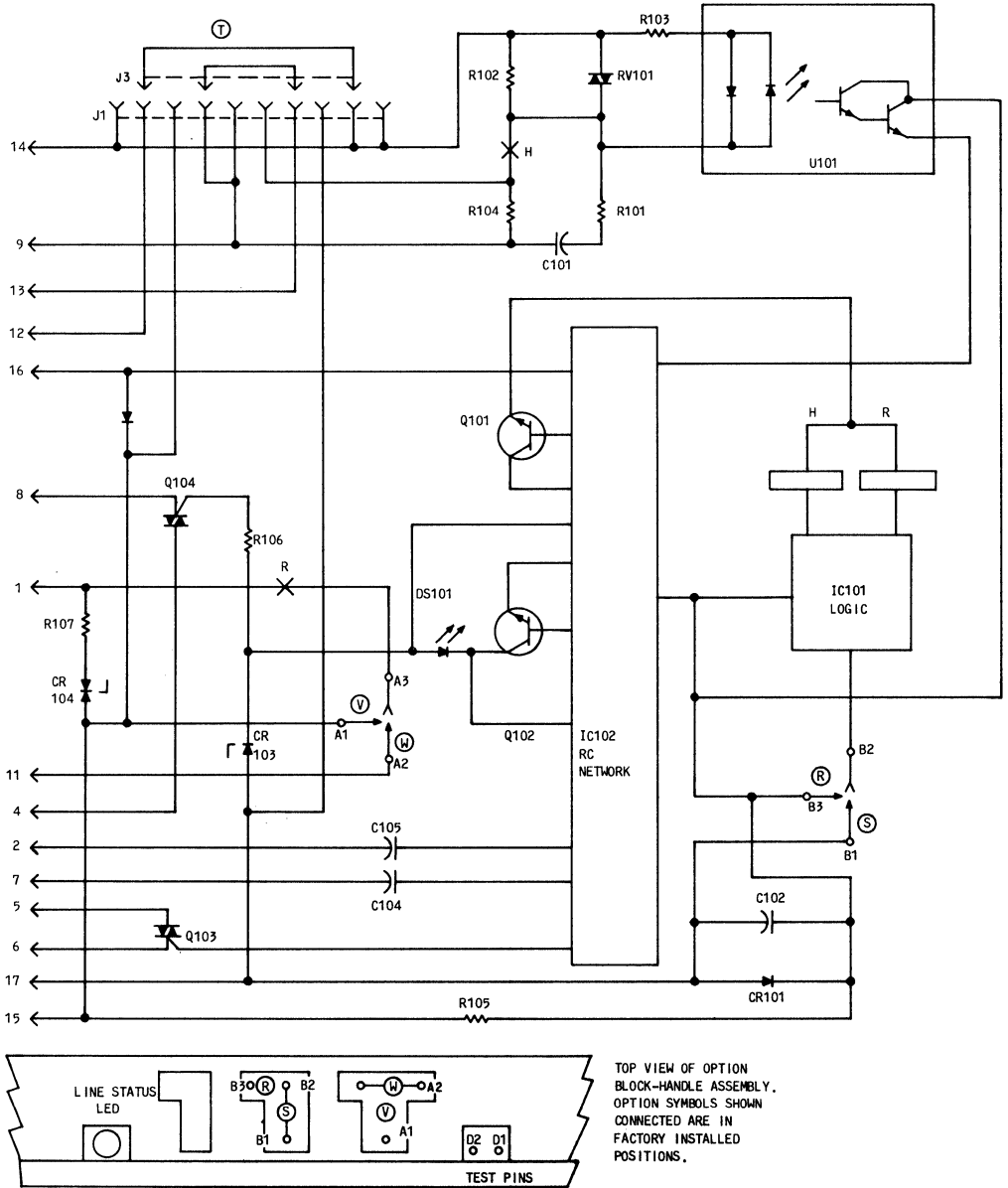


Fig. 93—Condensed Functional Schematic of 400H KTU (CO/PBX Line Circuit) (Sheet 2 of 2)¶

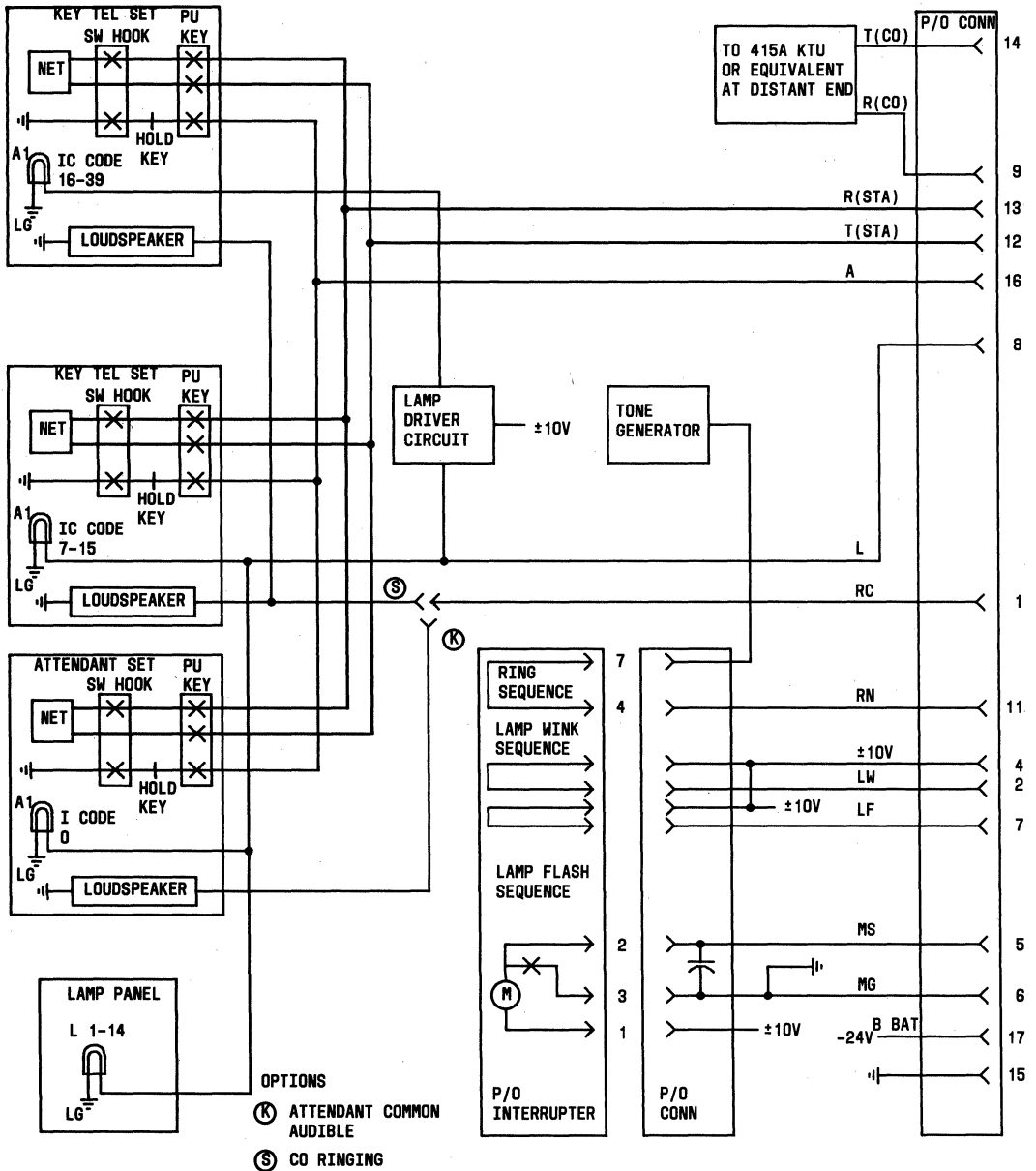


Fig. 94—Condensed Functional Schematic of 415A KTU (Automatic, DC Signaling, Private Line Circuit) (Sheet 1 of 2)

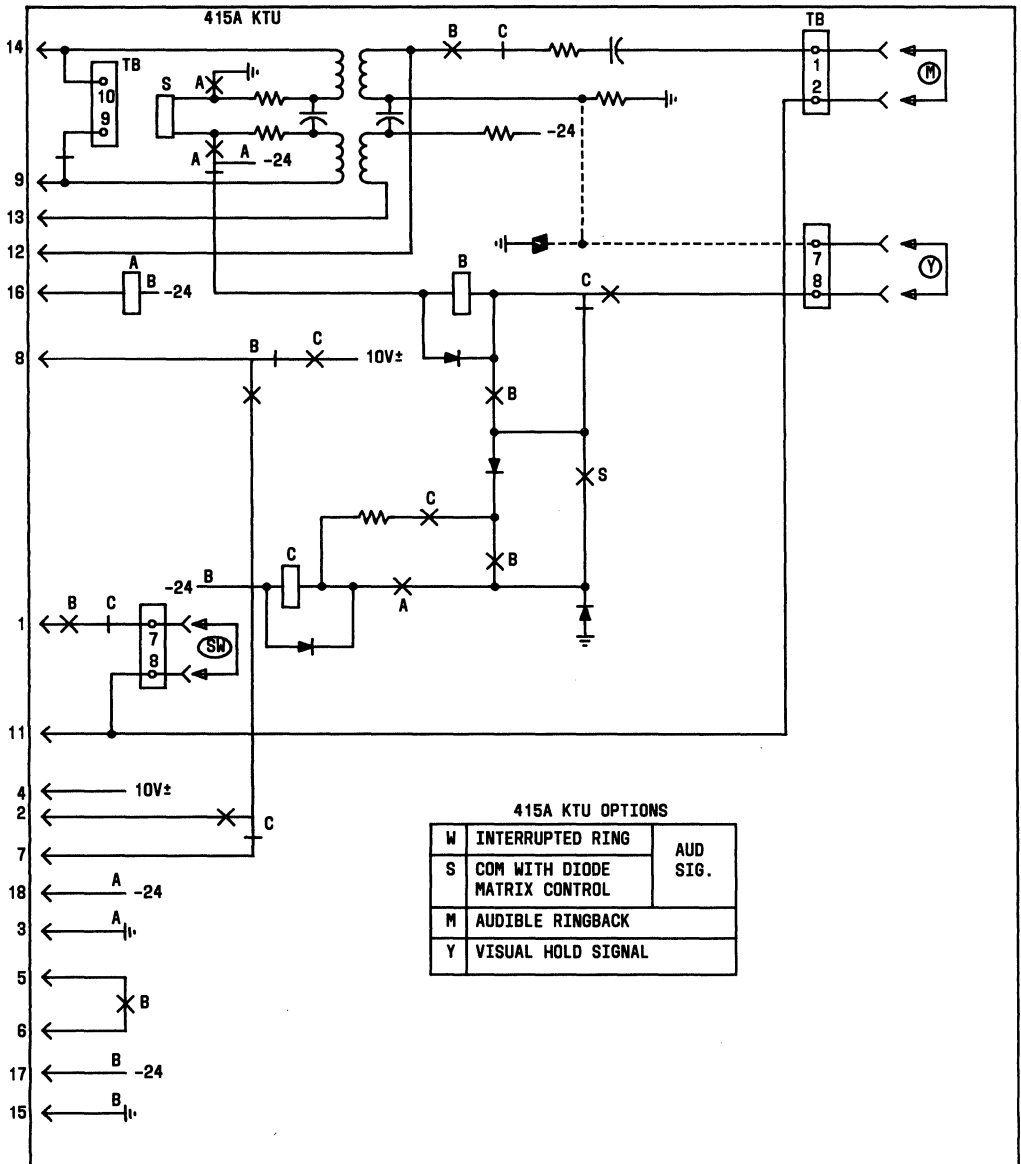
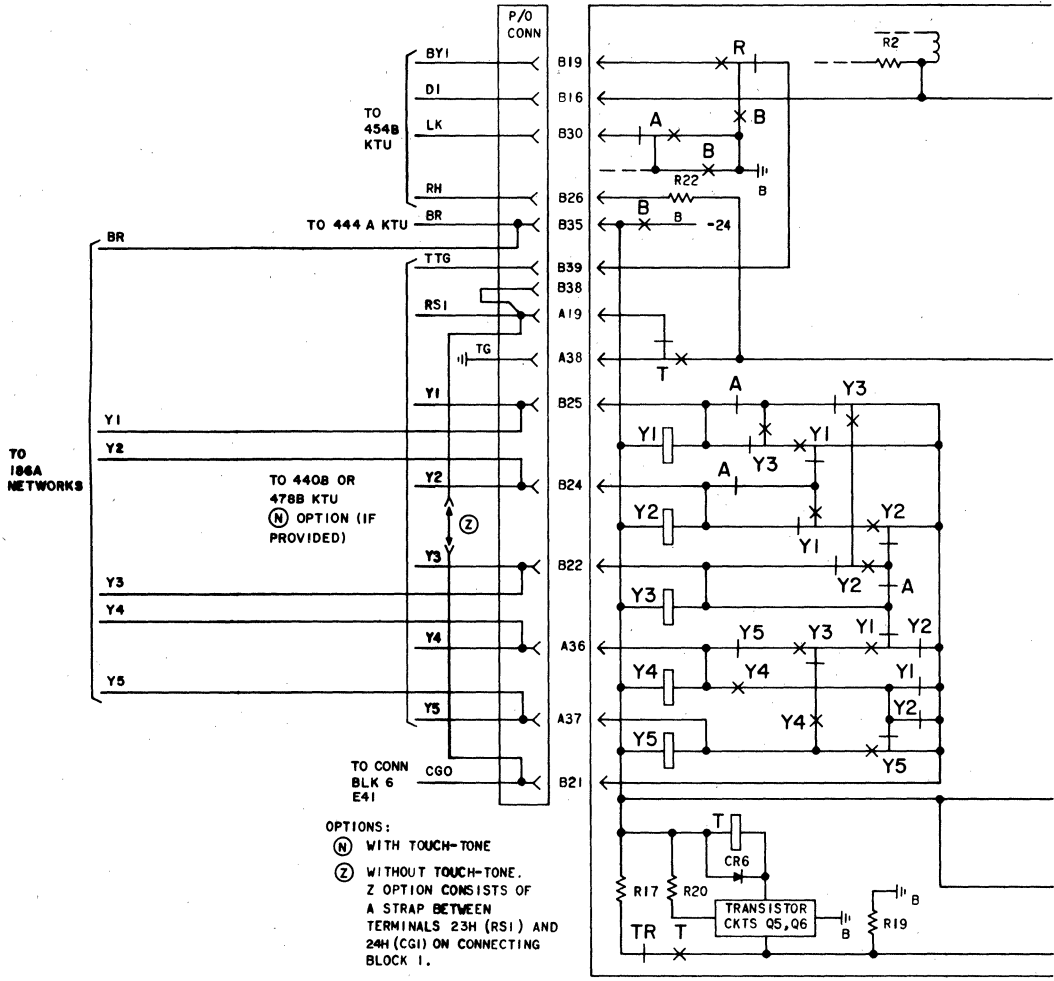


Fig. 94—Condensed Functional Schematic of 415A KTU (Automatic, DC Signaling, Private Line Circuit) (Sheet 2 of 2)



OPTIONS:  
 (N) WITH TOUCH-TONE  
 (Z) WITHOUT TOUCH-TONE.  
 Z OPTION CONSISTS OF A STRAP BETWEEN TERMINALS 23H (RS1) AND 24H (CG1) ON CONNECTING BLOCK 1.

Fig. 95—Condensed Functional Schematic of 424C KTU (Dial Intercom 19-Code Selector Circuit) (Sheet 1 of 2)

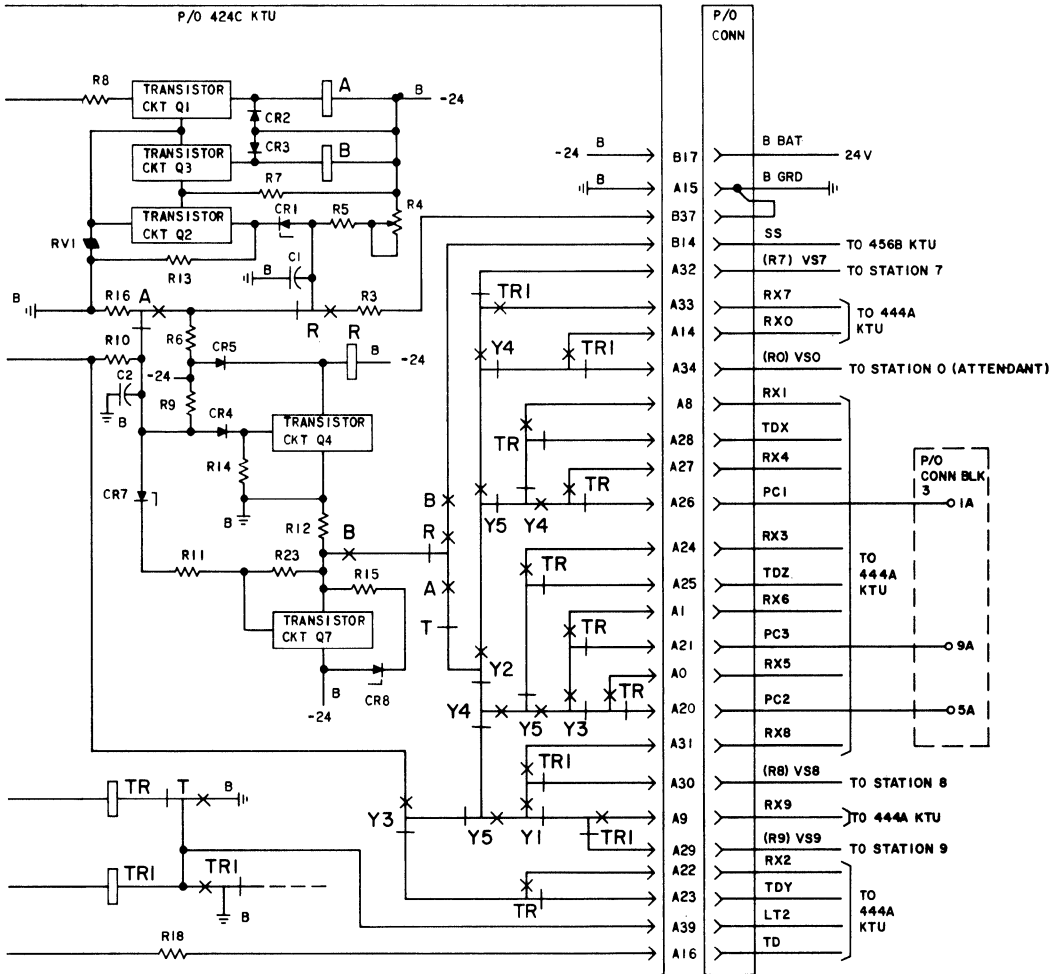


Fig. 95—Condensed Functional Schematic of 424C KTU (Dial Intercom 19-Code Selector Circuit) (Sheet 2 of 2)

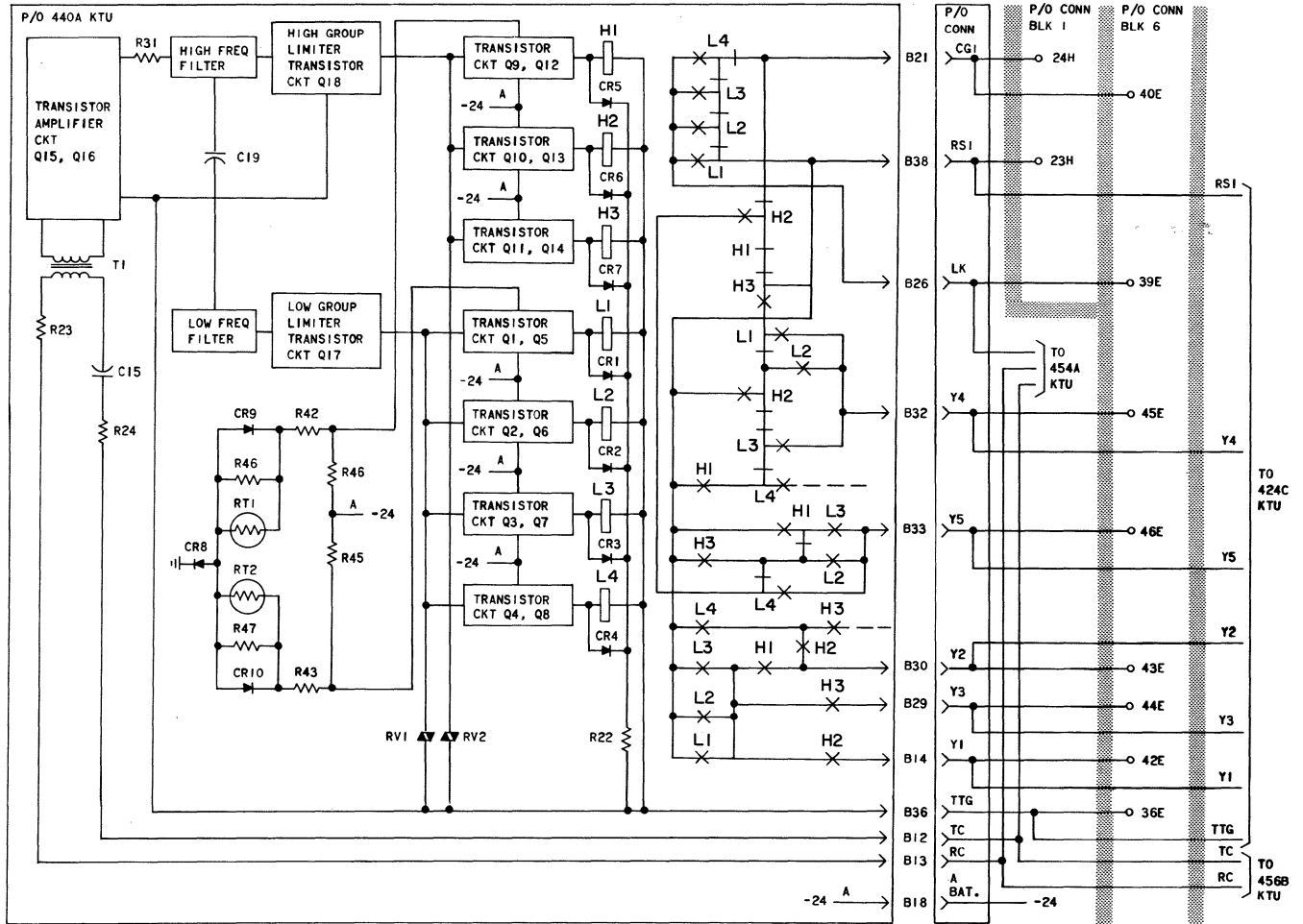


Fig. 96—Condensed Functional Schematic of 440A KTU (TOUCH-TONE Adapter Circuit)

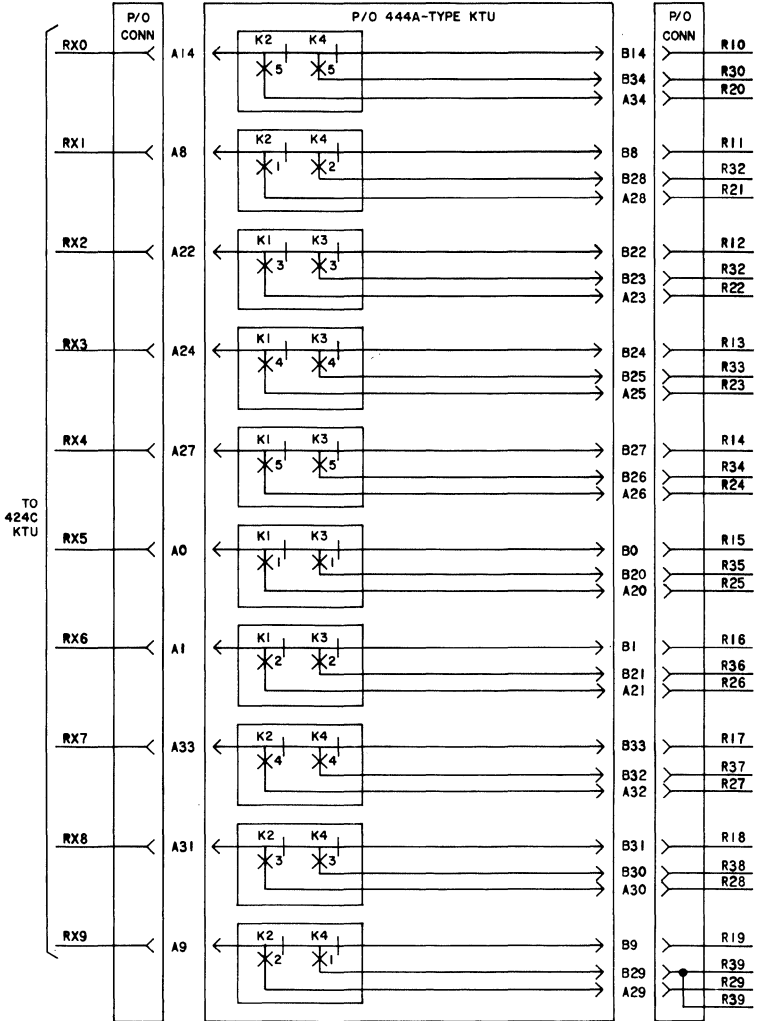


Fig. 97—Condensed Functional Schematic of 444-Type KTU (Selector Extender Circuit) (Sheet 1 of 3)



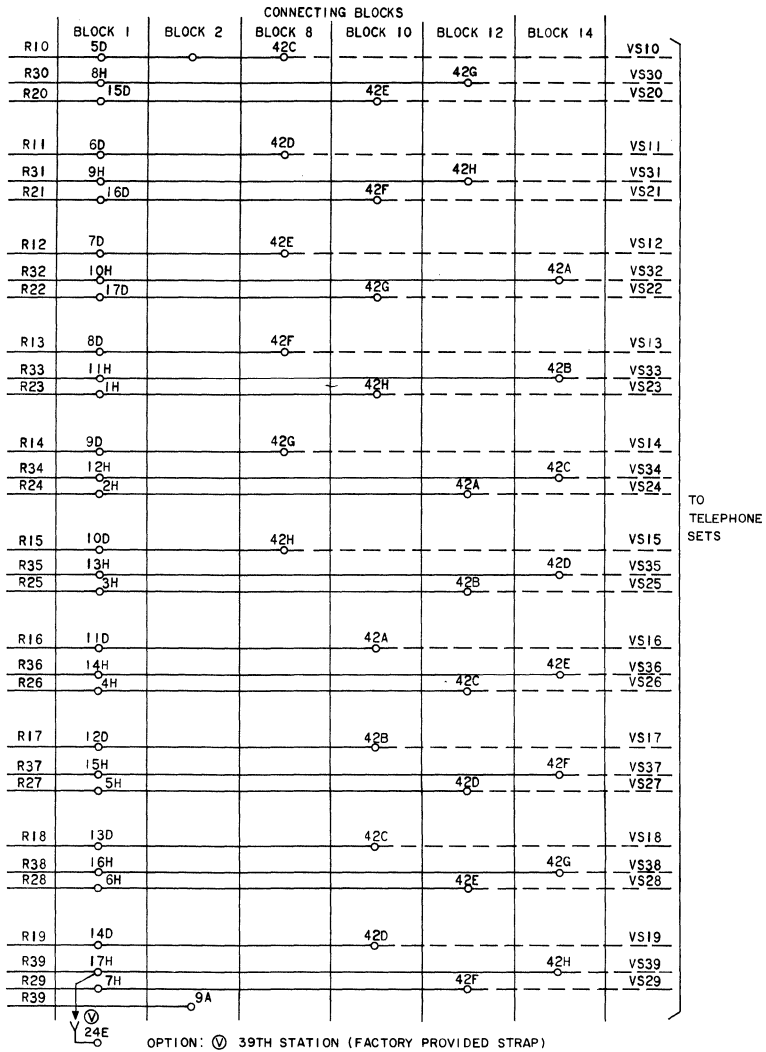


Fig. 97—Condensed Functional Schematic of 444-Type KTU (Selector Extender Circuit) (Sheet 2 of 3)

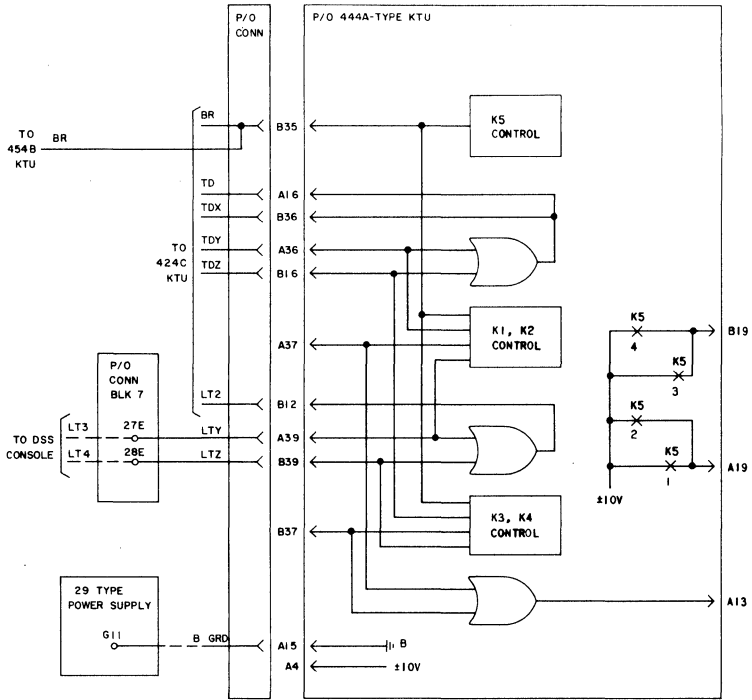


Fig. 97—Condensed Functional Schematic of 444-Type KTU (Selector Extender Circuit) (Sheet 3 of 3)

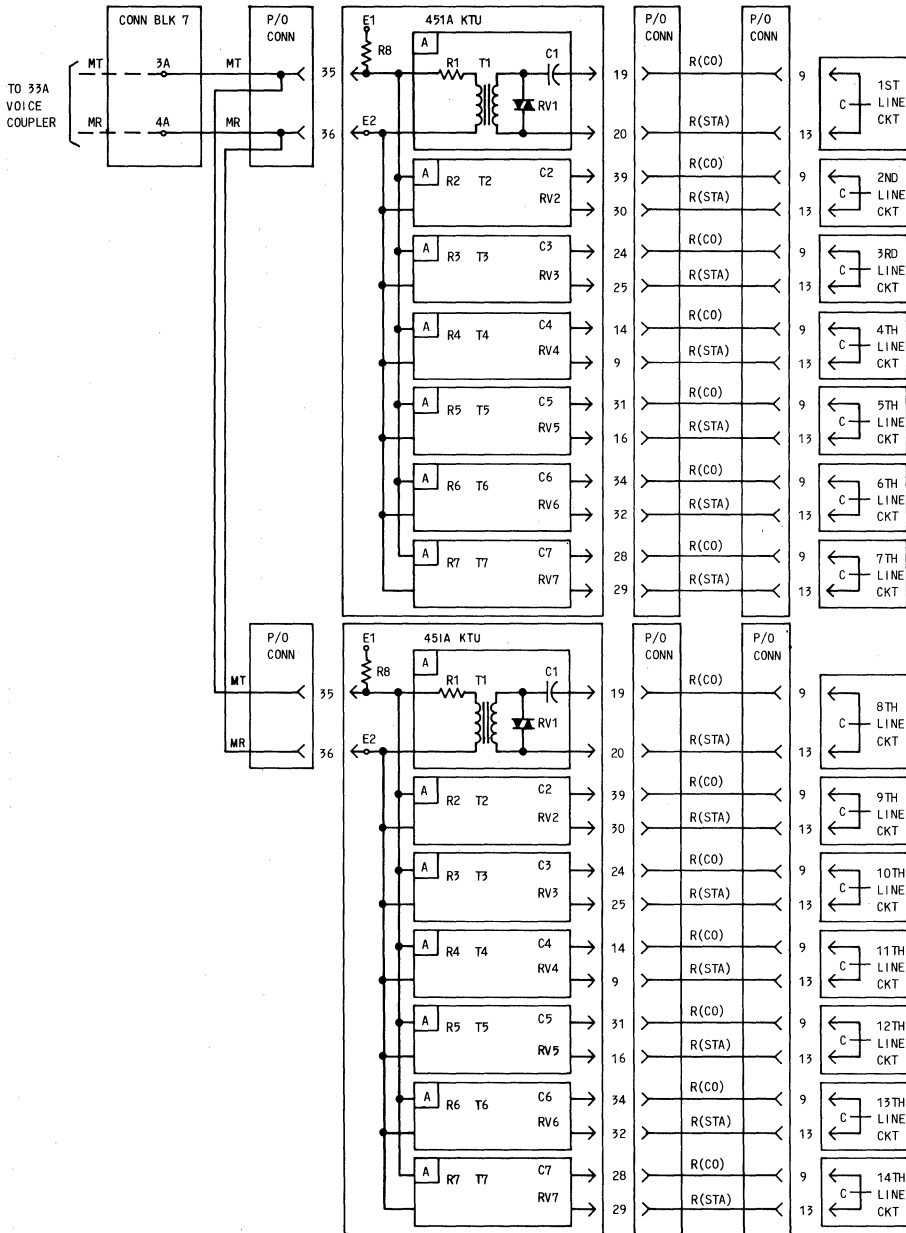


Fig. 98—Condensed Functional Schematic of 451A KTU (Music-On-Hold Circuit) as Used With 580A KSU

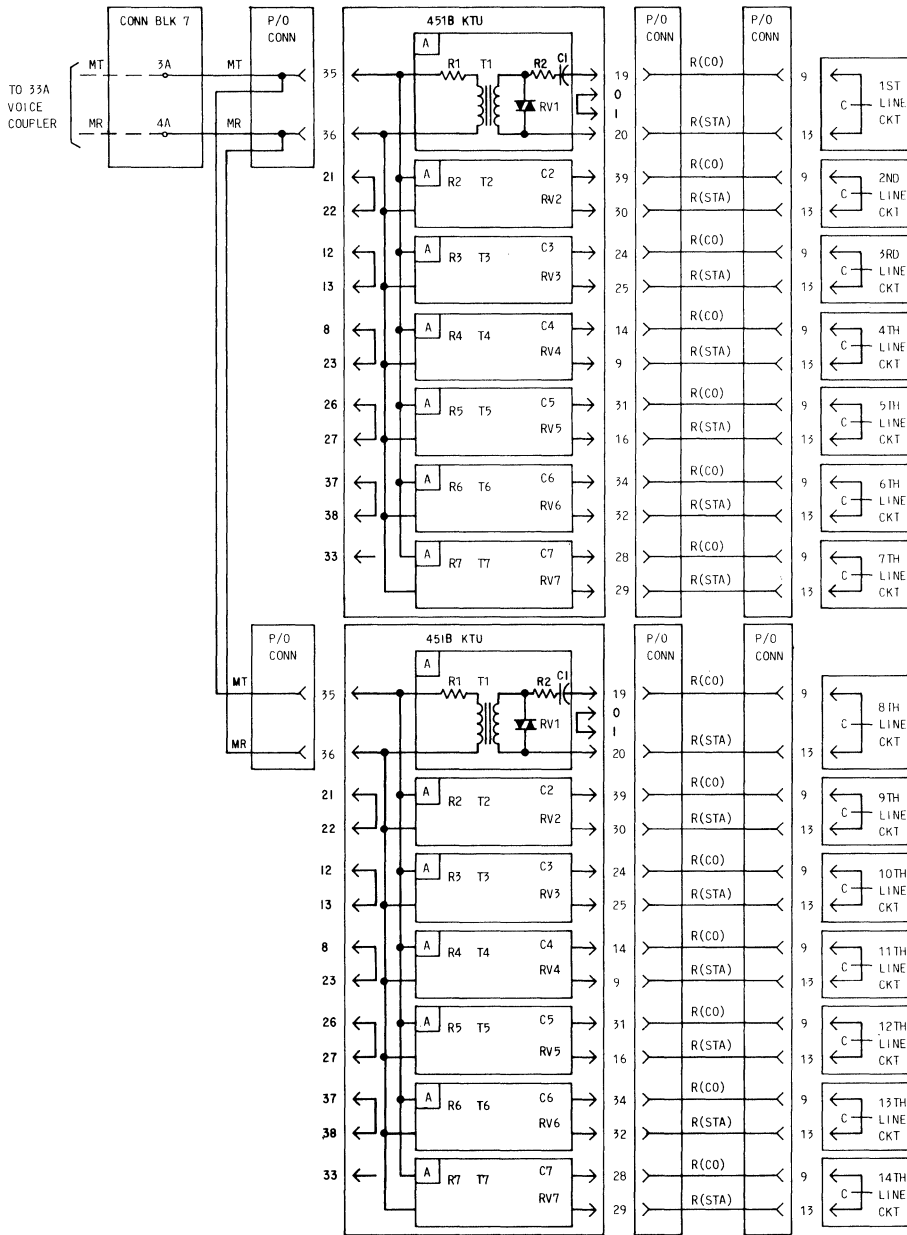


Fig. 99—Condensed Functional Schematic of 451B KTU (Music-On-Hold Circuit) as Used With 580A KSU

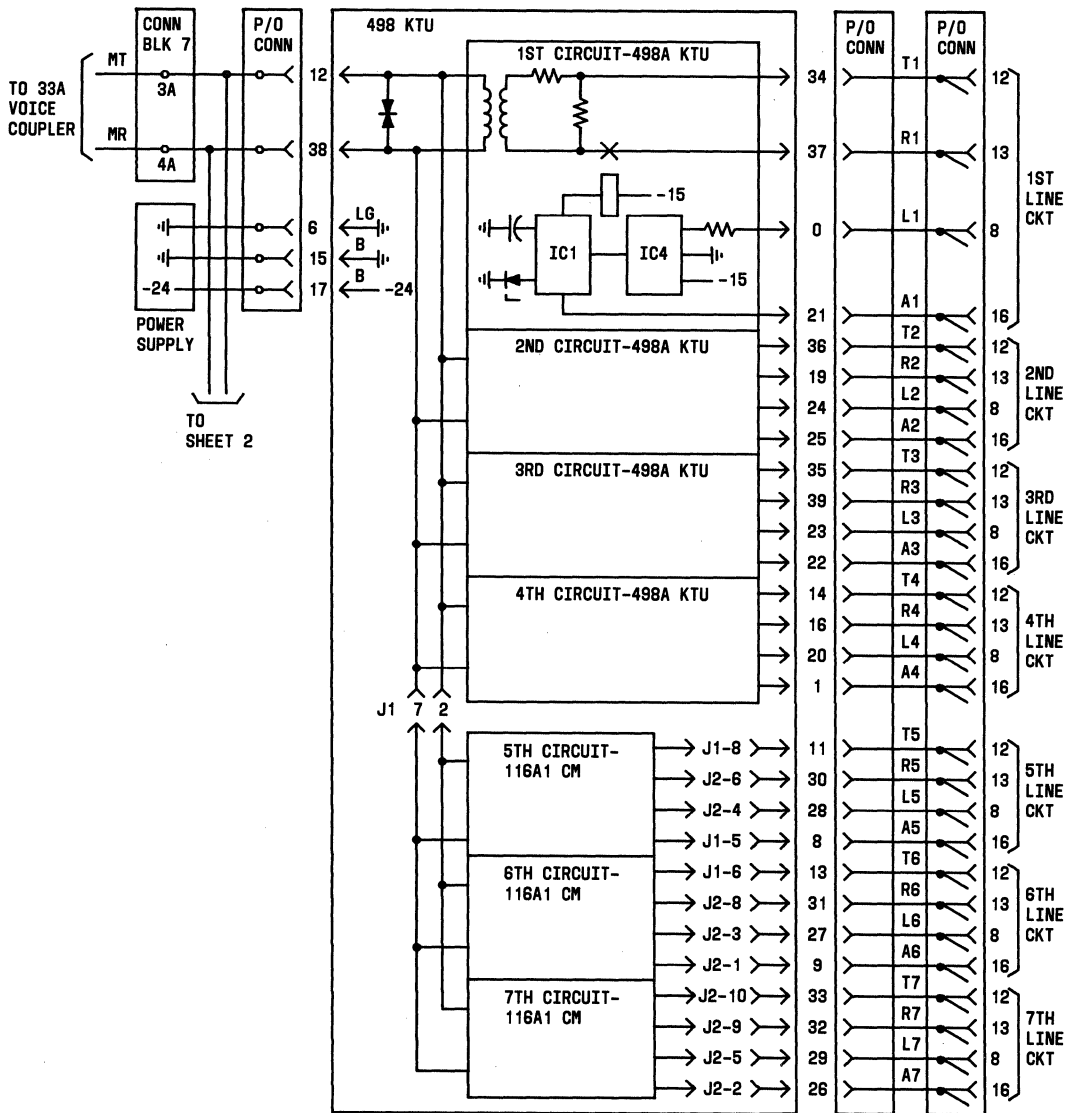


Fig. 100—Condensed Functional Schematic of 498A KTU (Music-On-Hold Circuit) as Used With 580B KSU (Sheet 1 of 2)†

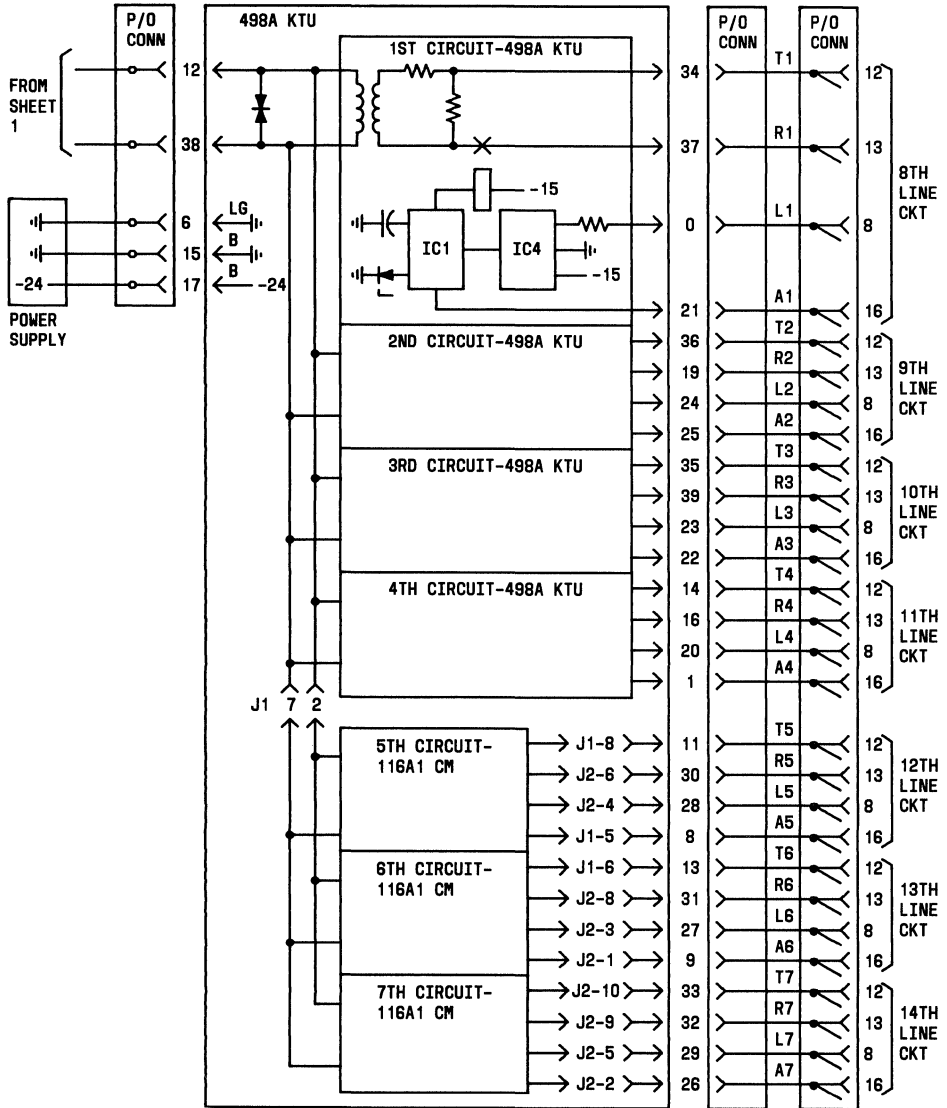


Fig. 100—Condensed Functional Schematic of 498A KTU (Music-On-Hold Circuit) as Used With 580B KSU (Sheet 2 of 2)

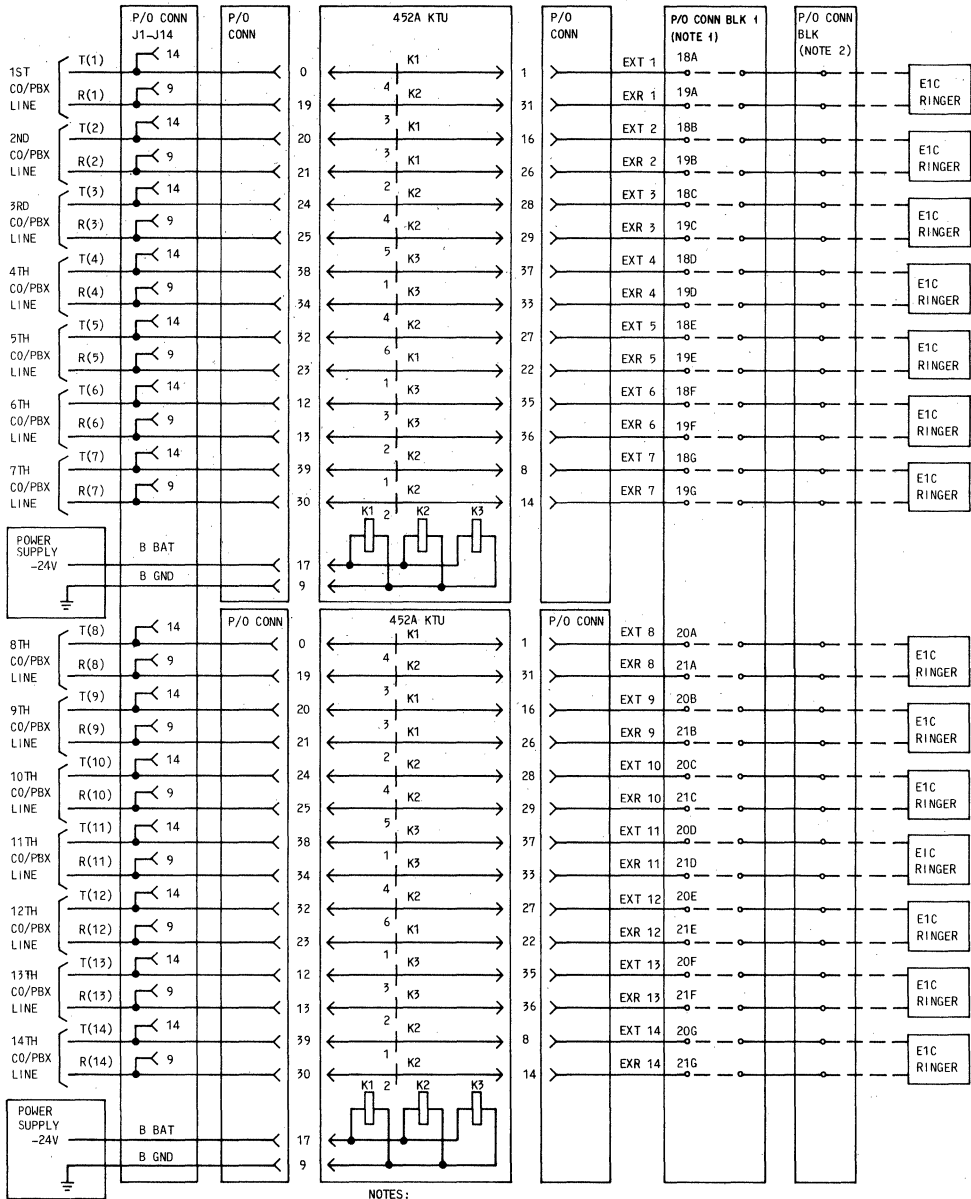


Fig. 101—Condensed Functional Schematic of 452A KTU (Power Failure Ringing Circuit)

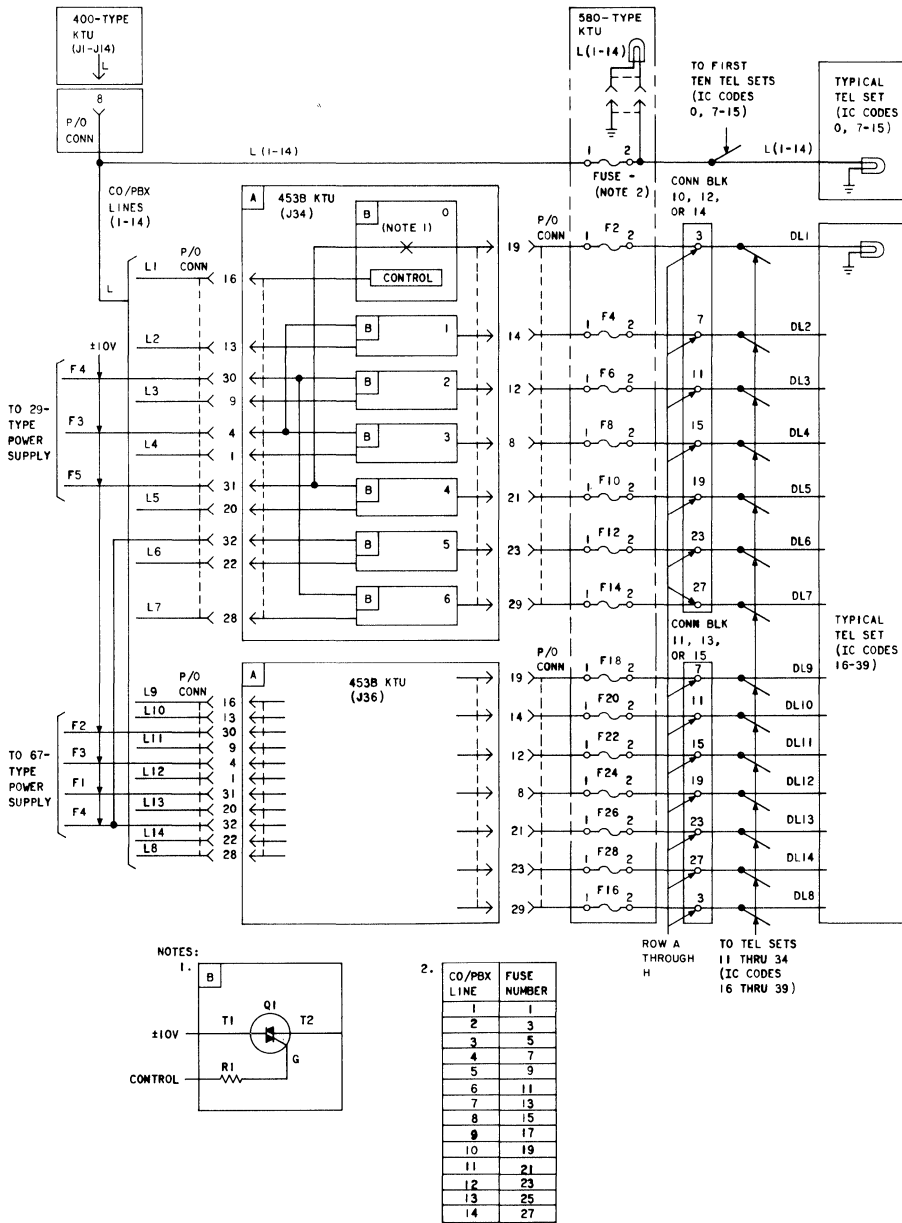


Fig. 102—Condensed Functional Schematic of 453B KTU (Lamp Driver Circuit)



454B KTU

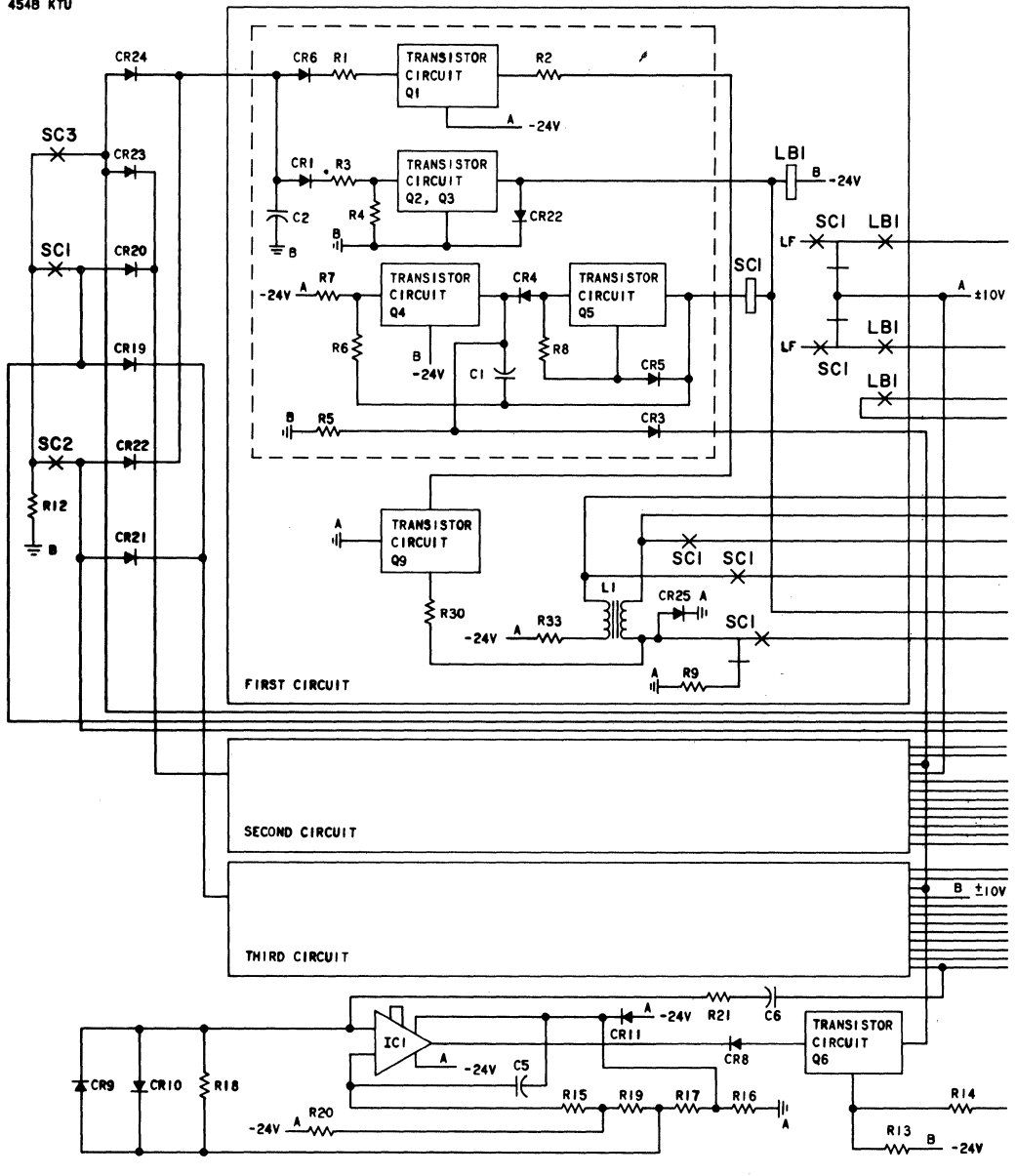


Fig. 103—Condensed Functional Schematic of 454B KTU (3-Path Access Circuit) (Sheet 1 of 2)

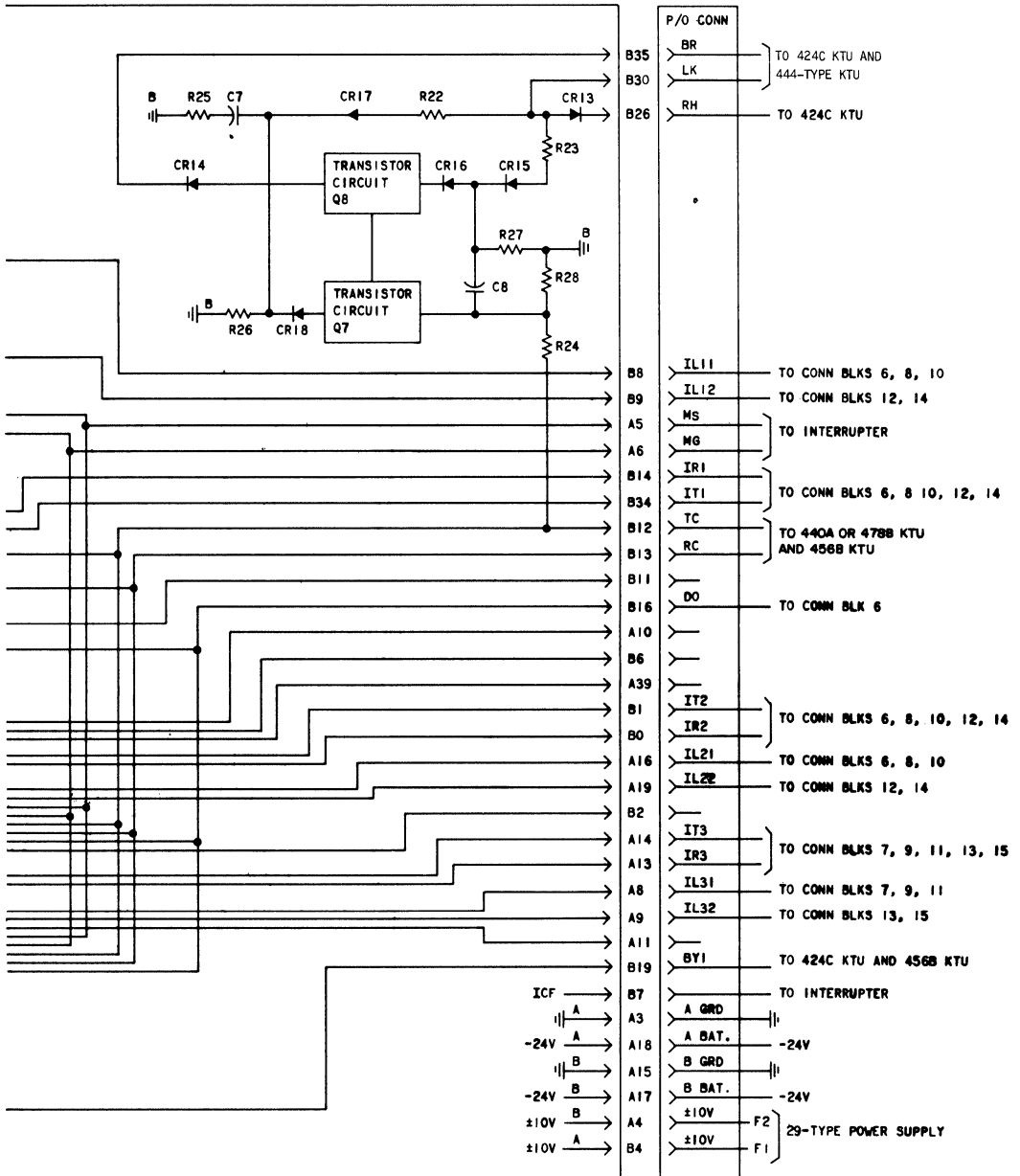


Fig. 103—Condensed Functional Schematic of 454B KTU (3-Path Access Circuit) (Sheet 2 of 2)

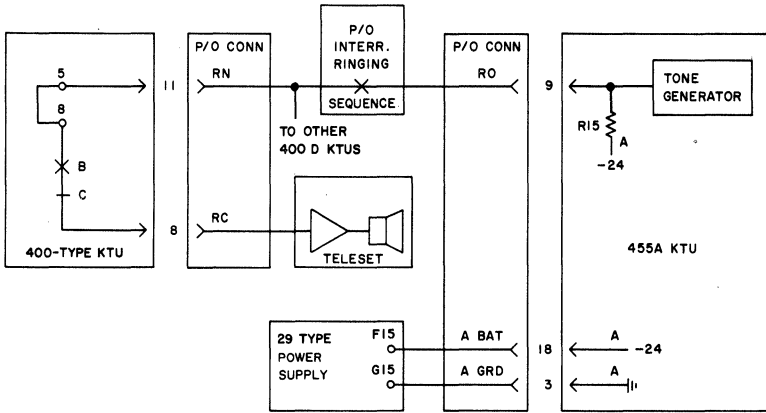


Fig. 104—Condensed Functional Schematic of 455A KTU (Tone Ringing Signal Generator)

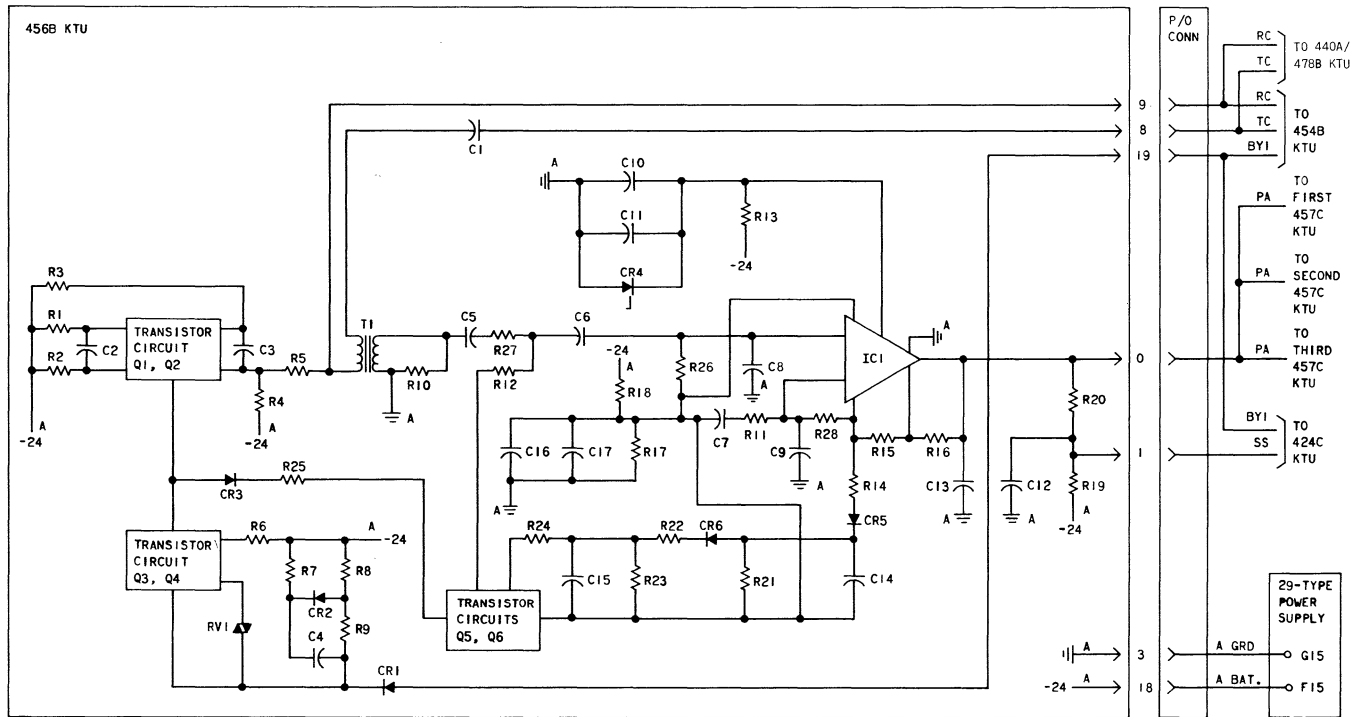


Fig. 105—Condensed Functional Schematic of 456B KTU (Voice and Tone Alerting Circuit)

NOTES:

1. SEE TABLE E FOR CONNECTIONS.
2. SEE FIGURE 32.
- FOR SPEAKER CONNECTIONS,
3. FUSE 46 FOR FIRST 497C (ZONE 1)  
FUSE 47 FOR SECOND 497C (ZONE 2)  
FUSE 48 FOR THIRD 497C (ZONE 3)

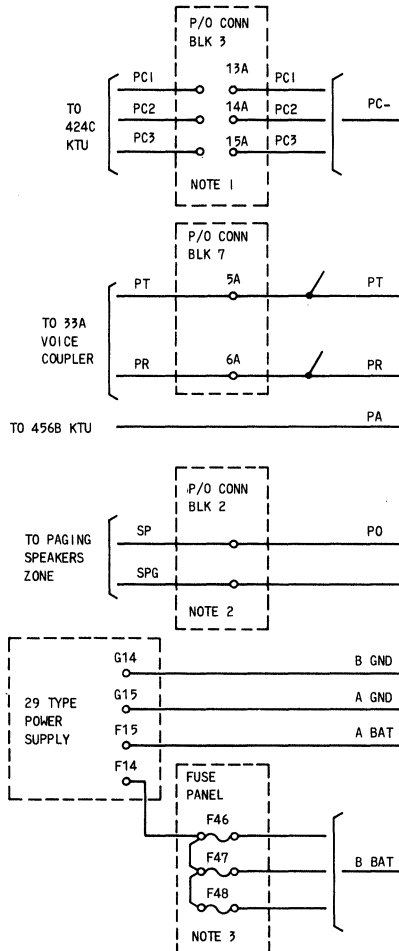


Fig. 106—Condensed Functional Schematic of 457C KTU (Paging Amplifier Circuit) (Sheet 1 of 2)

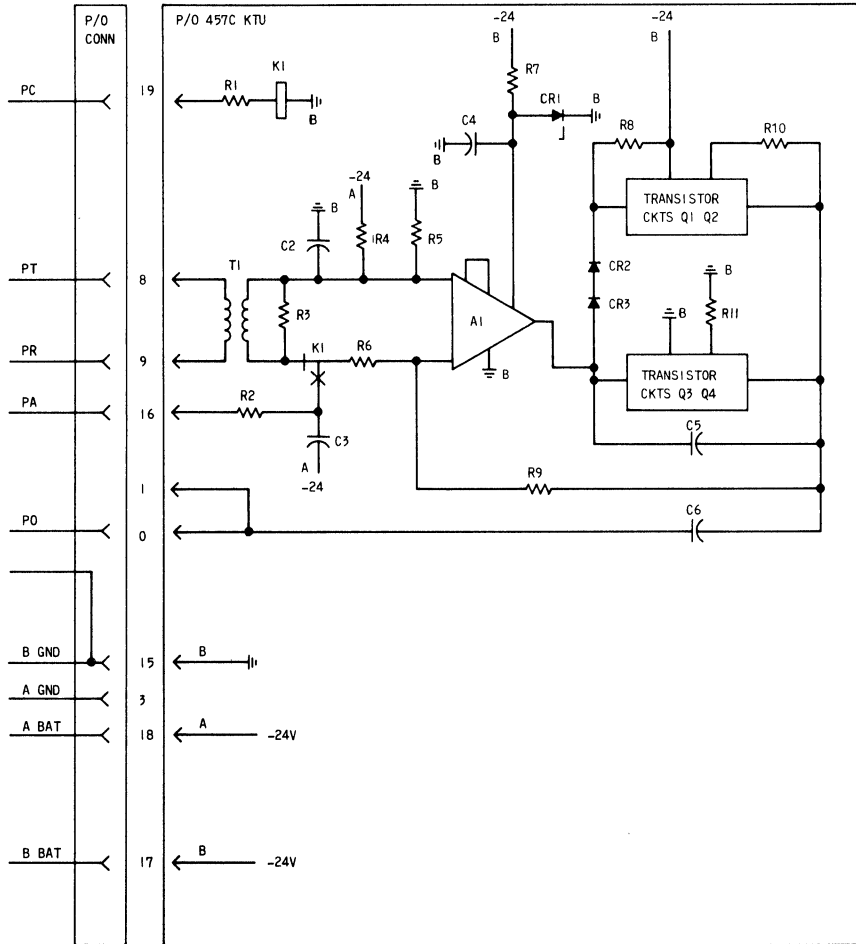


Fig. 106—Condensed Functional Schematic of 457C KTU (Paging Amplifier Circuit) (Sheet 2 of 2)

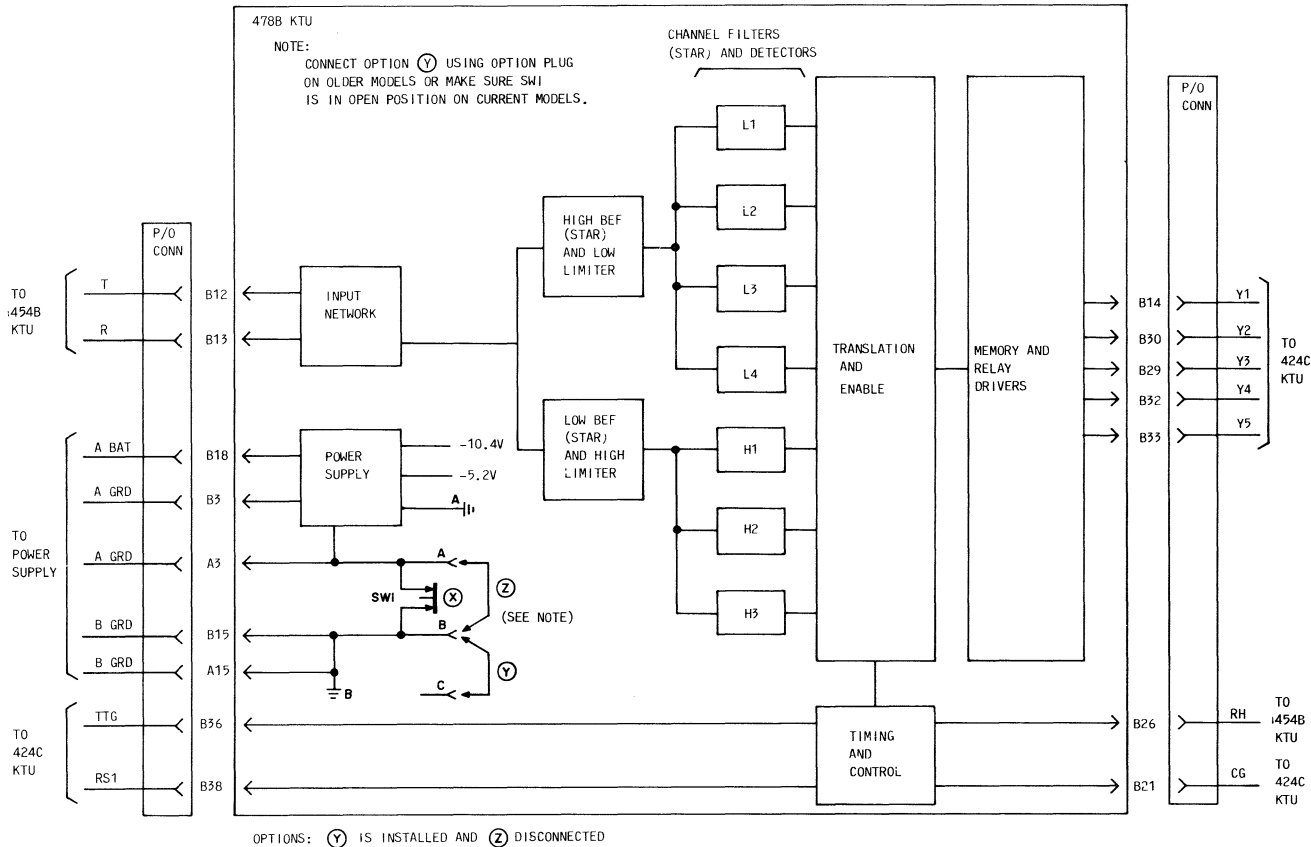


Fig. 107—Condensed Functional Schematic of 478B KTU (TOUCH-TONE Adapter Circuit)

## 4A COMMUNICATION SYSTEM

### COM KEY\* 416

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- 27A Apparatus Unit
- 109A Loudspeaker

**1.03** The system provides basic line services such as pickup, hold and illumination, one or two intercom paths, tone and voice signaling, multiline conferencing, built-in loudspeaker service, flexible tone ringing, automatic button restoration (ABR), outgoing service during power failure, privacy release, and recall (operator flash when used behind a PBX). Available optional features are privacy, music-on-hold (utilizing customer-provided music source), external ringing, power failure ringers, supplementary alerting device access, preset multiple signaling, customer-owned paging access wall loudspeakers, station restriction and TOUCH-TONE® dialing. TOUCH-TONE and rotary sets may be intermixed in the same system without additional equipment.

*Note:* Speakerphone capability is not provided.

**1.04** The 4A System has a maximum capacity of 4 CO/PBX lines and 16 stations. Two basic types of telephone sets, called primary and satellite, are employed. Each primary station contains the logic circuitry, power supply and clock circuitry for two CO/PBX lines and one intercom path. For small systems, one primary set may be used to provide two CO/PBX lines, one intercom path, and up to seven satellite stations. The addition of the second primary station simply doubles the system capacity. Satellite station sets provide the same service as primary station sets except they do not contain any control circuits.

**1.05** Every station can be programmed to ring on any combination of CO/PBX lines. All stations have access to all lines in the system; therefore, an attendant may or may not be used.

**1.06** The system components are protected by a self-resetting thermal cut-off in the power

#### 1. GENERAL

**1.01** This section provides identification, installation, connection, and maintenance information for the 4A Communication System (COM KEY 416).

**1.02** This section is reissued to add five system adjuncts:

- 24A Apparatus Unit
- 25A Apparatus Unit
- 26A Apparatus Unit

\*Trademark

#### NOTICE

Not for use or disclosure outside the  
Bell System except under written agreement



supply of the primary stations, making separate fusing unnecessary.

## 2. IDENTIFICATION

2.01 The 4A System provides up to 4 CO/PBX lines, up to 16 stations and 2 intercom paths. A brief description of system features is listed.

### BASIC FEATURES

- (a) **Pickup, Hold, and Illumination**—Standard key system pickup, hold and line status lamp rates, including wink hold.
- (b) **2-Path Intercom**—Each intercom path is associated with a separate button and lamp on each telephone set.
- (c) **Multiline Conferencing**—Two or more CO/PBX lines may be conferenced by *simultaneously* depressing the line buttons of the lines to be conferenced.

**Note:** Intercom and CO/PBX lines cannot be conferenced together.

- (d) **Tone and Voice Signaling**—CO/PBX line alerting signal is by tone source rather than conventional ringer. By lifting the handset, selecting an idle intercom path, and depressing a DSS button, the calling station may voice-signal the called party. Multiple stations may be signaled by depressing more than one DSS button at a time.
- (e) **DSS Volume Control**—Allows called party to adjust volume of voice signaling on DSS call.♦
- (f) **Built-in Loudspeaker Service**—By depressing the button designated SPKR, the telephone set user can bridge the speaker in his set onto the receiver of his handset. This enables others in the room to hear both sides of a conversation. If so desired, this feature may be disabled by the installer.
- (g) **Automatic Button Restoration**—ABR returns depressed line or intercom buttons to the unoperated position when the handset is replaced on the set.

(h) **RECALL**—Used to drop a line in order to receive a second dial tone without going back on-hook. When the telephone set is used behind a PBX, a momentary depression of the RECALL button will signal the attendant (similar to switchhook flash function).

(i) **CO/PBX Ringing**—Each station can be arranged to ring on all lines, any combination of lines, or not at all. Ringing is programmed at each station set and is customer accessible.

(j) **Wall Mounting**—Provides necessary hardware (D-180658 kit of parts) to wall-mount a satellite set.

**Note:** Primary sets cannot be wall-mounted.

(k) **Privacy Release**—Privacy release allows a station to permit privacy-equipped stations that have been locked out of call to bridge into the conversation. All 4A System telephone sets are factory-wired with privacy release.

### OPTIONAL FEATURES



**The following features should be implemented only when specifically covered in the service order.**

(l) **Privacy**—Privacy prevents a station from bridging into a CO/PBX call in progress.

**Note:** Intercom lines have no privacy.

(m) **Music-on-Hold**—Provides music from customer-provided music source to calls placed on hold.

(n) **External Ringing**—External ringing may be provided by connecting an external ringer across the CO/PBX tip and ring leads at the primary station.

(o) **Station Restriction**—Provides for outgoing call restriction by changing dial connections in telephone set.

(p) **TOUCH-TONE Set**—Provides TOUCH-TONE dialing. Rotary and TOUCH-TONE dial sets may be intermixed in the system without additional equipment.

(q) **Power Failure Ringer (24A Apparatus Unit)**—Provides two C4A ringers and associated circuitry to connect the ringers to the telephone lines in event ac power to the 4A Communication System is disrupted. One apparatus unit is required for each primary set in the system to be provided with power failure ringing.

(r) **Supplementary Alerting Device Interface (25A Apparatus Unit)**—Provides circuitry to accept an input from one designated direct station selection (DSS) button and/or any combination of four common audible leads to provide an output capable of driving a dc relay for ringing bells, gongs, horns, etc.

(s) **Preset Multiple Voice Signaling (26A Apparatus Unit)**—Provides preset multiple voice signaling which permits the customer to activate a combination of DSS addresses by depressing one designated DSS button. This feature is used for group signaling, all-page, emergency, etc.

(t) **Paging Access (27A Apparatus Unit)**—The 27A is an interface adjunct which provides the electrical interface between the 4A Communication System and a customer-provided paging system. The circuit provides for a single DSS input, a music input from a 33A voice coupler, and a drive circuit for an external relay which, when required by the customer paging system, will provide a contact closure when paging occurs.

(u) **109A Loudspeaker Set**—The 109A loudspeaker set includes speaker, amplifier, and two volume controls in a wood housing designed for wall mounting. The 109A is intended for indoor use only and is not intended for use in high noise level environments. The two customer accessible volume controls are for background music and paging volume.♣

## TELEPHONE SETS

**2.02** The 4A System uses telephone sets designed for this system (Fig. 1 and 2). They are not compatible with other systems.

**2.03** Two types of telephone sets are used in the system. The satellite set contains speech circuitry, line pickup key, DSS key, and loudspeaker. The primary set is a slightly larger set which, in addition to the components of the satellite set,

contains the logic circuit to provide hold and lamp control for two CO/PBX lines and lamp control for one intercom line. Solid state lamps are associated with each line pickup button to indicate ringing, hold, active, or idle status by standard flashing rates, steady lamps, or no lamps. Intercom status is also indicated by an ON or OFF lamp.

**2.04** Each telephone set contains a 664A (DSS) key, a speaker and volume control, and a 647M6 (10 button) key. The DSS field is interconnected with the intercom buttons. After selecting one of the idle intercom paths, the user must depress the desired DSS button which connects his handset transmitter to the speaker in the telephone set associated with that DSS button. The DSS button must be held depressed for the duration of the one-way voice transmission. Although the voice signaling path is unidirectional, the called station may establish a 2-way path by lifting his handset and depressing the intercom button on his set as instructed by the calling party. Calling party may then release DSS button. Multiple stations may be signaled by depressing more than one button at a time or the preset multiple voice signaling option may be used. The 664A key has a slide programming switch which connects that set speaker to the DSS number desired for that station. This key also has four vertical OFF-ON switches which control common audible ringing at the station. The loudspeaker located under the telephone set handset receives both the tone and voice signaling. Loudness is controlled by the volume control. Button assignments of the 647M6 key are: HOLD, four CO/PBX lines, two intercom paths, privacy-release (PRIV RLS), built-in loudspeaker service (SPKR), and RECALL. The SPKR button may be disabled by the installer if this feature is not desired by the customer.

**2.05** The 4A System will interface with all PBXs except that it cannot provide for ground-start operation of CO trunks which bypass the PBX in the event of PBX power failure. In all other respects, the system performs on PBX lines in the same manner as on CO lines. For PBX use, the only restriction on the number of telephone sets is that each 25-pair connector cable system can serve a maximum of 2 primary stations and 14 satellite stations. Although 4A System telephone sets in each system have full capabilities, they can contact telephone sets in other systems only via PBX lines. To signal the PBX operator, the RECALL button should be used.



Fig. 1—2836AM-50 (Primary) Telephone Set

**ORDERING GUIDE**

- Set, Telephone (order as required):
  - 836AM-50 (rotary dial primary set)
  - 837AM-50 (rotary dial satellite set)
  - 2836AM-50 (TOUCH-TONE primary set)
  - 2837AM-50 (TOUCH-TONE satellite set)
- Plate, Face, 836A—\* (for 836AM or 837AM)
- Plate, Face, 2836A—\* (for 2836AM or 2837AM)

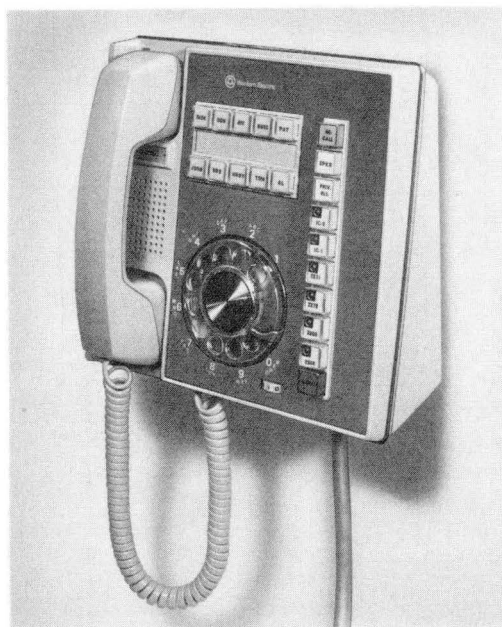
**Note:** Sets are supplied in ivory-50 only and are shipped with a disposable faceplate. Desired faceplate must be ordered separately.

\*Add color suffix as follows:

- Avocado—100
- Teak—108
- Walnut—109
- Gold—111
- Orange—112
- Brown—113
- Red—114
- Blue—115
- Black—118



A. DESK CONFIGURATION



B. WALL CONFIGURATION

Fig. 2—837AM-50 (Satellite) Telephone Set

- Kit of Parts, D-180658 (one required for each 837- or 2837-type set to be wall-mounted)
- Block, Connecting, 91A (order one for each primary station).

Order the following, as required, depending on the job requirements. Refer to Fig. 3 and 4 for typical wiring arrangements.

- Adapter, Bridging, KS-19252 (order by list number as required) (Fig. 3)
- Cable, Connector, B25A (specify desired length) (Fig. 3)
- Block, Connecting, 66E3-25 (Fig. 3)
- Block, Connecting, 66B4-25 (Fig. 4)
- Cable, Connector, A25B (specify desired length) (Fig. 4)
- Backboard, 184B1 (Fig. 4).

#### *Optional Apparatus (Order as Required)*

- Coupler, Voice, 33A (one required when music-on-hold or background music is provided)
- Kit of Parts, D-180605 (one required for each primary station to be equipped for music-on-hold)
- Kit of Parts, D-180604 (privacy circuit, one required for each station to be locked out)
- ♦Unit, Apparatus, 24A (one required for each primary set to be equipped for power failure ringing)
- Unit, Apparatus, 25A (one required for each KS relay used to operate auxiliary signals)
- Unit, Apparatus, 26A (one per each DSS zone designated to access any combination of the other DSS zones in the system)
- Unit, Apparatus, 27A (one per customer-provided paging system)
- Set, Loudspeaker, 109A
- Block, Connecting, 91A (one required for each 109A loudspeaker in system)
- Relay Set, KS-16626, L12 (if required)♦

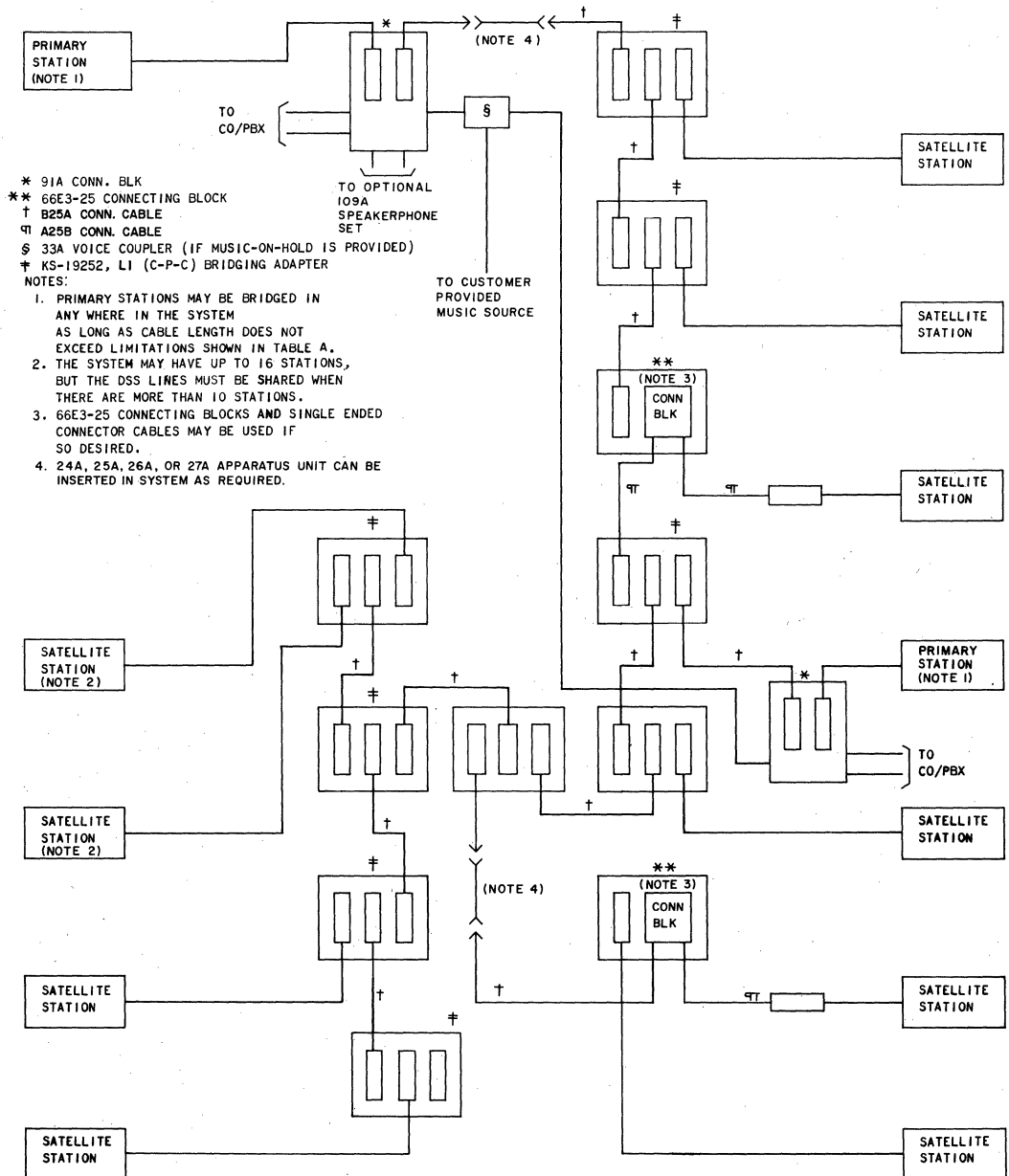
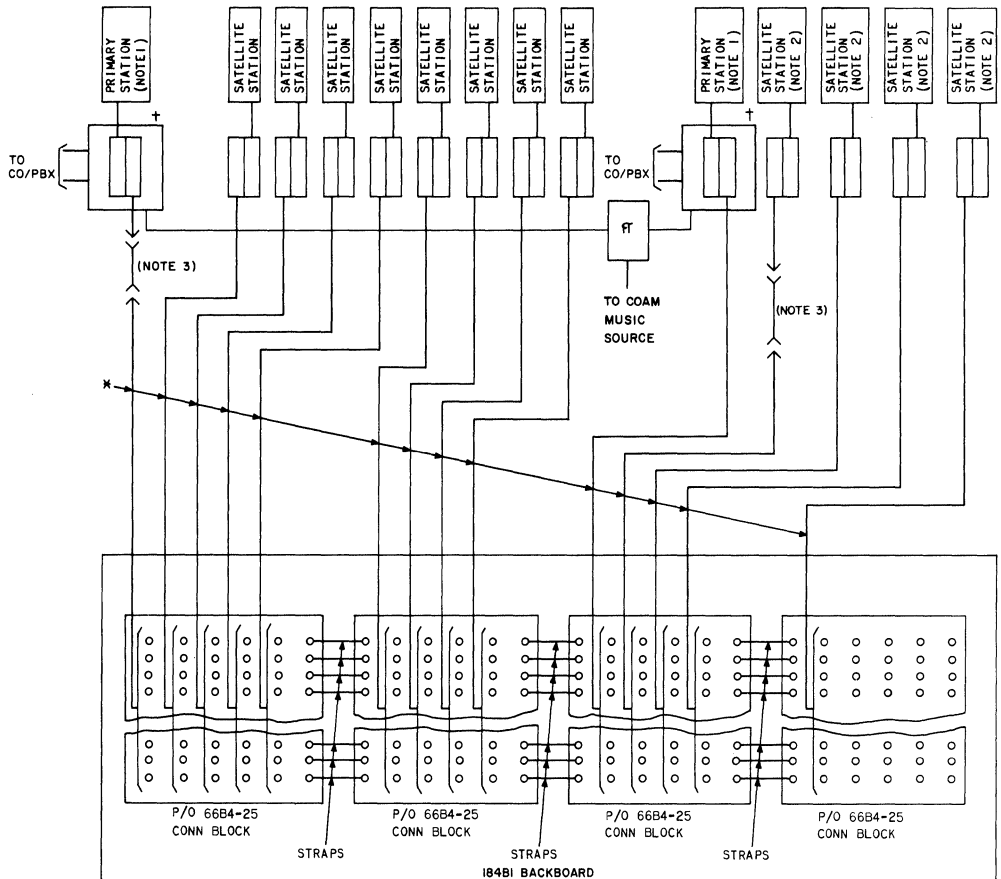


Fig. 3—Typical Installation, Using Bridging Adapters and Connecting Blocks



NOTES:

1. CONTROL STATIONS MAY BE BRIDGED IN ANYWHERE IN THE SYSTEM AS LONG AS CABLE LENGTH DOES NOT EXCEED LIMITATIONS SHOWN IN TABLE A.
2. THE SYSTEM MAY HAVE UP TO 16 STATIONS HOWEVER, DSS LINES MUST BE SHARED WHEN THERE ARE MORE THAN 10 STATIONS.
3. INSERT 24A, 25A, 26A, OR 27A APPARATUS UNIT IN SYSTEM AS REQUIRED.

- \* A25B CONN. CABLES (SINGLE-ENDED)
- + 91A CONNECTING BLOCK
- † 33A VOICE COUPLER (IF MUSIC ON HOLD IS PROVIDED)

Fig. 4—Typical Installation Using Home Run Method

**Replaceable Components**

- Dial, 8DT-119 (rotary) or 35AH3D (TOUCH-TONE)
- Cover, 840994560 (DSS key)
- Handset, K1B-50
- Cord, H4DU-50 (handset cord)
- Key, 647M6 (line)
- Assembly, Potentiometer, 840694350
- Assembly, Button, Lamp, 840362263
- Transformer, KS-21361, L1 (includes 6-foot power cord and heat sink)

**3. INSTALLATION**

**PLANNING**

**3.01** The primary stations should be located within power cord length (6 feet) of a grounded ac receptacle. The ac receptacle should be separately fused and not under control of a switch.

**⚠Caution:** *When necessary to use a power extension cord, use a 3-wire cord only.*



**Primary telephone set for 4A System must be installed where temperature does not fall below freezing (32°F or 0°C).**

**Caution:** *Except for the 110V power cord, no connection shall be made between any point in this system and building ground.*

**3.02** Normally, a 4A System installation will consist of up to 10 stations with a maximum of 16 stations if DSS codes are shared (primary stations included). The following cable restrictions apply to any installation:

- There should be no more than 1000 running feet of cable between any satellite station and both primary stations.
- No more than 2000 running feet (total) of cable should be used in any installation.

The 4A System can be expanded to a maximum of 16 stations (including primary stations and 109A loudspeaker sets) provided the cable restrictions in Table A are followed. There are only 10 DSS buttons so DSS lines must be shared, as required, when the system exceeds 10 stations. In a system where only one primary station is required, the total number of satellite sets shall not exceed 7 stations with no station more than 1000 feet from the primary station and no more than 2000 running feet (total) of cable in the system. See Fig. 3 and 4 for typical arrangements.

**TABLE A**

**LIMITATIONS ON CABLE LENGTH AND SYSTEM SIZE**

NUMBER OF STATIONS	MAXIMUM CABLE FEET FROM SATELLITES TO BOTH PRIMARY STATIONS*
10	1000
11	900
12	800
13	700
14	600
15	500
16	400

\*Total number of feet in any installation shall not exceed 2000 feet.

**3.03** Select appropriate apparatus according to job requirements (see ORDERING GUIDE).

**3.04** ⚠The apparatus units are to be mounted at a location where convenient access to the cabling system is provided.

**3.05** The following precautions are to be considered as to location of installation:

- (a) The 24A apparatus unit is to be located near any telephone set where this feature is required.



*The 24A apparatus unit must be mounted on a vertical surface, so the mercury relay (Fig. 15) on the printed wiring board is in a vertical position as indicated on the relay cover.*

- (b) The 26A apparatus unit is to be installed in indoor location (above 32°F).
- (c) The 27A apparatus unit is to be installed in indoor location (above 32°F) and mounted so the customer has access to screw terminals A1 and A2.
- (d) The 109A loudspeaker is designed for indoor locations (above 32°F). Speakers reach a depth of 30 feet. If a room is over 30 feet wide, facing speakers should be used (Fig. 24).

**Note:** Care shall be taken in location of speaker(s) (Fig. 24) to avoid feedback when paging from nearby stations. Spacing of up to 30 feet may be required between the speaker(s) and station sets.⚡

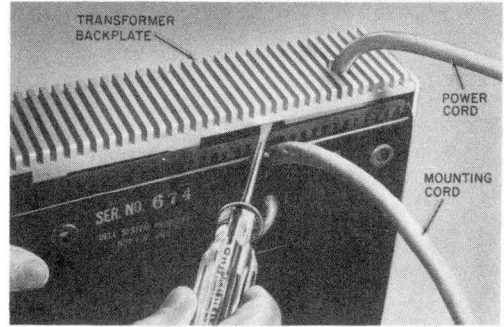
## INSTALLING

**3.06** Install 91A connecting blocks and KS-19252 bridging adapters, or 66E3-25 connecting blocks, at desired locations using shortest length of connector cables. Also install wall brackets from D-180658 kit of parts where wall sets are to be installed. Use proper mounting hardware depending on wall surface.

**3.07** Use care when unpacking telephone sets to avoid damage. Install sets in desired locations.

**3.08** Primary sets are factory-wired so that the CO/PBX lines appear on lines 1 and 2 and the intercom on IC1. If the system uses two primary sets, one must be modified to move the line appearances to 3 and 4 and IC2 as follows:

- (1) Unplug 110V power cord from power receptacle if connected. Remove the power transformer assembly by pulling out on the bottom of the heat sink. If desired, a screwdriver may be used to carefully pry the transformer loose (Fig. 5). **Do not pull on transformer cord.**
- (2) Remove line assignment connector (Fig. 6) by pulling straight up until connector clears



**Fig. 5—Removing Transformer**

pins on circuit board. **Take care not to bend pins on circuit board.**

- (3) Rotate connector 180 degrees so that side labeled lines 3 and 4 can be seen.
- (4) Reinsert connector so that outside row of holes (toward rear of set) mate with pins on board.
- (5) Replace transformer and heat sink assembly.
- (6) Plug in power cord.

**3.09** The DSS programming switch and common audible switches (Fig. 7) must be set as required at each station as follows:

- (1) Raise cover either by pressing on the extreme left end to tilt the cover or pry up the right end of the cover using a fingernail.
- (2) Determine the DSS code for that station and slide the program switch to that number. For example, Fig. 7 shows the station designated as DSS code 7.



**More than one station set may be programmed for the same DSS code. Also, a set may be programmed so that it does not have a DSS code by moving the switch to the OFF (extreme left) position. When positioning the program switch, take care to correctly position the switch in a detent.**



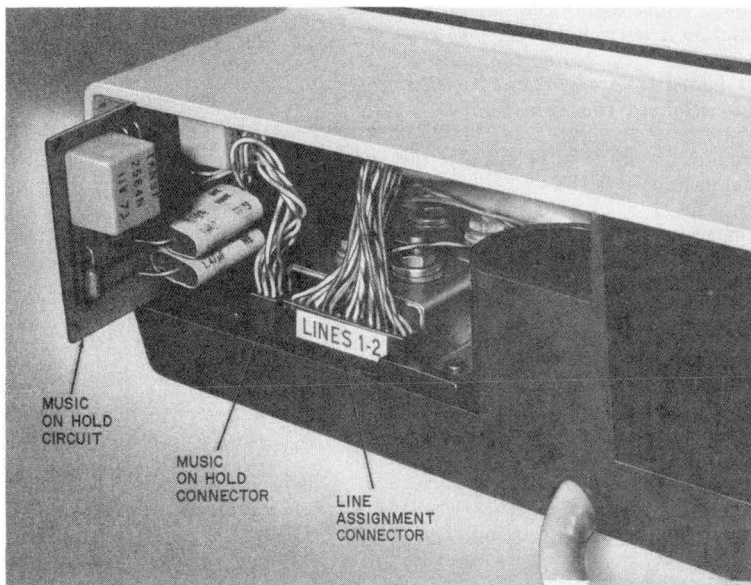


Fig. 6—Line Assignment Connector and Music-on-Hold Board

- (3) Select CO/PBX lines to ring at the stations by positioning the common audible switches to the ON position.
  - (4) Close switch cover.
- 3.10** Modify 837- or 2837-type telephone sets that are to be wall-mounted as follows:
- (1) Loosen four screws and remove the lower housing.
  - (2) Remove screw holding mounting cord attachment bracket at rear of set.
  - (3) Refasten bracket using screw in the position shown in Fig. 8.
  - (4) Rotate the lower housing 180 degrees from the desk model position and fasten housing to base.
  - (5) If plastic designation card cover has been installed, remove cover using a KS-16750 releaser, then remove screw from recess and discard screw.
  - (6) Install plastic handset hook (Fig. 9) from the D-180658 kit of parts using longer screw also furnished with kit.
  - (7) Replace plastic designation card cover.
- 3.11** The telephone set can be mounted with the mounting cord either run vertically down the wall or through a customer-provided opening in the wall. The set is mounted on the wall bracket supplied with the kit of parts by positioning the set, so that the four tabs on the bracket engage the openings in the lower housing, and sliding the set downward until the snap-lock engages. Check to make sure that all tabs are engaged and the set locked on the bracket. To remove the set, press the tab on the wall bracket, which extends below the set, toward the wall while pushing the set upward.
- OPTIONS**
- 3.12 External Ringer**—Connect leads from E1C ringer to screw terminals on 91A connecting block associated with primary telephone sets as shown in Table B. If an external ringer is desired

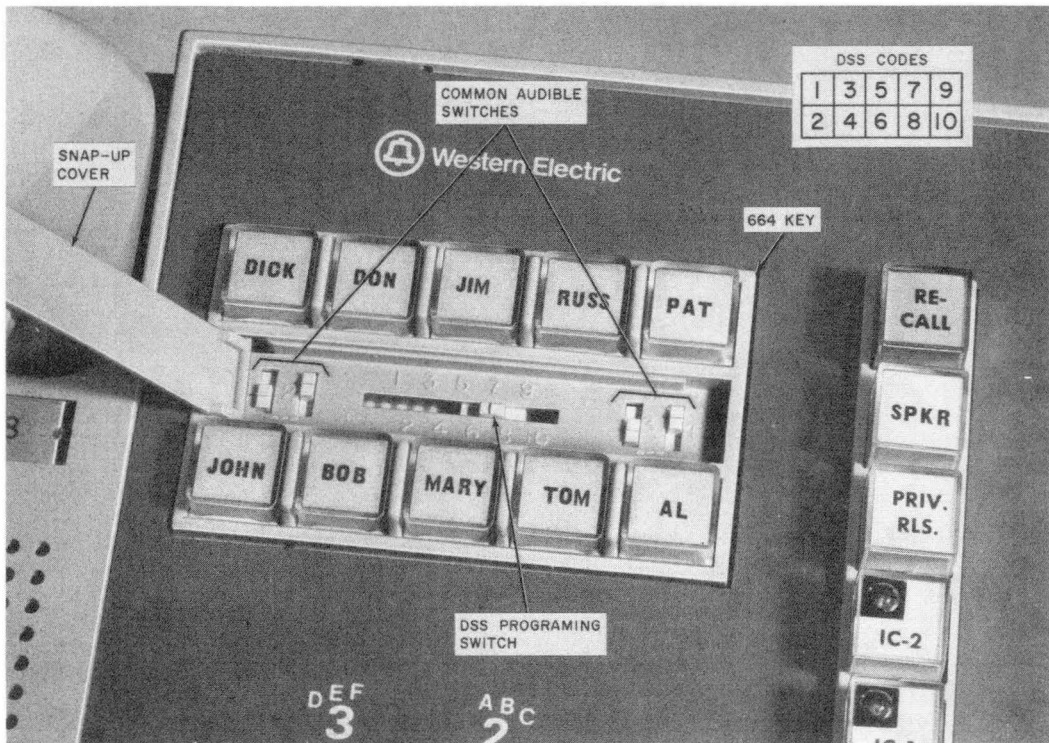


Fig. 7—DSS Key

at a satellite station, install the ringer at that location using D inside wire to connect it to the proper R( ) and T( ) terminals of the primary set 91A connecting block. **Do not attempt to wire ringer to any other pair in the system. Do not connect more than three EIC ringers to any CO/PBX line.**

### 3.13 Dial Restriction—Restrict stations as follows:

- (1) Remove faceplate by inserting a KS-16750 tool in the notch near the center of the faceplate and raising upward to bow faceplate (Fig. 10).
- (2) Loosen two captive screws holding DSS key and move key to side.

(3) On a TOUCH-TONE set, move the O-BK lead from terminal 36 to 31; on rotary sets, move the BL-R lead from terminal 28 to 39.

(4) Replace DSS key.

(5) Install faceplate by inserting in slots at bottom of set and bowing it until it will slide in slots at top of set (Fig. 11).

**3.14 Music-On-Hold**—This option requires the installation of a D-180605 kit of parts at each primary telephone set and one 33A voice coupler per system.

(a) Install kit of parts in the primary set(s) as follows:

- (1) Remove transformer as covered in 3.08 (1).

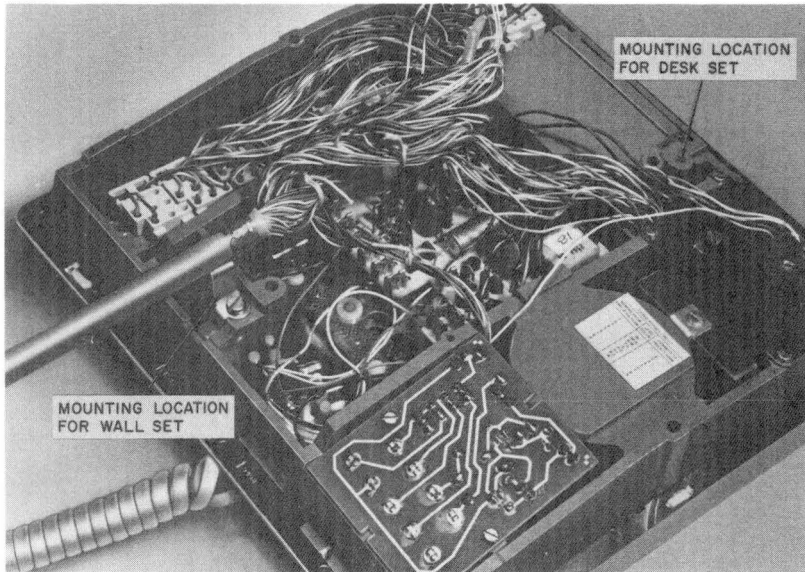


Fig. 8—Set Modification For Wall Mounting

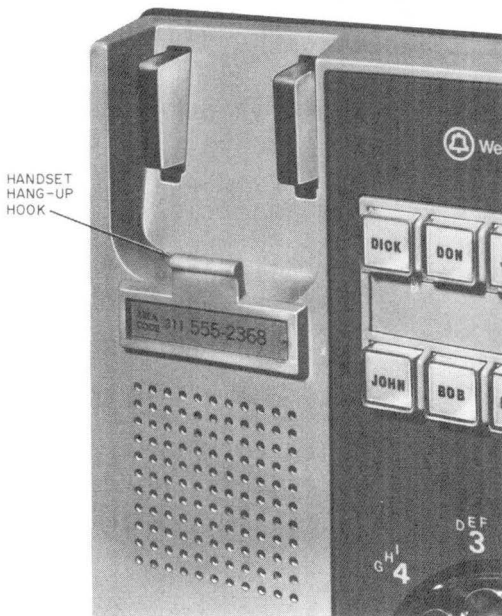


Fig. 9—Handset Hook Attachment For Wall Set

- (2) Insert music-on-hold circuit board vertically in slots provided in upper and lower housings (Fig. 6).
  - (3) Plug in connector from circuit board to the pins provided as shown in Fig. 6. The connector may be plugged in either way.
  - (4) Replace transformer and heat sink assembly.
  - (5) Plug in power cord.
- (b) Install the 33A voice coupler as follows:

- (1) Remove cover from coupler.
- (2) Mount coupler at location which permits customer to make connections and also allows connection to system.

**Caution:** Ensure that 35P fuses are installed with the spring at the bottom (Fig. 12) and set the volume control at approximately mid-range.

- (3) Connect primary station(s) to the voice coupler per Table C.

TABLE B

## EXTERNAL RINGER CONNECTIONS

RINGER ON CO/PBX LINE	PRIMARY STATION	CONNECT LEADS	
		FROM 91A CONN. BLOCK	TO E1C RINGER TERM.
1	1	R1	5
		T1	6
2		R2	5
		T2	6
3	2	R1	5
		T1	6
4		R2	5
		T2	6

*Note:* Use inside wire to make connections.

- (4) Replace cover.
- (5) Have customer connect his music source as shown in Table C.



*The customer-provided music source must be capable of providing one watt of undistorted RMS power into an 8-ohm load. In addition, the output of the music source must be ac coupled. Do not connect a source that has a dc voltage on the output.*

- (c) Adjust volume level for music-on-hold as follows:
  - Place a call to a station in the system.
  - Answer call and place it on hold.
  - Have customer adjust his music source for a comfortable listening level at the held station.

**Note:** The 33A voice coupler will accept input from any customer-provided apparatus that does not blow a fuse in the voice coupler.

A copy of the technical reference covering the 33A voice coupler can be obtained by contacting the Telephone Company Business Office or the Marketing Representative. If service call is caused by customer-provided equipment, billing should be made in accordance with BSP 660-101-312.

**3.15 Privacy**—This option requires the installation of a D-180604 kit of parts at each station to be locked out.

(a) Install as follows:

- (1) Remove telephone set lower housing to obtain access to the amplifier printed wiring board.
- (2) Transfer leads from push-on terminals on amplifier board to those on privacy circuit board (Fig. 13). See Table D or wiring label on loudspeaker housing in set.
- (3) Mount privacy circuit board on the two bosses located under the front handset pocket with component side of board facing into the upper housing (Fig. 14).

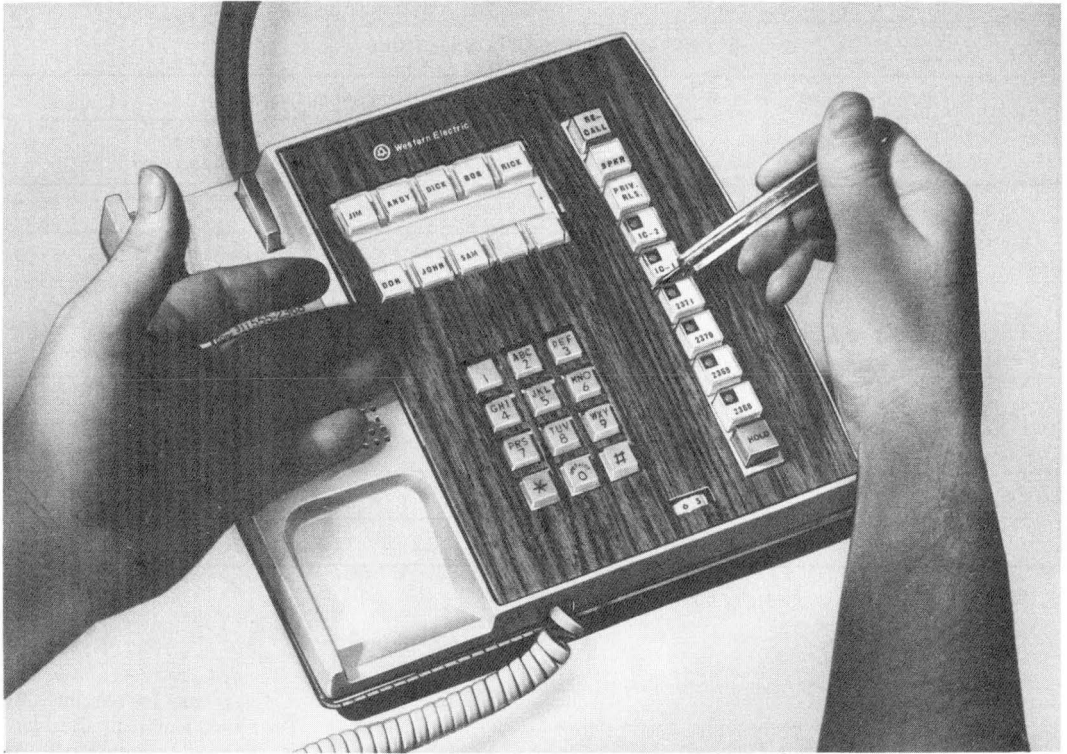


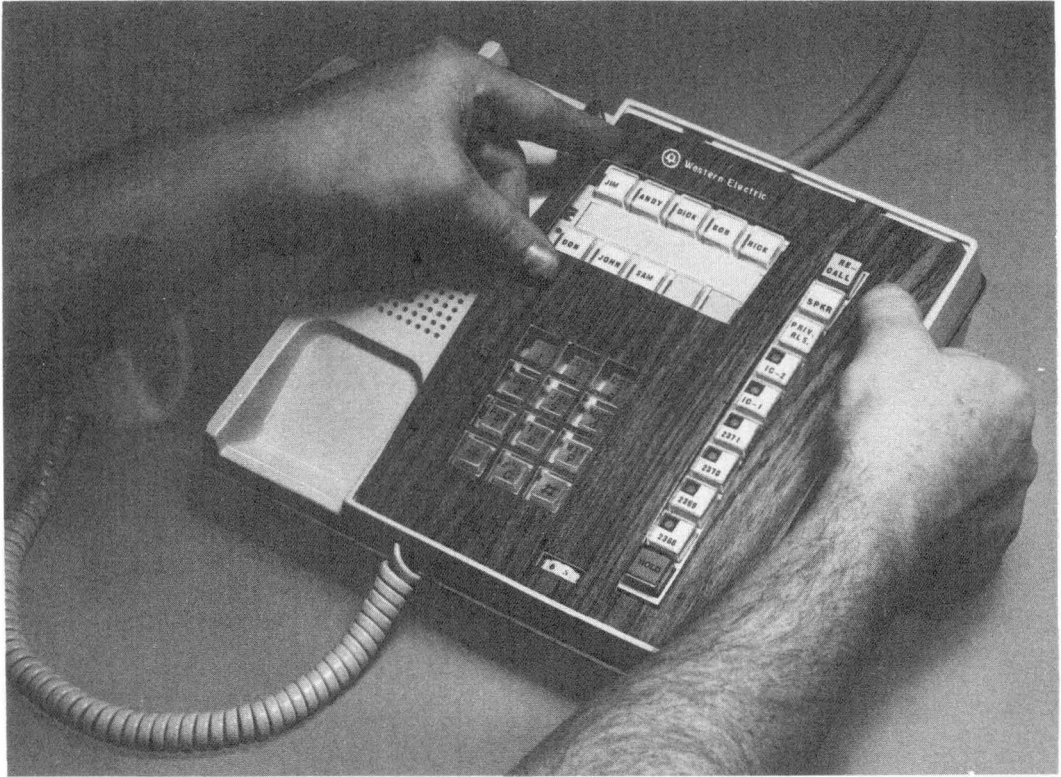
Fig. 10—Faceplate Removal

- (4) Secure board using two screws furnished with kit of parts.
  - (5) Replace lower housing.
- (b) ♦Test privacy feature as follows:
- (1) At a second station, go off-hook on an idle CO/PBX line.
  - (2) At the first station under test, go off-hook on same line. The first station should be locked out as evidenced by lack of sidetone.
  - (3) At the first station under test, select an idle line. Return to the line busied out by the second station by rapidly changing line buttons. The station should be locked out.
  - (4) Depressing the PRIV RLS button at the second station should permit the first station to bridge onto the busied-out line.
  - (5) If PRIV RLS button is not wired at second station, depress that station HOLD button. If the second station also has privacy kit installed, it will be locked out after depressing the HOLD button.



***To avoid excluding oneself, a station with privacy kit installed must depress PRIV RLS button to allow conferencing.***

- (c) Test privacy release as follows:
- (1) At station to be tested, go off-hook on an idle CO/PBX line to busy it out.



**Fig. 11—Replacing Faceplate**

(2) At second station equipped with a privacy circuit, go off-hook on the same line. No sidetone should be heard in this handset.

(3) At the first station, depress the PRIV RLS button momentarily. This should permit the second station to bridge onto the line.⚡

### 3.16 To disable SPKR:

(1) Remove faceplate by inserting a KS-16750 tool in the notch near the center of the faceplate and raising upward. See Fig. 10.

(2) Remove DSS key.

(3) Remove W-BR lead from telephone set terminal 9 and W-G from terminal 38. Insulate and store leads.

(4) Replace DSS key.

(5) Replace faceplate (see Fig. 11).

**3.17** Install connector cables for system as required.

### 3.18 ⚡24A Apparatus Unit

(a) Install the 24A apparatus unit as follows:

(1) Remove the cover and mount the base pan assembly (Fig. 15) on the desired vertical location (use appropriate fastener per BSP 080-720-105).



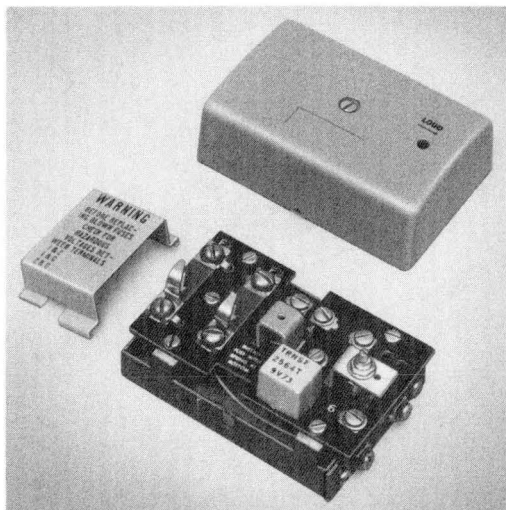


Fig. 12—33A Voice Coupler

TABLE C

33A VOICE COUPLER CONNECTIONS

33A VOICE COUPLER	91A CONN. BLOCK	CUSTOMER-PROVIDED MUSIC SOURCE
1		†
2		†
3	M	
4	M	
G*		

\* Connect to approved local ground.

† Connections to be made by customer.

(2) Remove the cable clamp or clamps (Fig. 15).

(3) Insert system cable or cables (Fig. 15).

TABLE D

TO ADD PRIVACY OPTION

LEAD COLOR	REMOVE FROM	CONNECT TO
	AMPLIFIER TERMINAL	PRIVACY TERMINAL
BL	1	1
BK-G	2	2
G-W	3	3
Y-S	4	4
G	5	5
R-S	6	6
S-Y	7	7
R-O	8	8
W	9	9

(4) Replace the cable clamp or clamps using the tapped hole in the base pan or standoff to hold the cable securely.

(b) Connect the 24A apparatus unit as follows:

(1) The 24A is factory-wired (Fig. 29) to provide power failure ringer service for CO/PBX lines 1 and 2. To connect the unit to lines 3 and 4, see Table E.

(2) Replace the housing.

(c) Test as follows:

(1) Unplug the ac line cord of the primary set serving CO/PBX lines 1 and 2. From any set, dial CO/PBX line 1. The power failure ringer will ring. Repeat for CO/PBX line 2.

(2) Hang up the calling set.

(3) Plug the ac line cord back into the ac receptacle.

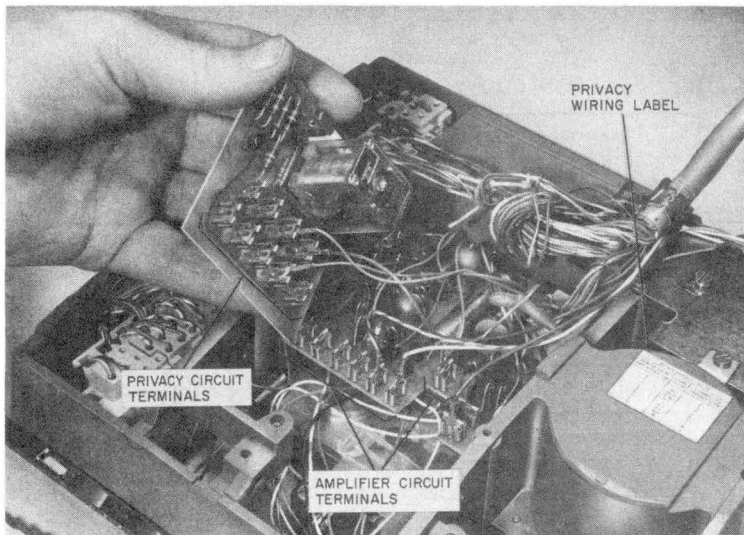


Fig. 13—Privacy Circuit Connections

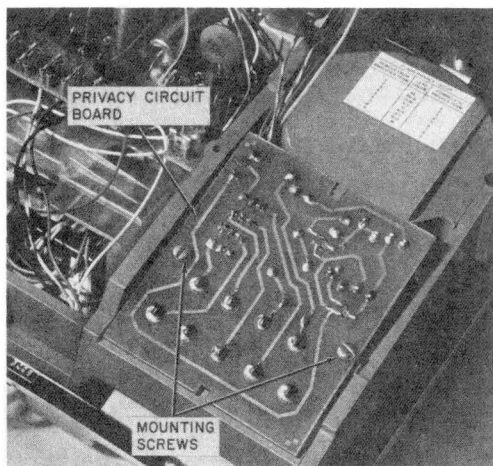


Fig. 14—Mounting Privacy Circuit

(4) From any set, dial CO/PBX line 1; then line 2. The power failure ringers should not ring.

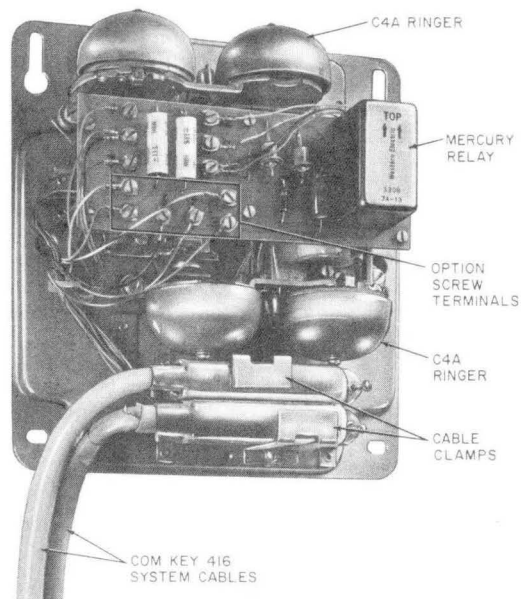


Fig. 15—24A Apparatus Unit



◆ TABLE E ◆

**24A APPARATUS UNIT**  
(CONNECTIONS FOR CO/PBX LINES 3 AND 4 ONLY)

REMOVE LEAD FROM*		CONNECT LEAD TO†	
LEAD COLOR	PRINTED WIRING BOARD TERMINAL	LEAD COLOR	PRINTED WIRING BOARD TERMINAL
BL-W	5*	O-R	5
W-BL	4*	R-O	4
BK-S	6*	Y-G	6
W-BR	9*	R-S	9
BR-W	7*	S-R	7

\* Insulate and store after removal.

† Leads are insulated and stored.

- (5) If a second 24A apparatus unit is connected, use the same procedure on CO/PBX lines 3 and 4.



***Be certain the ac line cord of each primary set is securely plugged back into its receptacle after completing these tests.***

### 3.19 ◆25A Apparatus Unit

- (a) Install the 25A apparatus unit as follows:
- (1) Remove the cover and mount the base pan assembly (Fig. 16 and 17) at the desired location (use appropriate fastener per BSP 080-720-105).
  - (2) Mount the KS-16626 L12 relay set per BSP 463-120-100 or the KS-16301 L17 relay per BSP 463-110-100.
- (b) Connect the 25A apparatus unit (Fig. 16) as follows:

- (1) Connect the auxiliary signal and power supply to KS-16626 L12 relay set and/or KS-16301 L17 relay set per BSP 463-120-100 or BSP 463-110-100, respectively.

- (2) If the auxiliary signal is to respond to any one DSS code, move the spade-tip lead associated with that code from terminals DSS 1-10 to terminal IN (Fig. 30).

- (3) If the auxiliary signal is to respond to any combination of common audible signals (CA 1-4), move the spade-tipped lead associated with that line and/or lines to the A through D terminals, respectively.

**Note:** The 25A apparatus unit may be coded to respond to both DSS codes and common audible signals.

- (4) Insert system cable or cables (Fig. 16).
  - (5) Position inserts (Fig. 16) inside cover to hold cables securely when cover is replaced.
  - (6) Replace cover.
- (c) Test as follows:

- (1) If the auxiliary signal is coded to respond to a DSS code, depress that DSS button at any station to operate the auxiliary signal. The signal will continue to operate as long as the button is depressed.

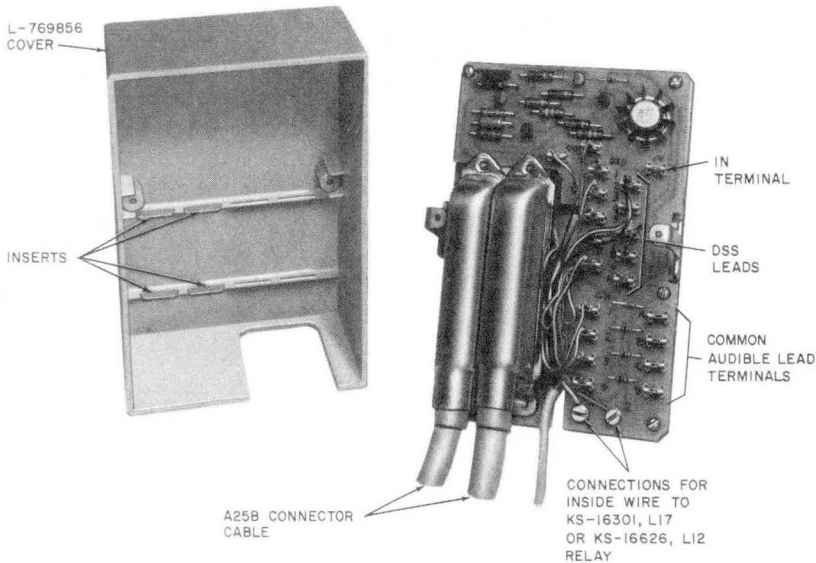


Fig. 16—♦25A Apparatus Unit♦

- (2) If the auxiliary signal is coded to respond to common audible signal(s), call each of these lines from a station. The auxiliary signal will follow the normal CO/PBX ringing pattern.♦

### 3.20 ♦26A Apparatus Unit

- (a) Install the 26A apparatus unit as follows:

- (1) Remove the cover and mount the base assembly (Fig. 18 and 19) on the desired location (use appropriate fastener per BSP 080-720-105).

- (b) Connect the 26A apparatus unit (Fig. 19) as follows:

- (1) Determine which DSS code will be used to access the input for multiple signaling and which DSS codes are to be called simultaneously (Fig. 31) and connect as follows:

- Remove the lead corresponding to the input code from the numbered terminal (Fig. 19)

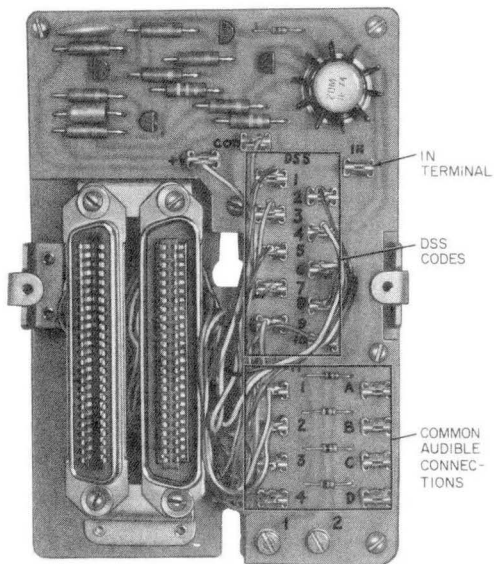


Fig. 17—♦25A Apparatus Unit Base♦

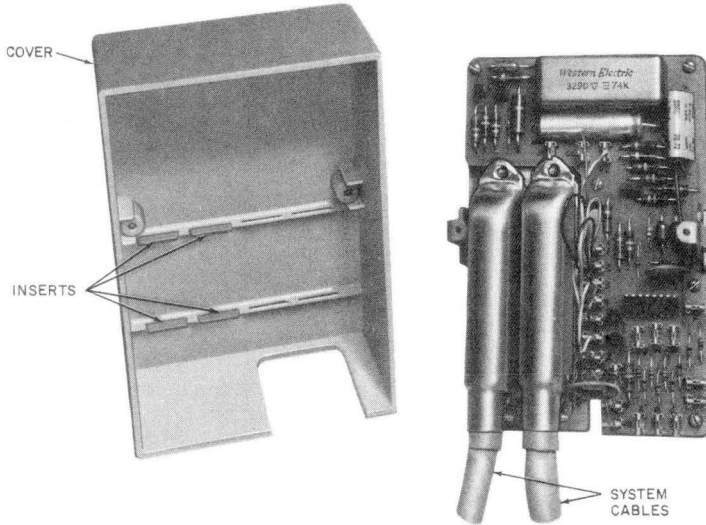


Fig. 18—26A Apparatus Unit With L-769856 Cover

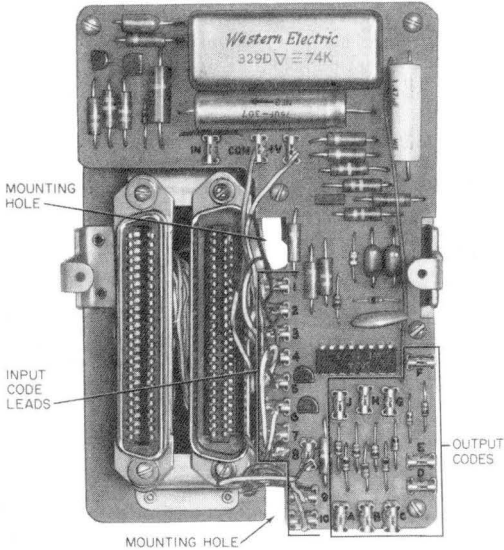


Fig. 19—26A Apparatus Unit Base

and 31) where it is stored; insert the lead in the IN terminal (Fig. 18 and 31).

- Remove the leads corresponding to the output codes and insert each lead in a separate terminal lettered A through J (Fig. 19 and 31).

**Note:** Selection of lettered terminals A-J are on a random basis, using only 1 DSS code per terminal. If possible, do not use adjacent terminals; this will prevent the possibility of shorted terminals.

- (2) Insert system cables (Fig. 18).
  - (3) Position inserts (Fig. 18) inside cover to hold cables securely in place when cover is replaced.
  - (4) Replace the cover.
- (c) Test as follows:

- (1) At an idle telephone set, adjust the volume control to maximum and set the DSS selector switch to DSS code 1.

**Note:** The SPKR button must be in the released (up) position.

- (2) Select and depress an idle intercom (IC) line button. Depress and hold the DSS button corresponding to the input code of the 26A apparatus unit and speak into the handset. Speech shall be heard from the loudspeaker in the station set if the 26A apparatus unit is coded to access the zone coded in step (1).
- (3) Repeat steps (1) and (2), moving the DSS selector switch through the remaining DSS zones.¶

### 3.21 ¶27A Apparatus Unit

- (a) Install the 27A apparatus unit as follows:

- (1) Remove the cover and mount the base pan assembly (Fig. 20 and 21) in the desired location (use appropriate fasteners per BSP 080-720-103).
- (2) If background music is to be provided, install the 33A voice coupler per 3.14(b).

**Note:** Only one 33A voice coupler is required in the system to provide music to the 27A

apparatus unit, all 109A loudspeakers, and to the primary set(s) for music-on-hold.

- (b) Connect the 27A apparatus unit as follows:

- (1) Determine the DSS code that will be used to access the input of the paging system. Remove the lead corresponding to the input code from the numbered terminal (Fig. 32) where it is stored and insert the lead in the IN terminal (Fig. 32).
- (2) If music is provided, connect screw terminals 5 and 6 of the 33A voice coupler to screw terminals M1 and M2 (Fig. 21).
- (3) If the customer's paging system requires a contact closure when the paging occurs, connect the coil circuit of a KS-16626 L12 relay set per BSP 463-120-100 to screw terminals R1 and R2 of the 27A. Also connect a shorting strap between screw terminals R3 and R4.
- (4) Insert system cable or cables (Fig. 20).
- (5) Position inserts (Fig. 20) inside cover to hold cables securely when cover is replaced.

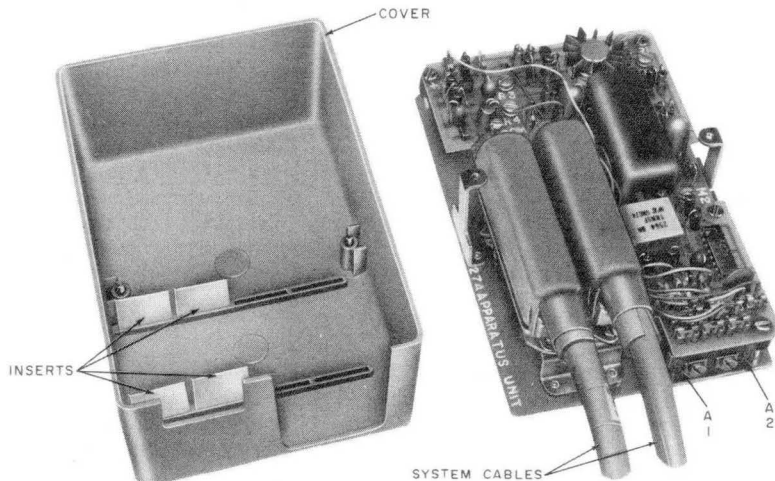


Fig. 20—¶27A Apparatus Unit With L-769856 Cover¶

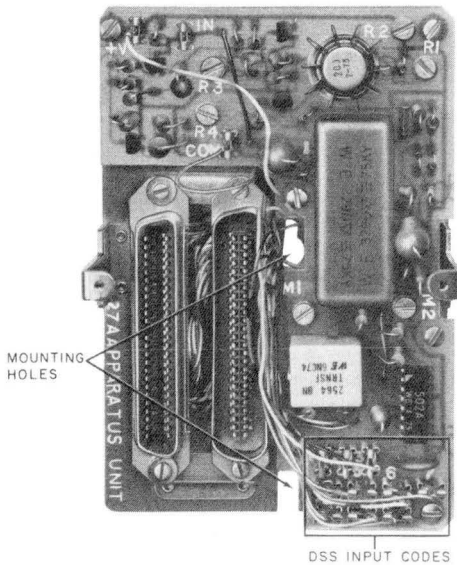


Fig. 21—327A Apparatus Unit

(6) Replace the cover.

(b) Test the installation as follows:

(1) Ask the customer to connect his paging system to screw terminals A1 and A2. If his paging system is not available, connect the red and green leads of a 107A loudspeaker to A1 and A2, respectively. Connect the yellow and brown leads of the 107A to a 2012B power transformer.

(2) At any telephone set, depress an idle IC button. Depress and hold the DSS button that corresponds to the paging system. If background music is provided, it will be muted. If an external relay was used, it will operate. Speak into the transmitter and have the customer adjust the volume of his paging system to the desired level. After the adjustment of the paging system volume for speech, the background music level may be varied by adjusting the potentiometer on the 33A voice coupler.



*If music-on-hold was previously furnished, do not adjust the level from the customer-provided music source.*

3.22 ♦109A Loudspeaker Set (Fig. 22, 23, 24, and 33)

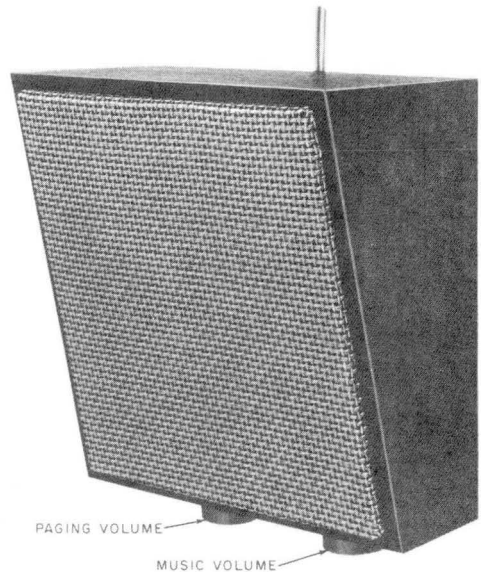


Fig. 22—109A Loudspeaker Set

(a) Install the 109A loudspeaker as follows:

(1) Mount the wall bracket assembly (Fig. 23 and 24) at the desired location. This assembly is mounted directly to a flat surface or an outlet box. Use appropriate fasteners per BSP 080-720-105.



*For each loudspeaker installed, the total number of telephone sets per system (as covered in 3.02) must be reduced by a like number.*

(2) If music is provided, install the 33A voice coupler as described in 3.14(b).

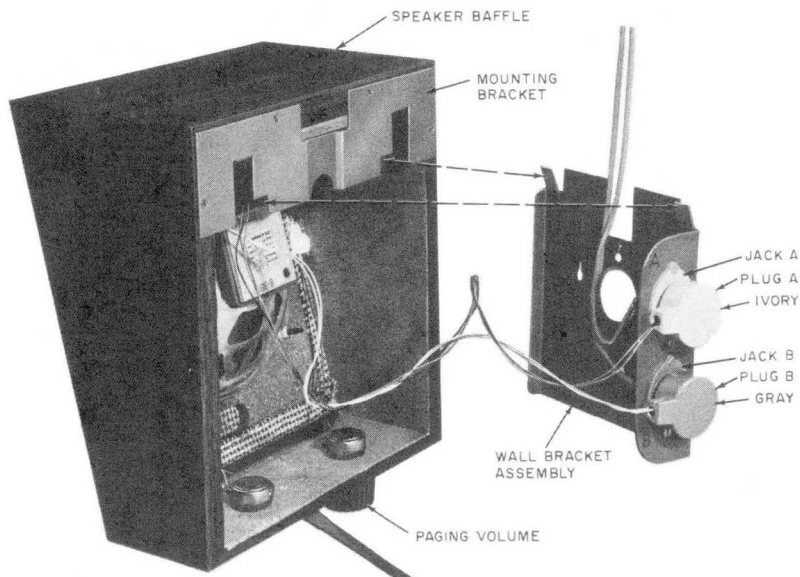


Fig. 23—109A Loudspeaker Set With Wall Bracket Assembly

**Note:** Only one 33A voice coupler is required in the system to provide music to all 109A loudspeakers and to the primary set(s) for music-on-hold.

(b) Connect 109A loudspeaker set as follows:

- (1) Connect +V, COM, and DSS to jack A (ivory) of the wall bracket assembly (Fig. 23) per Table F.
- (2) If music is provided, connect terminals 5 and 6 of the 33A voice coupler to terminals R and G of jack B (gray) of the wall bracket assembly (Fig. 23) using inside wire.
- (3) Connect plug A of loudspeaker into jack A of wall bracket assembly and plug B into jack B, ivory and gray to gray, respectively (Fig. 23).
- (4) Slip the speaker baffle mounting bracket over the mounting clips on the wall bracket assembly and pull the speaker down until it is firmly held (Fig. 23).

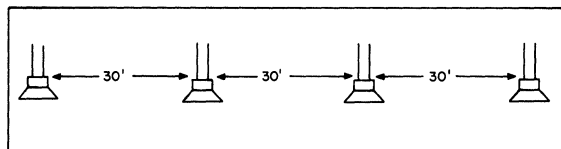
(c) If background music is provided, adjust the volume control of the 33A voice coupler to mid-range; then adjust the right-hand volume control(s) on the loudspeaker(s) to the desired music level (Fig. 22). The volume control of the 33A voice coupler may be readjusted, if necessary, to raise or lower the overall music level.



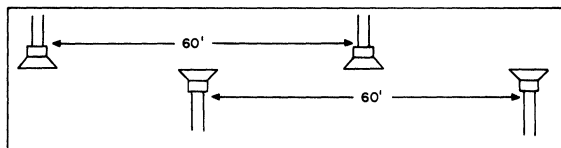
***If music-on-hold was previously furnished, do not adjust the level from the customer-provided music source.***

(d) Test the loudspeaker as follows:

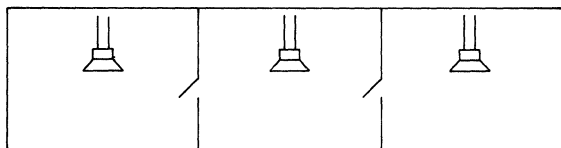
- (1) At any telephone set, depress an idle IC button and the DSS button that corresponds to the 109A loudspeaker set (if background music is provided it will be muted). Speak into the transmitter and adjust the volume control to the level desired by the customer (Fig. 22).



EXAMPLE A - SPEAKERS LOCATED ON ONE WALL OF ROOM (NOTES 1, 2 AND 3)



EXAMPLE B - SPEAKERS LOCATED ON OPPOSITE WALLS OF ROOM (NOTES 1 AND 2)



EXAMPLE C - SPEAKERS LOCATED IN INDIVIDUAL ROOMS (NOTES 1, 2 AND 4)

## NOTES:

1. EXAMPLES A, B AND C ARE FOR QUIET OR OFFICE TYPE ENVIRONMENTS. FOR A NOISY ENVIRONMENT, DISTANCE BETWEEN SPEAKERS MUST BE REDUCED TO A DISTANCE THAT WILL PROVIDE THE SAME LISTENING LEVEL.  
ALL SPEAKERS SHOULD BE LOCATED AT LEAST 60 FEET FROM ANY STATION USED FOR PAGING.
2. SPEAKER WIRING SHOULD BE RUN SEPARATELY, NOT PART OF A VOICE CABLE. QUAD CABLE SHOULD BE USED WITH BOTH PAIRS CONNECTED. SPEAKERS SHOULD BE HUNG AS CLOSE TO THE CEILING AS POSSIBLE.
3. SPEAKERS REACH A DEPTH OF 30 FT. IF ROOM IS OVER 30 FT. WIDE, FACING SPEAKERS SHOULD BE USED.
4. ONE SPEAKER WILL SERVE A ROOM UP TO 25 FT. BY 25 FT.

Fig. 24—Example of 109A Loudspeaker Locations



*If music-on-hold was previously furnished, do not adjust the level from the customer-provided music source. However, once the customer's paging system level has been set, the level of the background music may be altered by adjusting the screwdriver accessible potentiometer on the 33A voice coupler.*

#### 4. CONNECTIONS

- 4.01 Terminate the incoming CO/PBX lines on the 91A connecting block(s) associated with the primary station(s). See Table G.
- 4.02 Connect primary station line cords to customer-provided ac power.
- 4.03 Wiring schematics for 836-, 2836-, 837-, and 2837-type telephone sets are furnished in Fig. 25 through 28.

#### 5. METHOD OF OPERATION

##### ANSWERING CALLS

**5.01 Incoming Call on CO/PBX Line**—When audible tone signal sounds and lamp associated with CO/PBX button flashes, answer call as follows:

- (1) Lift handset (line buttons will not lock down unless handset is off-hook).
- (2) Depress CO/PBX button associated with flashing lamp—audible signal is silenced and lamp under CO/PBX button goes steady.
- (3) Answer call.

**Note:** The level of incoming voice signaling or tone ringing will be reduced while off-hook.

**5.02 Intercom Call**—When voice signal is heard:

- (1) Calling party will tell you what action to take (if any).

◆ TABLE F ◆

**109A LOUDSPEAKER SET  
CONNECTIONS TO JACK A (IVORY)**

FUNCTION OF LEAD IN COM KEY 416 CABLE	CONNECT (NOTE 1)		
	FROM	TO	
	JACK A (IVORY)	91A CONN BLOCK (SEE NOTES 2 & 4)	STD CUTDOWN ON 66-TYPE CONN BLOCK (OPTIONAL)
+V	R	45	Y-S
COM	B	20	S-Y
DSS (See Note 3)	G	D1	BR-BK
		D2	BK-BR
		D3	O-Y
		D4	Y-O
		D5	BR-Y
		D6	Y-BR
		D7	BL-V
		D8	V-BL
		D9	O-V
		D10	V-O

*Note 1:* Use inside wire to make connections.

*Note 2:* Short the four physically adjacent terminals 20, M, R1, and R2 and short the four physically adjacent terminals T2, T1, M, and 45.

*Note 3:* Connection is made to one of the DSS zones D1–D10 as appropriate.

*Note 4:* If connections are made to the 91A connecting block serving either primary set, the shorts of Note 2 are not required.



TABLE G

## CO/PBX LINE CONNECTIONS

LEAD DESIG.	AT 1st PRIMARY STATION	AT 2nd PRIMARY STATION
	91A CONN. BLOCK	91A CONN. BLOCK
R(1)	R1	
T(1)	T1	
R(2)	R2	
T(2)	T2	
R(3)		R1
T(3)		T1
R(4)		R2
T(4)		T2

(2) If necessary, lift handset and depress intercom button as per instructions to converse with calling party.

## PLACING CALLS

**5.03 Outgoing Call**—To make an outgoing call:

- (1) Lift handset.
- (2) Depress CO/PBX button associated with an idle line.
- (3) Dial number when dial tone is received.

**5.04 Intercom Call**—To make an intercom call:

- (1) Lift handset.
- (2) Select idle intercom path and depress button. No dial tone is provided on intercom.
- (3) Depress and hold button on DSS key corresponding to desired station that is to receive voice message. Multiple stations may be signaled by depressing more than one DSS button at a time, or the preset multiple voice signaling option may be used. Give message to called party. **DSS button must be held depressed during entire one-way conversation.**

- (4) Release button when one-way message is completed.
- (5) To carry on a 2-way conversation, the called party must pick up handset and depress the same intercom button on his set being used by the calling party.

**5.05 Multiple CO/PBX Conferencing**

(a) To conference CO/PBX lines:

- (1) Make outgoing call (5.03) to desired party.
- (2) Depress HOLD button; line button will restore and go on hold.
- (3) Make outgoing call on another idle CO/PBX line.
- (4) While holding the second CO/PBX line button down, depress the first held line button.
- (5) Additional parties may be added by repeating the above procedure.

**Note:** Since no amplification is provided, this type of conferencing is limited. When lines are conferenced using this manner of conferencing, distant stations may have trouble hearing each other and transmission is not guaranteed. All lines that are conferenced together may be put on hold simultaneously by depressing the HOLD button.

(b) To make a call during a conference:

- (1) Depress HOLD button—all buttons restore and lines go on hold.
- (2) Select an idle line.
- (3) Dial call.
- (4) To reenter conference again after call is completed, simultaneously depress conferenced buttons again.
- (5) If it is desired to add this call to the conference, hold this CO/PBX line button down and depress the conferenced CO/PBX line buttons.

(6) If it is desired to add another call to the conference, hold the conferenced CO/PBX line buttons down and depress button of CO/PBX line to be added.

(7) To prevent dropping one of the participants when setting up a conference, ensure that the conferenced CO/PBX line buttons are held down when adding another station.



***Intercom and CO/PBX lines cannot be conferenced together.***

### 5.06 **Privacy, Privacy Release**

(a) To bring a locked-out station into a conversation, depress the PRIV RLS button. The line will go on hold with the lamp winking. The button must be held depressed until the locked-out party bridges onto the line at which time the lamp goes steady. The button should then be released.

(b) To add a station equipped with privacy to a bridged conference, all of the sets already connected must depress their PRIV RLS button to allow the station to bridge onto the conference.

**5.07 *Built-in Loudspeaker Service***—To use, depress button on line key designated SPKR. When conversation is finished, depress button to release SPKR before replacing handset. Otherwise, a feedback “squeal” may be heard as the handset is brought near the speaker.



***Incoming voice and tone signaling will not be attenuated in the off-hook condition if the SPKR button is locked down. This button is not linked to the ABR mechanism.***

## 6. MAINTENANCE

**6.01** Maintenance of the 4A System is limited to making wiring checks, replacement of telephone sets, or those set components covered in this section. DO NOT attempt to modify or repair telephone sets or apparatus units in a manner other than covered.

**6.02** When trouble is encountered, ***first make a thorough check of all connections, then***

make the following checks before repair or replacement of telephone sets is considered.

- Primary station power cord is connected to a working ac receptacle.
- Primary station transformer(s) is securely in place.
- Sets are securely connected to adapters.
- Volume control is not turned all the way down.
- Lamps are not burned out.
- Incoming CO/PBX pairs are securely terminated on 91A connecting blocks associated with primary stations.
- Plugs are secure on line key.

**6.03** If more than one set has the same trouble, the trouble is usually in a primary station set. In multiple primary set installations (three and four CO/PBX lines), the trouble can be further isolated by unplugging one primary set and observing operation of the remaining primary set. If service provided by the disabled primary set does not restore to normal when the power cord is reconnected, that primary set is defective.

**6.04** If normal service is provided on at least one set but not on any other set, the problem is probably in the cabling. If all sets beyond a point on the cable bus relative to a primary set exhibit the same trouble, the cable fault is an open conductor path. If all sets exhibit the same trouble and service can be restored to sets near a primary set by disconnecting the cable bus beyond that point, the fault is a conductor short.

**6.05** Diagnostic Table H contains information to assist in troubleshooting the system.

### ***Dial Replacement***

**6.06** Replace rotary or TOUCH-TONE dial as follows:

- (1) Remove faceplate (see 3.13).
- (2) Remove DSS key (do not disconnect leads).

**TABLE H**  
**DIAGNOSTIC TABLE**

TROUBLE	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
One set does not ring on specified line(s) but lamp flashes properly.	Common audible switches not set properly.	Set the four common audible switches for desired ringing at that station.
One set does not receive voice signal on DSS.	Station designation not coded properly on DSS key.	Check for correct position of slide switch. Be sure switch is properly engaged in a detent (centered on number).
Low volume on ringing or voice signaling.	Volume control set too low. Handset off-hook.	Readjust volume. Replace handset.
One lamp does not light on one station but lights on other stations.	Lamp failure.	Replace lamp per 6.12.
A lamp does not light at any station and there is an audible buzz on the line associated with lamp.	Lamp pair shorted in a station or transposed on a connecting block.	Correct wiring.
No music-on-hold.	Blown fuse on 33A voice coupler, improper wiring of music-on-hold option.	Replace fuse. Check wiring of music-on-hold circuit board and 33A coupler.
Excessive crosstalk on lines 1 and 2 or 3 and 4 when on hold.	Improper installation of music-on-hold option.	1. Check wiring of 33A coupler. 2. Music-on-hold board installed in a set, but option not being furnished.
Music distorted or too low.	Improper adjustment of music level; customer's music source does not have sufficient output.	See 3.14.
Cannot drop a particular line at any station.	Failure of primary set logic circuit.	Replace primary set.
False hold condition when changing lines or lightly touching line buttons.	Defective line key.	Replace line key per 6.09.

(3) Remove and retain two screws holding dial in set.

(5) Transfer dial mounting brackets to new dial.

(4) Disconnect dial leads.

(6) Connect dial leads and replace dial in set using screws removed in (2).

TABLE H (Cont)

## DIAGNOSTIC TABLE

TROUBLE	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
No sidetone on CO/PBX line.	Incoming CO/PBX line is dead.	Check incoming tip and ring with test set.
	Incoming tip and ring terminated on wrong terminals.	Check connections.
	Switch pileup on telephone set is defective.	Change out telephone set.
	Privacy circuit (if set is so equipped) may be operating incorrectly.	Check to see if privacy relay is falsely operating when going off-hook. If yes, check connections. If okay, replace privacy circuit.
	If rotary dial set has dial restriction.	BL-R lead of telephone set not moved from terminal 28 to 39.
	If 66-type connecting blocks are used, the cutdown may be incorrect.	Check station cutdown.
	Set has privacy circuit and CO/PBX line is in use by another station.	No corrective action; wait until line is not in use.
All four CO/PBX lamps light dim; noise on intercom on all sets.	System power supply shorted.	Disconnect sets (one at a time). If problem persists, check cable.
Sidetone on CO/PBX lines; but no lamps on CO/PBX or intercom lines, no ringing on above lines, no intercom talk battery. Transformer usually warm.	No power applied to associated control set.	Verify power at ac outlet and ensure that sets are plugged in.
	Power supply was shorted long enough to permit thermal cutout in transformer to operate.	<ol style="list-style-type: none"> <li>1. Replace transformer.</li> <li>2. Replace primary set.</li> <li>3. Wait (up to 30 minutes) for thermal circuit breaker to reset automatically.</li> </ol>
Cannot dial.	Set wired for dial restriction option.	No corrective action necessary.
Noise from speaker as volume control is rotated.	Defective volume control.	Replace assembly as covered in 6.13.

◆ TABLE H (Cont) ◆

DIAGNOSTIC TABLE

TROUBLE	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
System wired for 3 or 4 CO/PBX lines, but only dial tone on lines 1 and 2. Cannot rotary dial on lines 1 and 2.	Line assignment connector not rotated.	Rotate line assignment connector as covered in 3.08.
Privacy circuit does not prevent pickup when going off-hook on a busy line.	Improperly wired or defective privacy circuit.	Correct wiring or replace privacy circuit.
Privacy circuit does not prevent pickup on busy line when rapidly changing lines, but is okay going off-hook.	Defective line key.	Replace line key.

(7) Replace DSS key.

(8) Test dial.

(9) Replace faceplate.

(5) Reset No. 1 switch to proper position and close cover.

### **Handset and Cord**

**6.07** The handset cord is equipped with standard modular set plugs. To remove cord from the set or handset, release catch by depressing with finger or KS-16750 tool. When reinserting plugs, make sure cord is locked in place.

### **DSS Key Cover Replacement**

**6.08** Replace cover as follows:

- (1) Raise cover perpendicular to key.
- (2) Move the No. 1 common audible switch to OFF.
- (3) Twist the cover clockwise and snap out.
- (4) Install new cover, twisting in the reverse direction.

### **Replacement of Line (647M6) Key**

**6.09** To replace the 10-button line key:

- (1) Remove faceplate and key collar.
- (2) Loosen key mounting screws at both ends of key and carefully lift key out of set.
- (3) Unplug all 508-type plugs from defective key.
- (4) Connect plugs to replacement key in the following order starting with the HOLD key: pink, blue, orange, green, brown, slate, white, red, black, yellow, and beige.

**Note:** Check that each plug is held in place by the matching locking tabs on the key body.

- (5) Replace key in its mounting **making sure that the key latch bar hook properly engages the telephone set ABR pivot bar.**

- (6) Check that the wiring will not interfere with contact or button operation and tighten the key mounting screws.
- 6.10** Any time the line key has been removed or replaced, the following functional tests and necessary adjustments should be made:
- (1) With the set plugged in, check the ABR on each CO/PBX line by going off-hook, depressing and locking the line button and gently replacing handset. The associated lamp should light while off-hook and the button restore when handset is replaced.
  - (2) Go off-hook, simultaneously lock down all four line buttons, and gently restore the handset. All buttons should release. Repeat for intercom buttons.
  - (3) Depress and lock one of the working CO/PBX line buttons and note that lamp is steady. Very slowly depress any of the other line buttons until the first button is released. If the first line goes on hold as indicated by the steady lamp changing to wink, the key is defective and should be replaced. Make this test for each working line.
  - (4) With handset on-hook, completely depress each line and intercom button one at a time. The associated lamp should not light. If any of the lamps light, adjust the ABR by loosening the screw on the ABR bracket in the upper left-hand corner of the faceplate opening. Move the bracket slightly toward the front of the telephone set. Tighten the screw and repeat above test.
- 6.11** After all tests and adjustments have been made, replace key collar and install faceplate (Fig. 11).

### ***Lamp Assembly Replacement***

- 6.12** If the lamp is defective, the button assembly must be replaced as follows:
- (1) Remove faceplate and key collar.

- (2) Pinch the button assembly between the thumb and forefinger at the second joint.
- (3) Firmly but gently tilt the button to one side with the thumb until it snaps free from the plunger. Still holding the button slightly tilted, withdraw it from the lamp socket.
- (4) Orient new button assembly so that lamp is in upper left corner of the button when viewed from front of set. Place button over lamp socket, gently slide it into the opening, and push on top until it snaps into place.

### ***Volume Control***

- 6.13** Replace potentiometer assembly as follows:
- (1) Remove faceplate.
  - (2) Remove DSS key. Do not disconnect leads.
  - (3) Remove one screw holding assembly to base and disconnect leads from terminal field.
  - (4) Install assembly in reverse order.

### ***Transformer***

- 6.14** The transformer is removed as covered in 3.08(1). When installing transformer, make sure plug is properly engaged.

### ***♦Apparatus Units***

- 6.15** Maintenance of the apparatus units is limited to checking for loose connection. DO NOT attempt to repair the apparatus units in the field. If after checking for loose connections the unit will not function, replace the entire unit.♦

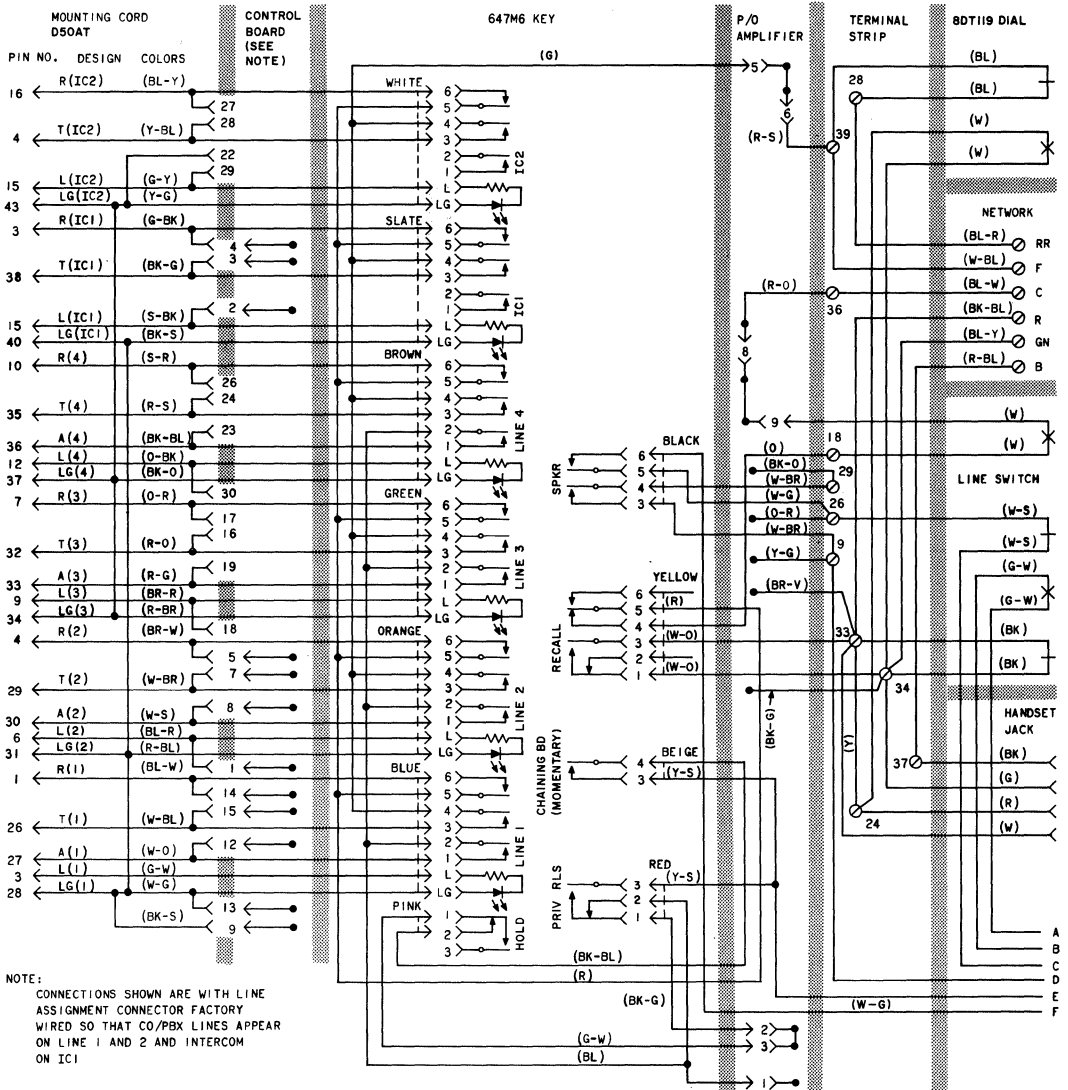


Fig. 25—Schematic, 836AM Telephone Set (Rotary Primary Station) (Sheet 1 of 2)

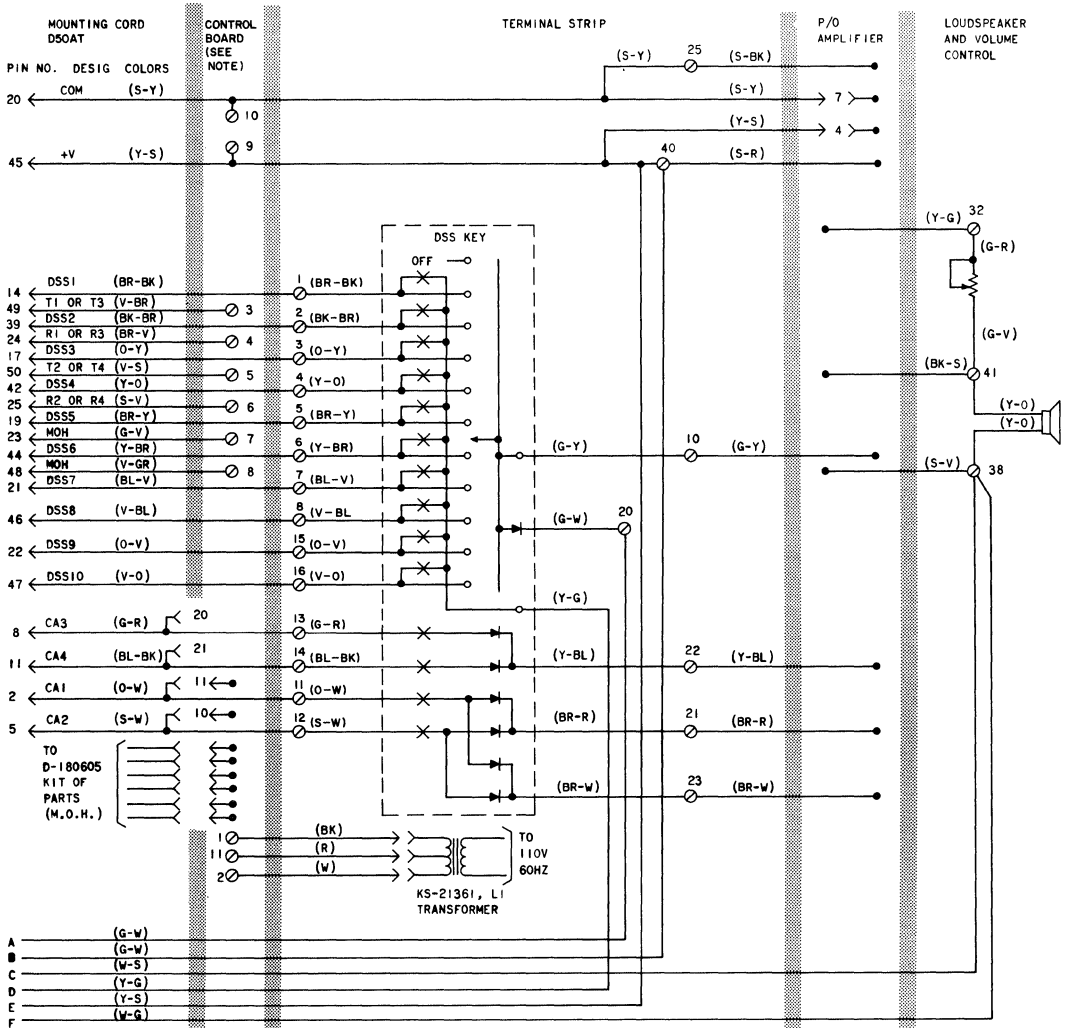


Fig. 25—Schematic, 836AM Telephone Set (Rotary Primary Station) (Sheet 2 of 2)



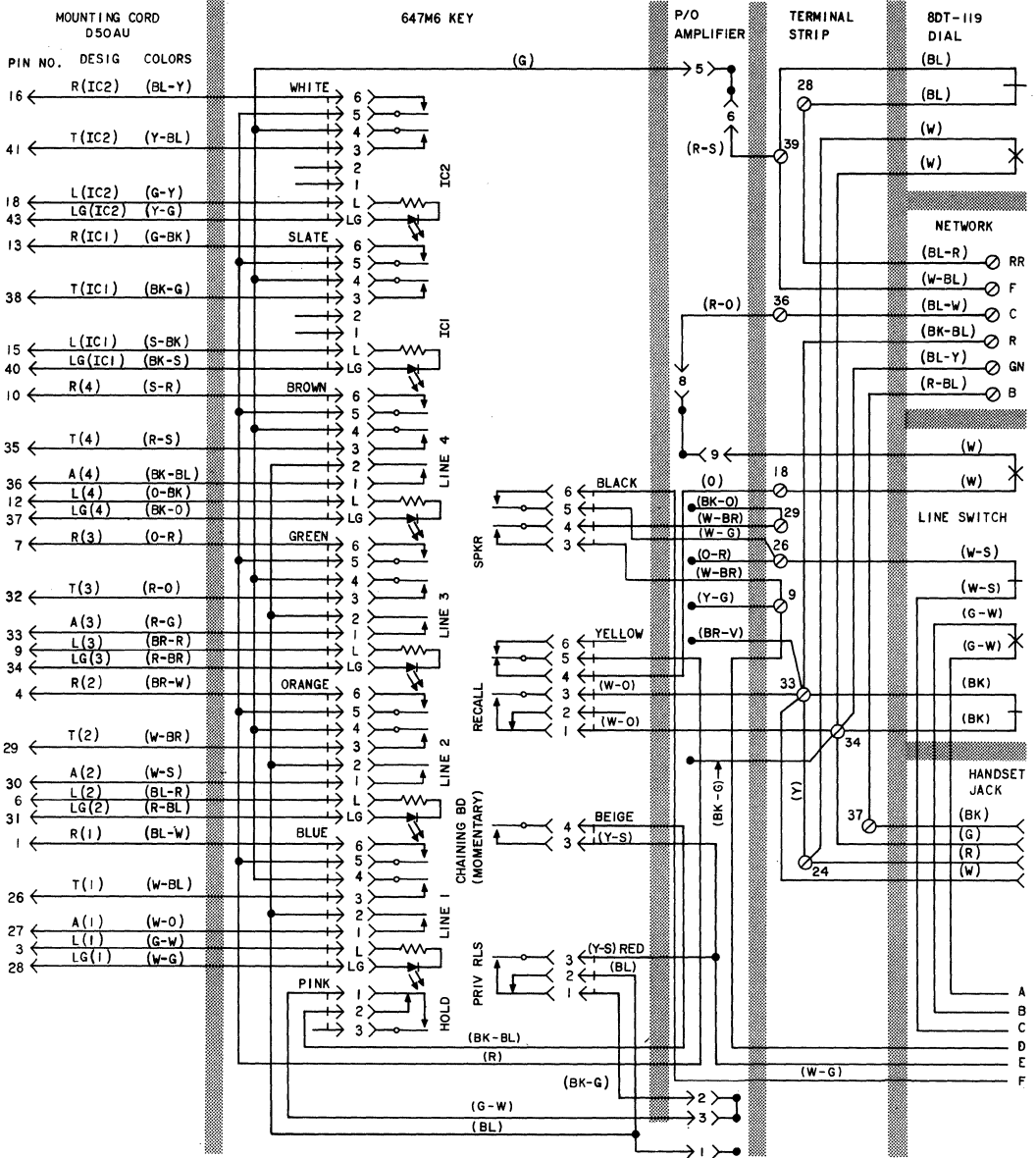


Fig. 26—Schematic, 837AM Telephone Set (Rotary Satellite Station) (Sheet 1 of 2)

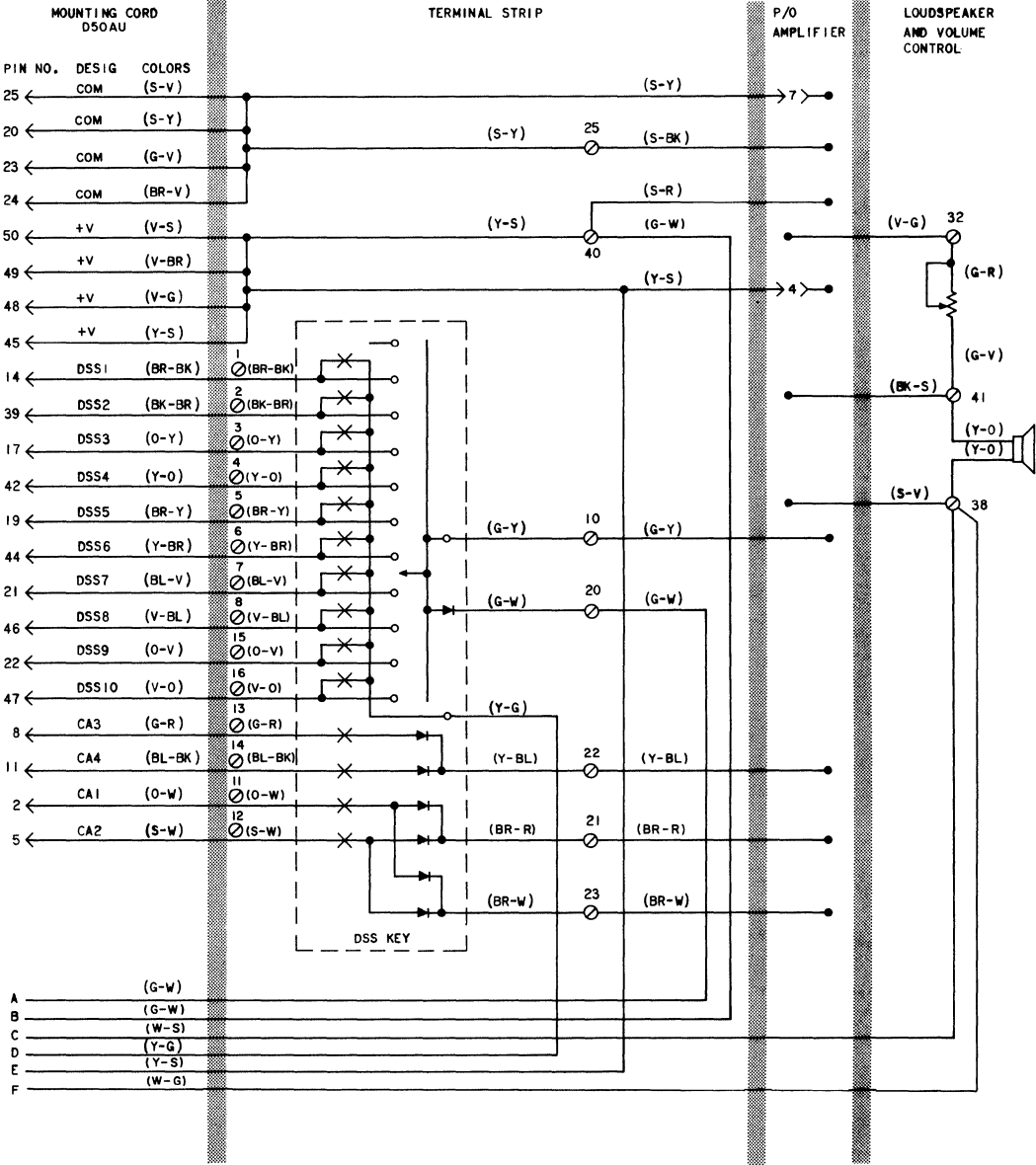


Fig. 26—Schematic, 837AM Telephone Set (Rotary Satellite Station) (Sheet 2 of 2)

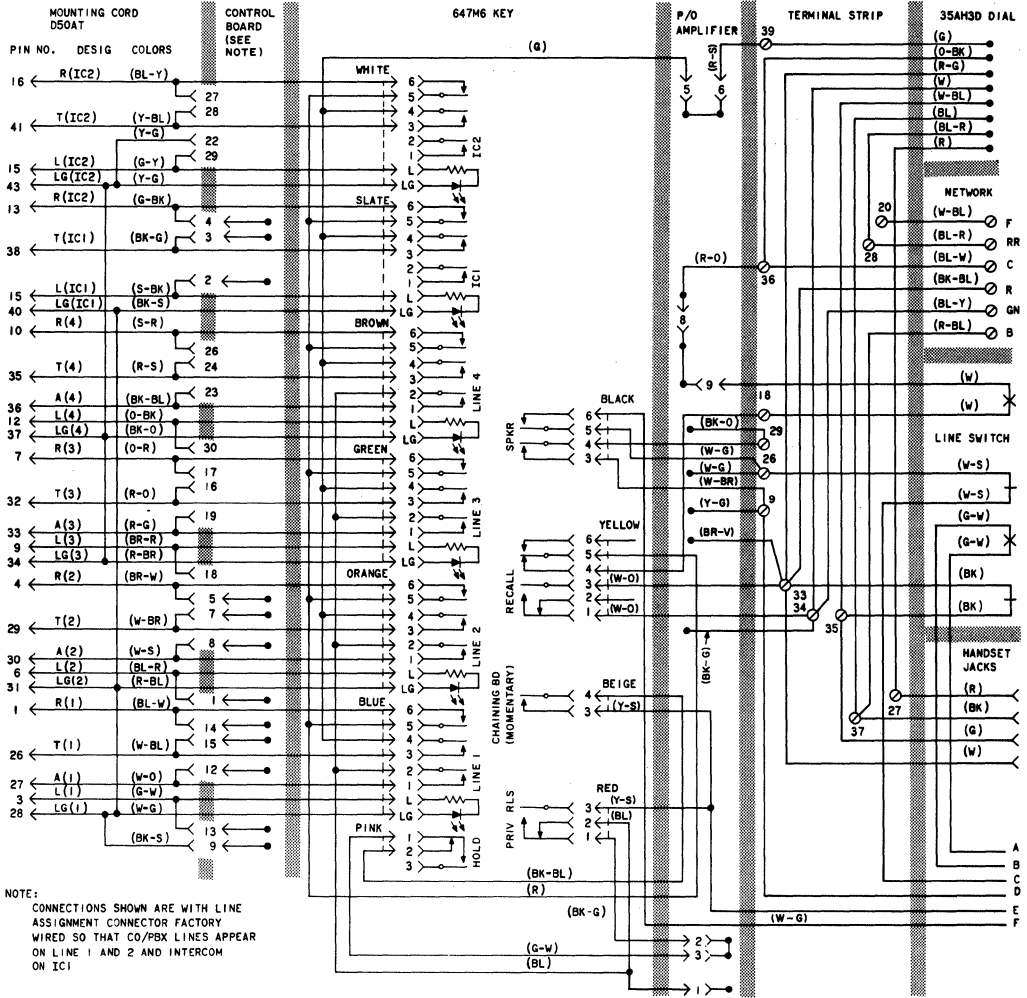


Fig. 27—Schematic, 2836AM Telephone Set (TOUCH-TONE Primary Station) (Sheet 1 of 2)

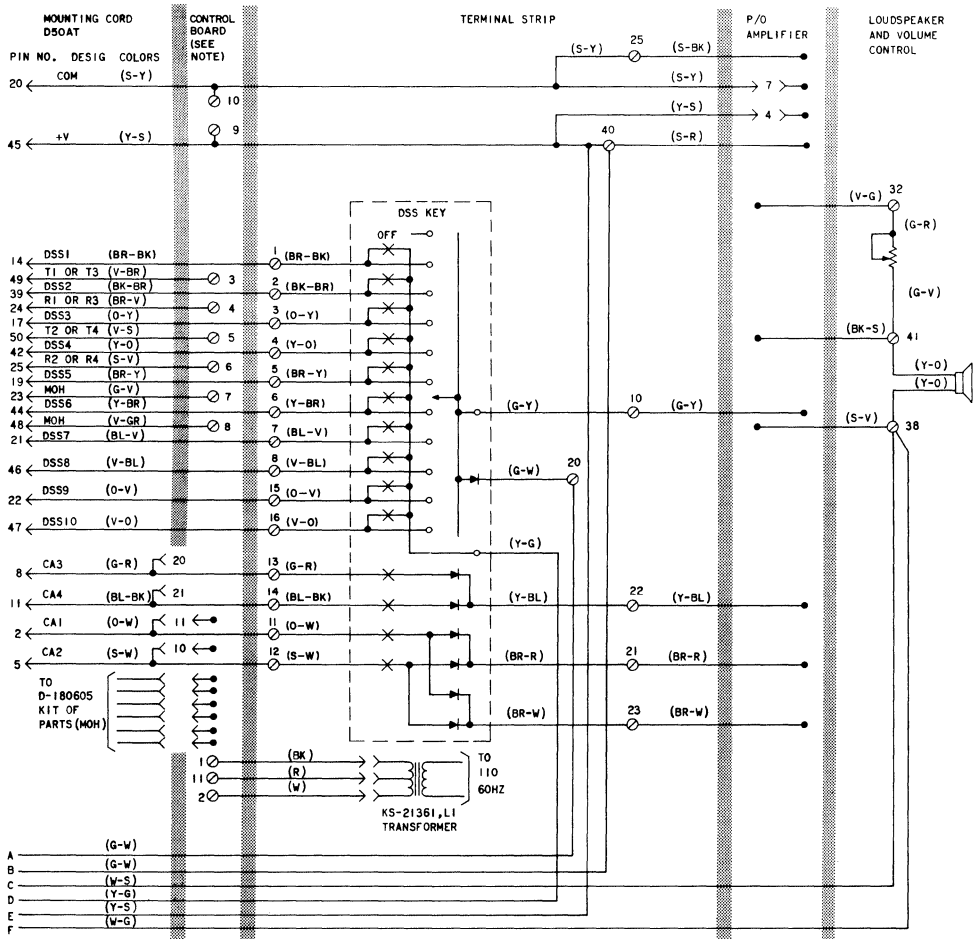


Fig. 27—Schematic, 2836AM Telephone Set (TOUCH-TONE Primary Station) (Sheet 2 of 2)

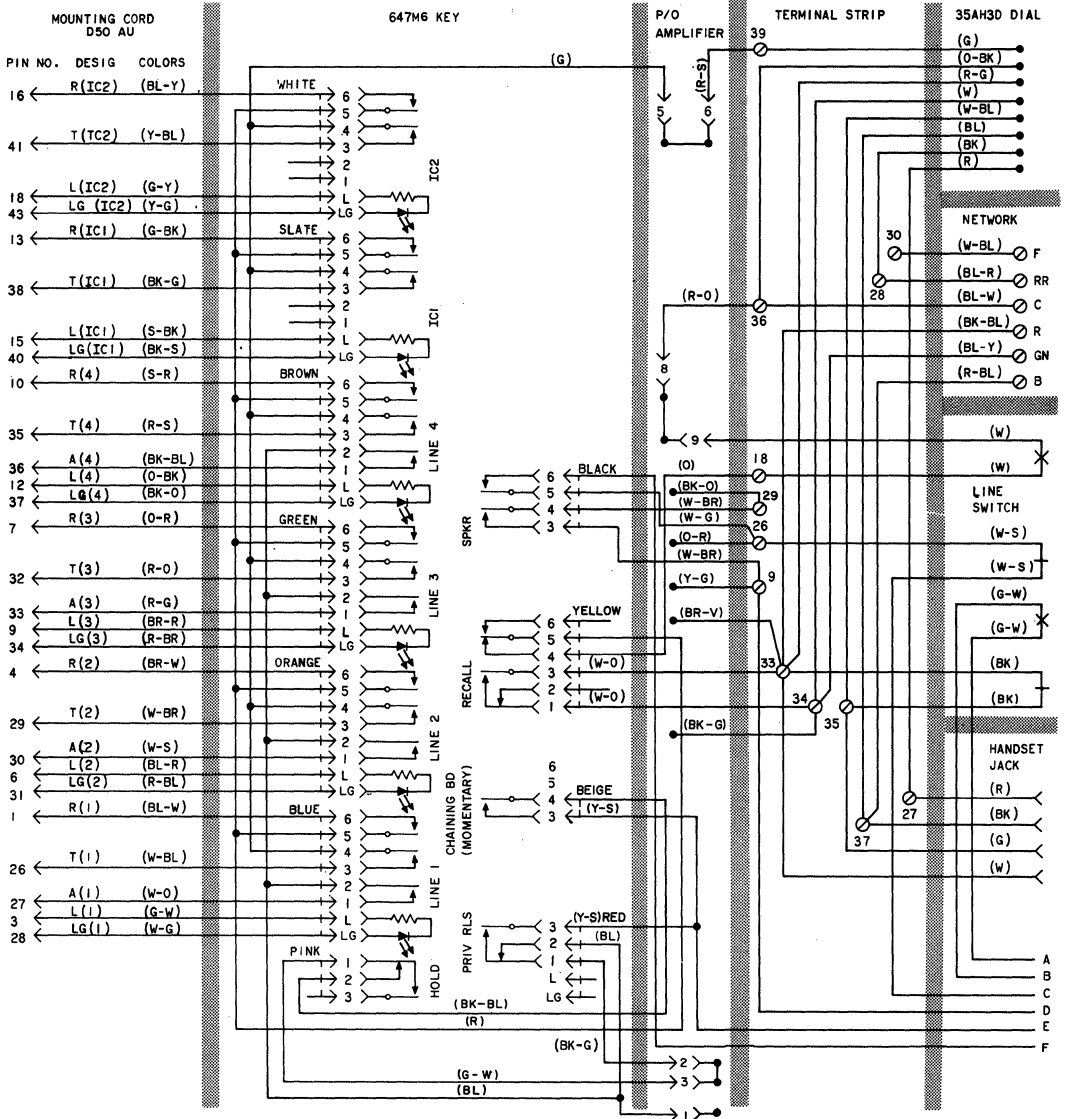


Fig. 28—Schematic, 2837AM Telephone Set (TOUCH-TONE Satellite Station) (Sheet 1 of 2)

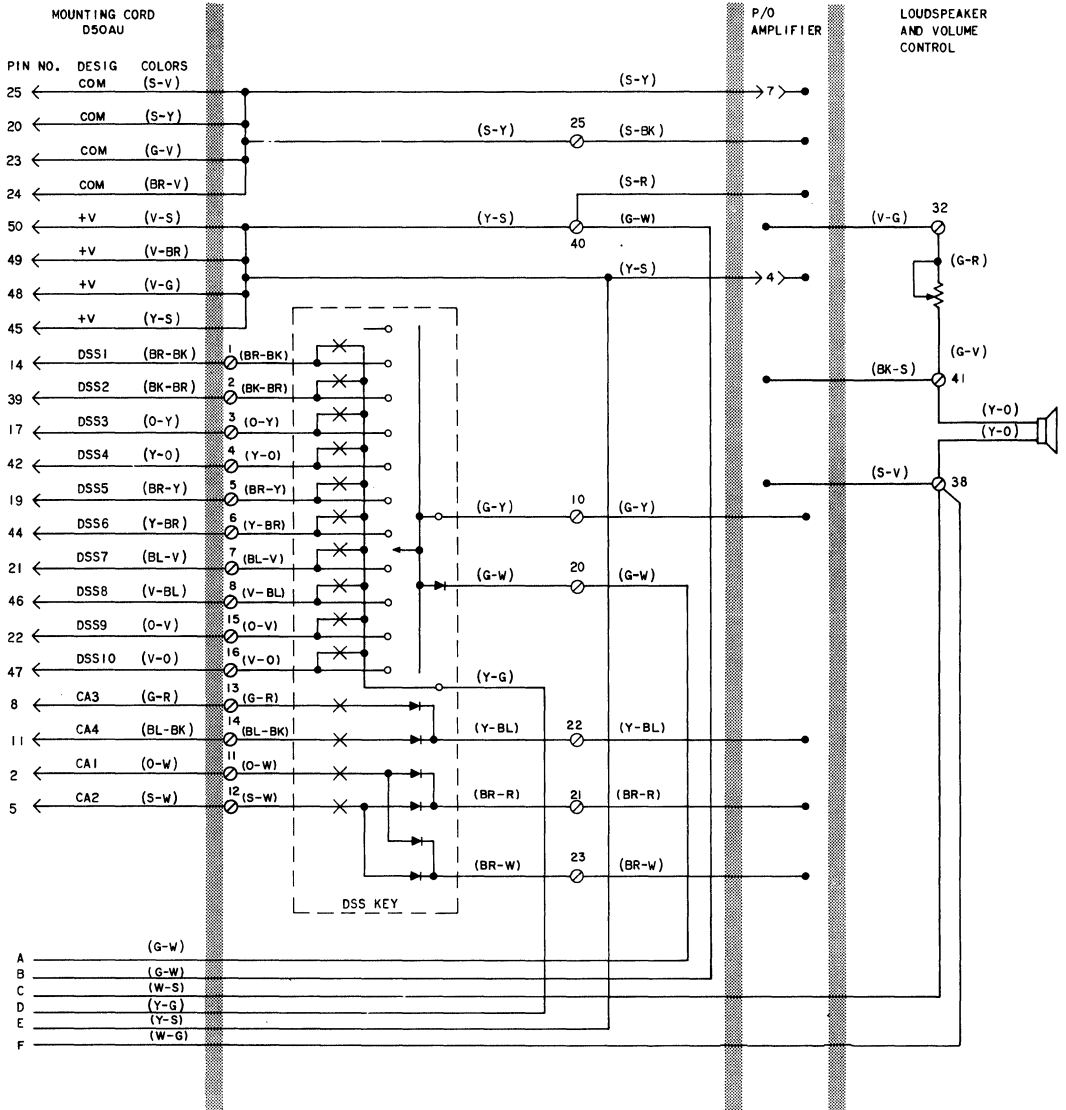


Fig. 28—Schematic, 2837AM Telephone Set (TOUCH-TONE Satellite Station) (Sheet 2 of 2)

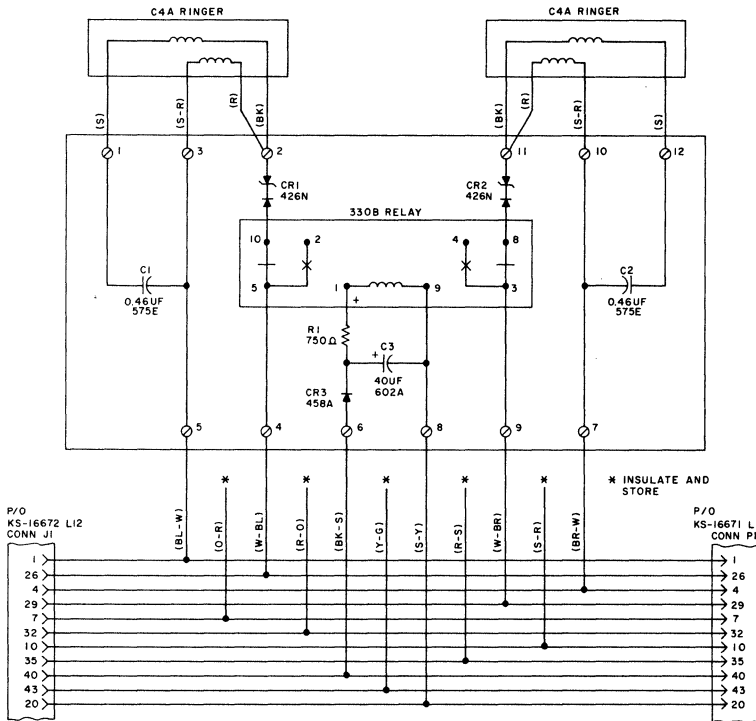


Fig. 29—Schematic, 24A Apparatus Unit

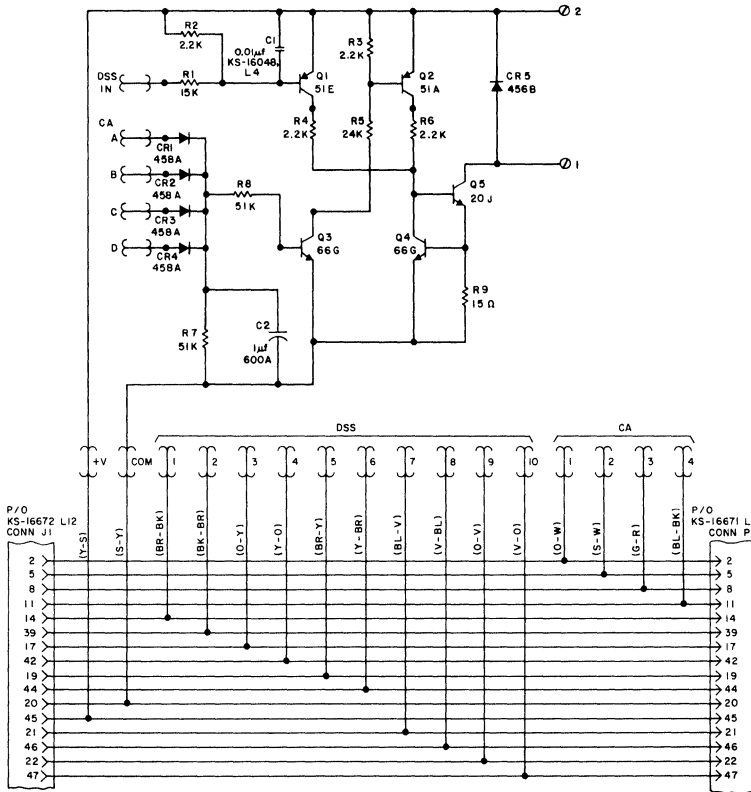


Fig. 30—Schematic, 25A Apparatus Unit



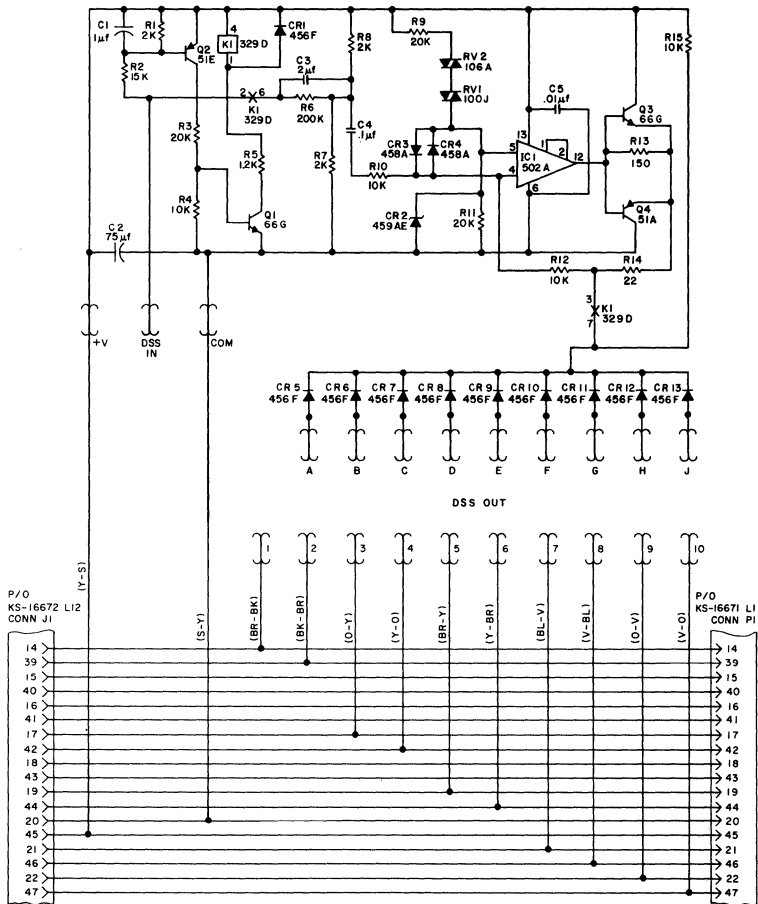


Fig. 31—Schematic, 26A Apparatus Unit

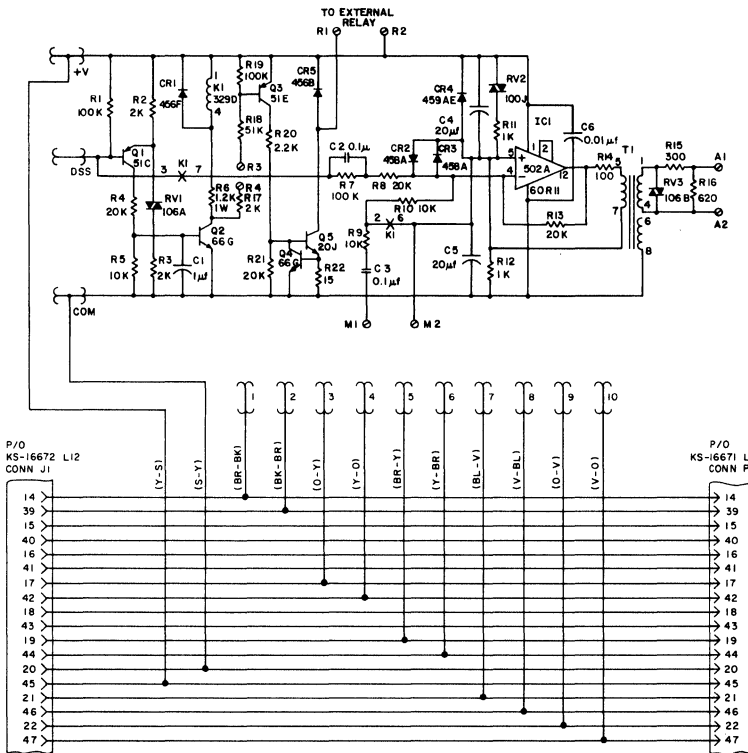


Fig. 32—Schematic, 27A Apparatus Unit

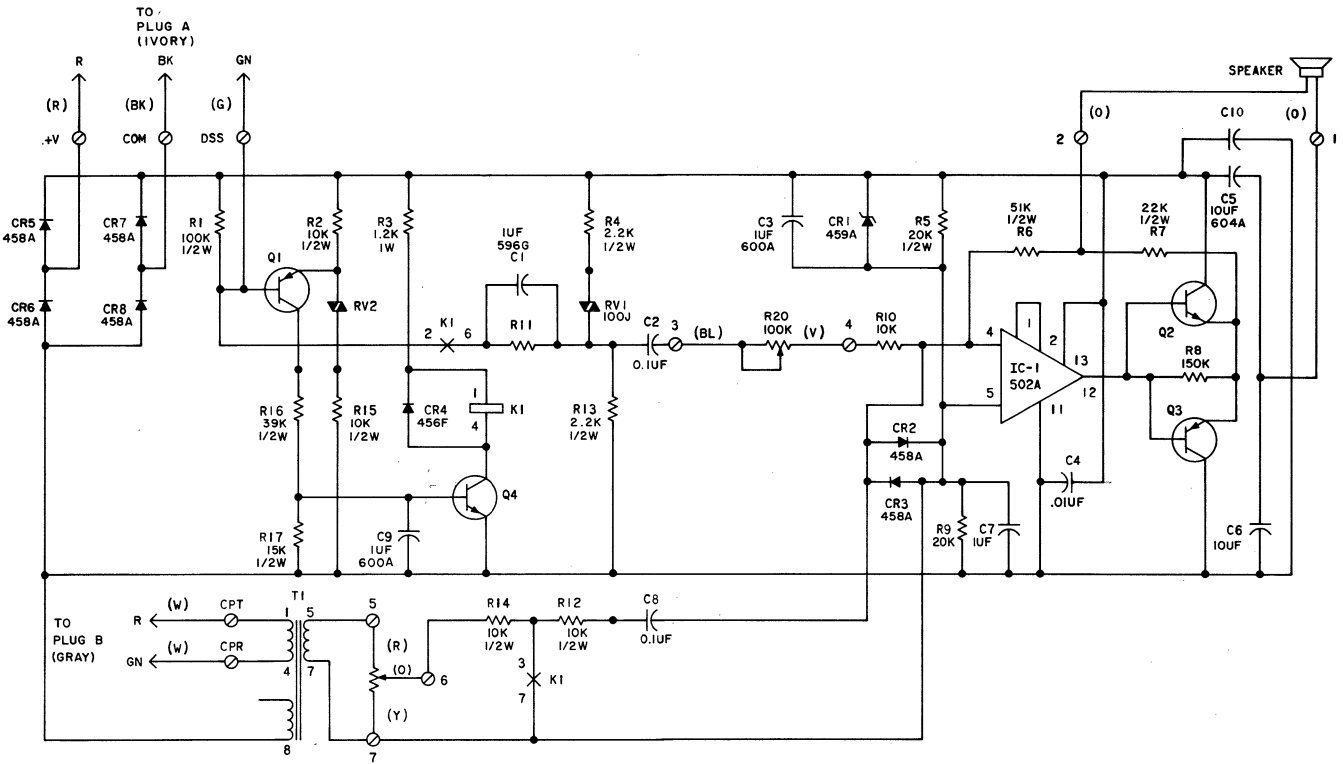


Fig. 33—Schematic, 109A Loudspeaker

## 4A COMMUNICATION SYSTEM

(COM KEY\* 416)

### IDENTIFICATION, INSTALLATION, CONNECTION, OPERATION, AND MAINTENANCE CUSTOMER EQUIPMENT

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**1. GENERAL**

**1.01** This section provides complete information on the 4A Communication System (COM KEY 416) using 981/2981- and 983/2983-type telephone sets.

**1.02** This section is reissued to:

- Add information relative to the Federal Communications Commission (FCC) Registration Program

- Show the 91B connecting block replacing the 91A (MD)
- Show the 33C voice coupler replacing the 33A (MD)
- Show the 30AM apparatus unit replacing the 30A (MD)
- Show the 19B4 power unit replacing the 19B2 (MD)
- Show the 2012D transformer replacing the 2012B (MD)
- Show the D-180980 music-on-hold kit of parts replacing the D-180730 (MD)
- Delete coverage of F-60591 Kit of Parts
- Add information on electrical protection and electro-magnetic interference protection
- Refer to additional external ringers
- Cover use of special handsets
- Add new Table A, combining previous Tables A and B
- Add new Table B
- Revise Table F
- Add new Fig. 7, 10, 26, 33, 39, 40, and 46
- Revise Fig. 8, 9, 11, 12, 21, 24, 28, 32, 38, 43, 44, 48, 49, 50, 51, and 52.

Since this reissue is a general revision, no revision arrows have been used to denote significant changes.

**1.03** The 4A System is a packaged, modular key telephone system having a maximum capacity of 16 stations with four common CO/PBX lines, one personal CO/PBX line per telephone, and two intercom paths. A wide selection of basic and optional features is available (see Part 2). The

system includes five types of telephones: (1) primary sets, (2) basic satellite desk sets, (3) basic satellite wall sets, (4) satellite sets with built-in speakerphone (BIS), and (5) satellite sets with hands-free answer on intercom (HFAI). Each primary set contains the control circuitry for two CO/PBX lines and one intercom path and the power circuitry to serve itself and some combination of up to seven satellite sets. The addition of a second primary set doubles the capacity of the system; up to seven more satellite sets can be connected, with each station in the system now served by up to four CO/PBX lines and two intercom paths. The satellite sets provide the same basic services as the primary sets, but they do not contain control and power circuits.

**Caution 1:** *The 4A System is designed to operate on CO/PBX loops of 20 milliamperes or greater.*

**Caution 2:** *The 4A System is not intended for installations where off-premises extensions are required.*

**1.04** Because the control and power circuitry of the 4A System is contained in the primary station sets, there is no need for separately mounted key service units such as most key systems require. The only equipment required in addition to the telephone sets are interconnecting cables, blocks, adapters, and small externally mounted units for some optional features. Systems with many optional features may require an externally mounted power unit.

**1.05** Each 4A station can be programmed by the customer to ring on any combination of the common CO/PBX lines. All stations have access to all common lines in the system; therefore, any set can be assigned as the attendant station, if one is required. Each station also has direct access to the ten intercom codes.

**1.06** All 4A telephone sets are available with either rotary or TOUCH-TONE® dialing. The primary set is available only in a desk-type model, but the basic satellite sets can be ordered in both desk and wall configurations. The BIS and HFAI sets are convertible from desk to wall mounting by means of a kit of parts. There are a total of ten telephone set codes in the 980-series (Table A). Figures 1 through 5 illustrate typical sets.

**1.07** The 4A System derives its ac power from a standard 117-volt 60-Hz source. The system components are protected by a self-resetting thermal cutout in the power supply of the primary station, making separate fusing unnecessary. The 19B4 power unit, used when supplementary dc power is required, has both input and output fusing.

**1.08** While the 980-series telephones provide more optional features than the 830 series (MD) used with the earlier 4A System (Section 518-450-105), the two series are compatible and interchangeable. They can coexist in the same system and 980-series sets can be used to replace 830-series sets in existing installations. However, if supplementary power is required, the primary sets must be from the 980 series.

**Note:** In a mixed system, optional code busy direct station selection (DSS) keys can only give busy indications for 980-series telephones.

**1.09** Certain components and apparatus used with the 4A System have been rated MD and replaced by new units. These units are listed in Table B. Throughout the rest of this practice, all references will be to the current versions of the units, **unless** the procedures applying to the MD unit are different in any way; in the latter case, both units will be given separate coverage.

**1.10** Schematics of the telephone sets and apparatus units of the 4A System are contained in SD-69856-01. The schematic of the 1A transmitter-receiver (built-in speakerphone module) is in SD-69800-01.

**1.11** For additional information on the following subjects, refer to the documents listed:

4A Speakerphone—Section 512-700-100

33C Voice Coupler—Section 463-341-102

Adjunct Repertory Dials—Section 501-164-201

KS-16301L17 Relay—Section 463-110-100

KS-16626L12 Relay Set—Section 463-120-100

19B4 Power Unit—Section 167-440-201

Wall-Mounting Fasteners—Section 080-720-105

TABLE A

SUMMARY OF 4A COMMUNICATION SYSTEM TELEPHONE SETS AND OPTIONS

TELEPHONE SETS		ROTARY	DESK PRIMARY	BASIC DESK SATELLITE	BASIC WALL SATELLITE	BIS SATELLITE	HFAI SATELLITE					
								981A01	981A02	981A03	983A01	983A02
								TOUCH-TONE	2981A01	2981A02	2981A03	1983A01
OPTIONS	OPTION	COMPONENT(S) REQUIRED										
Set Options	Personal Line	30AM Apparatus Unit (Note 1) D-180758 Kit of Parts	•	•	•	•	•					
	Privacy	D-180729 Kit of Parts	•	•	•	•	•					
	Wall Mounting	D-180747 Kit of Parts				•	•					
	Code Busy DSS Key	664C Key	•	•	•	•	•					
	Station Restriction	(Wiring Change Only)	•	•	•	•	•					
	Impaired Hearing Handset	G6BM Handset D-180851 Kit of Parts	•	•		(Note 2)	(Note 2)					
	Handset With More Receive Gain Than G6BM	D-180413 Handset D-180851 Kit of Parts	•	•		(Note 2)	(Note 2)					
	Weak Speech Handset	G7BM Handset D-180851 Kit of Parts	•	•		(Note 2)	(Note 2)					
	Noisy Location Handset	G8BM Handset D-180851 Kit of Parts	•	•		(Note 2)	(Note 2)					
	Acoustic or Inductive Coupling Handset	G15A Handset D-180851 Kit of Parts	•	•		(Note 2)	(Note 2)					
	G-Type Handset Equipped With Shoulder Rest	G4BM Handset D-180851 Kit of Parts	•	•		(Note 2)	(Note 2)					
	Long Loop, 3-dB Transmit Gain	G36AM Handset D-180851 Kit of Parts	•	•		(Note 2)	(Note 2)					
	External Speakerphone	4A Speakerphone D-180732 Kit of Parts					(Note 2)					
	Repertory Dialing	Adjunct Repertory Dial 870A1 or 2870A1 D10Y50 Cord		•		(Note 2)	(Note 2)					
	Built-In Speakerphone	(Factory-Installed)				•						
	Hands-Free Answering on Intercom	(Factory-Installed)					•					
System Options	Power Failure Ringing	24B Apparatus Unit										
	Supplementary Alerting Device Access	25A Apparatus Unit KS-16626L12 Relay or KS-16301L17 Relay Alerting Device and its Power Unit										
	Preset Intercom Voice Signaling	26A Apparatus Unit										
	Telephone Company - Provided Paging System	109A Loudspeaker Set										
	Customer-Provided Paging System Interface	27A Apparatus Unit (Note 3)										
	Background Music With Any Paging System	33C Voice Coupler (Note 4)										
	Music-On-Hold	33C Voice Coupler (Note 4) D-180980 Kit of Parts	•									
	Tone-On-Hold	D-180731 Kit of Parts	•									
	External Ringing	E1CM, S1AMP, or L1AM Ringer										
Supplementary Power	19B4 Power Unit											

Note 1: Mounted external to telephone set.

Note 2: Option not offered when set is wall mounted.

Note 3: KS-16626L12 relay may also be required.

Note 4: Only one 33C voice coupler is required per system.



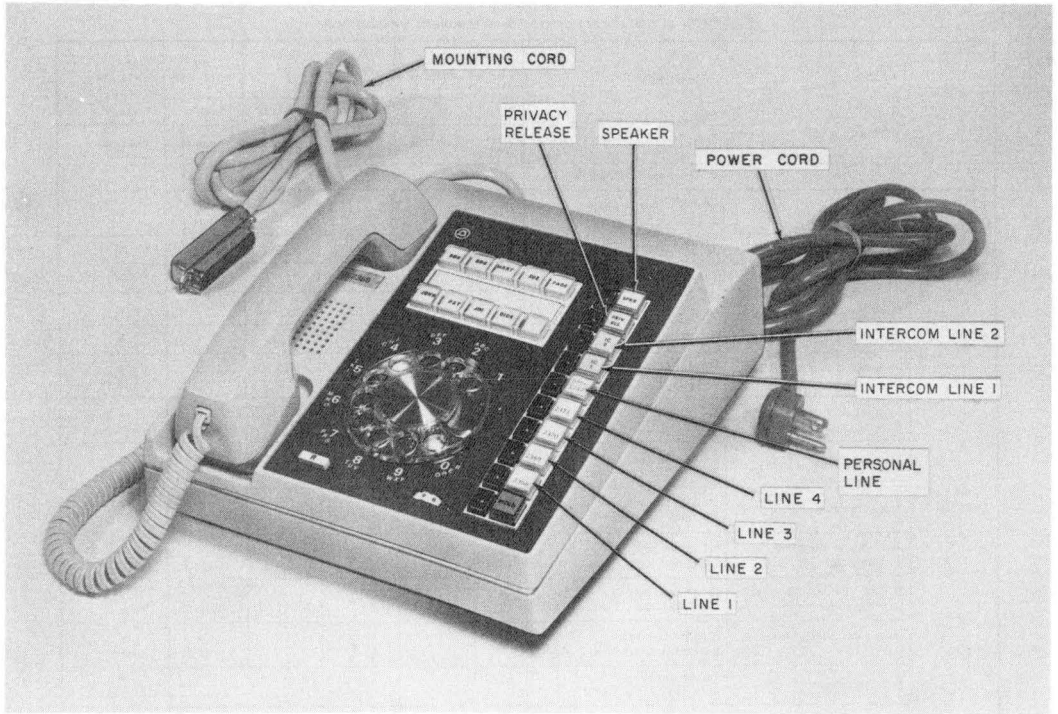


Fig. 1—Primary Telephone Set



Fig. 2—Basic Satellite Wall Telephone Set



Fig. 3—Built-In Speakerphone Satellite Telephone Set

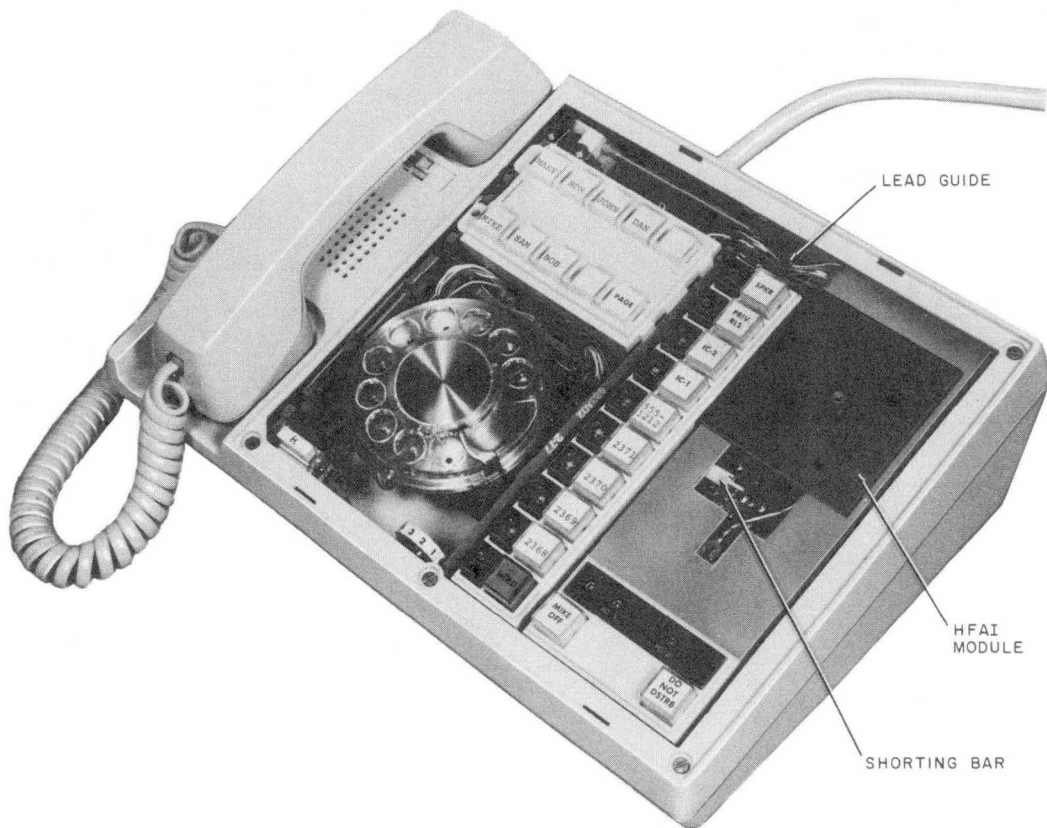


Fig. 4—Hands-Free Answer on Intercom Satellite Telephone Set With Faceplate Removed

E1-Type Ringers—Section 501-251-100

L1AM Ringer—Section 501-258-101

SIAMP Tone Ringer—Section 501-260-100

Electro-Magnetic Interface Protection—X-4235

## 2. IDENTIFICATION

2.01 The 4A System consists primarily of key telephone sets and various connecting hardware and cables. Basic operating features are supplied as part of the telephone sets, while additional

apparatus, installed in the sets or externally, provides optional features.

### BASIC FEATURES

2.02 The following features are provided in all 4A System telephone sets and require no additional installation:

- (a) **Pickup, Hold, and Illumination**—Standard key system pickup, hold, and line status lamp indications, including flash on incoming CO/PBX line calls, steady on answered calls, and wink-on-hold are provided. Systems with one primary set are limited to two common



TABLE B

## STATUS OF MANUFACTURE DISCONTINUED (MD) COMPONENTS AND APPARATUS

MD UNIT	REPLACED BY	REASON FOR CHANGE	APPLICATION OF MD UNIT
91A Connecting Block	91B	Meet FCC Registration Requirements in 4A System	Previously used unit can be reused in any installation
24A Apparatus Unit	24B	Meet FCC Registration Requirements in 4A System	Previously used unit can be reused in any installation
30A Apparatus Unit	30AM	Meet FCC Registration Requirements in 4A System	Previously used unit can be reused in any installation
33A Voice Coupler	33C	Meet FCC Registration Requirements in 4A System	Previously used unit can be reused in any installation
D-180730 Music-On-Hold Kit of Parts	D-180980	Meet FCC Registration Requirements in 4A System	Previously used unit can be reused in any installation
19B2 Power Unit	19B4	Meet New Underwriters Laboratories Standards	Any installation
2012B Transformer	2012D	Design Improvement	Any installation

disabled but equivalent service is provided by the speakerphone.

(e) **Tone Signaling**—The alerting signal for incoming CO/PBX lines is a tone source rather than conventional ringing. It is supplied through the built-in loudspeaker. Each station can be individually programmed by the customer to be tone signaled on any combination of incoming CO/PBX lines.

(f) **Voice Signaling**—Voice signaling rather than ringing or tone is provided on the intercom paths. The calling party alerts the called station by voice while holding down the appropriate DSS button. The called station receives this voice signal through its built-in loudspeaker. Multiple stations may be signaled by depressing more than one DSS button at a

time. When the called station picks up the handset, the loudspeaker is attenuated.

(g) **Multiline Conferencing**—Two or more CO/PBX lines can be conferenced by a station by simultaneously depressing the associated locking buttons. Transmission quality is degraded as more lines are added.

**Note:** Intercom lines cannot be conferenced with CO/PBX lines.

(h) **Recall**—The R button, located below and to the left of the dial on each set, has two functions: (1) to drop a line and reoriginate dial tone without going back on-hook and (2) to signal [flash] the attendant when the 4A System is behind a PBX or Centrex. The R button should be used for these operations instead of depressing

the switchhook which will cause the line or intercom buttons to restore.

- (i) **Outgoing Service During Power Failure**—Outgoing CO/PBX calls can be made from the 4A System even when local power has failed.

#### OPTIONAL FEATURES (TABLE A)

**2.03** The following options are available as separately installed items or as features of specific telephones:

- (a) **Personal Line**—Each station in the 4A System can be provided with one noncommon, personal CO/PBX line. Each such line requires the installation of a separately mounted 30AM apparatus unit which provides standard key system pickup, hold, and line status lamp indications for that line. The personal line is assigned to a button in the line pickup key. A given personal line may be shared by more than one station in the system, and it will ring at every station where it is connected. Music- or tone-on-hold is available as an option with this feature.
- (b) **TOUCH-TONE Dialing**—Rotary dialing can be replaced by TOUCH-TONE dialing by ordering appropriate telephone codes. Rotary dial and TOUCH-TONE dial sets may be intermixed in the 4A System without additional equipment.
- (c) **Privacy/Privacy Release**—A station equipped with the optional privacy feature is prevented from entering a CO/PBX call in progress. Privacy is implemented on a per-station basis by installation of a D-180729 Kit of Parts. The station can be released from this condition by the operation of the privacy release feature at the *other* station(s) on the call. All 980-series telephone sets have the factory-wired PRIV RLS button, which should be designated only when at least one station in the system has privacy installed.

**Note:** The privacy feature applies to all CO/PBX lines but not to intercom lines.

- (d) **Station Restriction**—Placing of all outgoing CO/PBX calls from a station can be prevented by shorting bar changes inside the set.

- (e) **Music-On-Hold**—Music from customer-provided music source is supplied to CO/PBX lines placed on hold. Installation of one 33C voice coupler per system and a D-180980 Kit of Parts in each primary station and each 30AM apparatus unit is required.

- (f) **Tone-On-Hold**—An alternative to music-on-hold, it provides intermittent bursts of tone to CO/PBX lines placed on hold. Installation of a D-180731 Kit of Parts in each primary station and each 30AM apparatus unit is required.

- (g) **Supplementary Alerting Device Access**—The operation of an external relay to control bells, gongs, horns, etc. by incoming ringing on CO/PBX lines and/or by depression of an assigned DSS button is provided. This feature requires installation of a 25A apparatus unit, an external relay, and a signal with its power source.

- (h) **Paging**—Voice announcements can be made over 109A loudspeaker sets or a customer-owned and maintained paging system. The latter arrangement requires the use of a 27A apparatus unit to provide proper interface with the 4A System. Background music may be provided by means of customer-provided music and a 33C voice coupler (same source and coupler used for music-on-hold). The paging path is activated by operation of a DSS button assigned to this feature. The 109A loudspeaker contains two customer-accessible volume controls for adjusting background music and paging volume; background music is automatically muted during paging.

**Note:** For normal voice inputs, the minimum output of the 27A apparatus unit is -30 dBm into 600 ohms.

- (i) **Preset Intercom Multiple Voice Signaling**—Allows any number of preselected stations and/or paging loudspeakers to be voice signaled simultaneously by means of a designated DSS button. A 26A apparatus unit is required for this feature.



**Remember that a DSS code used for supplementary signaling, paging, or preset intercom signaling is no longer available as a station code.**

(j) **Code Busy DSS Key**—Lamps in this DSS key indicate that one or more stations assigned to a DSS code are off-hook or being voice signaled. This feature can be implemented on a per-station basis by replacing the factory-installed DSS key with an identical size 664C key which contains LEDs.

**Note:** In systems where 980-series sets are mixed with 830-series sets, the 664C key will indicate busy 980-series sets only.

(k) **Power Failure Ringing**—The 24B apparatus unit provides two C4B ringers and associated circuitry to connect the ringers to the CO/PBX lines in the event ac power to the 4A System fails. Installation of a 24B for each primary station is required.

(l) **Hands-Free Answer on Intercom**—The HFAI is available only as a built-in feature of two 4A telephones (983A02 and 2983A02). It allows incoming intercom calls to be answered without any manual action by the called party; the microphone in the HFAI is turned on by the incoming call. The HFAI station user can operate a “mike-off” button to disable the microphone while still receiving voice signaling or use a “do-not-disturb” button to both disable the microphone and block voice signaling.

(m) **Speakerphone**—Speakerphone service permits hands-free conversations on CO/PBX and intercom lines and is available in the 4A System in two configurations only.

- (1) Built-in speakerphone telephone sets (983A01 and 2983A01).
- (2) An external 4A speakerphone connected to the HFAI telephone set. The installation of a D-180732 relay Kit of Parts is required. The 4A speakerphone cannot be used with any other 4A System telephone sets.



**In all telephones with speakerphone, the ability to bridge the set loudspeaker across the incoming line with the SPKR button is disabled.**

(n) **Repertory Dialing**—This feature is provided by connection of an 870A1 (rotary dial) or 2870A1 (TOUCH-TONE dial) adjunct repertory dial with a D10Y-50 cord to desk models

of satellite telephone sets. It allows numbers stored in the dial memory to be called by the operation of a single button.

(o) **Supplementary Power**—A 19B4 power unit can be used to increase the basic power capacity of the 4A System and to compensate for the additional power required for HFAl sets, code busy DSS keys, and 109A paging loudspeakers. If any of these optional features are employed in the 4A System, supplementary power may be required.

**Note:** The 19B4 power unit supplies only 24-volt battery to the 4A System. The built-in power supplies in the primary sets continue to provide lamp power to the system and control circuit power to the primary sets when a 19B4 is connected.

(p) **External Ringing**—This feature is provided by connecting an external ringer (such as an E1CM, S1AMP, or L1AM) across the CO/PBX tip and ring leads at the network interface.

(q) **Special Purpose Handsets**—The K1C handset supplied with each 4A System desk telephone can be removed and replaced with a standard G4 or G15 handset or with one designed for long loop, handicapped users, or noisy locations. A D-180851 Kit of Parts must be installed on the new handset to adapt it to the 4A System telephone.

## TELEPHONE SETS

**2.04** The 980-series telephone sets are completely new in design; all components are connected by means of plugs and jacks for quick assembly and replacement. Primary and basic satellite sets are packaged in housings of the same width, but the primary sets are somewhat deeper because of the control and power circuitry they contain. The BIS and HFAI satellite sets require a wider housing to accommodate their additional features.

**2.05** The basic features described in paragraph 2.02 appear in all sets. The 663A2 line key contains ten buttons—hold, four common CO/PBX lines, an optional personal line, two intercom paths, an optional privacy release, and built-in loudspeaker on/off control. The LED status lamps are associated with each line and intercom path button. The 664B DSS key consists of two horizontal rows of five

buttons, each of which may be assigned to one or more stations, a paging loudspeaker, supplementary ringing or preset multiple signaling. Between the two rows of DSS buttons and under a hinged cover are the programming switches for DSS code assignment and CO/PBX line ringing control. The built-in loudspeaker is located under the handset, and its volume control is below and to the right of the dial. The recall (R) key is below and to the left of the dial. All sets employ the K1C modular handset. The rotary dial is standard, but TOUCH-TONE dial is available.

**2.06** The internal arrangement of the telephones is based on the use of a molded plastic chassis to which the components of the set are attached and an electrical interconnect field into which the components are plugged (Fig. 5). The interconnect field also contains positions for plugging in optional features and switches A through H for adapting the set to options. Outside connections are made by way of the set mounting cord or separate cords for such optional features as personal lines, 4A speakerphone, and repertory dialing. In primary sets (Fig. 6), the mounting cord plugs into a wiring harness which distributes leads to the line key and the control logic board. In the other desk-type sets, the mounting cord plugs directly into the line key. The system connector cable is intended to be plugged directly into the wall sets without the use of mounting cords, which are not supplied with wall sets.

**2.07** Mounted on the base of each primary set is a logic board containing control and power circuitry for two CO/PBX lines and one intercom path, and a transformer for supplying ac power to the logic board (Fig. 6). Up to seven satellite telephones can derive their power from one primary set. Each primary set contains a polarity guard circuit which prevents battery reversals on the CO/PBX lines from interfering with TOUCH-TONE dial operation and multiline conferencing.

#### PBX INTERFACE

**2.08** The 4A System will interface with all PBXs except that it cannot provide for ground-start operation of CO trunks which bypass the PBX in the event of PBX power failure. In all other respects, the system performs on PBX lines in the same manner as on CO lines. For PBX use, the only restriction on the number of telephone sets is that each 25-pair connector cable system

can serve a maximum of 2 primary stations and 14 satellite stations. Although 4A telephone sets behind a PBX have full capabilities, they can contact telephones in other systems only via PBX lines. To signal the PBX operator, the recall button must be used.

#### FCC REGISTRATION

**2.09** The 4A System was tested per, and complies with, the rules and regulations in Subpart D of Part 68 of the FCC rules. The FCC has defined a register-only date after which new product, which is registered, can be installed. Old product which is not registered but had previously been installed is "grandfathered" and may be reinstalled.

**2.10** The system may be interconnected in a "home-run" configuration, in a bridged configuration, or in a combination of both methods (Fig. 7). All interconnections between the 4A System and the telephone network must be made via a standard jack (eg, RJ11C or RJ14C) and fully protected premises wiring. The type of network address signaling is E and the ringer equivalence number for the system varies from one to five as a function of the number of power failure ringer apparatus units a particular configuration contains.

#### ORDERING GUIDE

##### A. Telephone Sets

**2.11** Order the required telephone sets from the following list. Sets are supplied in ivory only and are shipped with E-6723 key designation tabs and disposable faceplates. Order the desired permanent faceplates separately:

- (a) **Primary Sets**—Order one for a system with one or two CO/PBX lines and one intercom path; order two for a system with three or four CO/PBX lines and two intercom paths.
  - 981A01 (desk model, rotary dial; includes D50AB-50 mounting cord)
  - 2981A01 (desk model, TOUCH-TONE set; includes D50AB-50 mounting cord).
- (b) **Satellite Sets**—Order as required.

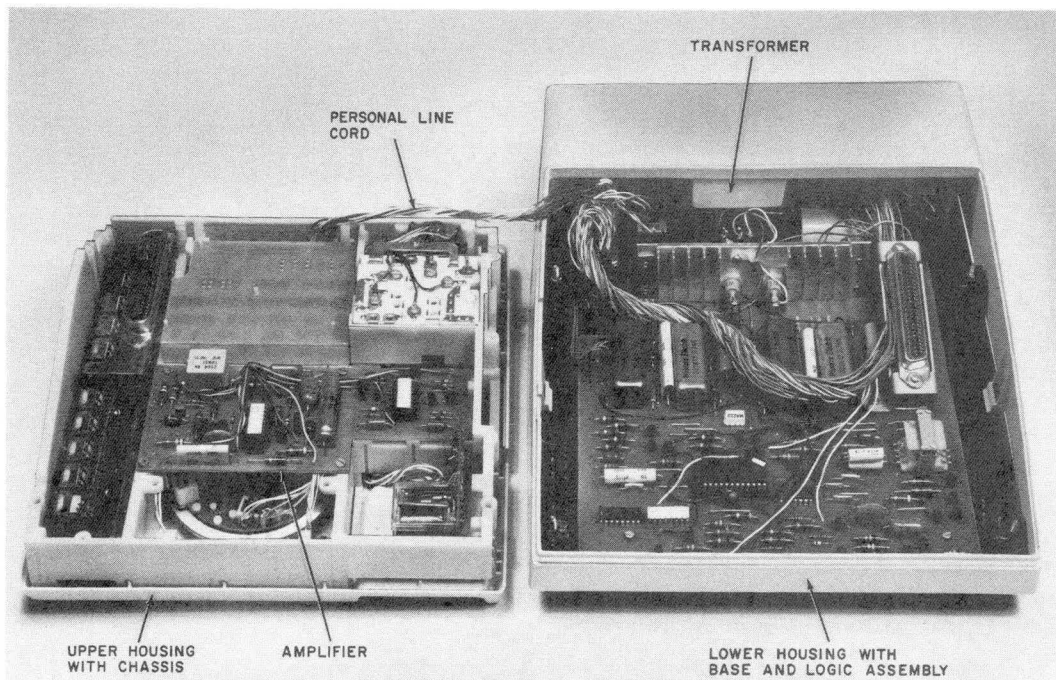


Fig. 6—Primary Set Disassembled

(1) Basic Satellite **Desk** Sets:

- 981A02 (desk model, rotary dial; includes D50AW-50 mounting cord)
- 2981A02 (desk model, TOUCH-TONE set; includes D50AW-50 mounting cord).

(2) Basic Satellite **Wall** Sets:

- 981A03 (wall model, rotary dial; mounting cord not included)
- 2981A03 (wall model, TOUCH-TONE set; mounting cord not included).

(3) The **BIS** Satellite Sets:

- 983A01 (desk model, rotary dial; includes D50AW-50 mounting cord, D8W-50 speakerphone power cord, 2012D transformer, and 86A connecting block to provide an interface for

D or H station wire or D inside wiring cable used to connect the 2012D to the BIS set)

- 2983A01 (desk model, TOUCH-TONE set; includes D50AW-50 mounting cord, D8W-50 speakerphone power cord, 2012D transformer, and 86A connecting block to provide an interface for D or H station voice or D inside wiring cable used to connect the 2012D to the BIS set).

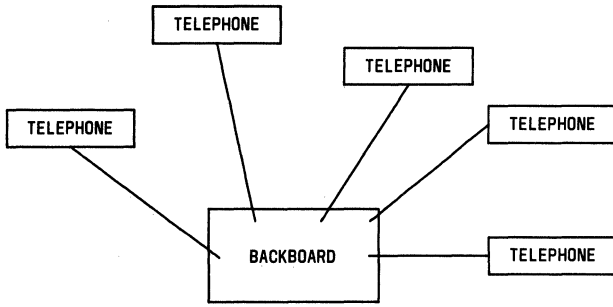
**Note:** Desk model of BIS set can be converted to wall set by use of kit of parts listed in paragraph 2.14.

(4) The **HFAI** Satellite Sets:

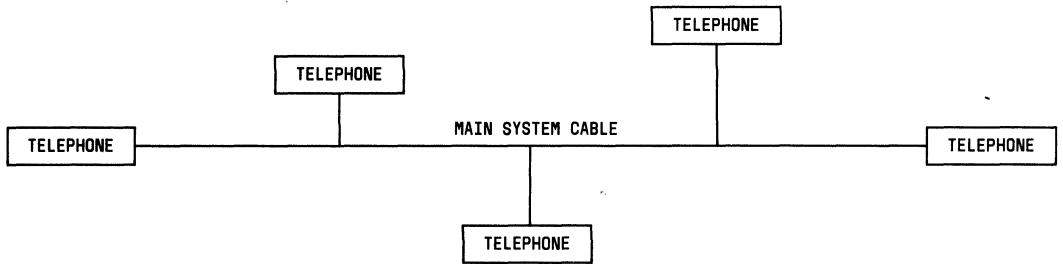


**Keep in mind when ordering HFAI sets that each one consumes as much power as any other two stations; therefore, either the total number of stations in the system may have**

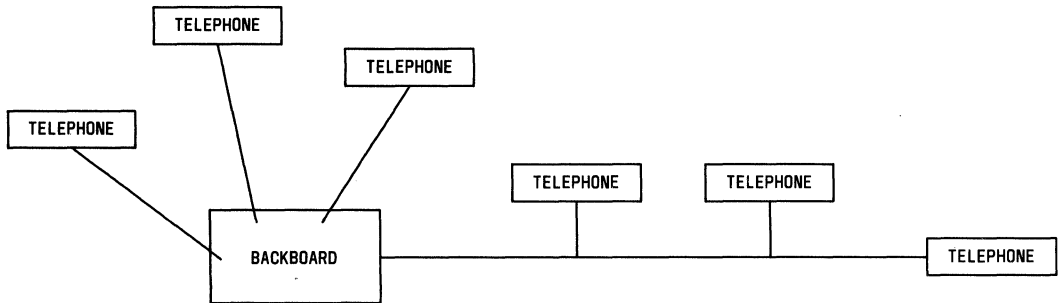




A. BASIC HOME-RUN WIRING SYSTEM



B. BASIC BRIDGED WIRING SYSTEM



C. COMBINATION OF BRIDGED WITH HOME-RUN SYSTEM

Fig. 7—Simplified Block Diagram of Basic Wiring Methods

***to be reduced or supplementary power used (see paragraph 3.13).***

- 983A02 (desk model, rotary dial; includes D50AW-50 mounting cord)
- 2983A02 (desk model, TOUCH-TONE set; includes D50AW-50 mounting cord).

**Note:** Desk model of HFAI set can be converted to wall set by use of kit of parts listed in paragraph 2.14.

**2.12** Order the following as required depending on the types of telephones being installed:

- Block, Connecting, 91B (order one for each primary station)
- Faceplate, 61C-† (for 981-type sets)
- Faceplate, 261C-† (for 2981-type sets)
- Faceplate, 63D-† (for 983-type sets)
- Faceplate, 263D-† (for 2983-type sets)

†Add color code suffix as follows:

Avocado (-100)  
Teak (-108)  
Walnut (-109)  
Gold (-111)  
Orange (-112)  
Brown (-113)  
Red (-114)  
Blue (-115)  
Black (-118)

**B. Optional Apparatus**

**2.13** Order the following apparatus as required to implement options (see Table A).

(a) ***Personal Line:***

- Unit, Apparatus, 30AM (order one for each personal line to be installed; includes 95B1 power unit)
- D-180758 Kit of Parts (consists of 86A connecting block, D8W-50 cord, jack assembly, plug retainer, and mounting bracket; order one for each primary, basic satellite, or

HFAI satellite set to be equipped with a personal line; do not order for BIS satellite set to be equipped with a personal line).

(b) ***External 4A Speakerphone*** (order one of each of the following for each HFAI station to be equipped):

- Adapter, 223C (includes D16H-50 cord and M2FG cord)
- D-180732 Kit of Parts (includes relay board and button stop for SPKR button)
- Loudspeaker, 108A (any color)
- Transmitter, 680A (any color)
- D-180508 Kit of Parts (provides ivory housing for loudspeaker and ivory trim for transmitter)
- Unit, Power, 85B1-49.

(c) ***Repertory Dialing:***

- Dial, Repertory, Adjunct, 870A1 (rotary dial) or 2870A1 (TOUCH-TONE dialing) (order one for each desk-type satellite station to be equipped for repertory dialing)
- Cord, D10Y-50 (order one for connecting dial to telephone; 2 feet long)
- Unit, Power, 95B1 (order one for each repertory dial).

(d) ***Power Failure Ringing:***

- Unit, Apparatus, 24B (order one for each primary set to be provided with power failure ringing).

(e) ***Access to Supplementary Alerting Device:***

- Set, Relay, KS-16626L12 or Relay, KS-16301L17 (order one for use with 25A apparatus unit to operate an auxiliary signal)
- Unit, Apparatus, 25A (order one for each supplementary signaling device to be operated)
- Desired alerting unit and its power source.

(f) **Preset Intercom Voice Signaling:**

- Unit, Apparatus, 26A (order one for each preset intercom voice-signaling arrangement to be installed).

(g) **Paging:**

- Set, Loudspeaker, 109A (order quantity required for paging and background music; includes wall mounting bracket with 85A connecting block attached, D8W cord, and four rubber washers).



*Each 109A loudspeaker consumes as much power as a primary, basic satellite, or BIS set. Refer to paragraph 3.14.*

- Coupler, Voice, 33C (one is required for background music on any paging system; **can be same one used for music-on-hold**)
- Unit, Apparatus, 27A (order one for interface between 4A System and a customer-owned and maintained [COAM] paging system)

**Note:** The 27A will not drive COAM speakers directly.

- Set, Relay, KS-16626L12 (order one for use with COAM paging system that requires a contact closure).

(h) **External Ringing:**

- Ringer, E1CM, S1AMP, or L1AM (order up to three for each CO/PBX line to be equipped with external ringing but no more than two if power failure ringing is provided).

(i) **Supplementary Power:**

- Unit, Power, 19B4 (order one if the power requirements of the system being installed exceed the capacity of the built-in power supplies in the primary sets; refer to paragraph 3.14 for details of calculating power requirements)

- Cord, Power (order one of required length for 19B4 power unit):

824013262 (P-40J326)—1-1/2 feet

824013270 (P-40J327)—2 feet

824013288 (P-40J328)—4 feet

824013296 (P-40J329)—6 feet

824010995 (P-40J099)—12 feet.

C. **Optional Components**

2.14 Order the following components as required to implement options (see Table A).

(a) **Privacy:**

- D-180729 Kit of Parts (privacy circuit board; order one for each station to be locked out).

(b) **Music-On-Hold:**

- Coupler, Voice, 33C (order only one per system when music-on-hold is provided and/or when background music is provided on paging system)
- D-180980 Kit of Parts (music-on-hold circuit board; order one for each primary station and each personal line to be equipped with music-on-hold).

(c) **Tone-On-Hold:**

- D-180731 Kit of Parts (tone-on-hold circuit board; order one for each primary station and each personal line to be equipped).

(d) **Wall Mounting:**

- D-180747 Kit of Parts (order one for each BIS or HFAI set to be converted from desk set to wall set).

(e) **Code Busy Indication:**

- Key, 664C (code busy DSS key; order one for each station to be equipped for busy status indication; includes E-6873 key designation tabs).



*Each 664C key consumes as much power as a primary, basic satellite, or BIS set.*

(f) **Handsets for Special Applications:**

- Handset, G6BM (impaired hearing, modular)
- Handset, D-180413 (more receive gain than G6BM, modular)
- Handset, G7BM (weak speech, modular)
- Handset, G8BM (noisy location, modular)
- Handset, G15AM (general use, modular)
- Handset, G4BM (G-type equipped with shoulder rest, modular)
- Handset, G36AM (long loop, 3-dB transmit gain, modular)
- D-180851 Kit of Parts (ivory transmitter and receiver covers; order one for each handset).

**D. Interconnection Components**

**2.15** Unless otherwise noted, the following list consists of typical components recommended for interconnecting the parts of the 4A System. Refer to Fig. 8 and 9 for typical connection arrangements.

- (a) Adapter, 3-Way Bridging, KS-19252 type
- (b) Block, Connecting, 91B (**required** for connecting primary set to network interface and system cable)
- (c) Blocks, Connecting, 66-Type in various configurations:
  - Backboard, 184A1 (includes two 66B4-25 blocks)
  - Backboard, 184B2 (includes four 66B4-25 blocks)
  - Block, Connecting, 66E3-25
  - Adapter, 161A (adapts 66-type terminals for spade-tipped leads).

(d) Cables, Connector (for system cabling between telephone sets; specify desired length):

- A25B (single-ended)
- A25B (double-ended)
- A25D (single-ended)
- B25A (double-ended).

(e) Cable, D Inside Wiring

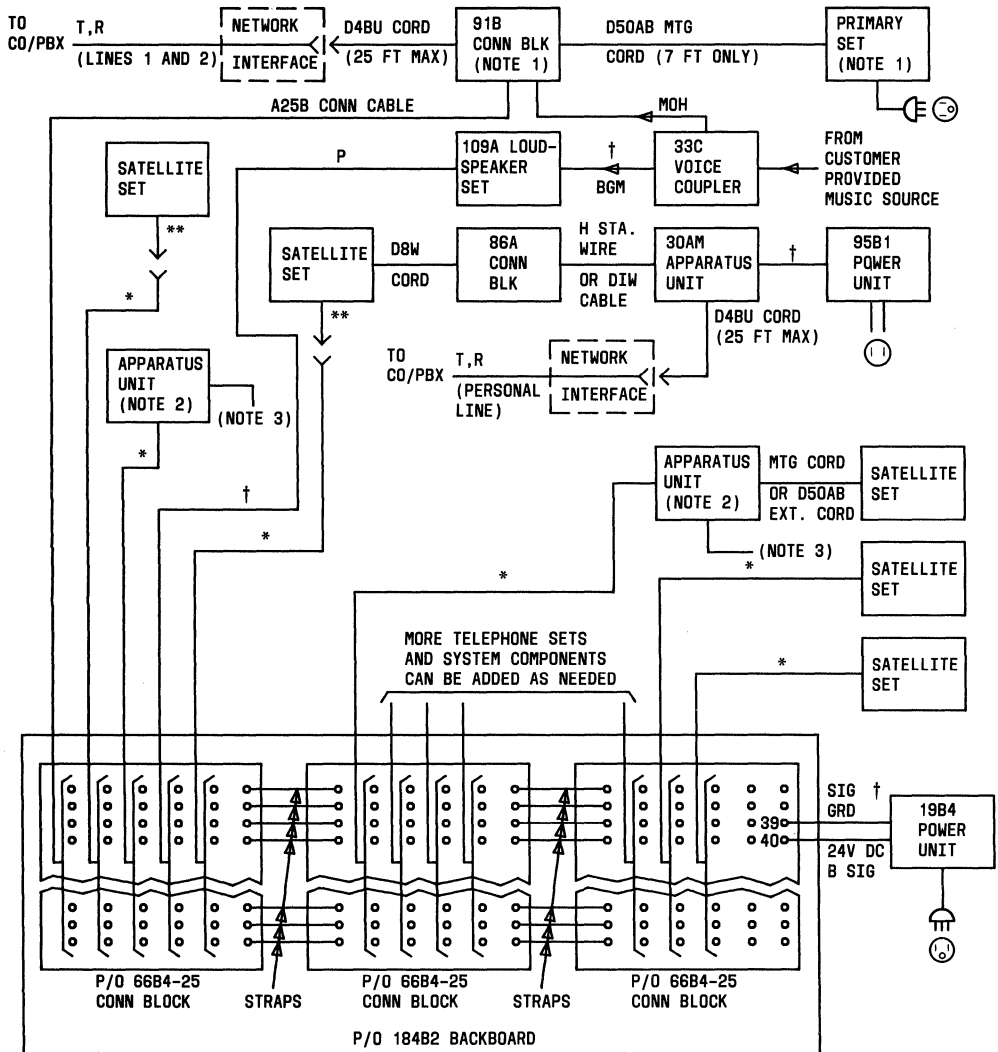
(f) Cord, D50AB-50 (7 feet or 18 feet; extension mounting cord for satellite sets; **not intended for extending primary set mounting cord**)

(g) Cord, D4BU or D6AP (double-ended, modular)

(h) Wire, Station, D, H, or SK

**E. Replaceable Components****2.16 All Sets:**

- Amplifier, 841009193
- Assembly, Dial, Rotary, 841010770 (includes 8TA-119 dial)
- Assembly, Dial, TOUCH-TONE, 841010762 (includes 35AU3A dial)
- Assembly, Loudspeaker, 841009053
- Cord, H4DU-50 (handset cord)
- Form, E-6723 (key designation tabs for line keys and standard DSS keys)
- Form, E-6873 (key designation tabs for code busy DSS keys)
- Handset, K1C-50
- Jack, 616JK (handset jack)
- Key, 663A2 (line key)
- Key, 664B (DSS key)
- Key, 683C (recall key)



SEE NOTES 1, 2 AND 3 OF FIG. 9.

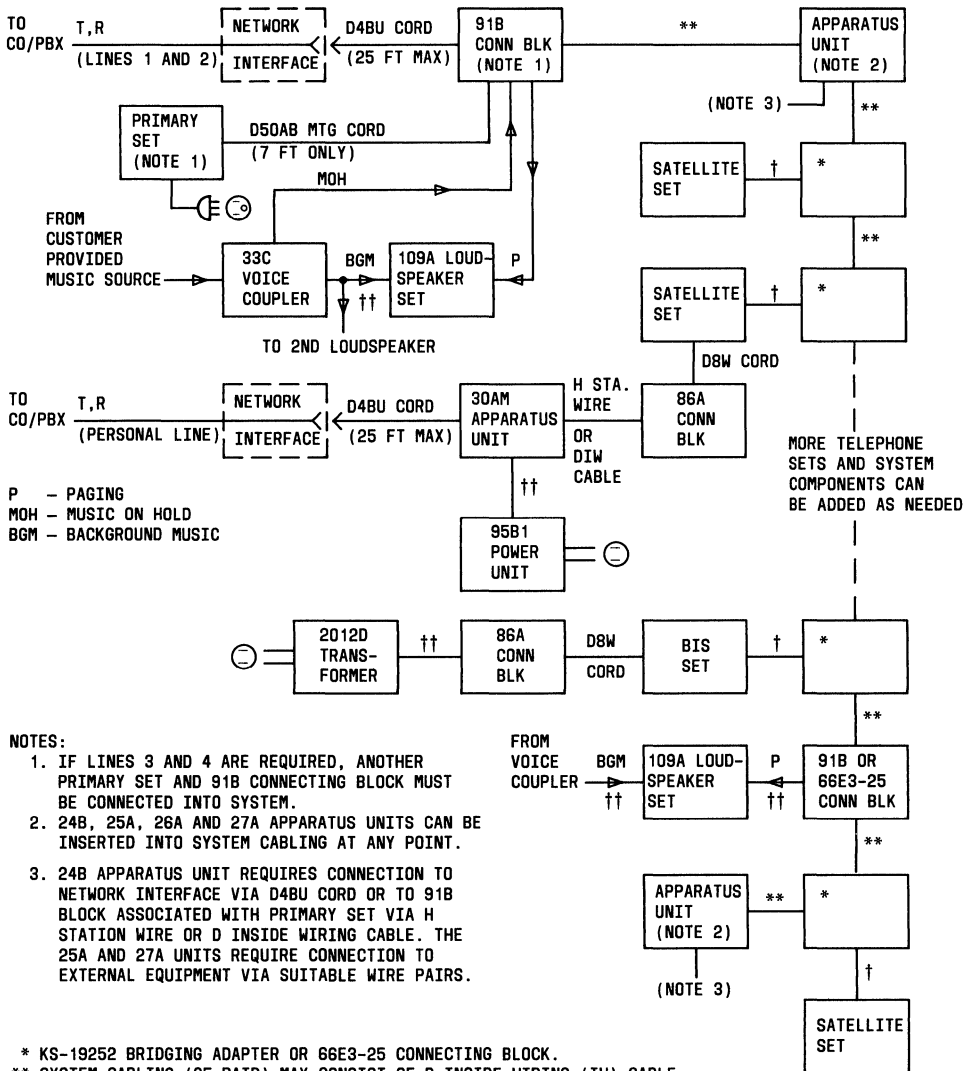
\* SYSTEM CABLING (25 PAIR) MAY CONSIST OF D INSIDE WIRING (IW) CABLE OR B25A, A25B OR A25D CONNECTOR CABLES.

\*\* SATELLITE SETS CONNECTED VIA MOUNTING CORDS SUPPLIED OR D50AB EXTENSION CORDS, USED WITH SYSTEM CONNECTOR CABLE OR 66E3-25 BLOCK WITH DIW CABLE.

† D OR H STATION WIRE OR DIW CABLE.

P - PAGING  
 BGM - BACKGROUND MUSIC  
 MOH - MUSIC ON HOLD

Fig. 8—Typical Installation Using "Home-Run" Connections



- NOTES:
1. IF LINES 3 AND 4 ARE REQUIRED, ANOTHER PRIMARY SET AND 91B CONNECTING BLOCK MUST BE CONNECTED INTO SYSTEM.
  2. 24B, 25A, 26A AND 27A APPARATUS UNITS CAN BE INSERTED INTO SYSTEM CABLING AT ANY POINT.
  3. 24B APPARATUS UNIT REQUIRES CONNECTION TO NETWORK INTERFACE VIA D4BU CORD OR TO 91B BLOCK ASSOCIATED WITH PRIMARY SET VIA H STATION WIRE OR D INSIDE WIRING CABLE. THE 25A AND 27A UNITS REQUIRE CONNECTION TO EXTERNAL EQUIPMENT VIA SUITABLE WIRE PAIRS.

\* KS-19252 BRIDGING ADAPTER OR 66E3-25 CONNECTING BLOCK.  
 \*\* SYSTEM CABLING (25 PAIR) MAY CONSIST OF D INSIDE WIRING (IW) CABLE OR B25A, A25B OR A25D CONNECTOR CABLES.  
 † SATELLITE SETS ARE CONNECTED VIA MOUNTING CORDS SUPPLIED, D50AB EXTENSION CORDS, OR A25B OR B25A CONNECTOR CABLES.  
 †† D OR H STATION WIRE OR DIW CABLE.

Fig. 9—Typical Installation Using Bridged Connections

- D-180828 Kit of Parts (963E-2 connectors for use as shorting bars on interconnect field)
- Potentiometer, 842618985 (loudspeaker volume control).

### 2.17 Primary Sets:

- Assembly, Base, and Logic, 841009087 (includes base, control logic board, and wiring harness)
- Assembly, Field, Interconnect, 841009954
- Cord, D50AB-50 (mounting cord, 7-foot only)
- Housing, Upper, 61AU-50
- Housing, Lower, 61BL-50
- Transformer, KS-21361L5 (includes 6-foot power cord and heat sink).

### 2.18 Basic Satellite Sets:

- Assembly, Field, Interconnect, 841009954 (wall sets only)
- Assembly, Field, Interconnect, 841009988 (desk sets only)
- Cord, D50AW-50 (mounting cord, desk sets only)
- Housing, Lower, 61AL-50 (desk sets only)
- Housing, Upper, 61AU-50
- Housing, Wall, 61AY-50 (wall sets only).

### 2.19 BIS Satellite Sets:

- Assembly, Field, Interconnect, 841015449
- Circuit, Interface Signaling, Voice, 841010788
- Cord, D8W-50
- Cord, D50AW-50
- Housing, Lower, 63AL-50
- Housing, Upper, 63AU-50

- Transformer, 2012D
- Transmitter-Receiver, 1A (BIS module)

### 2.20 HFAI Satellite Sets:

- Assembly, Field, Interconnect, 841015050
- Cord, D50AW-50
- Housing, Lower, 63AL-50
- Housing, Upper, 63AU-50
- Module, HFAI, 841010796.

## 3. INSTALLATION AND CONNECTION

### PLANNING

**3.01** Consult with the customer to determine where the 4A System stations should be installed, optional features desired, the best routes for interconnecting cables, intercom code assignments, paging requirements, and the optimum locations for connecting blocks, apparatus units, adapters, etc.

**Caution:** *Remind the customer that after installation has been finished, primary station power cords must remain plugged in or service will be interrupted.*

**3.02** Select the most appropriate method of interconnecting the stations of the 4A System (Fig. 7). Use existing cabling from a previous installation, if possible.

**Caution:** *If supplementary power from a 19B-type power unit is needed, the "home-run" method of cabling must be used.*

(a) "Home-run" cabling—In this method, each station is separately cabled back to a common cross-connection field such as a 184B2 backboard. A typical "home-run" installation is shown in Fig. 8. The "home-run" cabling method is preferred over other methods because it is usually simpler to install and allows maximum system growth.

(b) Bridged cabling—In this method, each station is bridged across a main cable which carries

system signals. Bridging points are provided by KS-19252 bridging adapters and/or 66E3-25 connecting blocks. See Fig. 9 for a typical bridged installation. The bridged method should only be used when all system power can be supplied from the primary set(s) and where significant system growth is not expected.

(c) Combination—A basic “home-run” system can be modified, if supplementary power is not needed, by bridging several stations across a direct line from the backboard. This method is useful where the distribution of stations is very unsymmetrical or where a close group of stations is remote from the rest of the system.

**Caution: The 91-type connecting block must always be used for connecting a primary set into the 4A System.**

**3.03** In all installations, regardless of the cabling method used, a primary station is connected into the system by plugging its 7-foot mounting cord into the associated 91B connecting block (Fig. 10). The 91B block also provides a modular jack for connection to the network tip and ring interface with a D4BU cord.

**3.04** In existing installations, 91A (MD) connecting blocks (Fig. 11) may be used to interface between primary sets and CO/PBX lines; it is permissible to reuse these blocks in other installations.

**3.05** Apparatus units 24B through 27A can be mounted where there is convenient access to system cabling. Each unit has input and output connectors which mate with the system cable connectors, allowing the unit to be inserted between stations or at the end of a cable run. Specific instructions for the location of apparatus units and other optional external equipment are included in the installation instructions for particular features.

**3.06** Select and order the appropriate apparatus according to the job requirements (see ORDERING GUIDE).

#### ELECTRICAL PROTECTION

**3.07** Under normal conditions, the 4A System will provide satisfactory performance in the presence of surges in the telephone plant caused by lightning. If care is exercised to follow good protection practices as discussed in Sections

518-010-105, 876-100-100, and 876-300-100, there should be no need to install a coupled bonding conductor.

**3.08 Coupled Bonding Conductor**—Under unusual circumstances, a particular installation may experience a high incidence of lightning-related troubles. This might be due to the excessive length of the bonding conductor between the protector and power grounds. Where the length of the bond between these grounds exceeds 20 feet, use of a coupled bonding conductor is recommended.

**3.09** A coupled bonding conductor follows the same route as the inside wiring cable. This conductor can consist of a shield, spare pairs of the inside wiring cable, or a wire tie-wrapped to unshielded cable. It is connected to the lug on the building entrance facility protector and to the equipment single point ground terminal. **Due to the mutual coupling between this wire and the tip and ring conductors, the potential difference appearing between the equipment ground and the protector lug is minimized.**

**3.10** In an actual 4A System installation, the coupled bonding conductor should be connected between the green wire ground terminal of the 117-volt 60-Hz power outlet serving each primary set, 19B4 power unit, or 30AM apparatus unit and the protector lug. To facilitate connection to the power outlet green wire ground, an outlet adapter such as the Hubbell part 5291 (brown) or 5291-1 (ivory) can be used.

#### ELECTRO-MAGNETIC INTERFERENCE

**3.11** The 4A System has been designed with adequate electro-magnetic interference (EMI) protection for most installations. However, a few installations very near radio transmitters may require additional EMI protection for either tip and ring or intercom circuits. Instructions for EMI protection are contained in X-4235, conversion of 981/2981- and 983/2983-type telephone sets (4A System).

#### POWER REQUIREMENTS

**3.12** The customer is responsible for providing suitable 117-volt 60-Hz power outlets, not under control of switches, for the following apparatus of a 4A System installation: each primary set, 19B-type power unit, BIS station, 4A speakerphone,



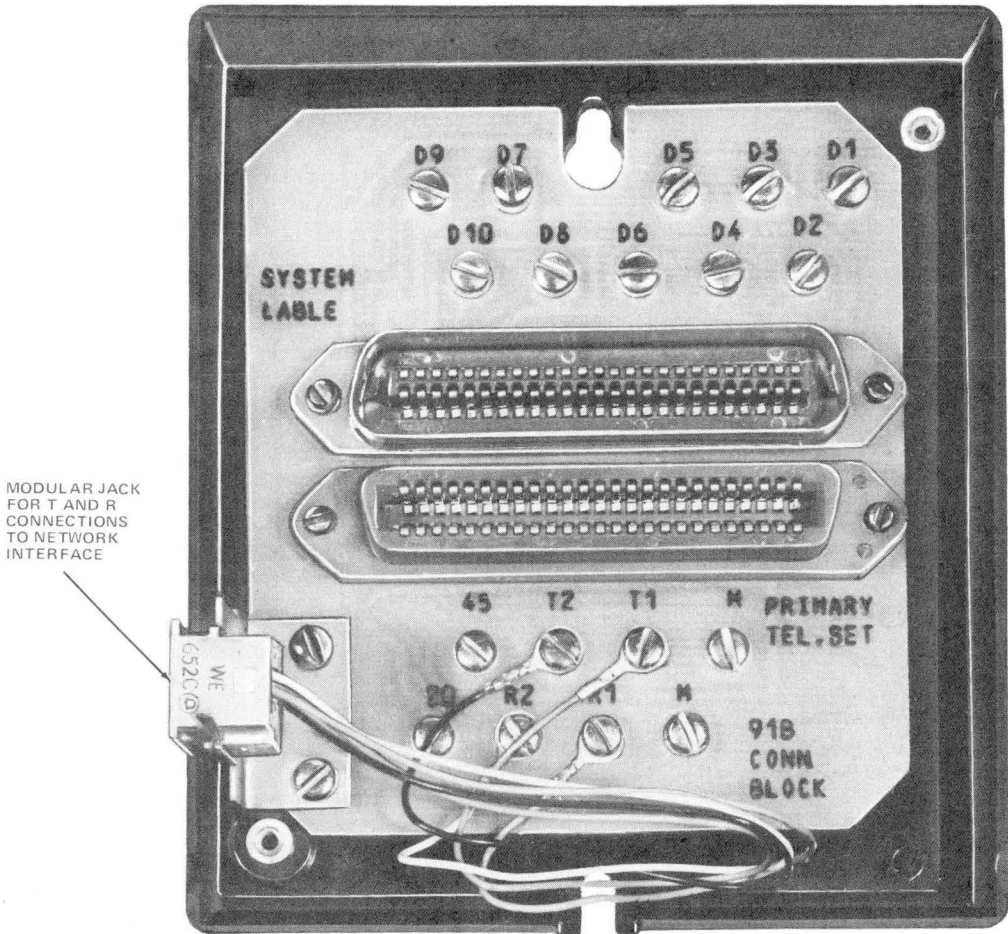


Fig. 10—91B Connecting Block

repertory dial, and 30A-type apparatus unit. The outlets should be separately fused, where possible, to avoid accidental system shutdown.

**Caution:** Plug primary set and power unit cords into grounded outlets only, in order to meet Underwriter's Laboratory conditions for listing and to provide proper system static electricity discharge protection. Make no connections between any point in the system and building ground, except

for the plug-ended 117-volt power cords and the 33-type voice coupler.

#### Supplementary Power

3.13 Sufficient power is available from the built-in power supplies in the primary sets for most 4A System installations. However, a concentration of optional features (HFAI sets, 109A loudspeakers, code busy DSS keys) can make it necessary to install a 19B4 power unit for supplementary power.

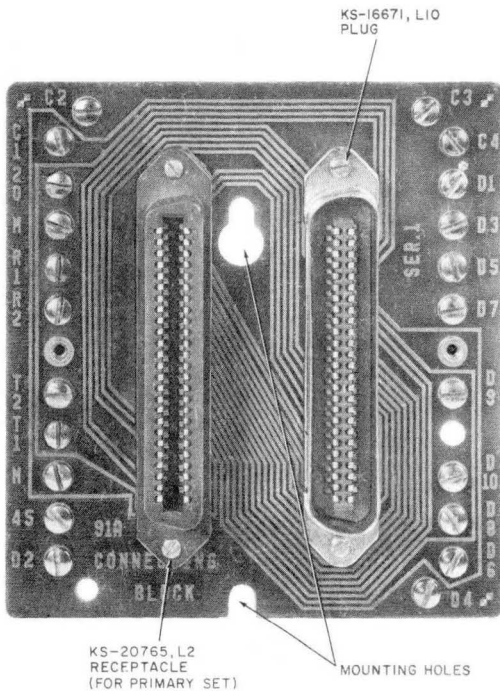


Fig. 11—91A (MD) Connecting Block

3.14 In order to determine whether supplementary power is required, follow this procedure to get the **station equivalent number** of the installation.

- (a) Calculate the values below based on the particular equipment being installed:

(Number of non-HFAI sets, including primary sets)  $\times$  1 = \_\_\_

(Number of HFAI sets)  $\times$  2 = \_\_\_

(Number of 664C code busy DSS keys in excess of two per system)  $\times$  1 = \_\_\_

(Number of 109A loudspeaker)  $\times$  1 = \_\_\_

Sum (station equivalent numbers) = \_\_\_

- (b) If the system has one primary station and the station equivalent number is greater

than 8, install a 19B4 power unit and use the "home-run" method of system connection.

**Note:** Refer to paragraph 3.35 for detailed installation and connection instructions for the 19B4 power unit.

- (c) If the system has two primary stations and the station equivalent number is greater than 16, install a 19B4 power unit and use the "home-run" method of system connection.

**Example:** Installation has one primary set, four basic satellite sets with code busy DSS keys, two HFAI sets, one BIS set, and one 109A loudspeaker.

(a)  $6 \times 1 = 6$  (non-HFAI sets)

$2 \times 2 = 4$  (HFAI sets)

$2 \times 1 = 2$  (664C keys)

$1 \times 1 = 1$  (loudspeaker)

Sum = 13.

Therefore, a 19B4 power unit is required.



**Supplementary power cannot extend the system capability (either 1 or 2 primary sets) beyond 16 station sets or 32 station equivalents.**

#### CABLING RESTRICTIONS

**Caution:** No more than 2000 running feet (total) of cable should be used for interconnecting the stations in any installation.

3.15 **Station Interconnection**—In installations where bridged cabling is used (Fig. 9), the maximum distance between any satellite station and both primary stations or between primary stations must not exceed the restrictions in Table C. In a small system where only one primary station is required and bridged cabling is used, the total number of station equivalents must not exceed eight since supplementary power cannot be used. When two primary sets are used with bridged cabling, the limit is sixteen.

TABLE C

## LIMITATIONS ON CABLE LENGTH AND SYSTEM SIZE IN BRIDGED SYSTEM

NUMBER OF STATION EQUIVALENTS	MAXIMUM CABLE FEET FROM SATELLITES TO BOTH PRIMARY STATIONS*
10 or less	1000
11	900
12	800
13	700
14	600
15	500
16	400

\* Sum of cable length from satellite set to first primary set and cable length from satellite set to second primary set. Total number of feet in any installation shall not exceed 2000 feet.

**3.16 Personal Line Cabling**—Personal lines do not utilize the system interconnection cables but require separate connections between stations and 30AM apparatus units. Figure 12 illustrates the limitations on the connection of personal lines. Bridged cabling can connect a maximum of 16 sets to a 30AM apparatus unit. Refer to paragraph 3.56 for detailed instructions on installing personal lines.

## SYSTEM CABLING AND CONNECTIONS

**3.17** Install the necessary connecting blocks, bridging adapters, apparatus units, and backboard at the desired locations and connect them with appropriate connector cables. Use the shortest possible lengths of cable consistent with other requirements of the installation. Where single-ended cables are used, cut them down on the connecting blocks in standard color-code sequence (Table D).

## TELEPHONE SETS

**3.18** Carefully unpack the telephone sets and install them at the locations requested by

the customer. When placing desk-type telephones, allow enough room adjacent to the sets for repertory dials and external speakerphones if these options are to be installed. Put the appropriate designation tabs in the buttons of the line and DSS keys.

**Note:** Do not install PRIV RLS tabs in any sets unless at least one station in the system is equipped with the privacy feature. On BIS satellite sets and HFAI sets to be equipped with 4A speakerphone, do not install the SPKR tab; this button is inoperative.

## A. Primary Sets

**Warning:** Do not plug in the primary station power cords until all installation is complete.

**Caution:** Do not use any extension cords between the set mounting cord and the 91B block.

**3.19** Place each primary set within power cord length (6 feet) of a suitable ac receptacle. Connect each primary set into the system by plugging its attached 7-foot D50AB-50 mounting cord directly into the assigned 91B block.

## B. Basic Satellite and HFAI Desk Sets

**3.20** Connect each set into the system with the attached D50AW-50 mounting cord; plug its free end into its assigned bridging adapter or extension cable.

## C. BIS Desk Sets

**3.21** Connect each set into the system with the attached D50AW-50 mounting cord; plug its free end into its assigned bridging adapter or extension cable. The BIS satellite desk stations require an additional connection to provide power for the built-in speakerphone. Mount the 86A block (Fig. 13) supplied with each BIS set in a convenient place near the station, and plug the D8W-50 cord extending from the back of the set into it. Use inside wire to connect terminals 7 and 8 of the 86A block to the 2012D transformer supplied with the set. **Do not plug the 2012D into an ac receptacle until all installation is complete.**

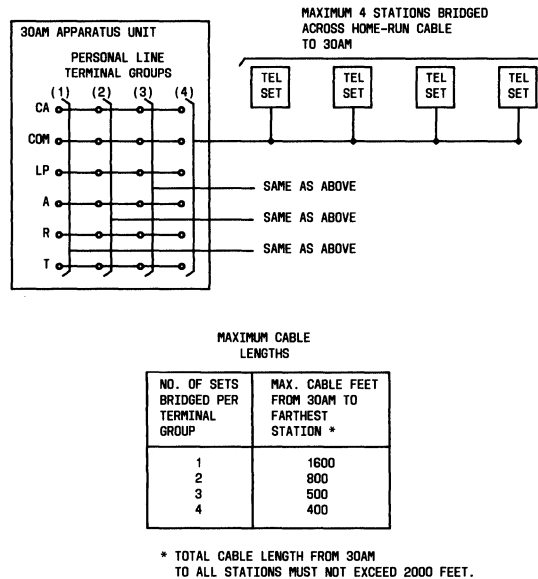


Fig. 12—Personal Line Cabling Limitations

#### D. Basic Satellite Wall Sets

**3.22** The wall model of the basic satellite telephone is a separately coded set and is equipped with a wall mounting plate and appropriate hardware. It is intended to be connected directly to a system connector cable and is, therefore, not supplied with a mounting cord.

**3.23** There are three basic methods of connecting a wall set into the system—(a), (b), and (c):

(a) A system cable can be run along the wall surface to the location where the set is to be mounted and connected directly to the set (Fig. 14).

(1) Attach the wall mounting plate to the wall using four No. 8 screws. Place a spacer, supplied with the set, on each screw so that the plate stands off from the wall.

(2) If the cable connector has a screw at the end, remove and discard the screw.

(3) Remove the connector mounting screw (Fig. 15) from the top of the connector bracket on the wall plate and save for Step (6). (The lower bracket screw is captive to the bracket and should be left in place.)

(4) Position the cable connector on the mounting brackets with the flange on its outer end between the stationary upper bracket and the floating clamp, and the flange on its lower end under the lower bracket (Fig. 15).

(5) Start the lower bracket captive screw through the lower flange of the connector so that the connector is held loosely on the wall plate.

(6) Put the mounting screw removed in (3) back into the upper bracket and run it through the flange of the connector and into the floating clamp. Tighten the screw enough to pull the floating clamp up firmly against the underside of the flange, but **do not overtighten**.

TABLE D

MOUNTING CORD/CONNECTOR CABLE LEADS AND CORRESPONDING  
TERMINALS ON 66-TYPE CONNECTING BLOCKS

CONNECTOR TERMINAL	DESIG-NATION	COLOR	66-TYPE BLOCK TERMINAL	CONNECTOR TERMINAL	DESIG-NATION	COLOR	66-TYPE BLOCK TERMINAL
26	T(1)	W-BL	1	38	ICT(1)	BK-G	25
1	R(1)	BL-W	2	13	ICR(1)	G-BK	26
27	A(1)	W-O	3	39	DSS 2	BK-BR	27
2	CA1	O-W	4	14	DSS 1	BR-BK	28
28	LP(1)	W-G	5	40	LP(IC1)	BK-S	29
3	LC(1)	G-W	6	15	LC(IC1)	S-BK	30
29	T(2)	W-BR	7	41	ICT(2)	Y-BL	31
4	R(2)	BR-W	8	16	ICR(2)	BL-Y	32
30	A(2)	W-S	9	42	DSS 4	Y-O	33
5	CA2	S-W	10	17	DSS 3	O-Y	34
31	LP(2)	R-BL	11	43	LP(IC2)	Y-G	35
6	LC(2)	BL-R	12	18	LC(IC2)	G-Y	36
32	T(3)	R-O	13	44	DSS 6	Y-BR	37
7	R(3)	O-R	14	19	DSS 5	BR-Y	38
33	A(3)	R-G	15	45	+V	Y-S	39
8	CA3	G-R	16	20	COM	S-Y	40
34	LP(3)	R-BR	17	46	DSS 8	V-BL	41
9	LC(3)	BR-R	18	21	DSS 7	BL-V	42
35	T(4)	R-S	19	47	DSS 10	V-O	43
10	R(4)	S-R	20	22	DSS 9	O-V	44
36	A(4)	BK-BL	21				
11	CA4	BL-BK	22		PRI- MARY		
37	LP(4)	BK-O	23		SATEL- LITE		
12	LC(4)	O-BK	24	48	MOH +V	V-G	45
				23	MOH COM	G-V	46
				49	T1/T3 +V	V-BR	47
				24	R1/R3 COM	BR-V	48
				50	T2/T4 +V	V-S	49
				25	R2/R4 COM	S-V	50

(7) Tighten the lower bracket screw so that the connector is securely mounted and does not wobble or shift around.

(8) Place the strain relief strap on the cable about 6 inches from the connector. Secure the cable to the lower edge of the mounting plate with the cable positioned as shown in Fig. 14.

(b) In some installations, a connector cable may be concealed in the wall and brought through an opening behind the telephone set (Fig. 16).

(1) Attach the wall mounting plate to the wall using four No. 8 screws. Position the plate over the opening in the wall so the cable can enter through the hole in the plate and

in such a way that the connector hood fits into the opening when mounted to the bracket. If the opening is too small to provide clearance for the hood, place a spacer on each mounting screw so the plate stands off from the wall.

(2) Attach the cable connector to the wall plate as described in paragraph 3.23(a)(2) through (7).

(3) Push any excess cable into the opening.

(c) If the connector cable cannot reach the location where the set is to be mounted or if the cable has been previously cut down on a 66-type connecting block, use a D50AB mounting cord as an extension cord.

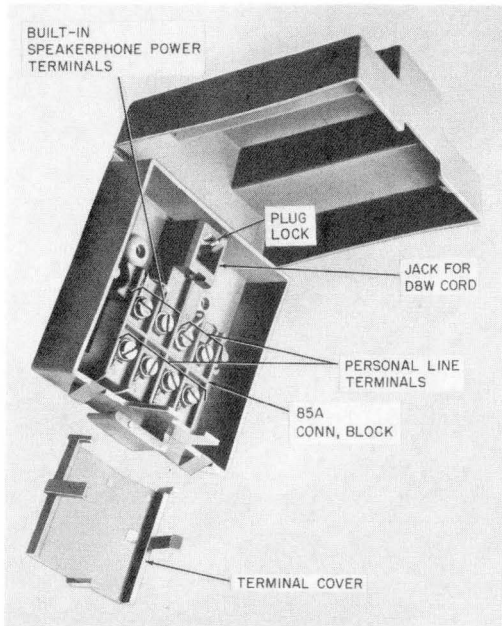


Fig. 13—86A Connecting Block

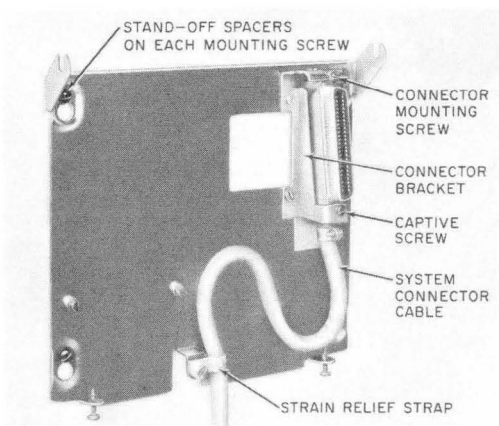


Fig. 14—Wall-Mounting Plate With Connector Cable Attached

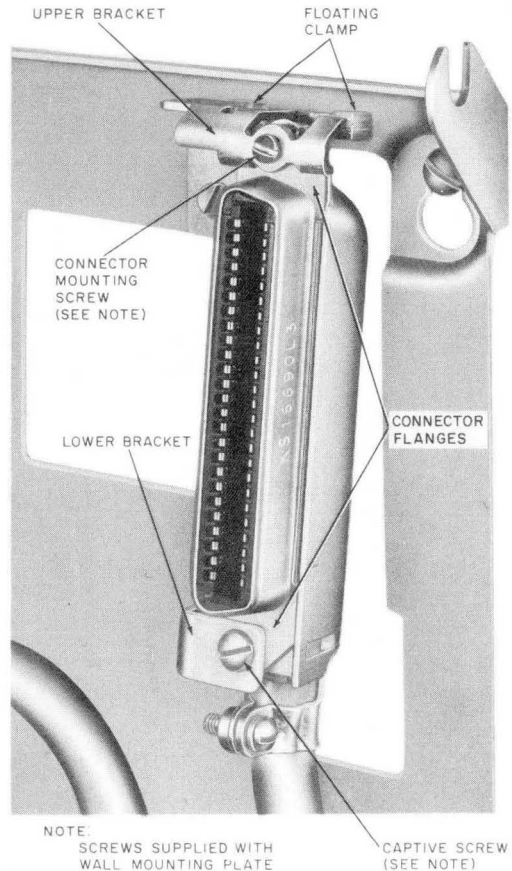


Fig. 15—Detail of Connector Mounting on Wall Plate

- (1) Attach the wall mounting plate to the wall using four No. 8 screws.
- (2) Mount a D50AB cord to the wall plate as described in paragraph 3.23(a)(2) through (7).

**Note:** If a D50AB cord is not available, use a D50AW mounting cord (Fig. 17). Do not attach the connector of the D50AW to the wall plate like the D50AB, but instead plug it directly into the line key connector in the back of the set. Secure the cord to the wall housing with the strain relief strap supplied

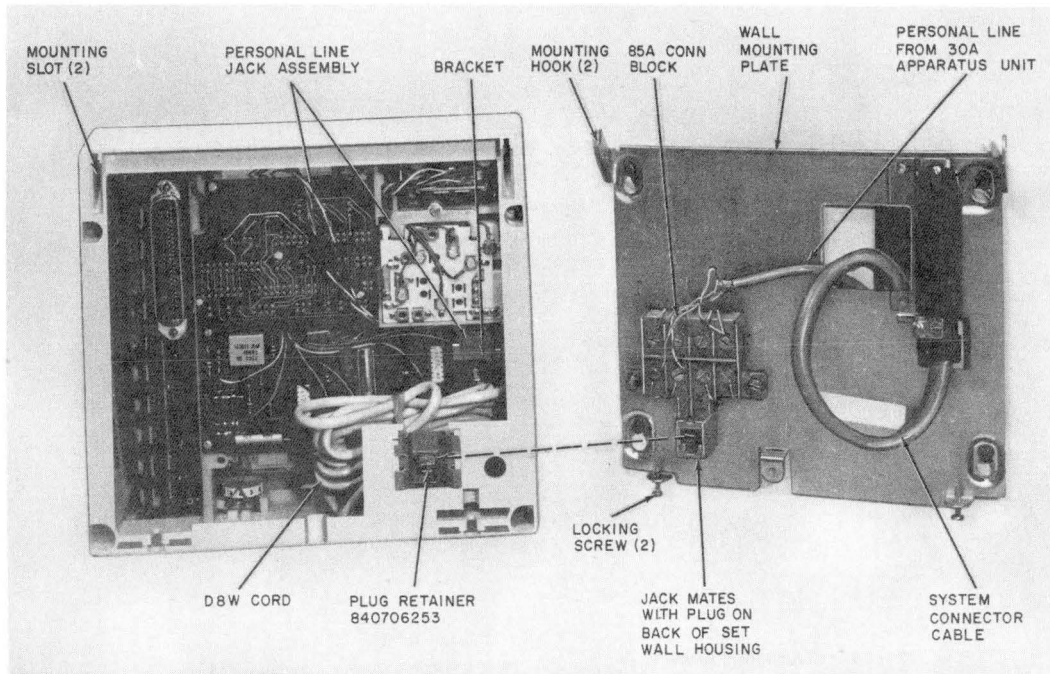


Fig. 16—Basic Satellite Wall Set Disassembled

with the set or the kit; position the strap which is already on the cord adjacent to the inside edge of the housing. **Remove the connector bracket from the wall mounting plate to prevent interference with the cord connector.** Before placing the set on the wall plate, position the cord inside the set as shown, and make sure the connector is tightly engaged. Plug loose end of extension cord into system cable or bridging connector.

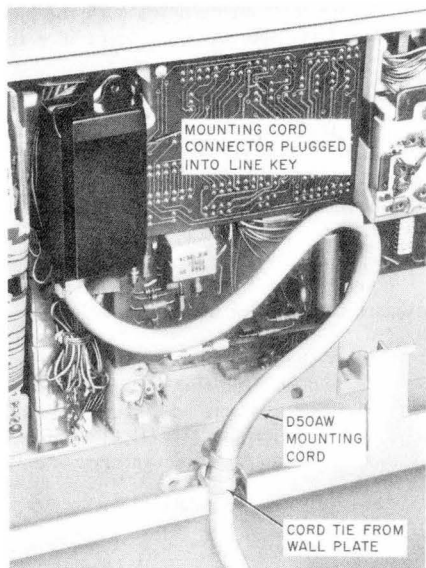
**3.24** Attach the wall telephone set to its associated wall mounting plate by tilting the set about 30 degrees and engaging the hooks at the top of the plate in the slots in the upper corners of the set housing (Fig. 18). Swing the set down so the line key plug engages the connector mounted on the wall plate. While pressing the set firmly against the plate, tighten the two locking screws

at the bottom of the wall plate to hold the set securely on the plate.

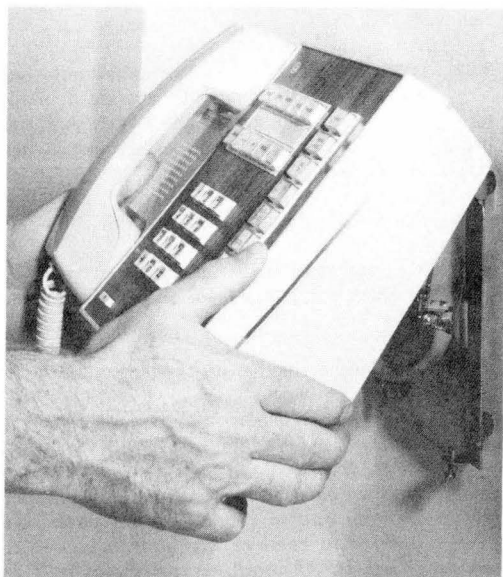
#### E. BIS Wall Sets

**3.25** A BIS wall set must be converted from a desk set by replacing its lower housing with a wall housing supplied with a D-180747 wall mounting kit. This kit also contains a wall plate, a handset hook, and other necessary hardware. Convert the set as follows:

- (a) Remove the number card retainer and the number card (Fig. 19).
- (b) Remove the screw under the number card and lift out the housing blank.
- (c) Replace the housing blank with the handset hook from the kit and secure it with the screw.



**Fig. 17—D50AW Mounting Cord Connected to Wall Set**



**Fig. 18—Mounting Wall Set on Wall Plate**



**Fig. 19—Handset Hook**

- (d) Put the number card and its retainer back into the slot over the screw.
- (e) Turn the set over and loosen the six captive screws which hold the lower housing.
- (f) Before removing the lower housing from the set, free the D8W cord from its strain relief in the housing.
- (g) Replace the lower housing with the wall housing from the kit. (The mounting cord attached to the lower housing is no longer used.)
- (h) Position the microphone on the BIS module in the lower right corner of the set in relation to the wall housing microphone port by aligning the two white marks on the microphone with the two marks on the housing.
- (i) Insert the free end of the D8W cord into the plug retainer from the kit of parts.
- (j) Snap the plug retainer onto the wall housing (Fig. 14) so the cord plug will mate with the jack in the 85A connecting block to be mounted on the wall plate (see paragraph 3.26).
- (k) Fold up the excess D8W cord, tie it with the plastic cord tie supplied with the kit, and store it inside the set behind the plug retainer.



**3.26** Attach the wall plate from the kit to the wall and connect the system cable to the connector bracket as described in paragraph 3.23(a), (b), or (c).

**3.27** Convert the 86A connecting block (Fig. 12) supplied with the set to an 85A block and mount it on the wall plate as follows:

- (a) Using a screwdriver, carefully pry the 85A connecting block portion away from the mounting cover. (The cover will not be used.)
- (b) Remove the white plastic plug lock from the top of modular jack of the 85A block.

**Warning: If the plug lock is not removed, the D8W cord plug will lock into the 85A block when the telephone is attached to the wall plate, and it will be extremely difficult to remove the telephone again.**

- (c) Replace the housing blank with the handset hook from the kit and secure it with the screw.
- (d) Put the number card and its retainer back into the slot over the screw.
- (e) Turn the set over and loosen the six captive screws which hold the lower housing.
- (f) Replace the lower housing with the wall housing from the kit. (The mounting cord attached to the lower housing is no longer used.)

**3.30** Attach the wall plate from the kit to the wall and connect the system cable to the connector bracket as described in paragraph 3.23(a), (b), or (c). Then attach the HFAI telephone to the wall plate as described in paragraph 3.24.

**G. All HFAI Sets**

**3.31** Each HFAI telephone set contains a factory-installed shorting bar which restricts its hands-free answer capability to intercom path 1. For the set to operate properly in a system with two intercom paths, the shorting bar must be removed.

**3.32** If the system being installed has only one primary set and one intercom path, make no modification to the sets; if the system has two primary sets and two intercom paths, modify each HFAI set as follows:

- (a) Remove the faceplate (paragraph 5.07)
- (b) Find the shorting bar mounted on two pins on the inner left side of the HFAI module (Fig. 4)
- (c) Pull the shorting bar off the pins and discard it
- (d) Replace the faceplate.

(c) Mount the 85A block on the wall mounting plate with the two screws supplied with the plate (Fig. 16).

(d) Using inside wire, connect terminals 7 and 8 to the output terminals of the associated 2012D transformer. **Do not plug the 2012D into an ac outlet until all installation is complete.**

**3.28** Complete the mounting of the BIS wall set by attaching the telephone to the wall plate as described in paragraph 3.24.

**F. HFAI Wall Sets**

**3.29** An HFAI wall set must be converted from a desk set by replacing its lower housing with a wall housing supplied with a D-180747 wall mounting kit. This kit also contains a wall plate, a handset hook, and other necessary hardware. Convert the set as follows:

- (a) Remove the number card retainer and the number card (Fig. 19).
- (b) Remove the screw under the number card and lift out the housing blank.



**If an existing system is ever expanded from one to two intercom paths, be sure to remove the shorting bars in all HFAI modules as described in paragraph 3.32.**

**BASIC FEATURES****A. CO/PBX and Intercom Line Assignments (Primary Sets Only)**

**3.33** Primary sets are factory-wired so the two incoming CO/PBX lines are picked up on line buttons 1 and 2 and the intercom on IC1. If the system uses two primary sets, one set must be modified to connect CO/PBX lines 3 and 4 and intercom path 2 to line buttons 3 and 4 and IC2. This is accomplished by changing a connector inside one set as follows:

- (a) Remove the power transformer and heat sink assembly from the back of the set by loosening the two retaining screws under the rear of the set (Fig. 20) and pulling out on the heat sink. It is not necessary to remove the screws but only to back them out about 1/8 inch. Pulling gently on the power cord to dislodge the transformer from the plug inside the set is permissible.
- (b) Find the line assignment connector plugged into the logic board near the back of the set (Fig. 21). The visible side is labeled "LINES 1 & 2."
- (c) Carefully disconnect the line assignment connector from the logic board by pulling straight up until it clears the plastic guide block around the pins on the board.
- (d) Rotate the connector 180 degrees so that the side labeled "LINES 3 & 4" is visible.
- (e) Carefully plug the connector back into the logic board in its new position.
- (f) Plug the transformer and heat sink assembly back into the rear of the set. Tighten the two retaining screws.

**B. CO/PBX Ringing and DSS Code Assignments (All Sets)**

**3.34** Located under the hinged cover on the DSS key of each station are four common audible switches which control CO/PBX ringing, and the DSS intercom code selection switch which determines the intercom code of the station (Fig. 22). Repeat the following procedure at each station.

**(a) CO/PBX Ringing Assignments:**

- (1) Raise the cover by pressing on the left end to tilt it up or pry up the right end with a fingernail.
- (2) Find out which CO/PBX lines are to ring at the station. Set the switch for each line either ON or OFF. On the standard DSS key (664B), ON is up and OFF is down; on the code busy DSS key (664C), ON is right and OFF is left. (Figure 22 shows the station coded to ring on lines 2 and 4.)

**(b) DSS Code Assignments:**

- (3) Find out which intercom code is to be assigned to the station. The following considerations and limitations should apply to code assignments.
  - If several stations are set for the same DSS code, they will all be voice signaled when that code is called.
  - The DSS codes can also be assigned to paging, supplementary alerting, and preset multiple signaling.
  - If the standard DSS key (664B) is used, the number of stations plus the number of options assigned to the same DSS code must not exceed 16.
  - If the code busy DSS key (664C) is used, the number of stations plus the number of options assigned to the same DSS code must not exceed 4.



***Do not assign an HFAI station to the same code with any other station set, apparatus unit, or loudspeaker set.***

- (4) To set the intercom code, slide the DSS intercom code selection switch to the proper number between 1 and 10 (or to OFF if the station is to have no DSS code). Be careful that the switch is not between detent positions. (Figure 22 shows the set coded as station 3.)
- (5) Close the switch cover.

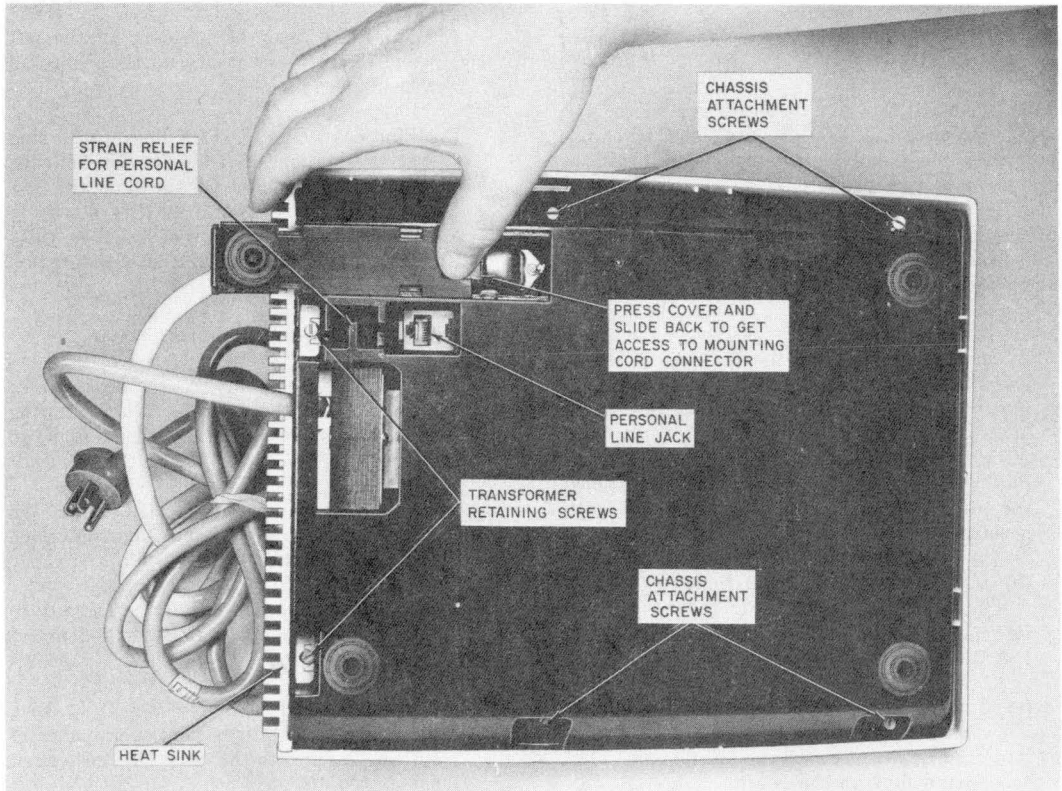


Fig. 20—Primary Set, Bottom View

### SUPPLEMENTARY POWER

**3.35** Mount the 19B4 power unit near the 184B2 backboard where the station cables are cut down (Fig. 8) and within available power cord length of a suitable ac outlet. Connect the 24V B SIG output to row 40 (S-Y) of a vacant column of one of the backboard connecting blocks and SIG GRD to row 39 (Y-S). Move the ac input tap from the 117-volt ac screw terminal to the 123-volt ac screw terminal. **Do not connect the power cord until all installation is complete.**



**Do not connect power unit SIG GRD to building ground.**

**3.36** The primary sets are factory-wired to supply all system power from their internal power supplies. When a 19B4 power unit is added, make the following connector change in **each** primary station:

- (a) Open the back of the set by removing the transformer assembly as described in paragraph 3.33(a)
- (b) Find the power connector labeled SYS plugged into the logic board near the back of the set (Fig. 21)
- (c) Carefully disconnect the power connector from the logic board by pulling straight up

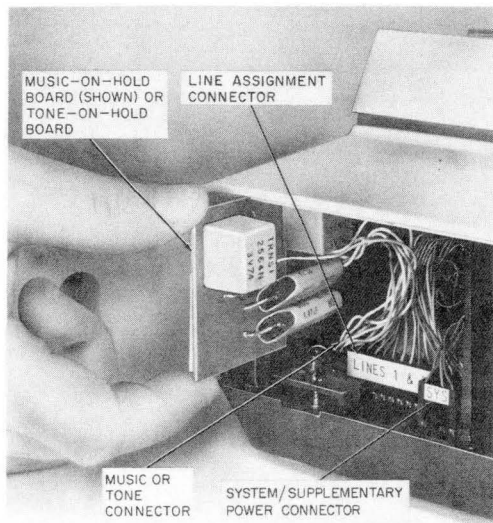


Fig. 21—Primary Set, Rear View With Heat Sink Removed

until it clears the plastic guide block around the pins on the board

- (d) Turn the connector around so that the side labeled SUPP shows
- (e) Carefully plug the connector block into the logic board in its new position
- (f) Replace the transformer assembly. Tighten the two retaining screws.

#### OPTIONAL FEATURES

**Note:** Refer to Part 5 for complete procedures for disassembling and assembling telephone sets.

##### A. Music-On-Hold

**3.37** This option requires a customer-provided music source, installation of a D-180980 Kit of Parts in each primary set, and one 33C voice coupler per system. Music- and tone-on-hold (paragraph 3.41) **cannot** be installed in the same system.

**3.40** Install the kit of parts in each primary set as follows:

- (a) Open the back of the set by removing the transformer assembly as described in paragraph 3.33(a).
- (b) Plug the circuit board connector into the keyed plug on the logic board (Fig. 21 and 23).
- (c) Insert the music-on-hold circuit board vertically in the slots in the housing and base (Fig. 21).
- (d) Replace the transformer assembly. Tighten the two retaining screws.

**3.41** Install the 33C voice coupler as follows:

- (a) Remove the cover from the coupler.
  - (b) Mount the coupler in some location where it can be conveniently connected to both the customer's music source and the 4A System.
  - (c) Connect terminals 3 and 4 of the 33C coupler to the primary stations via the two M terminals of the 91B connecting blocks using inside wire (Fig. 24). Connect GRD terminal to building ground.
- Note:** Music for lines 1 and 2 is connected through the 91B block for the first primary station, and music for lines 3 and 4 through the 91B block for the second primary.
- (d) Replace the cover on the coupler.
  - (e) Have the customer connect music source to terminals 1 and 2 on the outside of the coupler. (If customer's music source is not yet available, set the coupler potentiometer fully counterclockwise. Complete the installation when the music source is available.)



**The customer-provided music source must be capable of providing 1 watt of undistorted RMS power into an 8-ohm load. In addition, the output of the music source must be ac coupled. Do not connect a source that has a dc voltage on the output.**

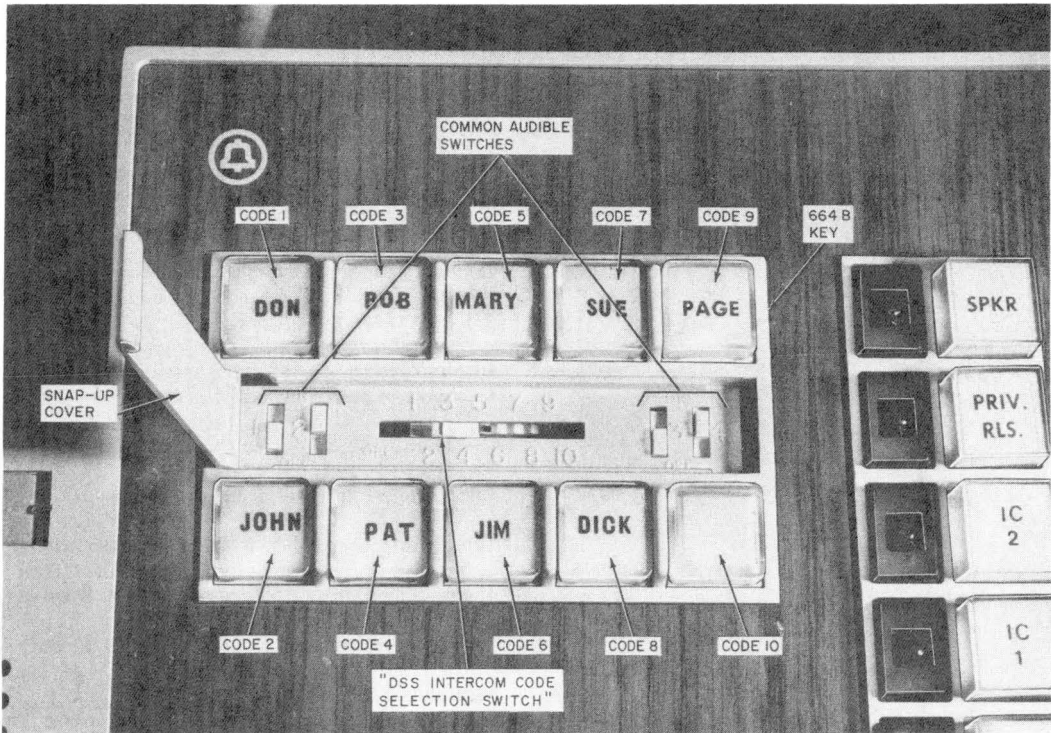


Fig. 22—DSS Key, Cover Open

*The 33C voice coupler will accept input from any customer-provided apparatus that does not blow a fuse in the coupler.*

- (f) After all installation is complete, adjust the music-on-hold circuit as described in paragraph 3.40.

**3.40** Adjust the volume level of the music-on-hold as follows:

- (a) Place a call to one of the 4A System stations on a CO/PBX line
- (b) Answer the call and place it on hold

- (c) Have the customer adjust the music source for a comfortable listening level on the held line.

**Note:** Refer to paragraph 3.58(f) for installation of music-on-hold with a personal line.

#### B. Tone-On-Hold

**3.41** This option requires the installation of a D-180731 Kit of Parts in each primary set. Tone- and music-on-hold cannot be installed in the same system. Install the kit of parts in each primary set in the same way as the music-on-hold kit (paragraph 3.38). After the installation is complete, test the tone-on-hold circuit as described in paragraph 3.42.

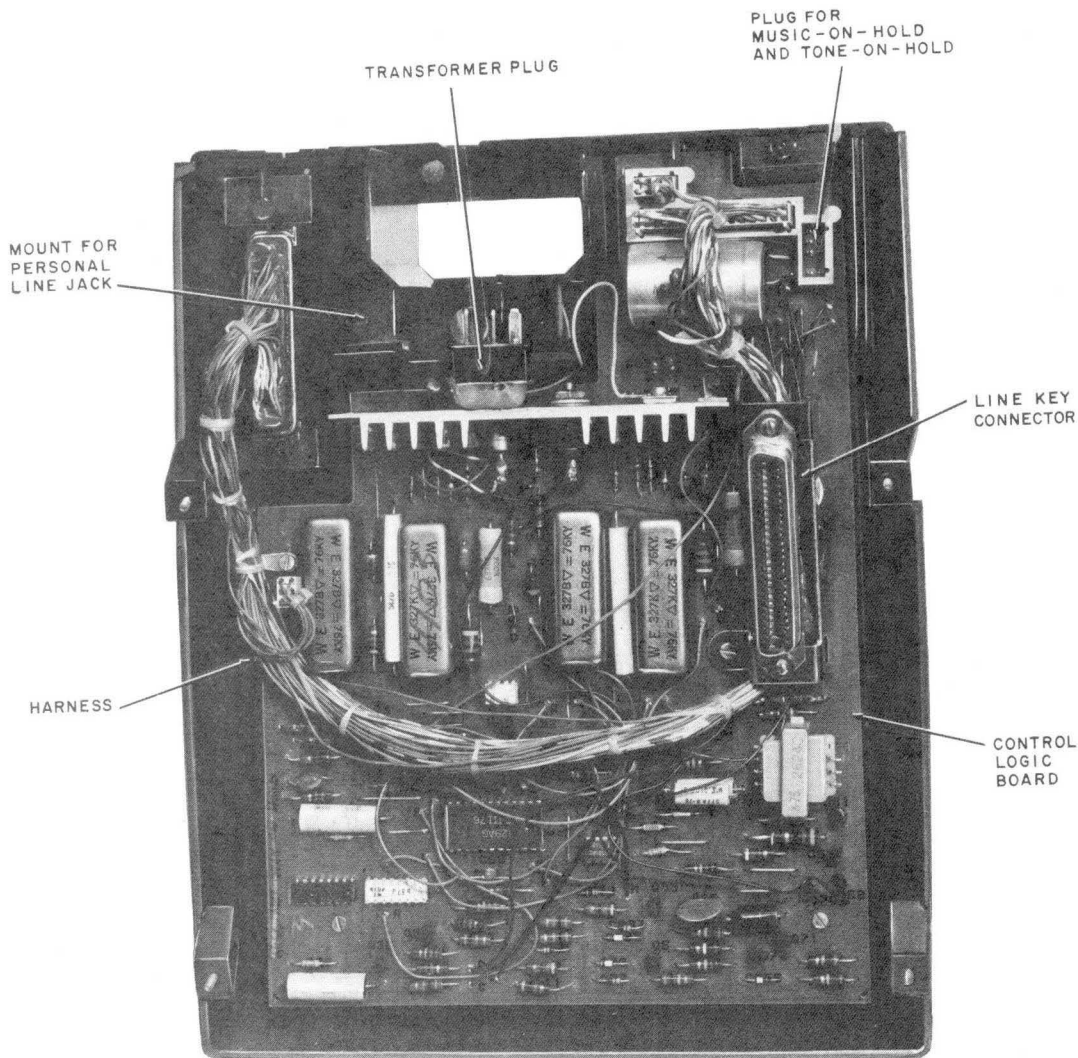


Fig. 23—Base and Logic Assembly of Primary Set

3.42 Test the tone-on-hold circuit as follows:

- (a) Place a call to one of the 4A System stations on a CO/PBX line
- (b) Answer the call and place it on hold

- (c) An intermittent tone at a comfortable level should be heard on the held line.

**Note:** Refer to paragraph 3.58(g) for installation of tone-on-hold with a persona line.

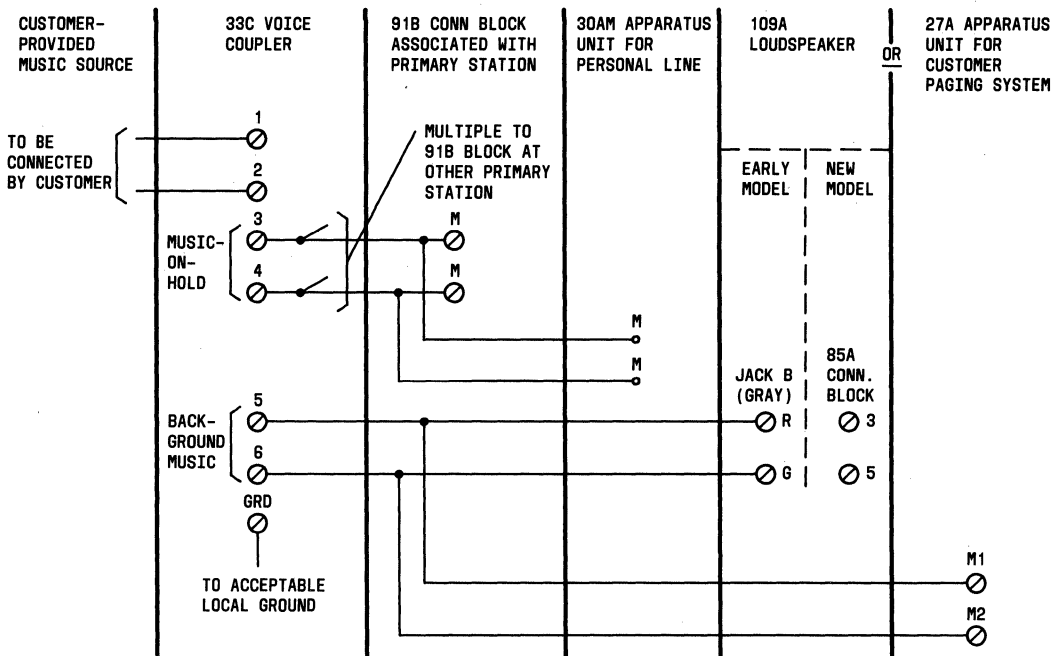


Fig. 24—Connections for Music-On-Hold and Background Music

### C. Paging (Telephone Company Provided System)

3.43 The 109A loudspeaker is designed for indoor installation (above 32°F). The power output of the speaker at low +V potentials is approximately 1/4-watt, and therefore, is intended for the typical business office and not for high noise environments. It has an effective range of about 30 feet; use facing speakers in a room of greater width. Be careful to locate loudspeakers so that feedback between them and nearby stations does not occur during paging; spacing of up to 60 feet between loudspeakers and stations may be required. Avoid mounting loudspeakers so that they are pointed directly at stations. Refer to Fig. 25 for typical loudspeaker installations. Install and connect the loudspeaker as follows.

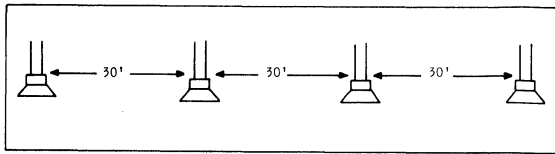


*The loudspeaker is normally connected into the 4A System via the 91B blocks associated with each primary set (Fig. 26). However, if the speaker is to be located remote from either*

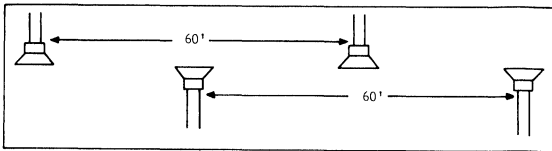
*primary, it can be connected via a 91B block cut into the system cabling (Fig. 26) or a 66-type block (Fig. 27). A 91A connecting block (MD) removed from an older installation may also be used for paging connections (Fig. 28).*

#### (a) Early Model or 109A Loudspeaker:

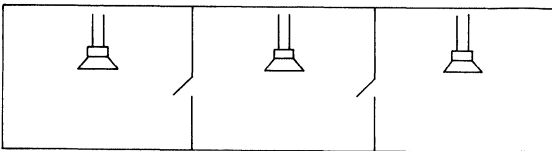
- (1) Attach the wall bracket assembly of each loudspeaker directly to a suitable wall surface or device box (Fig. 29).
- (2) Find out which QSS code is to be assigned to paging. Using inside wire, connect the loudspeaker(s) as shown in Fig. 26, 27, or 28.
- (3) If background music is to be provided over the 109A loudspeaker, install a 33C voice coupler if one is not already used for



EXAMPLE A - SPEAKERS LOCATED ON ONE WALL OF ROOM (NOTES 1 AND 2)



EXAMPLE B - SPEAKERS LOCATED ON OPPOSITE WALLS OF ROOM (NOTE 1)



EXAMPLE C - SPEAKERS LOCATED IN INDIVIDUAL ROOMS (NOTES 1 AND 3)

## NOTES:

1. EXAMPLES A, B AND C ARE FOR QUIET OR OFFICE TYPE ENVIRONMENTS. FOR A NOISY ENVIRONMENT, DISTANCE BETWEEN SPEAKERS MUST BE REDUCED TO A DISTANCE THAT WILL PROVIDE THE SAME LISTENING LEVEL. ALL SPEAKERS SHOULD BE LOCATED AT LEAST 60 FEET FROM ANY STATION USED FOR PAGING.
2. SPEAKERS REACH A DEPTH OF 30 FT. IF ROOM IS OVER 30 FT. WIDE, FACING SPEAKERS SHOULD BE USED.
3. ONE SPEAKER WILL SERVE A ROOM UP TO 25 FT. BY 25 FT.

Fig. 25—Examples of Loudspeaker Locations

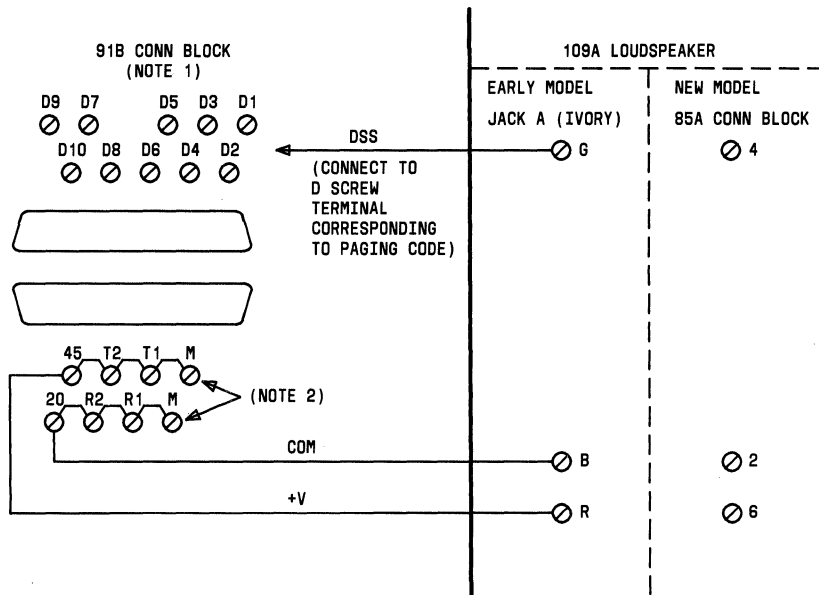
music-on-hold (the same coupler can be used for both functions), and connect as shown in Fig. 24.

- (4) While holding the loudspeaker up near the wall bracket, connect plug A into jack A of the bracket, and plug B into jack B, ivory to ivory and gray to gray, respectively.
  - (5) Slip the speaker baffle mounting bracket over the mounting clips on the wall bracket assembly and push the speaker down until it is firmly held.
  - (6) After all installation is complete, adjust and test each loudspeaker as described in paragraph 3.44.
- (b) **New Model of 109A Loudspeaker:**
- (1) The loudspeaker set is shipped completely assembled. Loosen the two locking screws on the bottom of the loudspeaker set and separate the wall bracket from the baffle

(Fig. 30). Unplug the D8W cord from the 85A block.

- (2) Attach the wall mounting bracket to a suitable wall surface or device box with four No. 8 screws; place the four rubber washers supplied with the set between the bracket and the mounting surface. All outside connections to the loudspeaker will be made at the screw terminals of the 85A block attached to the plate.
- (3) Find out which DSS code is to be assigned to paging. Using inside wire, connect the loudspeaker(s) as shown in Fig. 26, 27, or 28.
- (4) If background music is to be provided over the 109A loudspeaker, install a 33B voice coupler if one is not already used for music-on-hold (the same coupler can be used for both functions) and connect as shown in Fig. 24.





## NOTES:

1. CONNECTIONS CAN BE MADE AT A 91B BLOCK SERVING ONE OF THE PRIMARY STATIONS OR A 91B BLOCK INSERTED IN SYSTEM CABLING SPECIFICALLY FOR USE WITH LOUDSPEAKER.
2. STRAP ADJACENT TERMINALS AS SHOWN ONLY IF 91B BLOCK IS NOT ASSOCIATED WITH PRIMARY STATION.

Fig. 26—Paging Connections Using 91B Connecting Block

(5) While holding the loudspeaker baffle up near the wall bracket, plug the free end of the D8W cord into the modular jack of the 85A block (Fig. 30).

(6) Mount the loudspeaker baffle on the wall bracket by hooking the two pins on the inner sides of the baffle into the two mounting slots of the wall bracket. Press the baffle down against the bracket so that the two slots in the lower edge of the baffle fit over the two locking screws of the wall bracket; tighten the screws.

(7) After all installation is complete, adjust and test each loudspeaker as described in paragraph 3.44.

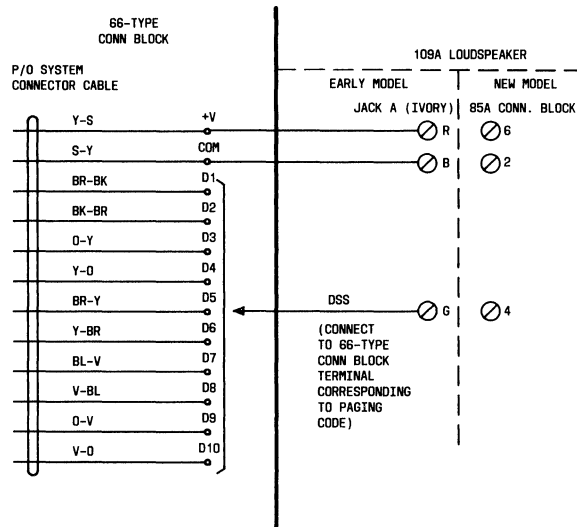
3.44 Adjust and test the paging system as follows:

- (a) If background music is provided, adjust the volume control of the 33C voice coupler to mid-range. Adjust the right-hand volume control of each loudspeaker for the desired music level. The volume control of the 33C may be readjusted if necessary to raise or lower the overall music level.



***If music-on-hold was previously installed, do not readjust the music level at the customer-provided source.***

- (b) At any station in the 4A System, select an idle intercom path and hold down the DSS button assigned to the paging system. While



**Fig. 27—Paging Connections Using 66-Type Connecting Block**

speaking into the handset in a normal voice, have the left-hand volume control on each loudspeaker adjusted to the output level desired by the customer. Background music will be muted while the system is used for paging.

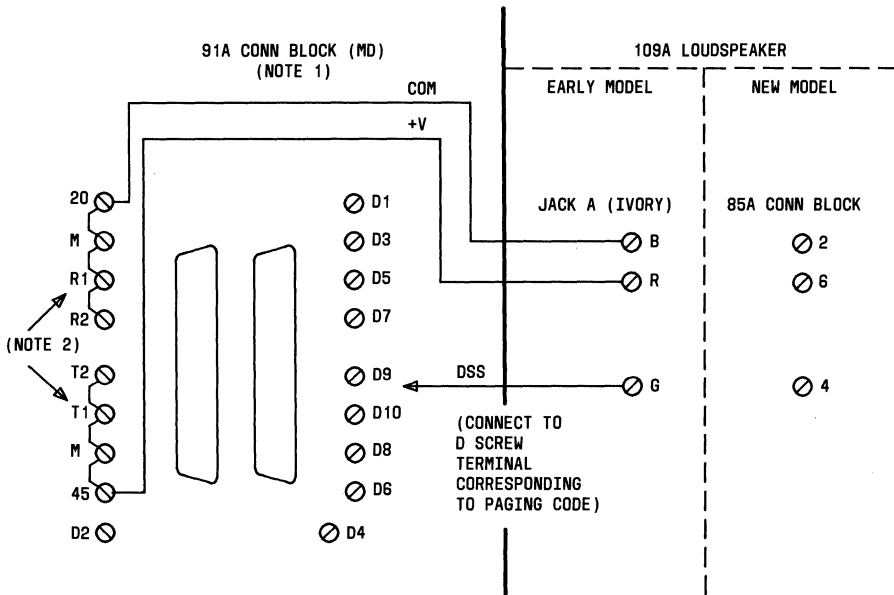
#### **D. Paging (Interface With Customer-Provided System)**

**3.45** The 27A apparatus unit (Fig. 31) has terminals for connection to the 4A System and the customer equipment; put it where there is convenient access to both. It must be located indoors where the temperature is always above 32°F.

- (a) Remove the cover and mount the base pan assembly of the 27A in the desired location so that terminals A1 and A2 are easily accessible by the customer.
- (b) Find out which DSS code is to be used to access the paging system. On the 27A, remove the lead corresponding to the code from the numbered push-on terminal where it is stored and insert it into the IN terminal.
- (c) If background music is to be provided, install a 33C voice coupler if one is not already used for music-on-hold (one coupler will serve

both functions). Connect screw terminals 5 and 6 of the coupler to screw terminals M1 and M2 of the 27A unit (Fig. 24 and 31). Connect GRD terminal to building ground.

- (d) If the customer paging system requires a contact closure when the paging occurs, install a KS-16626L12 relay set per Section 463-120-100. Connect the relay coil circuit to screw terminals R1 and R2, and connect a strap between screw terminals R3 and R4.
- (e) Plug in the system cable or cables. Position inserts inside cover to hold cable(s) securely when cover is replaced.
- (f) Replace cover.
- (g) Have customer paging system connected to screw terminals A1 and A2.
- (h) After all installation is complete, adjust and test the paging system as described in paragraph 3.44, except that loudspeaker output level adjustments are to be made by the customer on the customer's own units. If the customer



## NOTES:

1. CONNECTIONS CAN BE MADE AT A 91A BLOCK SERVING ONE OF THE PRIMARY STATIONS OR A 91A BLOCK INSERTED IN SYSTEM CABLING SPECIFICALLY FOR USE WITH LOUDSPEAKER.
2. STRAP ADJACENT TERMINALS AS SHOWN ONLY IF 91A BLOCK IS NOT ASSOCIATED WITH PRIMARY STATION.

Fig. 28—Paging Connections Using 91A (MD) Connecting Block

paging equipment is not available, a 107A loudspeaker can be substituted temporarily:

- (1) Connect the red and green leads of the 107A to A1 and A2, respectively.
- (2) Connect the yellow and brown leads of the 107A to a 2012D power transformer plugged into a suitable ac outlet.

vertical position as indicated by the arrows on the relay can.

**3.47** Both the 24B apparatus unit and the earlier 24A (MD) are factory-wired to provide power failure ringer service for CO/PBX lines 1 and 2. Internal wiring changes are required for use with lines 3 and 4. Connect the apparatus unit as described in (a) or (b).

**E. Power Failure Ringing**

**3.46** Locate the 24B apparatus unit (Fig. 32) near the telephone where power failure ringing is required. Remove the cover and mount the base pan assembly on a vertical surface so that the mercury relay on the wiring board is in a

(a) **24B Apparatus Unit**—In addition to the system cables, connections must be made with inside wire between the 24B and the 91B connecting block associated with the primary set or between the 24B and the network interface with a modular cord.

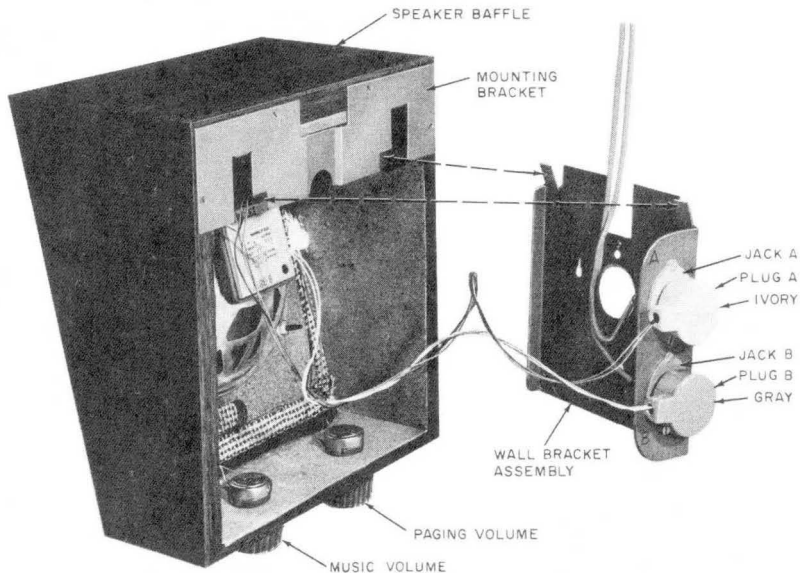


Fig. 29—109A Loudspeaker Set (Early Model)

(1) If the 24B is to be used with lines 1 and 2, either connect it with inside wire to the 91B block associated with the primary set where lines 1 and 2 are controlled or use a D4BU cord (25-foot maximum) to connect it directly to the network interface (Fig. 33). Skip to Step (3).

(2) If the 24B is to be used with lines 3 and 4, move the O (orange) lead from screw terminal 1-2 to 3-4 (do not disconnect any other leads). Either connect the 24B with inside wire to the 91B connecting block associated with the primary set where lines 3 and 4 are controlled or use a D4BU cord (25-foot maximum) to connect it directly to the network interface (Fig. 33).

(3) Remove the cable clamp(s) and plug in the system cable(s). Replace the clamp(s) using the tapped hole in the base pan or standoff to hold the cable securely.

(4) Replace the cover.

(5) Test the power failure ringing as described in paragraph 3.48.

(b) **24A Apparatus Unit (MD)**—All external connections are provided through the system cables.



**After the FCC register-only date, only those 24A apparatus units which have been removed from other installations may be used.**

(1) If the 24A is to be used with lines 1 and 2, go directly to Step (4).

(2) If the 24A is to be used with lines 3 and 4, disconnect, insulate, and store the five leads connected to terminals 4, 5, 6, 7, and 9 on the wiring board (do not disconnect the lead on terminal 8). Perform Step (3).

(3) Connect the five factory-insulated and stored leads to the vacant terminals as follows:

O-R to terminal 5  
 R-O to terminal 4  
 Y-G to terminal 6  
 R-S to terminal 9  
 S-R to terminal 7

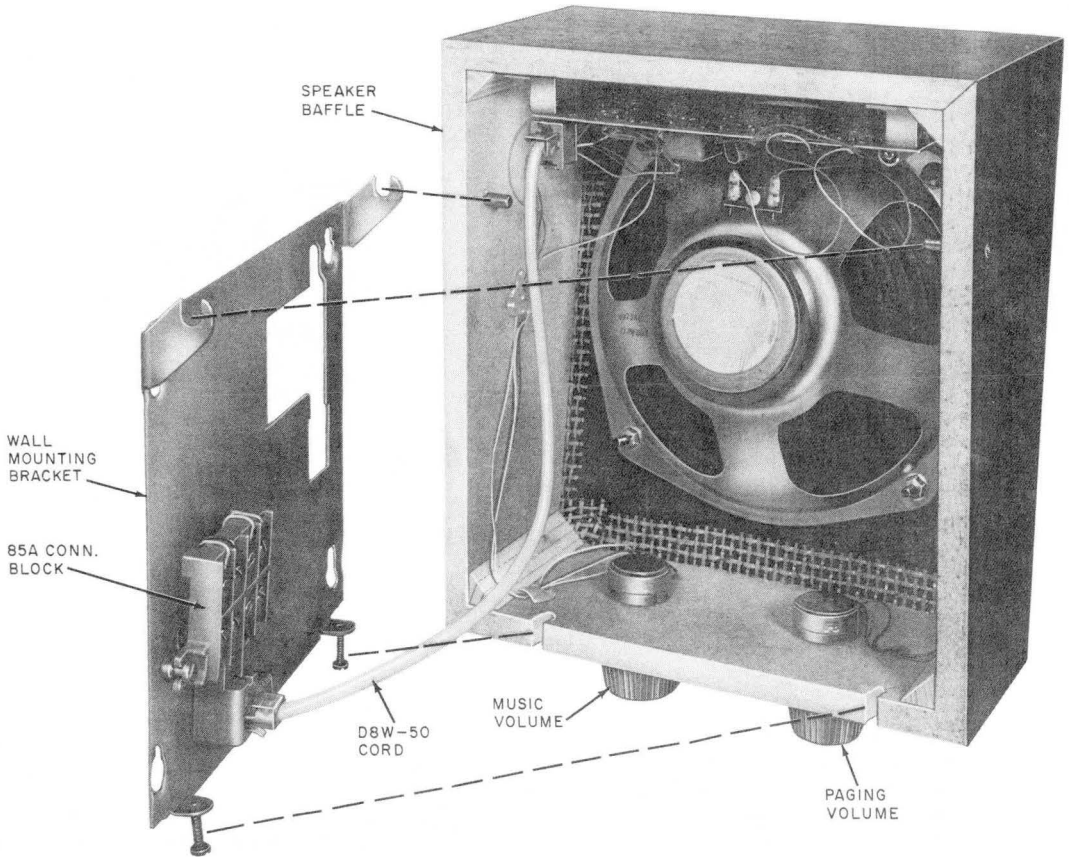


Fig. 30—109A Loudspeaker Set (New Model)

**Note:** A 24A apparatus unit wired for lines 3 and 4 can be rewired for lines 1 and 2 by disconnecting, insulating, and storing the five leads connected in (3) and then connecting the previously stored leads as follows:

BL-W to terminal 5  
 W-BL to terminal 4  
 BK-S to terminal 6  
 W-BR to terminal 9  
 BR-W to terminal 7

(4) Remove the cable clamp(s) and plug in the associated system cable(s). Replace

the clamp(s) using the tapped hole in the base pan or standoff to hold the cable(s) securely.

(5) Replace the cover.

(6) Test the power failure ringing as described in paragraph 3.48.

**3.48** Test the power failure ringing as follows:

(a) Unplug the ac line cord of the primary set serving CO/PBX lines 1 and 2.

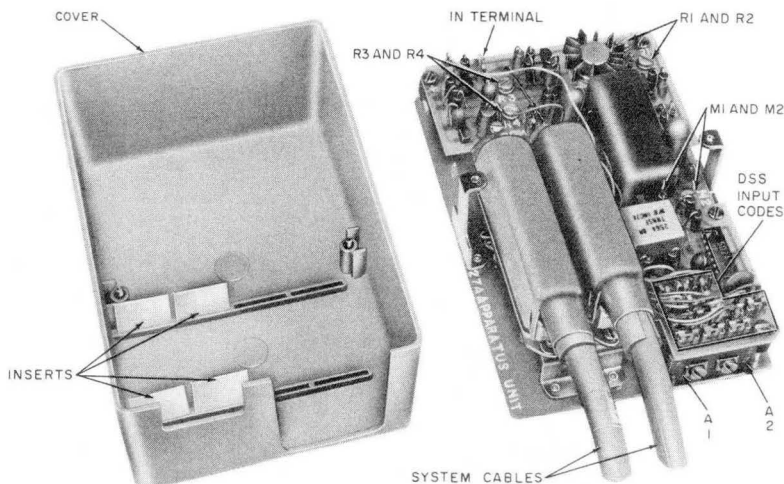


Fig. 31—27A Apparatus Unit

- (b) Place a call into the system on line 1. The power failure ringer should ring. Repeat for line 2.
- (c) Plug the ac line cord back into its receptacle.
- (d) Again place calls into lines 1 and 2. The power failure ringers should not ring.
- (e) If applicable, repeat above procedure for lines 3 and 4 at the second primary station to test the 24A or 24B apparatus unit associated with it.
- (f) If supplementary power is used and 24B apparatus units are installed, perform one additional test. Unplug the 19B4 power unit and again place calls to each line in the system; the appropriate power failure ringers should operate.

#### F. Supplementary Alerting Device Access

3.49 Install a 25A apparatus unit (Fig. 34) and an auxiliary signal as follows:

- (a) Remove the cover of the 25A and mount the base pan assembly at the desired location.

- (b) To provide a relay for the auxiliary signaling, mount a KS-16626L12 relay set per Section 463-120-100 or a KS-16301L17 relay set per Section 463-110-100.

- (c) Connect terminals 1 and 2 of the 25A to the coil of the auxiliary relay and connect the auxiliary signal to the relay per the applicable section listed in (b).

- (d) If the auxiliary signal is to respond to a DSS code, move the spade-tip lead associated with that code from storage terminal 1 through 10 on the 25A unit to the IN terminal.

- (e) If the auxiliary signal is to respond to any combination of common audible signals, move the spade-tip leads associated with the lines from storage terminals CA 1 through 4 to terminals A through D.

**Note:** The 25A apparatus unit can be coded to respond to both a DSS code and up to four common audible signals.

- (f) Plug in system cable or cables. Position inserts inside cover to hold cable(s) securely when cover is replaced.

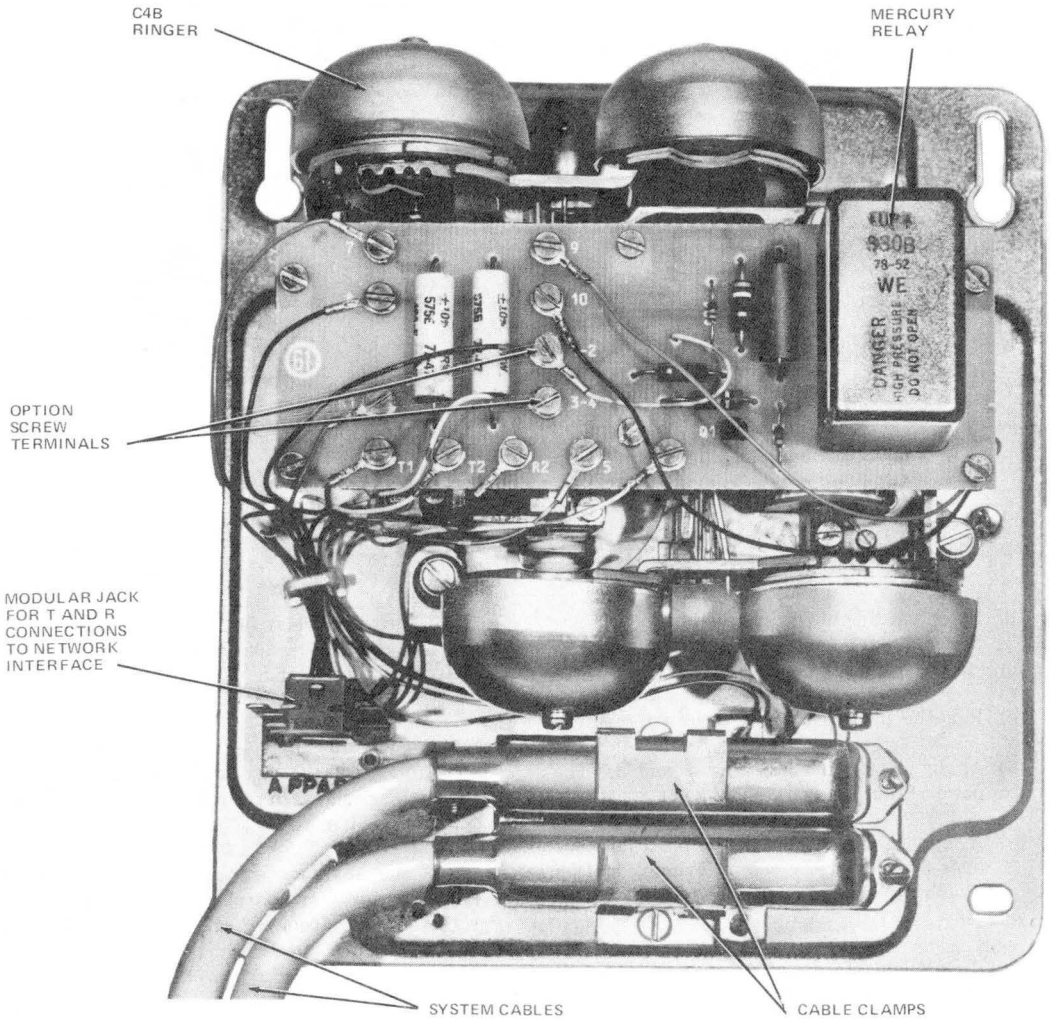


Fig. 32—24B Apparatus Unit

(g) Replace cover.

3.50 Test the supplementary alerting as follows:

(h) When all installation is complete, test the supplementary alerting as described in paragraph 3.50.

(a) If the auxiliary signal is connected to respond to a DSS code, depress that DSS button at any station to operate the signal. It should

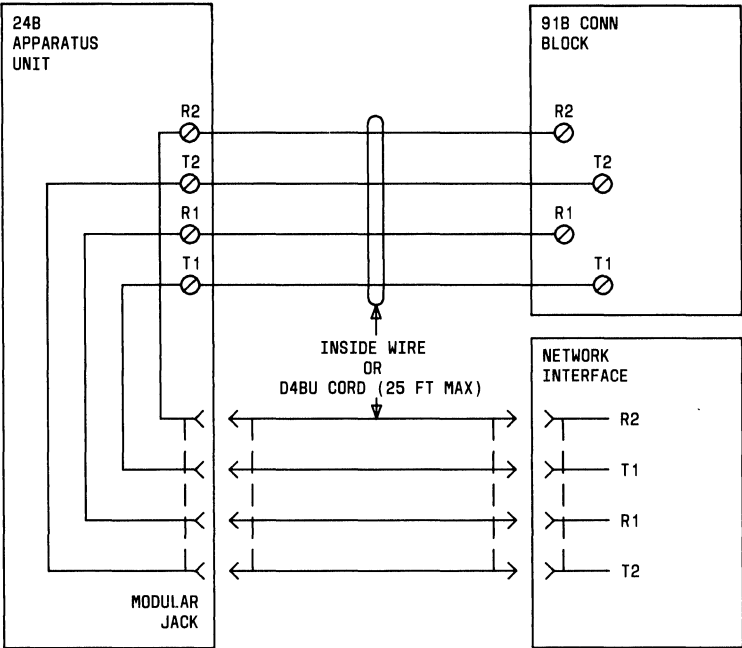


Fig. 33—Two Methods of Connecting 24B Apparatus Unit to CO/PBX Lines for Power Failure Ringing

continue to operate as long as the button is depressed.

**Note:** It is not necessary to use the handset or to select an intercom path for supplementary alerting via DSS code.

(b) If the auxiliary signal is to respond to common audible signals, place calls to the appropriate lines. The auxiliary signal should follow the normal CO/PBX ringing pattern.

**G. Preset Intercom Voice Signaling**

3.51 Install a separate 26A apparatus unit (Fig. 35) for each preset signaling group.

(a) Remove the cover and mount the base pan assembly in the desired location. It should be located indoors where the temperature is always above 32°F.

(b) Find out which DSS code will be used to access the input for multiple signaling and which DSS codes are to be called simultaneously.

(c) Remove the lead corresponding to the input code from the numbered storage terminal (1 through 10) and insert it into the IN terminal.

(d) Remove the leads corresponding to the called codes from the numbered storage terminals (1 through 10) and insert each one into a separate lettered output terminal (A through J). **If possible, do not use adjacent terminals; this will prevent shorted terminals.**



**An HFAl station can be voice signaled via a 26A, but the HFAl circuit will not seize the line to permit hands-free answer.**

(e) Plug in the system cable or cables. Position the inserts inside the cover to hold the



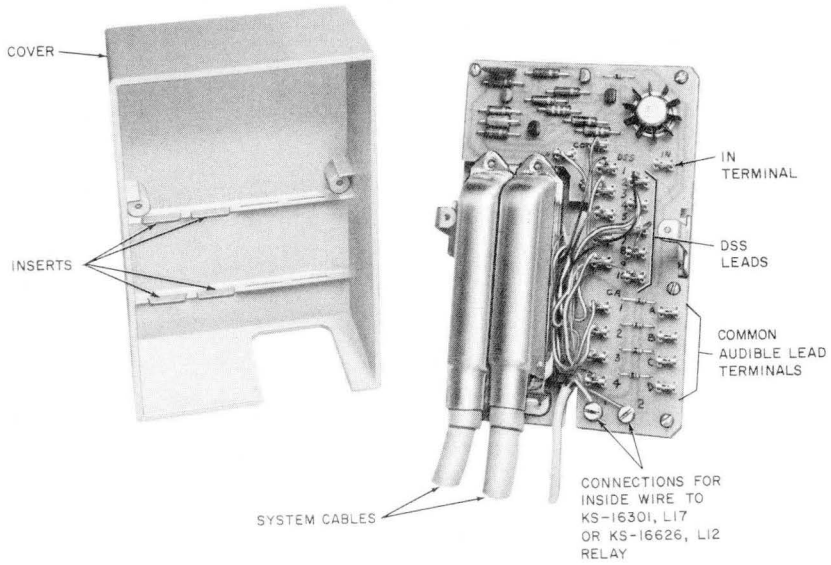


Fig. 34—25A Apparatus Unit

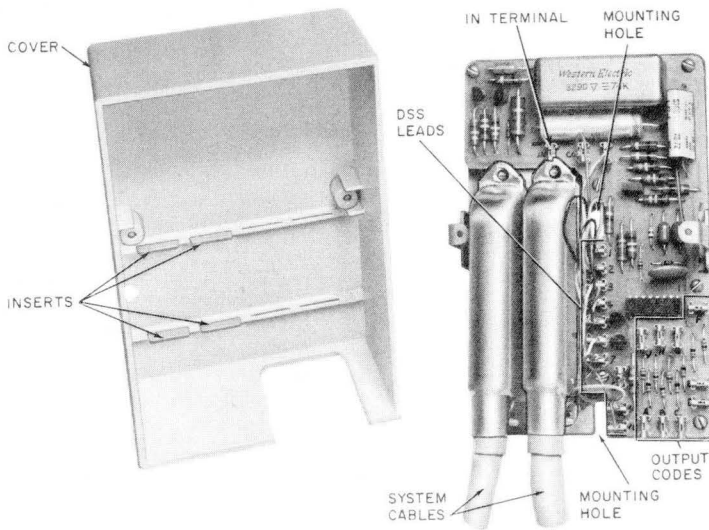


Fig. 35—26A Apparatus Unit

cables securely in place when the cover is replaced.

- (f) Replace the cover.
- (g) When all installation is complete, test the preset signaling as described in paragraph 3.52.

### 3.52 Test *each* preset signaling code as follows:

- (a) At an idle telephone, adjust the loudspeaker volume control to maximum and set the DSS programming switch to DSS code 1.

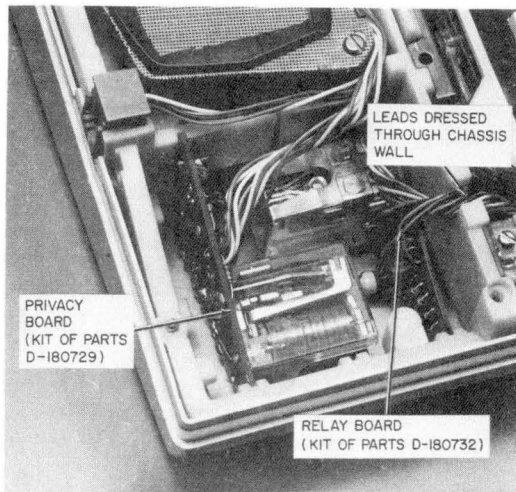
**Note:** The SPKR button must be in the released (up) position.

- (b) Select and depress an idle intercom line button. Depress and hold the DSS button corresponding to the input code of the 26A apparatus unit and speak into the handset. Speech shall be heard from the loudspeaker in the station set if the 26A apparatus unit is coded to access the zone coded in (a).
- (c) Repeat (a) and (b), moving the DSS selector switch through the remaining DSS zones.
- (d) If an HFAI station is in the preset signaling group, check to be sure that the HFAI circuit does not seize the line.
- (e) Return the DSS programming switch to its assigned station code position.

## H. Privacy

**3.53** This option requires the installation of a D-180729 Kit of Parts (privacy board) at each station to be locked out and the designation of the privacy release button in *all* stations in the system.

- (a) Remove the faceplate and upper housing of the telephone set to gain access to the area where the privacy board is to be mounted (see paragraphs 5.07 and 5.10).
- (b) Mount the privacy board in the lower left corner of the chassis by sliding it into the two notches with its relay to the right (Fig. 36).



**Fig. 36—Privacy and Relay Boards Installed in Telephone Set**

- (c) Move the DSS key aside (paragraph 5.23) so that the interconnect field is accessible (see Fig. 5). Do not unplug the DSS key.
- (d) Remove the three factory-installed shorting bars from the PRV position in the interconnection field (Fig. 37).

**Note:** Shorting bars removed from the interconnect field can be stored inside the telephone by taping them down to some surface where they will not interfere with other parts.

- (e) Insert the connector from the privacy board into the PRV position. Dress the leads around the right side of the loudspeaker and through the opening in the chassis wall (Fig. 5).
- (f) Put the DSS key back in its proper position (paragraph 5.24).
- (g) Reassemble the housing (paragraph 5.12) and faceplate (paragraph 5.09).
- (h) Install the PRIV RLS designation tab in the privacy release button of *every* set in the system.

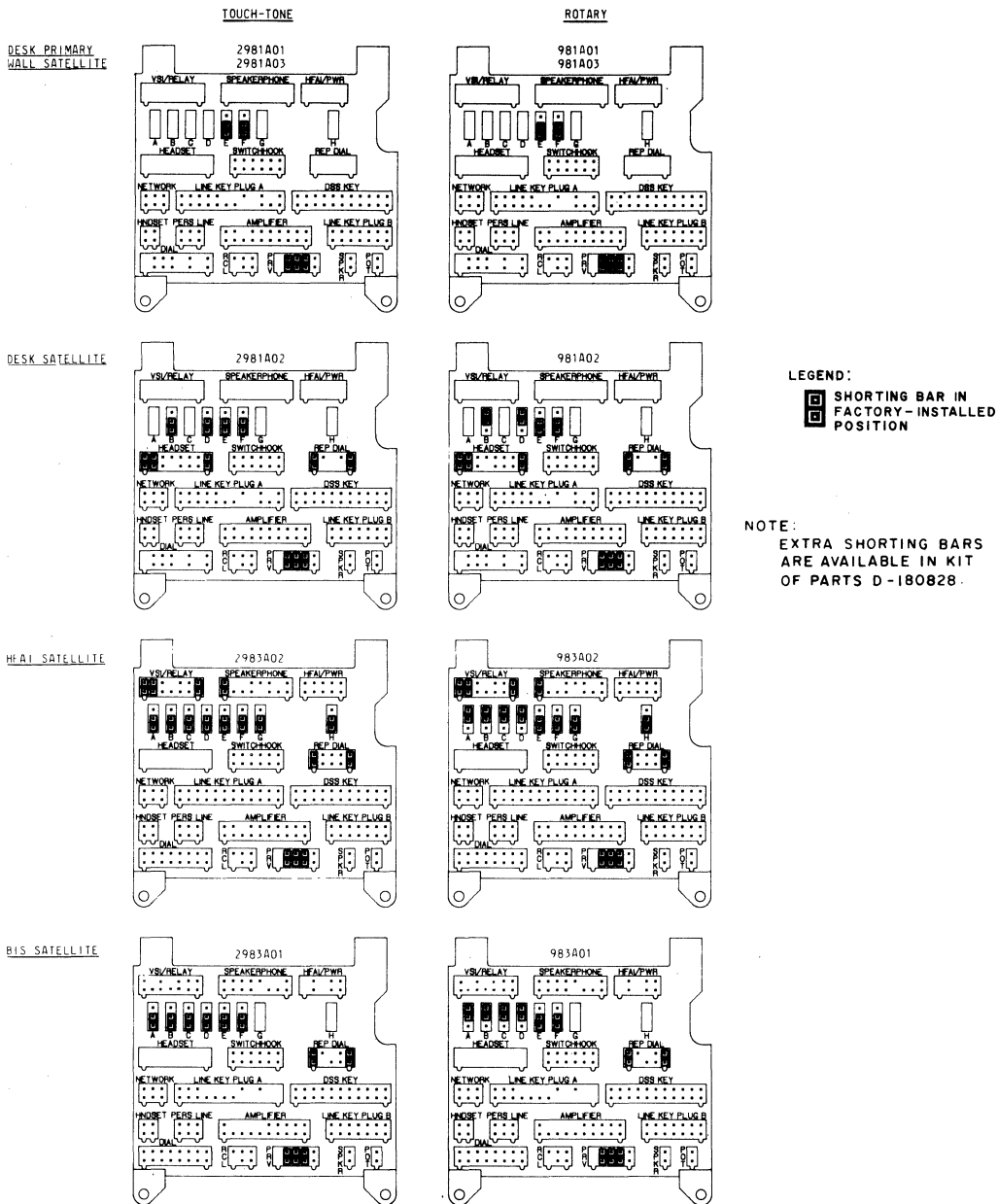


Fig. 37—Interconnect Fields Showing Factory Positions of Shorting Bars

- (i) After all installation is complete, test the privacy feature in each station as described in paragraph 3.54.



***If the privacy feature is ever removed from a set, be sure to restore the shorting bars removed in (d) to their original factory positions (Fig. 37). If the privacy feature is removed from all sets in the system, remove the PRIV RLS designation tabs from all sets.***

### 3.54 Test the privacy feature as follows:

- (a) At a second station in the 4A System, pick up an idle CO/PBX line.
- (b) At the first station where privacy is being tested, try to pick up the same line. This station should be locked out, as evidenced by lack of sidetone.
- (c) At the first station being tested, select an idle line. Then quickly return to the busy line. The station should still be locked out.
- (d) Operate the PRIV RLS button at the second station while the second station is off-hook on the busy line. This should permit the first station to bridge onto the busy line.

## I. Station Dial Restriction

3.55 This feature requires an internal wiring change at each station which is to be prevented from dialing out.

- (a) Remove the faceplate from the telephone set (paragraph 5.07).
- (b) Move the DSS key aside so that the interconnect field is accessible (paragraph 5.23). Do not disconnect the DSS key.
- (c) At switches E and F on the interconnect field (Fig. 37), move the shorting bar from the lower position to the upper position.
- (d) Put the DSS key back in its proper position (paragraph 5.24).
- (e) Replace the faceplate (paragraph 5.09).

- (f) After all installation is complete, test dial restriction at each equipped station by attempting to place an outgoing CO/PBX call; it should be impossible to break dial tone.

**Note:** At a station equipped with both dial restriction and a repertory dial, outgoing calls can be made using the repertory dial.

## J. Personal Line

3.56 The method of installation and connection of this feature depends on the type of telephone with which the line is used. In all cases, a 30AM apparatus unit (Fig. 38) must be installed for each personal line; a single 30AM can serve a maximum of 16 stations on the same line if the restrictions of Fig. 12 are observed.

3.57 The 30AM is a line circuit; the CO/PBX tip and ring leads of the personal line are connected to it via a D4BU cord from the network interface. Six station leads from the 30AM unit must be connected to the associated telephone(s) via a connecting block, a cord, a jack assembly, and mounting hardware provided in the D-180758 Kit of Parts which must be installed with all telephones, except BIS satellite sets, which are to have a personal line. The BIS sets already have the necessary internal wiring as part of their built-in speakerphone feature.



***There is no common audible switch under the DSS key cover for the personal line. Any set wired to the 30AM will ring on that line. To disable the ring signal, disconnect the CA lead either at the 66-type block on the 30AM or at screw terminal 6 of the 85A or 86A connecting block associated with the set.***

3.58 Install and connect the 30AM apparatus unit and the 86A connecting block as follows:

**Note:** In the case of BIS sets, installation of the 86A block has already been accomplished as part of the initial installation (paragraphs 3.21 and 3.27).

- (a) Install a 30AM apparatus unit in a place which is convenient to both the incoming CO/PBX personal line and the station(s) served,

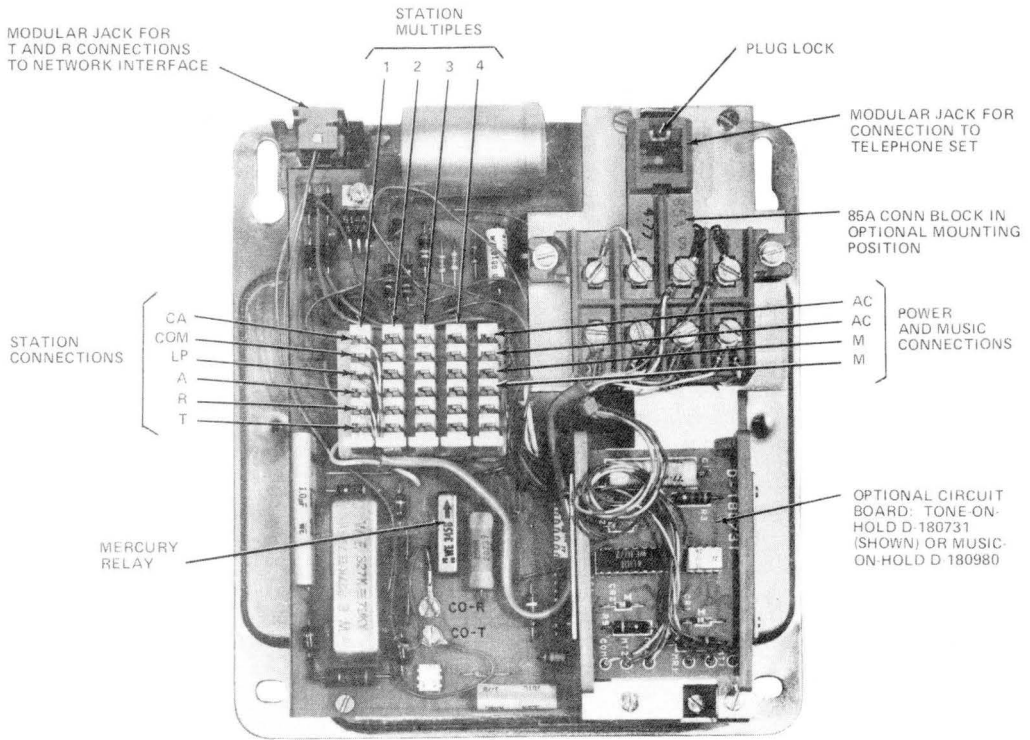


Fig. 38—30AM Apparatus Unit

and close to a suitable ac outlet. Remove the cover and mount the base pan assembly on a vertical surface so the mercury relay on the printed wiring board (Fig. 38) is in a vertical position as indicated by the arrow on the can.

(b) Using inside wire, connect the ac terminals of the 66-type block on the 30AM to the 95B1 power unit supplied with it (Fig. 39 and 40). **Do not plug the 95B1 into its assigned ac outlet until all installation is complete.**

(c) For **each** desk set served by the line, install the 86A connecting block supplied in a D-180758 Kit of Parts or with BIS sets within D8W cord length of the set.

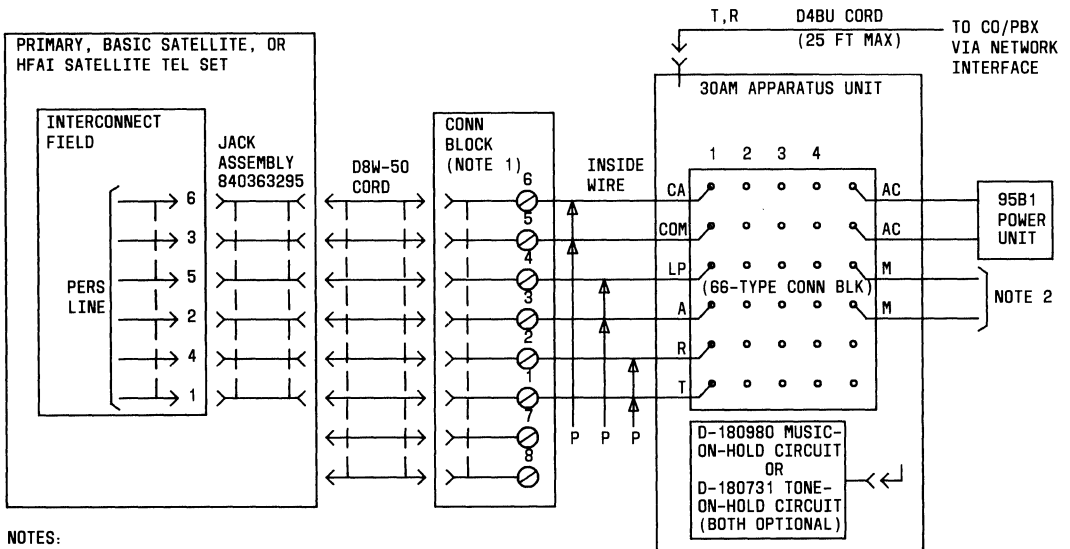
**Note:** If the 30AM apparatus unit is also to be installed within D8W cord length of

the set, the 86A block can be disassembled as described in paragraph 3.58(d)(1) and its 85A block mounted directly on the 30AM unit (Fig. 38). Be sure that the white plastic plug lock is not removed from the modular jack of the 85A.

(d) For **each** wall set, the 86A block must be converted to an 85A and mounted on the wall plate as follows:

(1) Using a screwdriver, carefully pry the 85A connecting block portion away from the mounting cover. (The cover will not be used.)

(2) Remove the white plastic plug lock from the jack so that a D8W cord plug cannot be locked into the jack.



## NOTES:

1. 86A CONNECTING BLOCK OR 85A BLOCK REMOVED FROM 86A AND MOUNTED ON WALL PLATE OR ON 30AM APPARATUS UNIT.
2. FOR MUSIC-ON-HOLD, CONNECT TO SAME 33C VOICE COUPLER USED WITH LINES 1-4 AND INSTALL D-180980 CIRCUIT BOARD. FOR TONE-ON-HOLD, NO EXTERNAL CONNECTIONS REQUIRED; INSTALL D-180731 CIRCUIT BOARD

Fig. 39—Personal Line Connections for Primary, Basic Satellite, or HFAI Set Using 30AM Apparatus Unit

**Warning:** If the plug lock is not removed, the D8W cord will lock into the 85A block when the telephone is attached to the wall plate, and it will be extremely difficult to remove the telephone again.

- (3) Mount the 85A block on the wall mounting plate with the two screws supplied with the plate.
- (e) Using inside wire, connect the 66-type block on the 30AM to the screw terminals of the 85A or 86A block associated with the station on the personal line (Fig. 39 and 40). Up to three additional stations may be connected **directly** to the 30AM. If more stations are to be added to the line, bridge them across the 86A blocks or use an external 66-type block for a common connection point. **Be sure to observe the cabling restrictions for personal lines described in paragraph 3.16 and Fig. 12.**

(f) If music-on-hold is to be provided on the personal line, install the circuit board from a D-180980 Kit of Parts in the slots on the front of the 30AM unit and plug in its connector. Using inside wire, connect the two M terminals on the 66-type block to terminals 3 and 4 of the same 33C coupler used with the common CO/PBX lines (Fig. 24, 39, and 40).

(g) If tone-on-hold is to be provided on the personal line, install the circuit board from a D-180731 Kit of Parts in the slots on the front of the 30AM unit and plug in its connector.

**3.59** Make the connection between the 86A block and the telephone as follows.

(a) **Primary Stations (Fig. 39):**

- (1) Separate the upper housing and chassis assembly from the base of the set as described in paragraph 5.19.

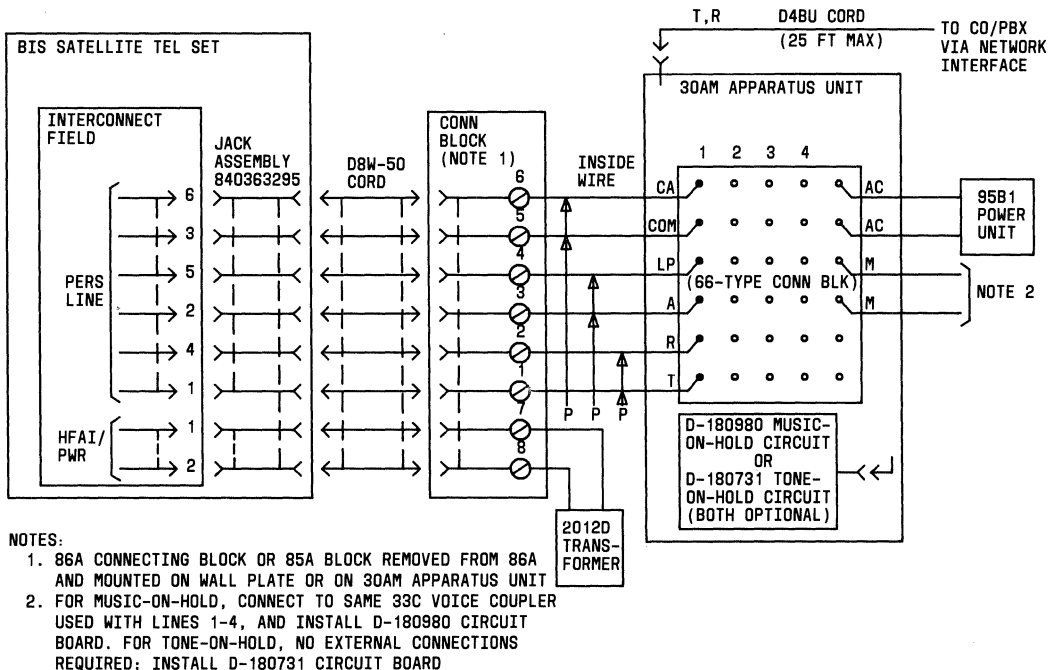
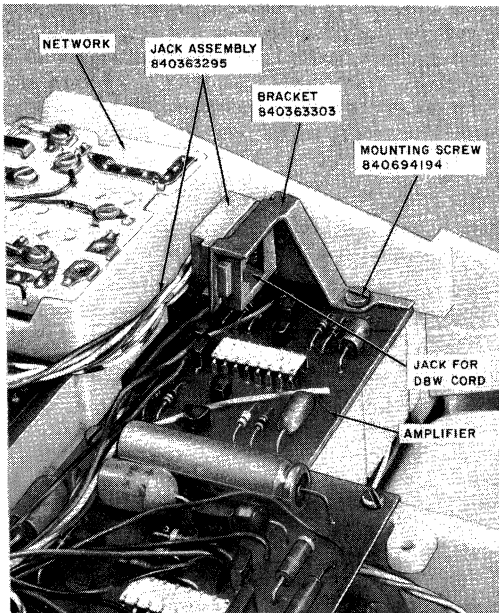


Fig. 40—Personal Line Connections for BIS Set Using 30AM Apparatus Unit

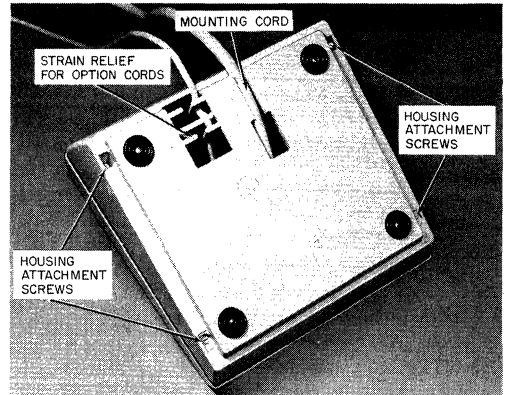
- Remove the faceplate (paragraph 5.07) and move the DSS key aside (paragraph 5.23) to gain access to the interconnect field.
  - Remove the jack assembly from the D-180758 Kit of Parts. It consists of a group of wires terminated with a 963-type connector on one end and a modular jack on the other end. Run the leads through the cord slot behind the interconnect field. Plug the 963 connector into the PERS LINE position on the interconnect field.
  - Replace the DSS key (paragraph 5.24) and the faceplate (paragraph 5.09).
  - Secure the modular jack to the base by placing the bottom of the jack in the mount provided adjacent to the harness connector, and swing the top of the jack down so the snap catch locks it in place (Fig. 23).
  - Reassemble the telephone set.
  - Plug one end of the D8W cord (from the kit of parts) into the personal line jack on the bottom of the set (Fig. 20). Secure the cord around the strain relief bars behind the jack.
  - Plug the other end of the D8W cord into the jack of the associated 86A block.
- (b) **Desk Models of Basic Satellite and HFAI Satellite Sets (Fig. 39):**
- Remove the lower housing (paragraph 5.13).
  - Turn the set over, remove the faceplate (paragraph 5.07), and move the DSS key aside (paragraph 5.23) to gain access to the interconnect field.

- (3) Install the jack assembly as described in paragraph 3.52(a)(3).
- (4) Replace the DSS key (paragraph 5.24) and the faceplate (paragraph 5.09).
- (5) Turn the set over and attach the modular jack to the chassis through the right-hand edge of the amplifier with the bracket and screw from the kit of parts (Fig. 41).



**Fig. 41—Installation of Personal Line Jack Assembly**

- (6) Plug one end of the D8W cord into the modular jack installed in (5).
- (7) Run the other end of the cord through the option cord opening in the lower housing (Fig. 42).
- (8) Reassemble the lower housing to the telephone set.
- (9) Secure the D8W cord around the strain relief bars.



**Fig. 42—Basic Satellite Desk Set, Bottom View**

- (10) Plug the free end of the D8W cord into the jack of the associated 86A block.
- (c) **Wall Models of Basic Satellite and HFAI Satellite Sets (Fig. 39):**
- (1) Remove the set from the wall mounting plate.
  - (2) Install the jack assembly and the D8W cord as described in (b)(2) through (6).
  - (3) Insert the free end of the D8W cord into the plug retainer from the kit of parts. Snap the retainer into the wall housing so that the cord plug will mate with the jack in the 85A connecting block mounted on the wall plate (Fig. 16). Fold up the excess cordage, tie with the plastic cord tie supplied with the kit, and store it inside the set behind the plug retainer.
  - (4) Mount the set on the mounting plate as described in paragraph 3.24. The end of the D8W cord mounted in the plug retainer on the wall housing should plug into the modular jack of the 85A block mounted on the wall plate.



(d) **BIS Satellite Desk and Wall Sets (Fig. 40):**

- (1) After the 30AM apparatus unit is connected to the 86A block associated with the BIS satellite set, no further installation is required. The D8W cord which connects power to the speakerphone circuit also provides the necessary personal line connections.
- (2) Be sure that the personal line is connected to terminals 1 through 6 and the 2012B transformer to terminals 7 and 8.

**3.62** The only remaining step is to connect the incoming personal line pair to the 30AM apparatus unit; refer to FINAL SYSTEM CONNECTIONS, paragraph 3.69. After all installation is complete, test each personal line by placing and receiving a call on it at each station where it is connected. Also check for music- or tone-on-hold, if provided, when the line is placed on hold. Pick it up in the same way as any other CO/PBX line by operating the personal line button on the line key.



*In existing installations, the 30A (MD) apparatus unit may be used for personal line; it is permissible to reuse this unit in other installations. Connections are shown in Fig. 43 and 44.*

**K. Code Busy DSS Key**

**3.61** Implement this feature in any 980-series telephone set by replacing the factory-installed 664B key with a 664C key as follows:

- (a) Remove the faceplate of the telephone set (paragraph 5.07).
- (b) Move the 664B DSS key aside (paragraph 5.23) and unplug it from the interconnect field.
- (c) Remove the 664B key from the set.
- (d) Plug the connector of the 664C key into the DSS KEY position on the interconnect field.
- (e) Mount the 664C key in the telephone (paragraph 5.24).

(f) Replace the faceplate (paragraph 5.09).

(g) Set the common audible and DSS code switches as described in paragraph 3.34.



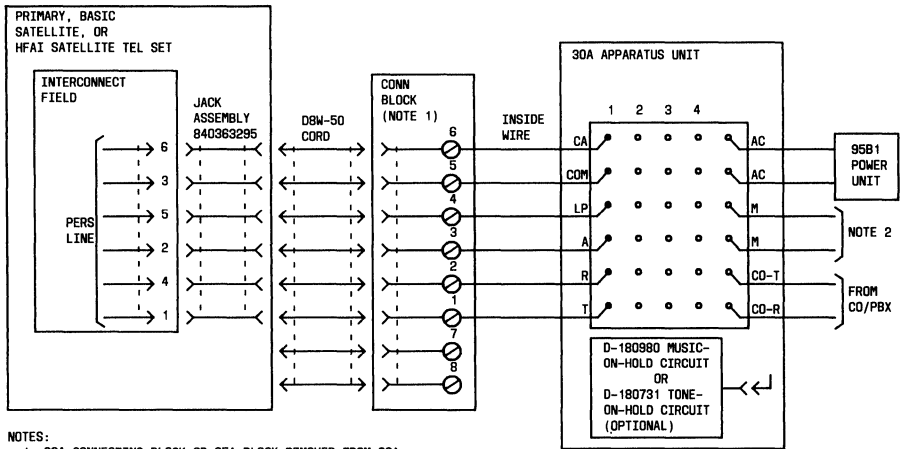
**When code busy keys are used in the system, the number of stations plus the number of options assigned to the same DSS code must not exceed 4.**

(h) Install E-6873 designation tabs in the new key. After all installation is complete, test each key by going off-hook and sliding the DSS programming switch from position 1 to 10. The LED for each code should light. Return the switch to its assigned position.

**L. 4A Speakerphone**

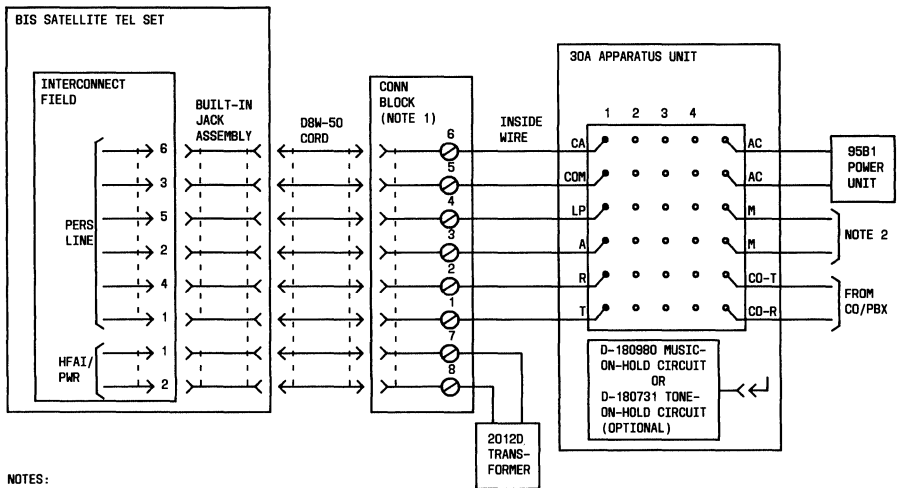
**3.64** Connect the 4A speakerphone to an HFAI station as follows:

- (a) If the speakerphone is to have ivory parts to match the telephone with which it is used, install a D-180508 Kit of Parts.
- (b) Place the loudspeaker and the transmitter of the speakerphone in their desired locations.
- (c) Mount a 223C adapter on a suitable vertical surface within cord lengths of the loudspeaker, transmitter, power unit, and telephone.
- (d) Connect the M2FG power cord to the 85B1 power unit. **Do not plug the 85B1 into its assigned ac outlet until all installation is complete.**
- (e) Plug the connectors of the mounting cords from the loudspeaker, the transmitter, and the 85B1 power unit into the connector of the D16H-50 cord supplied with the adapter (Fig. 45). Assemble this group of connectors in the 223C adapter and install the adapter cover.
- (f) Remove the faceplate and upper housing of the telephone set (paragraphs 5.07 and 5.10) and move the DSS key aside (paragraph 5.23).
- (g) Remove the three factory-installed shorting bars from the VSI/RELAY position on the interconnect field (Fig. 37). Remove the single



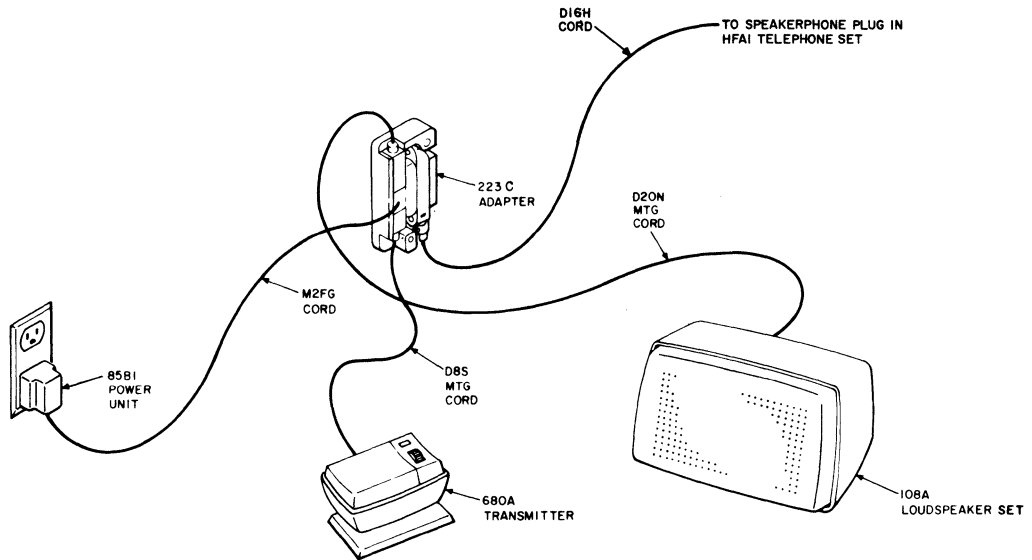
- NOTES:
1. 86A CONNECTING BLOCK OR 85A BLOCK REMOVED FROM 86A AND MOUNTED ON WALL PLATE OR ON 30A APPARATUS UNIT.
  2. FOR MUSIC-ON-HOLD, CONNECT TO SAME 33C VOICE COUPLER USED WITH LINES 1-4 AND INSTALL D-180980 CIRCUIT BOARD. FOR TONE-ON-HOLD, NO EXTERNAL CONNECTIONS REQUIRED; INSTALL D-180731 CIRCUIT BOARD.

Fig. 43—Personal Line Connections for Primary, Basic Satellite, or HFAI Set Using 30A (MD) Apparatus Unit



- NOTES:
1. 86A CONNECTING BLOCK OR 85A BLOCK REMOVED FROM 86A AND MOUNTED ON WALL PLATE OR ON 30A APPARATUS UNIT.
  2. FOR MUSIC-ON-HOLD, CONNECT TO SAME 33C VOICE COUPLER USED WITH LINES 1-4, AND INSTALL D-180980 CIRCUIT BOARD. FOR TONE-ON-HOLD, NO EXTERNAL CONNECTIONS REQUIRED; INSTALL D-180731 CIRCUIT BOARD.

Fig. 44—Personal Line Connections for BIS Set Using 30A (MD) Apparatus Unit



**Fig. 45—4A Speakerphone Installation and Connections**

shorting bar from the SPEAKERPHONE position. See note following paragraph 3.53(d).

- (h) At switches G and H on the interconnect field, move the shorting bars to the upper position.
- (i) Install the relay board from the D-180732 Kit of Parts by sliding it into the two slots on the right side of the opening in the lower left of the chassis (Fig. 36). Install the upper housing.
- (j) Move the dial aside (paragraph 5.25) and dress the leads of the relay board connector through the slot in the chassis wall and under the left side of the dial. Replace the dial in its normal position.
- (k) Plug the relay board connector into the VSI/RELAY position on the interconnect field. Dress the leads toward the front of the set to prevent interference with the ABR shaft.
- (l) Remove the collar from the line key and install the U-shaped plastic button stop from the kit of parts under SPKR button to make it

inoperative. Remove the SPKR designation tab. Put the collar back on the line key.

- (m) Turn the set over and remove the lower housing (paragraph 5.13).
- (n) Run the free end of the D16H-50 cord through the opening in the lower housing, through the cord slot behind the interconnect field, and plug the connector into the SPEAKERPHONE position.
- (o) Reinstall the DSS key (paragraph 5.24), put the collar back on the line key, and reinstall the faceplate (paragraph 5.09).
- (p) Reassemble lower housing to the telephone set (paragraph 5.15). Secure the speakerphone cord around the strain relief bars in the lower housing (Fig. 42).
- (q) After all installation is complete, test the speakerphone by operating it in the normal way to place and receive calls (paragraph 4.19).



**If the 4A speakerphone is ever disconnected from the telephone, be sure to restore the shorting bars removed in (g) and the bars moved in (h) to their original factory position (Fig. 37); remove the button stop installed in (1) and designate the SPKR button.**

**M. Repertory Dialing**

**3.63** Connect an 870A1 or 2870A1 adjunct repertory dial to the desk-type satellite, BIS, or HFAI station where repertory dialing is desired.

- (a) Place the dial near the station.
- (b) Remove the mounting cord supplied with the dial and replace it with the D10Y-50 cord. Connect each lead of the D10Y cord to the terminal where the same color lead of the original cord was connected (Table E).

**TABLE E**

**ADJUNCT REPERTORY DIAL MOUNTING CORD CONNECTIONS**

MOUNTING CORD LEADS	870A1 TERMINALS	2870A1 TERMINALS
W-BL	16	16
W-O	26	2
G-W	13	33
W-G	21	34
O-W	9	11
BL-W	2	17
BR-W	1	1
W-BR	8	32
S-W	3	*
W-S	6	*

\* Insulated and stored.

- (c) Connect the dial power cord to the 95B1 power unit. **Do not plug the 95B1 into its assigned ac receptacle until all installation is complete.**

- (d) Remove the lower housing (paragraph 5.13).
- (e) Remove the faceplate (paragraph 5.07); move the DSS key aside (paragraph 5.23).
- (f) Remove the two factory-installed shorting bars from the REP DIAL position on the interconnect field (Fig. 37). See note following paragraph 3.53(d).
- (g) Check switches B and D on the interconnect field. Be sure that the shorting bars are in the upper position for a rotary repertory dial and in the lower position for a TOUCH-TONE repertory dial.
- (h) Run the D10Y dial cord through the openings in the lower housing, through the cord slot behind the interconnect field, and connect it to the REP DIAL position.
- (i) Reassemble the telephone. Secure the cord around the strain relief bars in the lower housing (Fig. 42). Excess cordage can be tucked into the telephone set.
- (j) After all installation is complete, test the repertory dialing feature by using it to dial CO/PBX calls.



**If the repertory dial is ever removed from the station, be sure to restore the shorting bars removed in (f) and moved in (g) to their original factory positions (Fig. 37).**

**N. External Ringing**

**3.64** Up to three external ringers, such as the E1CM, S1AMP, or L1AM, can be provided on any of the CO/PBX lines:



**No more than three additional ringer equivalents shall be connected to the CO/PBX lines. If 24A or B apparatus units are used in the system, each must be considered as one of the ringer equivalents on their respective lines.**

Using a D4BU cord (25-foot maximum) connect the external ringer to the network interface of the common or personal line where external ringing is desired. **Do not attempt to wire the ringer to any other pairs in the system.**

## O. Special Handsets

**3.65** Standard modular G-type handsets can be used with the desk sets when modified with the D-180851 Kit of Parts. This kit consists of ivory colored transmitter and receiver caps needed to replace the standard caps on the G-type handsets. Modified G-type handsets can be used to provide the following features when the K-type handset is incompatible:

- Impaired hearing handset
- Handset with more receive gain than G6BM (D-180413)
- Weak speech handset (G7BM)
- Noisy location handset (G8BM)
- Acoustic or inductive coupling to customer-provided equipment (G15A)
- G-type handset equipped with shoulder rest (G4BM)
- Long loop—3-dB transmit gain (G36AM).

## FINAL SYSTEM CONNECTIONS

**3.66** Make sure all components of the 4A System are properly mounted and interconnected and the required options are installed.

**3.67 Common CO/PBX Lines**—Connect the incoming common CO/PBX lines 1 and 2 to the 91B connecting block associated with the first primary station using a D4BU cord (25-foot maximum) between the network interface and the modular jack on the 91B (Fig. 46). Connect lines 3 and 4 to the 91B block associated with the second primary station in the same manner.

**Note:** If lines 3 and 4 are used, be sure that the line assignment connector on the logic board of the second primary station has been reversed as described in paragraph 3.33.

**3.68** Connections for common CO/PBX lines on 91A (MD) blocks are shown in Fig. 47.

**3.69 Personal CO/PBX Lines**—Connect the incoming personal line to the 30AM apparatus unit using a D4BU cord (25-foot maximum) between the network interface and the modular jack on the 30AM (Fig. 38, 39, and 40).

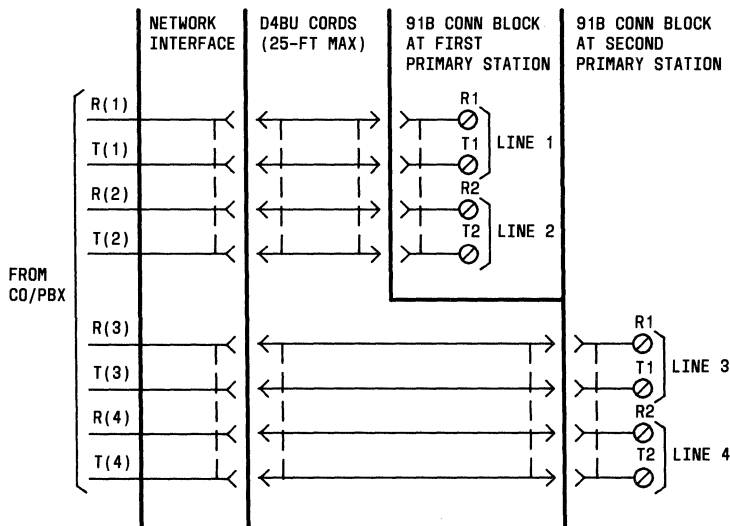


Fig. 46—CO/PBX Line Connections Using 91B Connecting Block

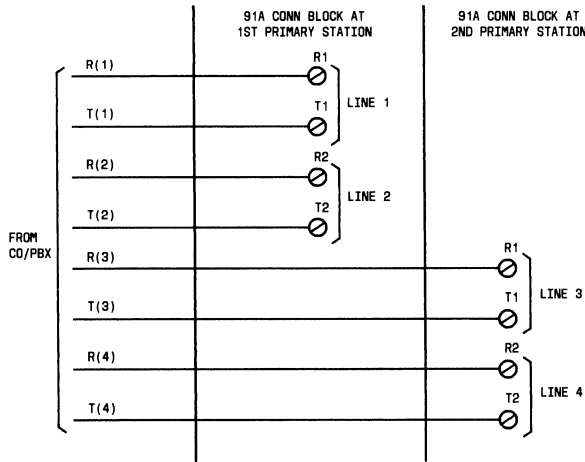


Fig. 47—CO/PBX Line Connections Using 91A (MD) Connecting Block

3.70 Connections for personal line on the 30A (MD) apparatus unit are shown in Fig. 43 and 44.

3.71 **Power Connections**—Plug the following units of the 4A System into the ac receptacles assigned to them:

- Each primary station
- The 19B4 power unit.



**Remember that primary set power cords must be plugged in even when a 19B4 unit is used.**

- The 85B1 power unit of each 4A speakerphone used with an HFAI station
- The 2012D transformer of each BIS station
- The 95B1 power unit of each 30AM apparatus unit
- The 95B1 power unit of each repertory dial.

3.72 Test the entire system by operating all of its features in the normal manner. If trouble develops, refer to Part 5, Maintenance.

#### 4. METHOD OF OPERATION

##### ANSWERING CALLS USING HANDSET

4.01 **Incoming Call on CO/PBX Line**—When a tone signal sounds and a CO/PBX line button lamp flashes, answer the call as follows:

- (a) Lift the handset.
- (b) Depress the line button where the lamp is flashing. The tone ringing is silenced and the lamp goes steady.
- (c) Talk with the calling party. [While the call is in progress, the level of incoming voice and tone signaling from the loudspeaker is reduced unless the built-in loudspeaker service is being used (paragraph 4.29).]

4.02 **Intercom Call**—When an intercom voice signal is heard and an intercom path button lamp lights, answer the call as follows:

- (a) Listen for instructions from the calling party.
- (b) If a two-way conversation is to be conducted, lift the handset and depress the proper intercom path button to establish the talking path.

## PLACING CALLS USING HANDSET

**4.03 Outgoing Call on CO/PBX Line:**

- (a) Lift the handset.
- (b) Depress an idle line button (line 1 through 4 or the personal line). The associated lamp lights steady.
- (c) When dial tone is heard, dial the desired number.

**Note:** When making several calls in quick succession, use the RECALL button to get dial tone instead of hanging up the handset after each call.

**4.04 Intercom Call:**

- (a) Lift the handset.
- (b) Depress an idle intercom path button (1 or 2). The associated lamp lights at all stations. (There is no dial tone on intercom.)



***On outgoing intercom calls from stations equipped with the standard DSS key, the calling party has no way of knowing beforehand if the code being called is busy. At stations having a code busy DSS key, the code of any station which is off-hook or being voice signaled is identified by a steady light in the DSS button.***

- (c) To voice signal the called station, depress and hold the DSS button corresponding to the code of the called station. Transmit the one-way message to the called station. Release the DSS button when the message is completed.
- (d) When the called party answers [as described in paragraph 4.02(b)], a two-way conversation path is established and the DSS button need not be depressed again.

**Note:** Multiple stations can be signaled by operating more than one DSS button at a time or by using the preset multiple voice-signaling option (see paragraph 4.31).

## HOLD OPERATION

**4.05** Any CO/PBX line call can be put on hold while the station is used for another call:

- (a) Tell the distant party that you are going to put the call on hold.
- (b) Depress the HOLD button momentarily. The CO/PBX line button restores to its unoperated position and its lamp changes from steady to wink.

**4.06** To pick up a line on hold, depress the winking line button. The button locks down, the lamp changes from wink to steady, and the connection is established again.

## ANSWERING CALLS USING BUILT-IN SPEAKERPHONE

**Note:** On BIS satellite sets, incoming tone ringing and intercom voice signaling are transmitted over the loudspeaker mounted under the handset. Two-way speakerphone conversations utilize the loudspeaker in the speakerphone module on the right side of the set.

**4.07 Incoming Call on CO/PBX Line**—When a tone signal sounds and a CO/PBX line button lamp flashes, answer the call as follows:

- (a) Depress the line button where the lamp is flashing. The tone ringing is silenced, the lamp goes steady, and the speakerphone turns on automatically. The red speakerphone lamp lights.
- (b) Face the set and carry on the conversation in a normal voice. The volume of the incoming call can be adjusted with the control on the speakerphone module.
- (c) When the conversation is finished, depress the speakerphone OFF button.

**Note:** Whenever the speakerphone OFF button is operated, all depressed CO/PBX line or intercom path buttons will restore.

**4.08 Intercom Call**—When an intercom voice signal is heard and an intercom path button lamp lights, answer the call as follows:

- (a) Listen for instructions from the calling party.
- (b) If a two-way conversation is to be conducted, depress the proper intercom path button to turn on the speakerphone and establish a talking path.
- (c) When the conversation is finished, depress the speakerphone OFF button.

#### PLACING CALLS USING BUILT-IN SPEAKERPHONE

##### 4.09 *Outgoing Call on CO/PBX Line:*

- (a) Depress an idle line button (line 1 through 4 or the personal line). The lamp next to the button lights and dial tone is heard on the speakerphone loudspeaker.
- (b) Dial the desired number.
- (c) When the call is finished, depress the speakerphone OFF button.

##### 4.10 *Intercom Call:*

- (a) Depress an idle intercom path button. The lamp next to the button lights and the speakerphone turns on. The red speakerphone lamp lights. No dial tone is heard.
- (b) To voice signal the called station, depress and hold the appropriate DSS button, face the set, and transmit the one-way message via the speakerphone microphone. Speak in a normal voice. Release the DSS button when the message is completed.
- (c) When the called party answers, a two-way conversation path is established. Carry on the conversation using the built-in speakerphone.
- (d) When the call is finished, depress the speakerphone OFF button. Depressed intercom button will restore.

#### Built-In Speakerphone Operating Features

**4.11 Mike Off**—To interrupt transmission to the distant party during a speakerphone

call, depress and hold down the MIKE OFF button. Incoming conversation from the distant party is not affected.

**4.12 Transferring From Speakerphone to Handset**—Simply pick up the handset and continue the call in the normal way. The speakerphone turns off automatically.

**4.13 Transferring From Handset to Speakerphone**—Hold down the line button(s) and hang up the handset. The line button(s) remains operated and the speakerphone is turned on. Continue the call using the built-in speakerphone.

#### ANSWERING INTERCOM CALLS AT HFAI STATION

**Note:** The HFAI feature is used only for answering intercom calls originated at other stations. To place an intercom call from an HFAI station, use the standard procedure described in paragraph 4.04 or the 4A speakerphone (paragraph 4.21) if one is connected.

**4.14** Incoming intercom calls at an HFAI station turn on the transmitting microphone in the HFAI module so that the calls can be answered without any manual action. The calling party controls the microphone, turning it on when the DSS button is released following a voice announcement, and turning it off when the DSS button is depressed. The operation of the HFAI feature is as follows:

- (a) An incoming call is preceded by a medium pitch (625-Hz) tone burst over the set's built-in speaker. One of the two green lamps on the HFAI module stays on throughout the call, indicating which intercom path is being used; the red lamp turns on when the caller releases the DSS button, indicating that the microphone is on.
- (b) While the red lamp is on, face the set and answer the call in a normal voice.
- (c) Continue the conversation with the distant party, speaking only when the red lamp is on.
- (d) No action is required at the HFAI station when the call ends. When the caller hangs up, the mike and IC lamps go out and the HFAI module turns off.



**HFAI Operating Features**

**4.15 Mike Off**—To interrupt transmission to the distant party during an HFAI call, depress the locking MIKE OFF button on the HFAI module. Incoming conversation from the caller is not affected. To release the MIKE OFF button, depress it again. While the MIKE OFF button is depressed, the microphone is totally disabled and cannot be turned on by the distant party.

**4.16 Do-Not-Disturb**—If reception of incoming intercom calls at the HFAI station is not desired, depress the locking DO NOT DSTRB button. This causes a low pitch (156-Hz) tone to be transmitted to any caller who has called the station by operating a DSS button; it also disables the amplifier in the local set, preventing reception of intercom voice signals. To return to the normal HFAI mode, redepess the DO NOT DSTRB button, unlocking it.

**4.17 Transferring From HFAI Mode to Handset**—Tell the caller that transfer from the HFAI mode to handset is taking place and that operation of the DSS button is no longer required. Depress the proper IC button on the line key, pick up the handset, and continue the call in the normal manner.

**CALLING AN HFAI STATION**

**4.18** To place an intercom call to an HFAI station:

- (a) Lift the handset.
- (b) Depress an idle intercom path button. The associated lamp lights at all stations.
- (c) Depress and hold the DSS button corresponding to the code of the HFAI station.
- (d) If the HFAI station is not busy and not in the "do-not-disturb" mode, a medium pitch tone burst is heard when the DSS button is depressed to voice signal the station. Make the announcement to the HFAI station after the tone. Release the DSS button to hear the HFAI station's response.

**Note:** After the HFAI station has answered, operation of the DSS button to talk again does not result in any more tones.

(e) If the HFAI station is in the "do-not-disturb" mode, a continuous low pitch tone is heard when the DSS button is depressed. The call cannot be completed. Hang up and call again later.

(f) If the HFAI station is busy with another call, no return signal is heard. Hang up and call again later.

**4A SPEAKERPHONE OPERATION**

**4.19** The 4A speakerphone can be installed only with an HFAI station telephone set. It is used to provide optional hands-free operation on CO/PBX line calls or outgoing intercom calls.

**4.20 Incoming Calls**—When a tone signal sounds and a CO/PBX line button lamp flashes, answer the call as follows:

- (a) Depress the line button where the lamp is flashing.
- (b) Operate the ON button of the speakerphone transmitter. The tone ringing will be silenced and the lamp will go steady.
- (c) Talk with the calling party using the transmitter and the loudspeaker.
- (d) When the conversation is over, operate the OFF switch on the speakerphone transmitter.

**Note:** Operation of the speakerphone OFF switch does not cause line buttons to pop up. To restore line buttons, lift the handset momentarily. Always do this after a conference call.

**4.21 Outgoing Calls:**

- (a) Depress an idle line or intercom button.
- (b) Operate the ON button of the speakerphone transmitter. Dial tone is heard on CO/PBX lines but not on intercom.
- (c) Dial the desired CO/PBX number or voice signal the desired station.
- (d) When the called party answers, use the transmitter and the loudspeaker to carry on the conversation.

- (e) When the conversation is over, operate the OFF button on the speakerphone transmitter. [See Note following paragraph 4.20(d).]

**4.22** When it is not desired to transmit conversation from the surrounding area to the distant station, disable the transmitter by holding down the ON button. Incoming conversation will not be affected.

**4.23** To transfer from speakerphone to handset operation during a conversation, simply lift the handset. Transfer occurs automatically.

**4.24** To transfer from handset to speakerphone operation during a CO/PBX line conversation:

- (a) Put the line on hold
- (b) Hang up the handset
- (c) Turn the speakerphone on
- (d) Depress the CO/PBX line button.

**4.25** To transfer from handset to speakerphone operation during an intercom call:

- (a) Hang up the handset
- (b) Turn the speakerphone on
- (c) Depress the IC button.

#### MISCELLANEOUS OPERATING TECHNIQUES

**4.26 Multiline Conferencing**—Two or more CO/PBX lines and any 4A System station can be conferenced by placing several successive calls on hold and then picking them up together as follows:

- (a) Establish a CO/PBX line connection either by answering an incoming call or completing an outgoing call.
- (b) Put the call on hold by depressing the HOLD button; the line button will restore to its unoperated position and its lamp will wink.
- (c) Establish another CO/PBX line call.
- (d) While holding down the second line button, depress the held line button. The local

station and the two CO/PBX lines are then conferenced together.

- (e) Additional CO/PBX lines may be added by repeating (b), (c), and (d).

**Note:** The number of lines which can be conferenced satisfactorily is limited because transmission quality among the lines will be degraded as more lines are added.

- (f) To put all the outside lines on hold simultaneously, depress the HOLD button; to reenter the conference, simultaneously depress the line buttons again.



**Intercom and CO/PBX lines cannot be conferenced together.**

**4.27 Multistation Conferencing**—To add other stations in the system to a CO/PBX line call, follow this procedure:

- (a) Place the CO/PBX line call on hold.
- (b) Using the intercom, call the station or stations wanted in the conference and tell each to pick up the line on hold.
- (c) Return to the held line by picking it up at the local station again. The conference is established when the other stations pick up the held line also.
- (d) If any of the stations to be conferenced has the **privacy** feature, all the stations should hold down their PRIV RLS buttons until everyone has picked up the held line.
- (e) Any station can hang up during the conference without affecting the other parties.

**4.28 Repertory Dialing**—At stations where a repertory dialing adjunct is attached, outside dialing can be done either on the telephone set dial, the dial on the adjunct, or by means of the memory buttons on the adjunct. Refer to Section 501-164-202 for detailed information on the operation of the repertory dialer.

**4.29 Built-In Loudspeaker Service (Stations Without Speakerphone)**—To amplify and

broadcast to the surrounding area the incoming part of a telephone conversation, depress the SPKR button on the line key. The button locks down until depressed again. Adjust the output to the desired level with the thumbwheel volume control. When the conversation is over, release the SPKR button before replacing the handset so that feedback "squeal" does not occur when the handset is brought near the speaker.



***Incoming voice and tone signaling is not attenuated in the off-hook condition if the SPKR button is locked down. This button is not linked to the ABR mechanism.***

**4.30 Paging**—The paging system is used in the same way as voice signaling on intercom. To make an announcement, go off-hook, select an idle intercom path, depress the DSS button of the paging code. Transmit the message over the handset while holding down the DSS paging button.

**4.31 Preset Multiple Voice Signaling on Intercom**—This feature is used in the same way as voice signaling a single station. Go off-hook, select an idle intercom path, then depress the DSS button corresponding to the preset group of stations to be signaled. Transmit the message over the handset while holding down the DSS code button.

**4.32 Supplementary Signaling**—To operate an auxiliary signal via a 25A apparatus unit, momentarily depress the DSS button assigned to supplementary signaling. Repeat the operation as required.

## 5. MAINTENANCE

**5.01** Maintenance of the 4A System is limited to wiring checks, replacement of entire telephone sets or components specified as replaceable (see ORDERING GUIDE), and replacement of external apparatus. Do not attempt to modify or repair telephone sets or apparatus units in any way not covered in this practice.

**5.02** When trouble develops, first make a thorough check of all interconnecting cable connectors. Check for the following conditions before considering the replacement of any components:

- Primary station power cords connected to working ac receptacles
- Primary station power transformers securely in place
- Set mounting cords securely connected at both ends
- All component connectors securely seated on the interconnect field
- Shorting bars in their proper positions on the interconnect field
- Wall sets mounted so that the connectors on the wall plate mate properly with the connectors on the back of the set
- Loudspeaker volume control set to normal level
- Incoming CO/PBX pairs from building entrance facility securely terminated on network interface blocks
- Tip and ring pairs from network interface blocks to 91B connecting blocks and 30AM apparatus units properly connected
- Correct wiring on apparatus units and adjuncts.

## DIAGNOSTIC PROCEDURES

**5.03** If normal service is provided on at least one primary set and possibly some satellite sets, the problem is likely to be in the cabling. If all sets beyond a point in the cable bus relative to a primary set exhibit the same trouble, the cable fault is probably an open conductor path.

**5.04** If all sets exhibit the same trouble, the following sequence should be tried. Disconnect all satellite sets from the system cabling; leave each primary set connected to its assigned 91B connecting block. The primary set(s) should be operating properly; if they do not, check the tip and ring coming into the 91B block for dial tone. Replace the primary set if necessary. Once it is functioning correctly, reconnect the system cable to the 91B block. If the primary set now fails to work, the problem is a short or a reversed wire in the cable. If the primary set works properly, start adding satellite sets, one at a time, until the problem reappears. Replace the last added set and reconnect the remaining sets.

**5.05** Table F contains information for diagnosing and correcting troubles in a 4A System installation. Block diagrams of the 981/2981- and 983/2983-type telephone sets are shown in Fig. 48 through 52.

#### DISASSEMBLY AND ASSEMBLY OF TELEPHONE SETS

**5.06** The installation of some of the options available with the 4A System and the replacement of some internal parts require that the telephone set housing and related components be disassembled and reassembled. See paragraphs 5.07 through 5.20 for instructions on procedures which are common to several installation or replacement operations.

##### A. Faceplate

**5.07** To remove the faceplate from any telephone set:

- (a) Insert the blade of a small screwdriver between the center of upper edge of the faceplate and the adjacent housing (Fig. 53).
- (b) Carefully tip the handle of the screwdriver back away from the telephone set, disengaging the tab on the center of the upper edge of the faceplate from the housing.
- (c) Lift the faceplate away from the set.

**5.08** With the faceplate off, the following components are accessible:

- Dial
- DSS key
- Upper housing.

**5.09** To install the faceplate:

- (a) Insert the tabs on the lower edge under the lip of the housing.
- (b) Using the thumb and forefinger of each hand, bow the center of the faceplate up slightly (Fig. 54). Position the tab on the upper edge under the lip of the housing and release the faceplate.

(c) Be sure that all tabs are engaged and that the faceplate fits securely around all components.

##### B. Upper Housing

**5.10** The upper housing is secured to the telephone set chassis by four screws in the primary and basic satellite sets (Fig. 55) and five screws in BIS and HFAI sets. The screw on the left side under the handset also serves to hold the housing blank or handset hook, depending on whether the set is desk or wall mounted. The other screws are captive in the housing. To take off the housing:

- (a) Remove the faceplate (paragraph 5.07)
- (b) Remove the number card retainer and the number card
- (c) Remove the housing blank (desk sets) or handset hook (wall sets) and the screw which holds it
- (d) Loosen the captive screws
- (e) Lift the housing off the set.

**5.11** With the upper housing off (Fig. 5), the following components are accessible:

- Loudspeaker assembly
- Slots for mounting privacy board and relay board, and/or voice signaling interface board (Fig. 36)
- Handset cord jack
- Recall key
- Loudspeaker volume control
- Line key
- BIS module
- HFAI module.

**5.12** To replace the upper housing, reverse the disassembly procedure of paragraph 5.10. Tighten the screws. Replace the number card and its retainer.

TABLE F

## DIAGNOSTIC ROUTINES

TROUBLE	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
<i>Note:</i> Before taking the specific steps recommended below, perform the general maintenance checks listed in paragraphs 5.02, 5.03, and 5.04.		
<b>TIP-RING</b>		
Dialing not possible.	Set wired for dial restriction option.	Check positions of switches E and F (paragraph 3.55). If option is not desired, rewire.
No sidetone on CO/PBX line.	Incoming CO/PBX line dead.	Check incoming tip and ring with test set.
	Incoming tip and ring terminated on wrong terminals.	Check connections (Fig. 46).
	Switch pile-up on telephone defective.	Change out telephone set.
	Privacy circuit (if set is so equipped) operating incorrectly.	Replace privacy circuit (paragraph 3.53).
	Set has privacy circuit and CO/PBX line is in use by another station.	No corrective action necessary; wait until line is not in use.
	If set is supposed to have dial restriction, switches E and F on interconnect field may not be in proper positions.	Check positions of switches E and F (paragraph 3.55).
	If 66-type connecting blocks are used, cutdown may be incorrect.	Check station cutdown.
System wired for 3 or 4 CO/PBX lines, but dial tone only on lines 1 and 2.	Line assignment connector not rotated on second primary set.	Rotate line assignment connector on second primary set (paragraph 3.33).
<b>VOICE SIGNALING</b>		
One set does not receive voice signaling on DSS.	Station designation not coded properly on DSS key.	Check for correct position of slide switch (paragraph 3.34). Be sure switch is properly engaged in detent (centered on number).
Low volume on tone ringing or voice signaling.	Volume control set too low.	Readjust volume.
	Handset off-hook.	Replace handset.

**TABLE F (Contd)**  
**DIAGNOSTIC ROUTINES**

TROUBLE	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
<b>VOICE SIGNALING (Contd)</b>		
DSS signaling to other sets possible, but DSS signaling from other sets not possible, and SPKR button does not work.	Amplifier or speaker defective.	Replace amplifier and/or speaker (paragraphs 5.27 and 5.42).
DSS signaling from other sets possible, but DSS signaling to other sets not possible, and SPKR button does not work.	Amplifier defective.	Replace amplifier (paragraph 5.42).
Noisy intercom system.	Earth ground connected to system cable at some point.	Be sure that G terminal on 19B4 power unit is not grounded. Check all terminal blocks for improper grounds.
Excessive noise heard from set loudspeaker during intercom voice signaling.	Unauthorized connection between system (particularly 19B4 power unit) and building ground.	Check wiring of system for connections to building ground and remove all except for 117 volts power cords and 33C voice coupler.
Noise from speaker as volume control is rotated.	Defective volume control.	Replace volume control (paragraph 5.33).
<b>COMMON AUDIBLE TONE SIGNALING</b>		
One set does not ring on some line(s), but lamp flashes properly.	Common audible switches not set properly.	Set the four common audible switches for the desired ringing at that station (paragraph 3.34).
<b>HOLD</b>		
One line goes on hold when going off-hook.	"A" lead open between malfunctioning set(s) and primary set controlling that line.	Check cable connections.
False hold condition when changing lines or lightly touching line buttons.	Defective line key.	Replace line key (paragraph 5.35).
Excessive crosstalk on lines 1 and 2 or 3 and 4 when on hold.	Improper installation of music-on-hold option.	Check wiring of 33C coupler. Remove music-on-hold board if option is not being used.

TABLE F (Contd)

## DIAGNOSTIC ROUTINES

TROUBLE	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
<b>MUSIC-ON-HOLD</b>		
No music-on-hold.	Blown fuse on 33C voice coupler.	Replace fuse.
	Improper wiring of music-on-hold option.	Check connection between coupler and 91B connecting block (Fig. 23).
Music distorted or too low.	Improper adjustment of music level.	Readjust music level (paragraph 3.40).
	Customer's music source does not have sufficient output.	Request that customer upgrade music source.
Music-on-hold source crosstalks into intercom lines.	System installed without a 91B connecting block at each primary set.	Install and connect a 91B connecting block at each primary station (Fig. 8 and 9).
<b>POWER</b>		
As system activity increases, all functions except sidetone on CO/PBX lines fail. Power transformers unusually warm. System restores within 30 minutes.	System is overloaded; thermal cutout is operating. Equivalent station count is exceeded.	Add supplementary power to system.
Lamps dim, voice signaling distorted, and code-busy DSS key does not work.	System is overloaded with sets and/or options.	Review requirements for system wiring and supplementary power (paragraph 3.13).
19B4 power unit blows fuses as system activity increases.	Excessive optional features.	Remove some features. Station equivalent number must be less than 32 (paragraph 3.14).
19B4 power unit blows fuses when plugged in.	Reversed polarity on system supply bus.	Correct polarity to system cable at cut down.
Transformer unusually warm, excessive noise heard from set loudspeaker during intercom voice signaling.	Power supply was shorted long enough to permit thermal cutout in transformer to operate.	<ol style="list-style-type: none"> <li>1. Replace transformer (paragraph 3.33).</li> <li>2. Replace primary set.</li> <li>3. Wait up to 30 minutes for thermal circuit breaker to reset automatically.</li> </ol>

**TABLE F (Contd)**  
**DIAGNOSTIC ROUTINES**

TROUBLE	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
<b>POWER (Contd)</b>		
Lines go on hold when going off-hook; voice signaling does not work; no ringing on any line.	SYS/SUPP plug connected for supplementary power when this is not provided.	Put SYS/SUPP plug in proper position (paragraph 3.36).
	If system has supplementary power: It may not be connected to ac.	Connect 19B4 power unit to live ac outlet.
	Fuse blown.	Correct condition that caused blown fuse and replace fuse.
Sidetone on CO/PBX lines, but no lamps on CO/PBX or intercom lines, no ringing, no intercom talk battery.	No power applied to associated primary set.	Verify power at ac outlet and sets plugged in.
<b>CODE BUSY</b>		
DSS busy lamps stay on when station is idle or will not go on when station is busy.	Excessive voltage drop on +V bus. System loaded at or near capacity with long cable runs and/or too many stations bridged at ends of long runs.	<ol style="list-style-type: none"> <li>1. If 91B connecting blocks are not used with primary sets, install them.</li> <li>2. Calculate equivalent set count (paragraph 3.14). Install supplementary supply and home run system if necessary.</li> <li>3. Rearrange layout of wiring to reduce long runs. Reduce bridging at ends of runs.</li> </ol>
	Number of stations plus number of options assigned to same DSS code exceeds 4.	Reduce number to 4.
<b>LAMPS</b>		
One lamp does not light at one station, but lights at other stations.	Lamp failure.	Replace line key (paragraph 5.35).
A particular lamp does not light at any station, and there is an audible buzz on the line associated with the lamp.	Lamp pair shorted or transposed on a connecting block.	Correct wiring.
All CO/PBX lamps light dim; noise on intercom on all sets.	System power supply shorted.	Disconnect sets one at a time. If problem persists, check cable.



**TABLE F (Contd)**  
**DIAGNOSTIC ROUTINES**

TROUBLE	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
<b>PRIVACY</b>		
Privacy circuit does not prevent pickup when going off-hook on a busy line.	Defective privacy circuit.	Replace privacy circuit (paragraph 3.53).
Privacy circuit does not prevent pickup on busy line when rapidly changing lines, but is okay going off-hook.	Defective line key.	Replace line key (paragraph 5.35).
<b>HANDS-FREE ANSWER</b>		
In system with two intercom paths, HFAI station seizes only path 1 on hands-free answering.	Shorting bar not removed from HFAI module.	Remove shorting bar from module (paragraph 3.31).
In system with only intercom path 1 active, HFAI station latches up on intercom path 2 when called on path 2.	Shorting bar missing from HFAI module.	Install shorting bar in module (paragraph 3.31).
In system with only intercom path 2 active, HFAI station will not seize path 2 when called but will latch up on path 1 when called.	Primary set coded to serve CO/PBX lines 3 and 4 and intercom path 2.	Code primary set to serve CO/PBX lines 1 and 2 and intercom path 2 (paragraph 3.33).
<b>PERSONAL LINE</b>		
Talking and dialing possible on personal line, but no hold, lamp, or ringing.	95B1 power unit used with 30AM apparatus unit disconnected from ac outlet or from 30AM unit.	Check connection and wiring (Fig. 39 through 42).
	95B1 inoperative.	Replace 95B1 power unit.
	No power at ac outlet.	Plug 95B1 into live outlet.
Personal line goes on hold when going off-hook.	System "A" lead open.	Check wiring for open in "A" lead between set and 30AM apparatus unit (Fig. 39 through 42). Correct if necessary.
	No system +V.	Check power wiring and connections.
Personal line on all sets except BIS sets.	System tip and ring reversed.	Reverse tip and ring at output of 30AM apparatus unit.

TABLE F (Contd)

## DIAGNOSTIC ROUTINES

TROUBLE	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
<b>REPERTORY DIALING</b>		
Set goes on hold after hanging up while the TOUCH-TONE repertory dial is dialing. or Rotary pulses heard in handset while the rotary repertory dial is dialing.	Switches B and D on interconnect field not in proper positions.	Correct positions of shorting bars at switches B and D (paragraph 3.63).

**C. Lower Housing (All Satellite Desk Sets)**

**5.13** The lower housing is secured to the telephone set chassis by four captive screws in the basic satellite desk set (Fig. 42) and by six screws in the BIS and HFAI desk sets. To remove the housing:

- (a) Turn the set over and remove any option cords from the strain relief bars
- (b) Loosen the attachment screws
- (c) Pull the housing away from the set.

**5.14** With the lower housing off (Fig. 56), the following components are accessible:

- Amplifier (on the chassis)
- Interconnect field (on the chassis)
- Mounting cord (on the lower housing).

**5.15** To install the lower housing, reverse the disassembly procedure of paragraph 5.13. Tighten the screws.

**D. Wall Housing (All Satellite Wall Sets)**

**5.16** In place of the lower housing on the desk set, the wall set has a housing which adapts it to the wall mounting plate. Remove the wall housing as follows:

- (a) If the set is on a wall plate, loosen the two locking screws at the bottom of the

plate (Fig. 16). Swing the telephone up (detaching the line key from the mounting cord) and lift to unhook it from the top of the plate.

- (b) Place the set face down and detach the housing by loosening the four captive screws which hold it to the chassis.

**5.17** With the wall housing off, the following components on the chassis are accessible.

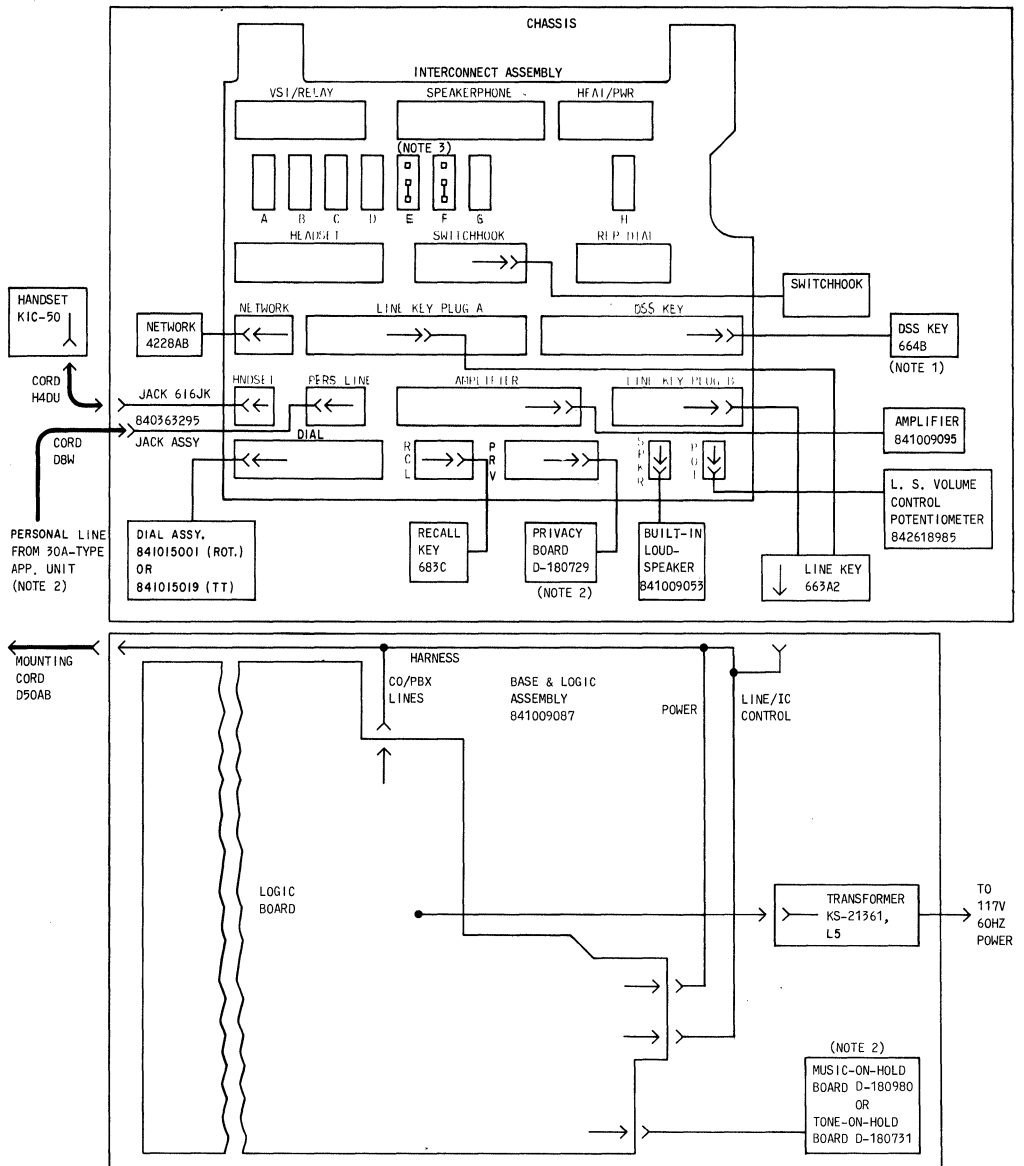
- Amplifier
- Interconnect field.

**5.18** To install the wall housing:

- (a) Put the housing back on the chassis and tighten the four screws.
- (b) Attach the wall set to the wall plate by tilting the set back about 30 degrees and engaging the hooks at the top of the plate in the slots in the upper corners of the set housing (Fig. 18). Swing the set down so the line key plug engages the connector mounted on the wall plate. While pressing the set firmly against the plate, tighten the two locking screws at the bottom of the plate (Fig. 16).

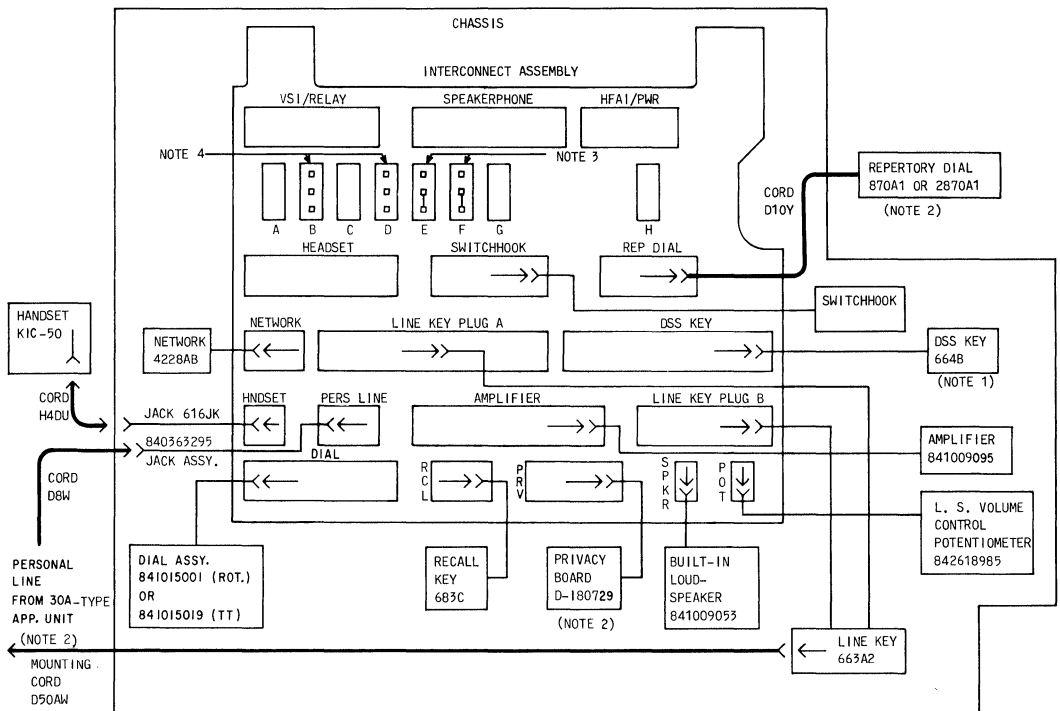
**E. Lower Housing (Primary Sets)**

**5.19** The additional control logic and power circuitry contained in the primary set is mounted on the base and logic assembly (Fig. 6). Above this assembly and held in place between it and the upper housing is the lower housing which



- NOTES:
1. CAN BE REPLACED WITH CODE BUSY DSS KEY 664C.
  2. OPTIONAL FEATURE.
  3. SHORTING BARS FACTORY-INSTALLED FOR UNRESTRICTED STATION DIALING.

Fig. 48—Block Diagram of Primary Set



## NOTES:

1. CAN BE REPLACED WITH CODE BUSY DSS KEY 664C.
2. OPTIONAL FEATURE.
3. SHORTING BARS FACTORY-INSTALLED FOR UNRESTRICTED STATION DIALING.
4. SHORTING BARS FACTORY-INSTALLED IN UPPER POSITION FOR ROTARY SET AND IN LOWER POSITION FOR TOUCHTONE SET.

**Fig. 49—Block Diagram of Basic Satellite Desk Set**

encloses the sides, front, and back of the set. To remove this lower housing:

- (a) Disconnect the handset cord from its jack.

Turn the set over and loosen the four captive chassis attachment screws (Fig. 20). If the set is equipped with a personal line, disconnect the D8W cord from its jack.

- (b) While holding the base and chassis assembly together with both hands, turn the set back over to its normal position. Lift the chassis assembly off the base and place upside down on the desk adjacent to the left side of the base (Fig. 6).

- (c) If the set is equipped with a personal line jack assembly, remove the jack from the base by pushing the retaining latch toward the front of the base and pulling up the jack.

- (d) Lift the lower housing off the base.

- 5.20** To install the lower housing and reassemble the set, reverse the procedure of paragraph 5.19.

#### REMOVAL AND INSTALLATION OF COMPONENTS

- 5.21** All replaceable components of the 980-series telephone sets have leads terminated in

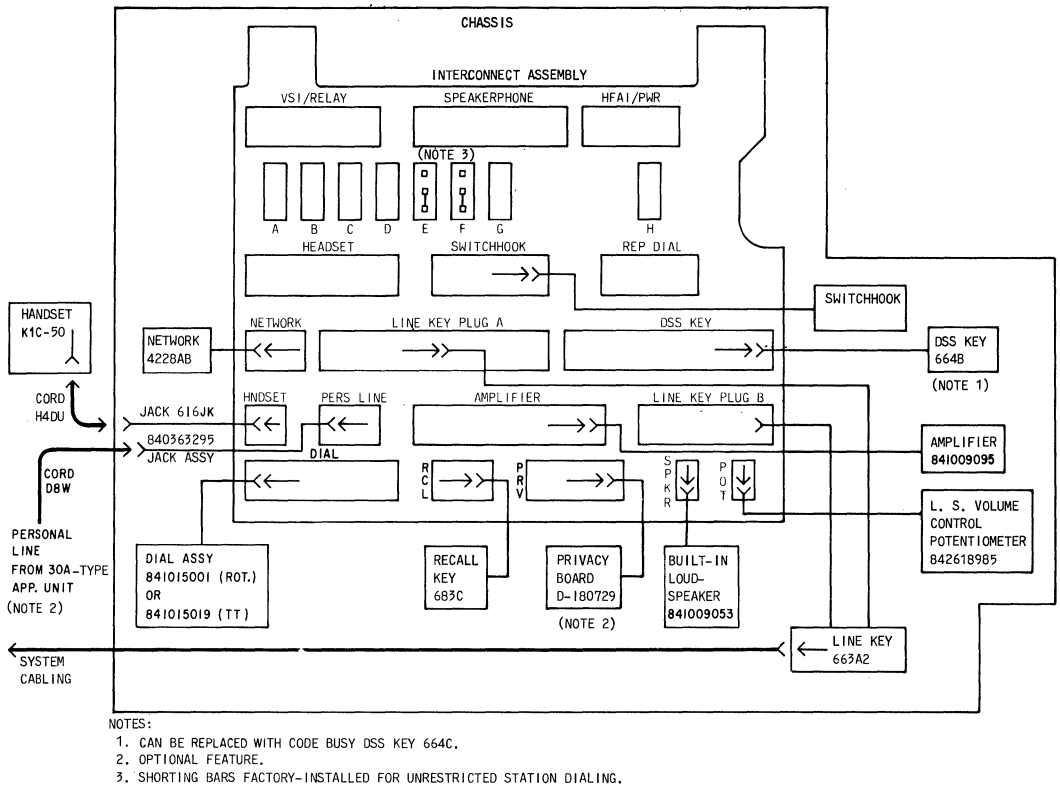


Fig. 50—Block Diagram of Basic Satellite Wall Set

963-type connectors for plugging into the interconnect field. To disconnect one of the components from the interconnect field, grasp all the wires just above the connector at the cord tie (Fig. 57) and pull straight out. (It is difficult to grasp the jack itself; the wires are attached to it in such a way that pulling on them to disconnect is not damaging, provided all the wires are pulled together.)

**5.22** To plug a component into the interconnect field, first determine the correct orientation of the connector with respect to the proper interconnect field slot; they are keyed to fit together only one way. Grasp the wires just above the jack and push the jack firmly into the interconnect field.

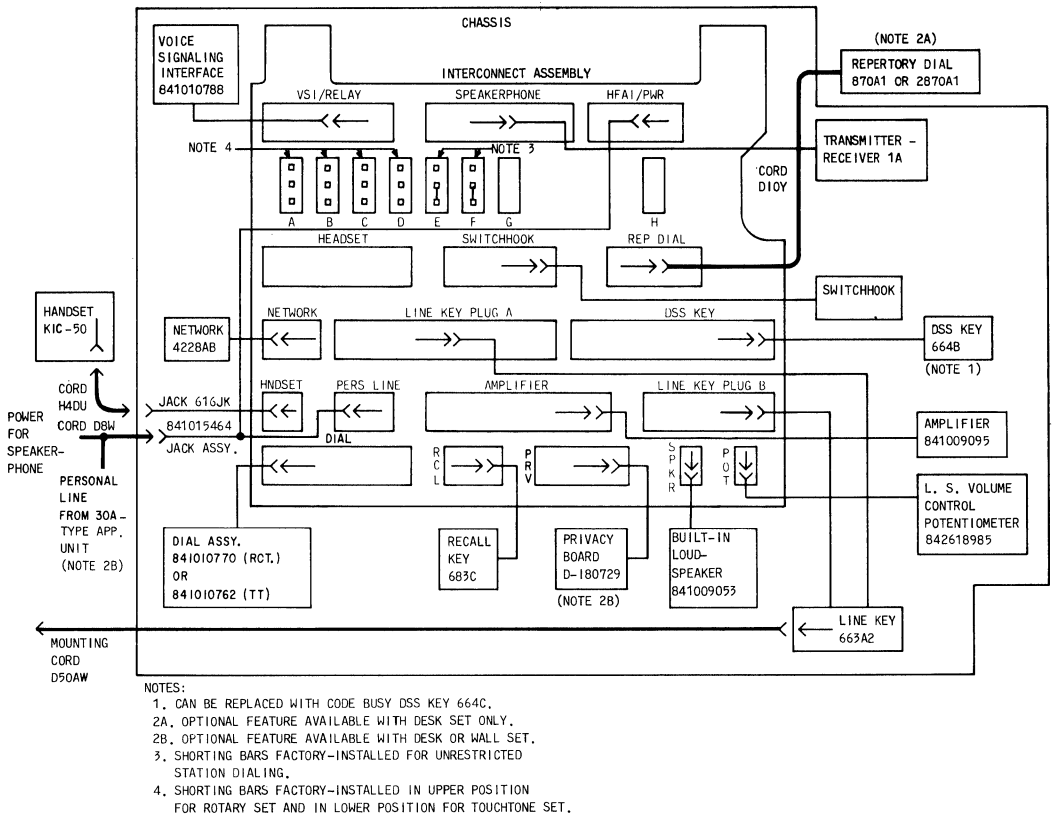


*In order to gain access to the interconnect field, it is always necessary to move the DSS key out of the way as described in paragraph 5.23, but not necessary to unplug it.*

#### A. DSS Key

**5.23** To remove the key:

- Remove the faceplate (paragraph 5.07)
- Push the metal latch on the left side of the key (Fig. 55) to the right to release the key
- Swing the left side of the key up and disengage the right side from the chassis



**Fig. 51—Block Diagram of BIS Satellite Set**

(d) Lift the key up from the chassis and unplug its connector from the interconnect field.

#### 5.24 To install the DSS key (664B or 664C):

(a) Plug the DSS key connector into the DSS KEY position of the interconnect field.

(b) Engage the right side of the key in the right side of the opening in the chassis.

(c) Push the key down so that its latch snaps into the left side of the opening in the chassis. Make sure that it is level and firmly mounted.

(d) Set the common audible and DSS programming switches as described in paragraph 3.34 and designate the buttons.

(e) Test the DSS key by operating each button for its assigned purpose. If the key has a busy field, test it as described in paragraph 3.61(h).

(f) Replace the faceplate (paragraph 5.09).

#### B. Dial

5.25 To remove the rotary dial or TOUCH-TONE dial:

(a) Remove the faceplate (paragraph 5.07).



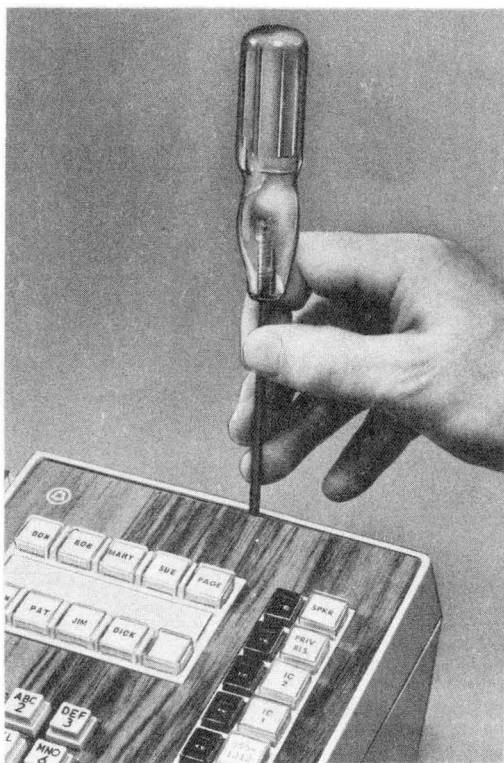


Fig. 53—Removing Faceplate

- (c) Swing the dial down so the left side snaps under the latch on the left side of the opening in the chassis. Dress the dial leads to the left side of the lead guide in the chassis wall (Fig. 5).
- (d) Be sure the dial is level and the latch firmly engaged.
- (e) Test the dial by using it to place a call.
- (f) Replace the DSS key (paragraph 5.24).
- (g) Replace the faceplate (paragraph 5.09).



*Conversion between rotary dial and TOUCH-TONE dial changes the set code. Local plant and company practices will dictate whether this*

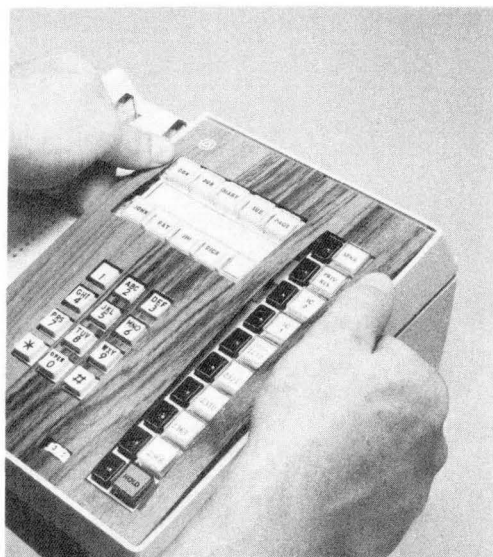


Fig. 54—Installing Faceplate

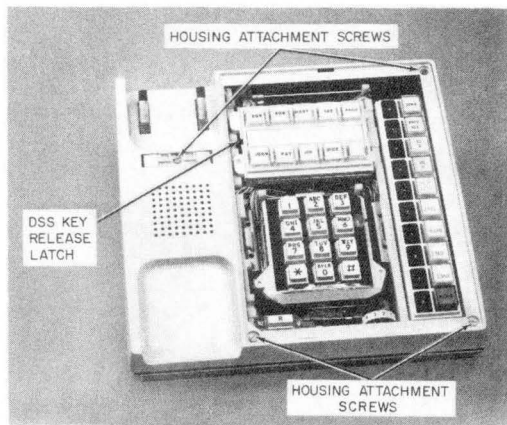


Fig. 55—Basic Satellite Set, Faceplate Removed

*option should be exercised. When interchanging dials, the shorting bars in positions A, B, C, and D must be removed to the upper*



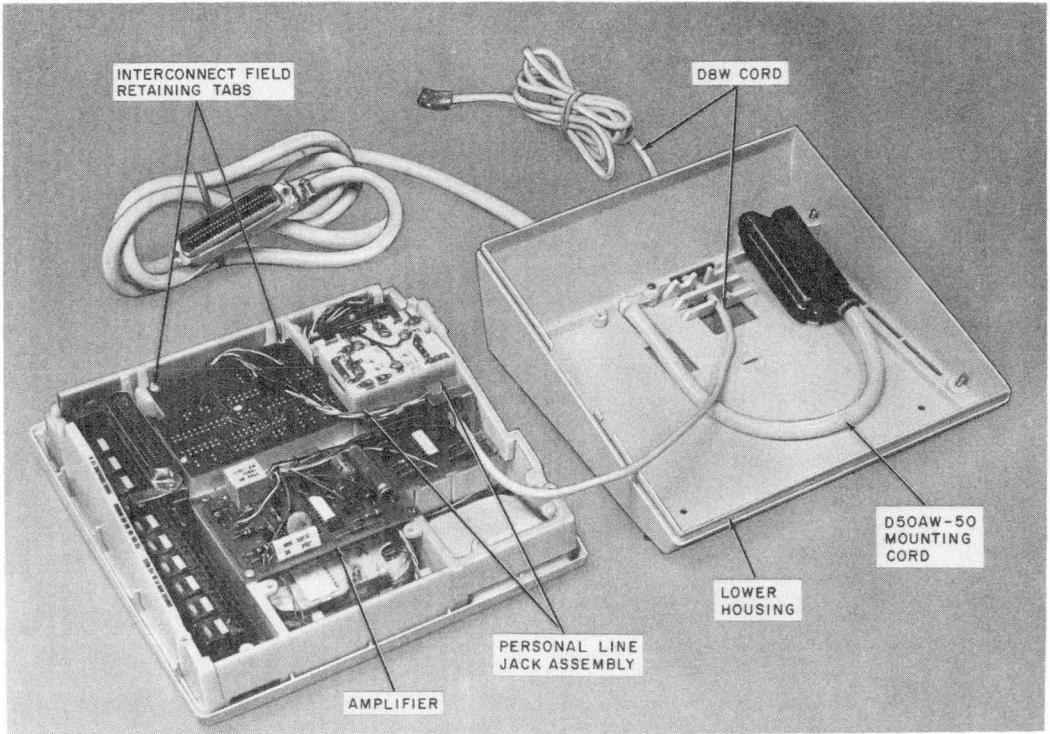


Fig. 56—Basic Satellite Desk Set Disassembled

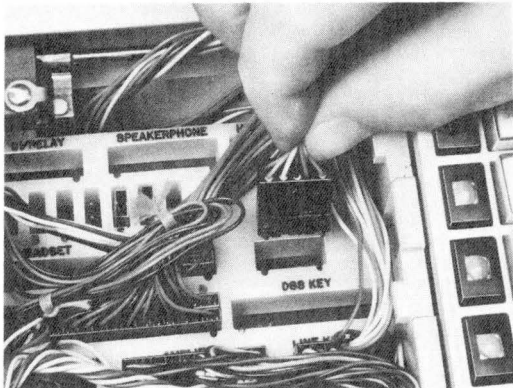


Fig. 57—Unplugging a Component Connector From Interconnect Field

*position for rotary dialing or to the lower position for TOUCH-TONE dialing.*

### C. Loudspeaker Assembly

5.27 To remove the loudspeaker assembly:

- (a) Remove the faceplate (paragraph 5.07) and the upper housing (paragraph 5.10).
- (b) Remove the two noncaptive thread-forming screws which hold the loudspeaker on the chassis (Fig. 5). Save these screws for installing a new loudspeaker.
- (c) Move the DSS key aside to get access to the interconnect field (paragraph 5.23).

(d) Lift the loudspeaker assembly up from the chassis and disconnect its connector from the interconnect field.

**5.28** To install the loudspeaker assembly:

- (a) Secure the loudspeaker to the chassis with the same two screws removed in paragraph 5.27(b).
- (b) Dress the leads around the chassis as shown in Fig. 5.
- (c) Plug the connector into the SPKR position of the interconnect field.
- (d) Replace the DSS key (paragraph 5.24).
- (e) Replace the upper housing (paragraph 5.12) and the faceplate (paragraph 5.09).
- (f) On sets where the SPKR button is operative, test the loudspeaker by going off-hook, selecting an idle intercom line, and depressing the SPKR button. Speak into the handset. Listen for normal speech coming from the built-in loudspeaker. On BIS sets or HFAI sets with 4A speakerphone, place an intercom call to these sets from another set.

**D. Handset Jack**

**5.29** The handset jack rests in a slot on the left side of the chassis (Fig. 5). To remove it:

- (a) Remove the faceplate (paragraph 5.07) and the upper housing (paragraph 5.10)
- (b) Move the DSS key aside to gain access to the interconnect field (paragraph 5.23)
- (c) Disconnect the handset cord from the jack
- (d) Lift the handset jack out of its slot and unplug its connector from the interconnect field.

**5.30** To install the handset jack:

- (a) Push the jack down into its slot on the left side of the chassis so the opening faces to the left.

(b) Connect the jack connector to the HNDSET position in the interconnect field. (Dress the leads around the right side and front of the loudspeaker.)

(c) Replace the DSS key (paragraph 5.24).

(d) Replace the upper housing (paragraph 5.12) and the faceplate (paragraph 5.09).

(e) Connect the handset cord to the jack.

(f) Test the handset jack by making a call with the handset.

**E. Recall Key**

**5.31** To remove the recall key:

(a) Remove the faceplate (paragraph 5.07) and the upper housing (paragraph 5.10).

**Warning: Do not remove the two screws on the top of the recall key.**

(b) Pull the key up out of its slots in the chassis (Fig. 5). It will be necessary to move the dial aside to gain access to the key leads (paragraph 5.25).

(c) Move the DSS key aside to get access to the interconnect field (paragraph 5.23).

(d) Unplug the recall key connector from the interconnect field.

**5.32** To install the recall key:

(a) Push the key down into the slots in the chassis.

(b) Plug the connector into the RCL position of the interconnect field. Dress the leads through the opening in the chassis wall near the upper left side of the dial and then under the dial.

(c) Replace the DSS key (paragraph 5.24) and the dial (paragraph 5.26).

(d) Replace the upper housing (paragraph 5.12) and the faceplate (paragraph 5.09).

- (e) Test the recall key by going off-hook and depressing the key to break dial tone.

#### F. Loudspeaker Volume Control

**5.33** To remove the loudspeaker volume control:

- (a) Remove the faceplate (paragraph 5.07) and the upper housing (paragraph 5.10)
- (b) Pull the control up out of its slots in the chassis (Fig. 5)
- (c) Move the DSS key (paragraph 5.23) and the dial (paragraph 5.25) aside to gain access to the interconnect field
- (d) Unplug the loudspeaker volume control connector from the interconnect field.

**5.34** To install the loudspeaker volume control:

- (a) Push the volume control mounting bracket down into the slots in the chassis
- (b) Plug the connector into the POT position of the interconnect field
- (c) Replace the DSS key (paragraph 5.24) and the dial (paragraph 5.26)
- (d) Replace the upper housing (paragraph 5.12) and the faceplate (paragraph 5.09)
- (e) Test the loudspeaker volume control by adjusting it through its entire range while performing the test described in paragraph 5.28(f).

#### G. Line Key

**5.35** The line key is not repairable in the field and must be replaced if any of the buttons are defective or if any of the LEDs associated with the line and intercom buttons burn out. To remove the line key:

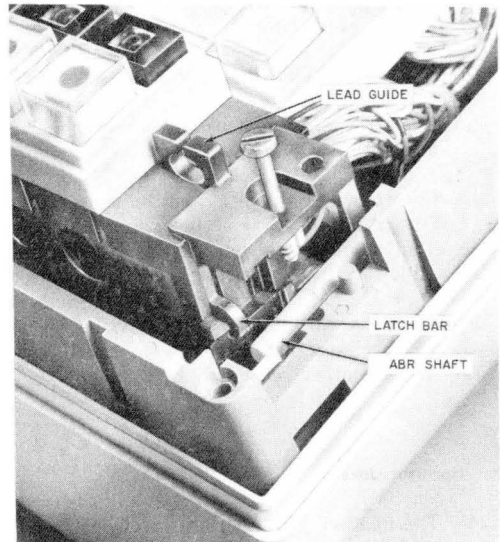
- (a) Remove the faceplate (paragraph 5.07) and the upper housing (paragraph 5.10)
- (b) Loosen the captive screws on each end of the key (Fig. 5), and remove the key collar
- (c) Pull the key upward to disengage it from the connector inside the set

- (d) Move the DSS key aside to gain access to the interconnect field (paragraph 5.23)

- (e) Unplug the two line key connectors from the interconnect field.

**5.36** To install the line key:

- (a) Push the latch bar all the way into the upper end of the key so it will engage the ABR shaft properly (Fig. 58).



**Fig. 58—Line Key Installation**

- (b) Place the key in its proper position on the chassis and push it down so it engages the mating connector inside the set and the latch bar engages the ABR shaft.

- (c) Carefully dress the line key leads through the slot in the chassis wall so they are not pinched or pulled.

- (d) Depress a line button on the key so it locks down; then release it by depressing the ABR shaft at the lever called out in Fig. 5.

- (e) Tighten the two mounting screws.

- (f) Connect the larger line key connector to LINE KEY PLUG A and the smaller connector to LINE KEY PLUG B of the interconnect field.
- (g) Replace the DSS key (paragraph 5.24).
- (h) Replace the upper housing (paragraph 5.12) and the faceplate (paragraph 5.09).

**5.37** When the line key has been replaced, test it as follows:

- (a) Go off-hook and operate each CO/PBX line button. Dial tone should be heard on each working line and the associated lamp should light steady. Each button should release and its lamp extinguish when the handset is slowly replaced or when another line button is operated.
- (b) Go off-hook and pick up an idle CO/PBX line. Put it on hold by depressing the HOLD button. The line key should restore and its lamp should wink.
- (c) Go off-hook and operate each intercom button. The lamp associated with each button should light when the button is depressed. Each button should restore and its lamp extinguish when the handset is replaced.
- (d) Go off-hook, simultaneously lock down four line buttons, and then slowly replace the handset. All buttons should release and the lamps extinguish. Repeat for the two intercom buttons.
- (e) If any other set in the system is equipped with privacy, designate the PRIV RLS button and check as described in paragraph 3.54.
- (f) Check the SPKR button by going off-hook, picking up an idle CO/PBX line, and then putting the incoming dial tone on the built-in speaker by operating the button.

#### H. BIS Module

**5.38** To remove the 1A transmitter-receiver module from a BIS satellite set:

- (a) Remove the faceplate (paragraph 5.07) and the upper housing (paragraph 5.10)

- (b) Loosen the four captive screws which hold the module on the chassis
- (c) Move the DSS key aside to gain access to the interconnect field (paragraph 5.23)
- (d) Unplug the 1A module connector from the interconnect field
- (e) Lift the module out of the set.

**5.39** To install the 1A module:

- (a) Place the module in its proper position on the chassis, being careful that its latch bar engages the ABR shaft in the same way as the line key latch bar [paragraph 5.36(a) and (b) and Fig. 58]. Make sure that the electret opening on the microphone is completely visible through the lower housing port. Tighten the four captive screws.



*When module is installed in wall set, position the microphone by aligning the two white marks on the microphone with the two marks on the wall housing wall.*

- (b) Dress the 1A module leads through the guide on the line key (Fig. 58) and plug the connector into the SPEAKERPHONE position of the interconnect field.
- (c) Replace the DSS key (paragraph 5.24).
- (d) Replace the upper housing (paragraph 5.12) and the faceplate (paragraph 5.09).
- (e) Test the 1A module by operating the BIS feature in its normal manner on a CO/PBX call (paragraphs 4.07 through 4.13).

#### I. HFAI Module

**5.40** To remove the HFAI module from an HFAI satellite set:

- (a) Remove the faceplate (paragraph 5.07) and the upper housing (paragraph 5.10)
- (b) Loosen the two captive screws which hold the module to the chassis

- (c) Move the DSS key aside to gain access to the interconnect field (paragraph 5.23)
- (d) Unplug the HFAI module connector from the interconnect field
- (e) Lift the module out of the set.

**5.41** To install the HFAI module:

- (a) Attach the module to the chassis of the set with the two captive screws.
- (b) Dress the HFAI module leads through the guide on the line key (Fig. 58) and plug the connector into the HFAI/PWR position on the interconnect field.
- (c) If the system uses only intercom path 1, be sure the shorting bar is mounted on the two pins on the inner left side of the module (Fig. 4). If the system has two intercom paths, remove the shorting bar.
- (d) Replace the DSS key (paragraph 5.24).
- (e) Replace the upper housing (paragraph 5.12) and the faceplate (paragraph 5.09).
- (f) Test the HFAI module by operating the HFAI feature in its normal manner on an intercom call (paragraphs 4.14 through 4.18). If the system has two intercom lines, test the HFAI station on both lines.

**J. Amplifier**

**5.42** To remove the amplifier from a telephone set:

- (a) Disconnect the set from the system. Remove the lower housing of a desk set (paragraph 5.13), or the wall housing of a wall set (paragraph 5.16), or remove the chassis assembly from the base of a primary set as described in paragraph 5.19(a) and (b) to obtain access to the amplifier.
- (b) Detach the amplifier by removing the four screws which hold it to the chassis (Fig. 6 and 56). Save these screws for installing the new amplifier. If the set has a personal line jack assembly bracket attached to the right side of the amplifier, remove it.

- (c) Remove the faceplate (paragraph 5.07).

- (d) Move the DSS key (paragraph 5.23) and the dial (paragraph 5.25) aside and disconnect the amplifier connector from the interconnect field.

- (e) Lift the amplifier away from the set, pulling its cord through the dial opening in the chassis.

**5.43** To install the amplifier:

- (a) Position the amplifier on the underside of the chassis with its leads through the dial opening in the chassis. The right side of the amplifier board, as viewed in Fig. 6 and 56, must slide under the retaining tab on the chassis wall. Insert and tighten the four thread-forming screws. If the personal line jack bracket is required, attach it to the amplifier.

- (b) Dress the leads through the guide on the right side of the chassis wall above the dial and plug the connector into the AMPLIFIER position of the interconnect field.

- (c) Replace the DSS key (paragraph 5.24), the dial (paragraph 5.26), and the faceplate (paragraph 5.09).

- (d) Install the lower housing (paragraph 5.15) or the wall housing (paragraph 5.18), or mount the chassis assembly on the primary set base (paragraph 5.20). Connect the set back into the system.

- (e) Test the amplifier by performing the procedure in paragraph 5.28(f). Also use the handset to place an intercom call to another set.

**K. Voice-Signaling Interface Circuit**

**5.44** The voice-signaling interface circuit is a factory-installed board mounted in the two slots on the right side of the opening in the lower left of the chassis of each BIS set. It occupies the same position in BIS sets that the 4A speakerphone relay board occupies in HFAI sets (Fig. 36). To remove a voice-signaling interface board:

- (a) Remove the faceplate (paragraph 5.07) and the upper housing (paragraph 5.10)

- (b) Pull the board up out of its slots in the chassis
- (c) Move the DSS key (paragraph 5.23) and the dial (paragraph 5.25) aside to gain access to the interconnect field
- (d) Unplug the connector of the voice-signaling interface board from the interconnect field.

**5.45** To install a voice-signaling interface board:

- (a) Push the board down into the slots in the chassis with its components to the left.
- (b) Move the dial aside (paragraph 5.25) and dress the leads of the board through the slot in the chassis wall and under the left side of the dial.
- (c) Replace the dial (paragraph 5.26).
- (d) Plug the board connector into the VSI/RELAY position on the interconnect field. Dress the leads toward the front of the set to prevent interference with the ABR shaft.
- (e) Replace the DSS key (paragraph 5.24).
- (f) Replace the upper housing (paragraph 5.12) and the faceplate (paragraph 5.09).

**5.46** Test the voice-signaling interface circuit as follows:

- (a) Set the speakerphone volume control to a low level and the voice-signaling loudspeaker volume control to a high level.
- (b) Using the handset and an idle IC line, voice signal from the BIS station on its own DSS code. The voice signaling should be heard from the set loudspeaker, but not from the speakerphone.
- (c) Repeat the procedure of (b) using the speakerphone instead of the handset.
- (d) Release the DSS button, then depress it again and voice signal again. Voice signaling should now be heard from both the set loudspeaker and the speakerphone.

**L. Interconnect Field Assembly**

**5.47** If any of the connector pins on the interconnect field are damaged or bent beyond repair, the entire assembly can be replaced. To remove the interconnect field:

- (a) Remove the faceplate (paragraph 5.07).
- (b) Remove the DSS key from the telephone (paragraph 5.23).
- (c) Unplug all the component connectors from the interconnect field.
- (d) Turn the telephone over.
- (e) Remove the lower housing of a desk set (paragraph 5.13), the wall housing of a wall set (paragraph 5.16), or the base and logic assembly from a primary set (paragraph 5.19) to get access to the set amplifier and the back of the interconnect field.
- (f) Remove the four screws which hold the amplifier on the chassis.
- (g) Move the amplifier enough to free the front edge of the interconnect field. On basic satellite and HFAI sets with personal line, it will also be necessary to move the jack assembly bracket (Fig. 43).
- (h) Lift the interconnect field out of the chassis.

**5.48** Install a new interconnect field of the correct code (see ORDERING GUIDE) in the telephone as follows:

- (a) Insert the interconnect field assembly into the chassis with its rear edge under the two retaining tabs (Fig. 56).
- (b) Move the amplifier back into its proper position with its rear edge over the interconnect field and secure it to the chassis with the four screws. If a personal line jack assembly bracket was removed, attach it again.
- (c) Install the lower housing (paragraph 5.15), wall housing (paragraph 5.18), or base and logic assembly (paragraph 5.20).
- (d) Turn the telephone over.

- (e) Plug all of the component connectors into the interconnect field. **Be sure the shorting bars of the interconnect field are in their correct positions (Fig. 37).**
- (f) Replace the DSS key (paragraph 5.24).
- (g) Replace the faceplate (paragraph 5.09).

**M. Base and Logic Assembly**

- 5.49** The base and logic assembly in primary sets is removed and replaced as described in

paragraphs 5.19 and 5.20. The entire base and logic assembly, not including the power transformer and the D50AB mounting cord, must be replaced. When a new assembly is installed, test it by placing and receiving calls on the intercom and CO/PBX lines served by that primary set. Also check the hold function and line status indications.

**N. Power Transformer**

- 5.50** The transformer is removed and replaced as described in paragraph 3.33(a) and (f).

**21A COMMUNICATION SYSTEM**  
**(COM KEY\* 2152)**  
**DESCRIPTIVE AND ORDERING INFORMATION**

**1. GENERAL**

**1.001** This addendum supplements Section 518-450-110, Issue 2. Place this pink sheet ahead of Page 1 of the section.

**1.002** This addendum is issued to add information pertaining to the Federal Communications Commission's (FCC) Registration Program.

**2. CHANGES TO SECTION**

**2.001** On Page 3, following paragraph 1.04, add the following:

**1.05** After January 1, 1980, connection of customer-provided equipment (CPE) or telephone company-provided equipment to the 21A Communication System requires the use of a 33B

voice coupler when providing music-on-hold. Also after January 1, 1980, the 415C, 454C, 460C, 471C, 479C, and 481B key telephone units (KTUs) must be used when providing their related services. Previously connected or Class C voice couplers and KTUs may be used for additions and maintenance at grandfathered installations for the life of the equipment, provided they are not modified. Class C stock may also be used in new installations after January 1, 1980.

**1.06** Incoming central office (CO) lines to be installed in compliance with the FCC Registration Program must be routed through a standard network interface. Information on approved interfaces is contained in Sections 463-400-100 through 463-400-150.

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**21A COMMUNICATION SYSTEM**  
**(COM KEY\* 2152)**  
**DESCRIPTIVE AND ORDERING INFORMATION**

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**1. GENERAL**

1.01 This section provides information for the 21A Communication System. Installation, connections, and maintenance are covered in Section 518-450-111.

1.02 This section is reissued to:

- Add information on the 101A2 connecting unit, 702B and 703B feature panels, 400H and 498A KTUs, 34C cabinet, D-180780 Kit of Parts, and KS-21939L2 loudspeaker
- Expand satellite information to include use of 14A1-type terminal blocks
- Provide method of increasing number of 20-button telephone sets served by a 100B1 connecting unit
- Add Replaceable Components to the Ordering Guide
- Rate 702A and 703A feature panels MD
- Change the name of some features to agree with standard terminology.

Since this reissue is a general revision, no revision arrows have been used to denote changes.

1.03 The Bell System Practices listed below provide additional information on key telephone units (KTUs), related communication systems, and other pertinent subjects.

SECTION	TITLE
518-215-400	Line Service KTUs
518-215-401	Auxiliary Service KTUs
518-215-402	Intercom Service KTUs
518-215-403	Control Service KTUs
518-450-100	7A Communication System
518-450-102	14A Communication System
503-701-110	832- and 2832-Type Telephone Sets
503-702-110	833- and 2833-Type Telephone Sets
518-010-105	KTS Grounding and Special Protection Requirements

SECTION	TITLE
463-341-102	Voice Connecting Arrangement FTP (33A Voice Coupler)
981-251-100	Loudspeaker Paging Systems—General Description

**1.04** This issue of the section is based on the following drawings:

SD-69656-01, Issue 2—6B1 and 6C1 Consoles

SD-69657-01, Issue 2—7B1 and 7C1 Consoles

SD-69930-01, Issue 2—21A Communication System Equipped With 100A1 and 100B1 Connecting Units

SD-69941-01, Issue 1—21A Communication System Equipped With 101A1, 101A2, and 101B1 Connecting Units

SD-69932-01, Issue 2—128A3-, 128A4-, and 138A4-Type Console

SD-69934-01, Issue 1—128A6- and 138A6-Type Console

SD-69915-01, Issue 1—20A Apparatus Unit

SD-69924-01, Issue 1—22A Apparatus Unit

SD-69921-01, Issue 2—Audio Features, 451-Type and 498A KTUs

SD-69942-01, Issue 1—400H KTU.

## 2. SYSTEM FEATURES

**2.01** The 21A Communication System (Fig. 1) is a modular Key Telephone System (KTS) which offers a wide choice of features and options in an arrangement which is flexible and expandable. Its basic purpose is to provide a system in which telephone stations in a customer location can originate and answer calls on CO/PBX lines and communicate among themselves; all other features support and augment these functions. The maximum size of COM KEY 2152 is 21 CO/PBX lines and 52 stations.

**2.02** The system is designed to permit selection of mounting arrangements, power supply, and terminations for a variety of system

sizes—depending on the number of lines and/or number of stations. Three basic units of hardware have been developed for COM KEY 2152 which permit this system flexibility:

- Feature panels—for mounting the required and optional KTUs
- Power panels—required in singular or combination depending on the number of lines and stations and the number of 10- and 20-button telephone sets
- Connecting units—provide the system terminations and optional wiring; selected by the size of the system and type of telephone sets.

**2.03** The telephone sets used with COM KEY 2152 are the same as those developed for earlier COM KEY systems. Unlike the earlier systems, the 832- and 833-type or intercom-only sets can be intermixed in a COM KEY 2152 System to satisfy the customer's needs. When expansion requires stations to be added, this can be accomplished by the addition of the required connecting unit to provide the necessary terminations. The original connecting unit need not be replaced. In some cases, additional terminations can be added to the 100B1 connecting unit to change the 10- or 20-button telephone set mix.

**2.04** The COM KEY 2152 also provides flexibility in both the line and feature appearances at a given station. If desired, up to 14 lines can be square, that is, appear at all stations; or two of the button appearances, called flexible buttons, can be used to provide any of the following:

- Square line pickup
- Personal line pickup
- Automatic signaling intercom pickup
- Third intercom link pickup
- Automatic private line.

A personal or "nonsquare" line is a CO/PBX line which serves only a limited number of stations, perhaps as few as one or two, and can be picked up only at those stations (and by the attendant). With personal lines, the caller has direct access to

a line which is less likely to be busy than a square one. On outgoing calls, the station user does not have to compete with as many other users as he would on a square line. As far as operating methods and characteristics are concerned, square and personal lines are standard CO/PBX lines in all respects. If the attendant is not to pick up a personal line, the corresponding button must be blocked. In addition, if the line is not to ring at the attendant, the common audible diode must be removed.

In COM KEY 2152, lines 1 through 5 are square on **all** stations (10- or 20-button); lines 1 through 12 are square on 20-button telephone sets. All lines appear at attendant sets.

**2.05** In COM KEY 2152, the attendant station (code 0) is factory-wired to receive tone ringing on all CO/PBX lines, square and personal (common audible feature). Other stations, instead of or in addition to the attendant, can be arranged to have common audible. The maximum number of station codes that can be signaled at one time is 10. The procedure for answering calls can vary between installations, depending on customer needs. Individual stations can be optionally wired for CO/PBX ringing (flexible station ringing feature) on a maximum of two lines in addition to the attendant. If two lines are to ring at a station other than the attendant, neither of the two lines can ring **alone** at another station, that is, both lines must also ring at the second station. Additionally, if it is desired that one of the two lines not ring at the attendant station, the other line cannot ring at the attendant station either. Both common audible diodes would have to be removed.

**2.06** In the case of a personal line, installer wiring options allow CO ringing to be connected to the served stations, in addition to the attendant positions or to the served station alone. A personal line is often used for a principal station and a secondary station (boss and secretary, for example), one of whom will usually answer incoming calls directly rather than receiving them through an attendant. However, an attendant can handle personal line calls that are not answered at the intended station within a reasonable time.

**2.07** Three types of intercom are used with COM KEY 2152 and employ tone and voice signaling on the called station loudspeaker: (1) dial intercom among all stations on two or three paths; (2)

optional automatic signaling intercom among selected stations; (3) at attendant positions, the DSS feature with a dedicated intercom path, if installed, can be used to signal stations without dialing.

**2.08** The hands-free answer on intercom (HFAI) feature allows any station so equipped to answer either a dial intercom or DSS call over a microphone circuit automatically turned on by the incoming call. This can be done without using the station handset and even while another call is in progress.

**Note:** The HFAI is not activated by the automatic signaling intercom circuit. Connection to the paging system from the stations is under control of the intercom circuit. Connections to the paging circuit from the attendant positions can be either through the common IC paths or the dedicated link, provided the attendant has DSS.

If the system is equipped with three intercom paths, all stations must be wired for the three paths.

**2.09** Depending on the size of the system and the features installed, the answering position(s) may use the same type of telephone set as the other stations (must have ring transfer) or may require one, two, or three of a new family of telephone and selector consoles developed for COM KEY 2152.

**2.10** As factory-wired, the 21A Communication System furnishes common audible ringing at station code 0. All incoming lines will ring at that station unless otherwise arranged (see information on common audible and additional station ringing). The calls are answered by lifting the handset (if using a telephone set) and depressing the flashing line pickup button. The method of forwarding the call may vary depending on the equipment at the attendant station, as follows.

- (a) With all arrangements, the answered call can be placed on hold using the HOLD key on the telephone set or console at which time the steady lamp will change to wink. The attendant then selects an idle intercom path, dials the desired station, and voice-signals that there is a call on a particular CO/PBX line. If necessary to reenter the conversation, the pickup button must be depressed again.

(b) If equipped with a DSS console, the attendant can voice signal the desired station by depressing the associated locking DSS button. When the DSS button is depressed, the CO/PBX line is automatically put on hold. Using the DSS does not require accessing an intercom path since the attendant uses the dedicated link which does not require the selector. If the intercom station is equipped with HFAI, 2-way conversation is possible. A call from a DSS console will preempt an automatic signaling intercom call, dial intercom call, or CO/PBX ringing. The attendant may then either go back to the held line by depressing the RE-ENT button on the DSS console or may pick up another CO/PBX line by depressing the associated button after depressing RST button to clear DSS console, leaving the held line to be picked up by the station.

(c) At positions having an intercom/line conferencing console (128A3 or 138A4), incoming calls are answered using the line pickup buttons on the lower field. Calls can be forwarded in the usual manner by holding and using an intercom path or by DSS if so equipped. In addition, the intercom/line conferencing field can be used to connect a line that does not appear at a station, such as a nonsquare line, as follows:

- (1) Answer flashing line by depressing button; then place line on hold.
- (2) Select idle intercom path (lamp off) and signal desired station using dial intercom.

**Note:** DSS cannot be used here for conferencing.

- (3) When station answers, depress buttons in intercom/line conferencing field associated with held CO/PBX line and selected intercom link which will connect outside party with station.
- (4) Operate RLS button to remove attendant from conversation.
- (5) When the intercom station goes on-hook, the status lamp in the intercom/line conferencing field will light indicating the connection can be released by depressing the push-to-operate, push-to-release buttons. **Only one call at a time can be processed**

### **through the intercom/line conferencing field.**

**2.11** The intercom/line conferencing field can also be used to set up a preset conference call. The procedure is the same as above except the attendant dials the preset conference code on the intercom. Once the conference stations are on the line, the CO/PBX line button in the intercom/line conferencing field is depressed. A third option permits the attendant to make a CO/PBX call for stations unable to do so, ie, an intercom-only station. To do this, the attendant first completes the CO/PBX call by depressing button in the lower field and dialing the desired number. The attendant then places that call on hold and calls the station on dial intercom using an idle path on the lower button field. The attendant then operates the intercom button, then the CO/PBX line button in the intercom/line conferencing field corresponding to the two parties. After operating the RLS button, the attendant is free to handle other calls.

### **Option Wiring**

**2.12** All option wiring has been assigned to blocks 1 and 2 of the 100- and 101-type connecting units, except for some of the paging feature wiring and wiring for the 33A voice coupler which appear on block 4 of the 100A1 and 101A1/101A2 connecting units. Blocks 1 and 2 are color-keyed, with the colors corresponding to those designated for centralized key system installations; ie, red for line service terminations, blue for telephone set terminations, and yellow for auxiliary and dial intercom terminations. Black lines are used to define the color segments.

**2.13** In some instances it may be necessary to provide connections between a 100A1 and a 100B1 connecting unit or between a 101A1/101A2 and 101B1 connecting unit. An example of this is an automatic signaling intercom in which one station appears in the 100A1 and the other station appears in the 100B1. Another example is an intercom-only station whose flexible button terminations appear in the 100B1 or 101B1 connecting unit, picking up the third intercom path—the leads of which appear only in the 100A1 or 101A1/101A2 connecting unit.

**2.14** To avoid running exposed jumpers between connecting units, eleven unassigned pairs are provided between a 100A1 and 100B1 or a 101A1/101A2

and 101B1, and are designated SP1-SP22 to be used as required.

### 3. COMMON APPARATUS

#### MOUNTING FACILITIES

**3.01** Apparatus for mounting the power units, KTUs, and cross-connect terminal fields is selected from separately ordered components on the basis of required capacity (lines and stations) and the type of mounting (wall, floor, or relay rack). Preassembled packages are not provided for this purpose with the 21A Communication System.

##### A. Apparatus Box, Cabinet, and Cover

**3.02** The 121B apparatus box (Fig. 2 and 3) has the following features:

- Consists of a molded plastic housing and hinged gate assembly
- Can be mounted on wall, using separately ordered 197A backboard, or on 23-inch relay rack, using D-180675 Kit of Parts (bulb-angle relay rack) or D-180865 Kit of Parts (channel-type relay rack)
- Approximate dimensions are 34-1/4 inches high, 25-1/2 inches wide, and 16 inches deep.

**3.03** The 34-type cabinet provides the following features:

- Used in floor-mount installations
- Hinged carrier gate with caster to support weight when gate is opened
- Glides or optional casters (D-180780 Kit of Parts) on each corner of a 34C cabinet for easy movement.

**Note:** The 34C cabinet replaces the 34B cabinet but either 34C or 34B can be used with COM KEY 2152. (If equipping 34B with optional casters, use D-180700 Kit of Parts.)

**3.04** The 154-type cover (Fig. 4) provides the following features:

- Used to cover 34-type cabinet and 121B apparatus box

- Provides finished appearance where required for office decor.

**Note:** The 154B cover replaces the 154A cover; however, either the 154A or 154B can be used in COM KEY 2152. The 154B has an improved airflow.

##### B. Feature Panels

**3.05** The 702-type feature panel has the following features.

- Metal framework assembly with slots and prewired connectors for holding 400-series KTUs.
- "Basic" panel providing up to 7 CO/PBX lines, 2- or 3-path intercom, and various optional features.
- Holds fourteen 4-inch and seven 8-inch KTUs.
- KTU connectors are factory-wired to connectors which mate with cables from connecting unit and power panel. Panel supplied with connector hold-down bracket.
- Mounts in middle front area of gate.
- Approximate dimensions are 8-13/16 inches high, 22-5/16 inches long, and 9-5/8 inches deep.
- Fuse board in far right position—has light emitting diode (LED) to indicate blown fuse.
- Wired for music-on-hold feature.

**Note 1:** The 400H KTU can be used in either a 702A (MD) or 702B feature panel. However, a 400H cannot be used in a 702A (MD) feature panel if music-on-hold is provided. In addition, when providing music-on-hold, a 451-type KTU must be used in a 702A (MD) feature panel and a 498A KTU equipped with a 116A1 CM must be used in a 702B feature panel. The KTUs are not electrically interchangeable.

**Note 2:** On the 702B feature panel, the appearances of codes 0 and 18 are changed on the 474A KTU (DSS diode matrix and preempt tone generator) so that only one 474A

is required on small systems (up to 17 stations plus paging).

**3.06** The 703-type feature panel has the same physical features as the 702-type feature panel, plus:

- Mounts on lower front area of gate
- Holds twenty-two 4-inch and two 8-inch KTUs
- Provides 14 additional CO/PBX lines and various optional features.

**Note:** The 400H KTU can be used in either a 703A (MD) or 703B feature panel. However, a 400H cannot be used in a 703A (MD) feature panel if music-on-hold is provided. In addition, when providing music-on-hold, a 451-type KTU must be used in a 703A (MD) feature panel, and a 498A KTU equipped with a 116A1 CM in a 703B feature panel. The 498A KTU provides music-on-hold on four lines, 116A1 CM provides this feature on an additional three lines. The KTUs are not electrically interchangeable.

**3.07** The B-coded feature panels can be mixed with A-coded feature panels in the same installation as long as the restrictions concerning the line circuits and music-on-hold circuits are observed in the individual panels.

### C. Connecting Units

**3.08** The 100A1 connecting unit (Fig. 5) provides the following features.

- 66-type connecting blocks mounted on metal framework.
- Connecting blocks factory-wired to connector cables which mate with cables from panels, power panels, and other connecting units.
- All installer wiring on front of blocks.
- Mounts on backboard of 121B apparatus box or 34-type cabinet.
- Provides terminations for incoming CO/PBX lines, station cables for twenty-eight 10-button

and six 20-button telephone sets (two answering positions).

- All options for 34 stations are grouped in blocks 1 and 2, including flexible buttons and personal lines.

***Danger: Before working on the C battery capacitors, remove the power plug and wait at least 20 seconds to allow capacitors to discharge.***

**3.09** The 100B1 connecting unit (Fig. 6) has the same physical features as 100A1, plus:

- Provides terminations for additional eighteen 20-button telephone sets.
- All interconnections to 100A1 connecting unit and power panel are through plug-ended connector cables.

**3.10** The 101A1 connecting unit has the same physical features as 100A1, plus:

- Provides terminations for incoming CO/PBX lines and station cables for twenty-eight 20-button telephone sets.
- All option wiring appears in same manner as 100A1.

**3.11** The 101A2 connecting unit has the same physical features as 100A1, plus:

- Provides terminations for incoming CO/PBX lines and station cables for twenty-eight 20-button telephone sets.
- Option blocks mounted on gate.
- Identical to the 101A1 except the T, R, L, and A leads of CO/PBX lines 6 through 12 appear on option block 1 of the 101A2 where they can be cross-connected to the station flexible buttons if required.

**3.12** The 101B1 connecting unit has the same physical features of 100B1, plus:

- Provides terminations for additional twenty-four 20-button sets.

- All connections to 101A1 or 101A2 connecting unit and power panel are through plug-ended connector cables. See Section 518-450-111 for routing of ground wiring.

#### D. Power Panels

**3.13** Power panels are available for use with COM KEY 2152, the choice depending on the size of the installation. They differ primarily in the type of power units they contain. The **basic panel** has the following features:

- Metal framework 23-1/8 inches wide and 12 inches high
- Mounts on upper front area of hinged carrier gate
- Line status lamps
- Fuse panel with 70-type fuses (Fig. 7)
- Interrupter.

**Note:** In COM KEY 2152, the KS-15900L3 interrupter runs continuously as long as power is applied to the system.

- Capacitor for A battery
- Resistors for C battery
- Outputs wired to connectors mounted on power panel bracket.

#### (a) **2A Power Panel:**

- 19C3 power unit
- 215C1 transformer to supply 15/18 volts ac.

#### (b) **2B Power Panel:**

- 29E1 power unit.

#### (c) **2C Power Panel:**

- 29E1 power unit
- 67E1 power unit for supplementary lamp power and for interrupter motor.

#### (d) **2D Power Panel:**

- 67E1 power unit wired for use with the 101B1 connecting unit and in conjunction with the 2C power panel.

#### E. Key Telephone Units

**3.14** The electronic control circuitry of COM KEY 2152 is contained in 400-series plug-in, printed circuit board KTUs. Table A provides a list of all of these units with pertinent physical and functional data. The KTUs are mounted in the 702- and 703-type feature panels. There are dedicated slots in the panel for each type of KTU, except for the 457C and 481A which are mounted in "option slots" in various combinations, depending on the requirements of specific installations. Figures 8 and 9 show the arrangement of KTUs in the 702- and 703-type feature panels, respectively.

#### 4. STATION APPARATUS

**4.01** In COM KEY 2152, each nonattendant station utilizes a single telephone set. Each answering position (up to three per installation) will have a telephone set or a telephone console depending on the number of CO lines served, and it may also have one or two selector consoles providing the DSS/SB and MW/SB features. All telephones (except intercom-only sets) and consoles are available in an ivory colored housing only, with a choice of nine faceplate colors (Table B). The features that can be provided with each set are detailed in Table C. Figure 10 shows some of the telephone sets used with COM KEY 2152.

#### TELEPHONE SETS

##### (a) **832BM Telephone Set (11-button):**

- Rotary dial
- 10-button key with HOLD button, 7-line pickup buttons, and 2 intercom buttons
- May be equipped with third IC path
- RECALL button simulates switchhook flash
- Built-in amplifier and loudspeaker



- Automatic button restoration returns depressed buttons to unoperated position when handset is placed on-hook
  - Conferencing of CO lines
  - Equipped with modular handset components
  - PRIV RLS, RECALL, and RING TRANSFER features **cannot** be provided.
- (b) **832CM Telephone Set (13-button):**  
Same as 832BM except as listed.
- 3-button key with RECALL, privacy release (PRIV RLS), and ring transfer (RING TR) buttons
  - Factory-wired with privacy circuit; PRIV RLS button operational
  - RING TR button not factory-connected.
- (c) **832DM Telephone Set (11-button):**  
Same as the 832BM except arranged for wall mounting. The line switch allows the handset to hang vertically to the left of the housing.
- (d) **832EM Telephone Set (13-button):**  
Same as the 832CM except arranged for wall mounting.
- (e) **833BM Telephone Set (20-button):**
- Two 10-button keys with HOLD, 14 line pickup buttons, 3 intercom buttons, RECALL button, PRIV RLS, and RING TR buttons
  - Privacy circuit factory-provided and PRIV RLS operational
  - Equipped with modular handset components
  - Equipped with automatic button restoral (ABR) some earlier modules were not so equipped.
- (f) **833CM Telephone Set (20-button):**  
Same features as 833BM as listed.
- Privacy circuit must be provided and connected in the field
  - No provision for PRIV RLS
- RING TR button factory-provided but not connected.
- (g) **833DM Telephone Set (20-button):**  
Same as 833BM except arranged for wall mounting.
- (h) **833EM Telephone Set (20-button):**  
Same as the 833CM except arranged for wall mounting.
- (i) **2832BM Telephone Set (11-button):**  
Same as 832BM except equipped with a TOUCH-TONE® dial.
- (j) **2832CM Telephone Set (13-button):**  
Same as 832CM except equipped with a TOUCH-TONE dial.
- (k) **2832DM Telephone Set (11-button):**  
Same as 2832BM except arranged for wall mounting.
- (l) **2832EM Telephone Set (13-button):**  
Same as 2832CM except arranged for wall mounting.
- (m) **2833BM Telephone Set (20-button):**  
Same as 833BM except equipped with a TOUCH-TONE dial.
- (n) **2833CM Telephone Set (20-button):**  
Same as 833CM except equipped with a TOUCH-TONE dial.
- (o) **2833DM Telephone Set (20-button):**  
Same as 2833BM except arranged for wall mounting.
- (p) **2833EM Telephone Set (20-button):**  
Same as 2833CM except arranged for wall mounting.
- (q) **575AM Telephone Set (6-button):**
- For use at stations which are to access intercom lines only
  - Can be wired for 2- or 3-path intercom. Comes factory-wired for two intercom paths; the third path must be wired in the field.

- (r) **2575AM Telephone Set (6-button):**  
Same as 575AM except equipped with a TOUCH-TONE dial.

**TELEPHONE CONSOLES**

- (a) **128A3T or 128A3R Console (Fig. 11):**

- Intercom/line conferencing key field with one button for each of the 14 lines and 3 intercom paths
- TOUCH-TONE (T suffix) dial or rotary (R suffix) dial
- 3 intercom buttons, RECALL button, PRIV RLS button, and ring transfer button
- 2 flexible buttons
- Release button to release any line or intercom button to unoperated position
- Handset cradle is not a functional switchhook
- 20-type PBX console housing
- Headset jack with amplifier
- Built-in amplifier and loudspeaker
- Handset jacks supplied with G15 handset
- 14-line capacity (includes 2 flexible lines).

- (b) **128A4T or 128A4R Console:** Same as 128A3-type except as listed.

- 3-ring transfer buttons
- 21-line capacity (includes 2 flexible lines)
- No intercom/line conferencing field.

- (c) **138A4T or 138A4R Console (Fig. 11):**

- Separate intercom/line conferencing key field with one button for each of the 21 lines and for each of the 3 intercom paths
- Similar to 128A4-type with addition of upper key field

- Used to couple any two pickups together without restricting use of associated 21-line telephone on other calls

- 30-type PBX console housing

- Supervision provided on CO/intercom conferences.

**Note:** No supervision or amplification provided on CO-to-CO calls.

**SELECTOR CONSOLES**

- (a) **6B1 Console (MW With SB) (Fig. 12):**

- 18 station selection
- MW button field with SB lamps incorporated in MW buttons
- Same size housing as 830-series telephones.

- (b) **7B1 Console (MW With SB) (Fig. 12):**

- Similar to 6B1
- 34 station selection.

- (c) **6C1 Selector Console (DSS With SB) (Fig. 13):**

- 17 station selection
- DSS button field with SB lamps incorporated in DSS buttons
- Dedicated intercom link allows signaling of other stations regardless of status of intercom selector circuit and common intercom paths
- Automatic hold feature places incoming line on hold when attendant signals called station
- Does not tie up intercom selector circuit used by other stations
- When station signaled from this console is receiving signaling from some other source, that source will be preempted by console signal

- Beep tone sent to each preempted station (if system has HFAI)
- Same size housing as 830-type telephones
- Built-in chime tone generator and amplifier
- DND lamp signal superimposed on station busy lamps
- One each paging, restore, and reenter buttons.

(d) **7C1 Selector Console (DSS With SB) (Fig. 13):**

- Similar to 6C1
- 34 station selection
- 3 paging buttons.

(e) **128A6Y Console (DSS With SB) (Fig. 14):**

- Features similar to 6C1 and 7C1
- 52 station selection
- 20-type PBX console housing.

(f) **138A6Y Console (DSS and MW With SB) (Fig. 14):**

- Similar to 128A6Y with addition of upper key field
- Separate MW field without SB lamps
- 30-type PBX console.

## 5. OPTIONAL APPARATUS

### A. 683A (MD) or 683AE Transmitter

#### 5.01 683A (MD) or 683AE Transmitter:

- Provides microphone and other circuitry required for HFAI and the do not disturb (DND) function
- On-Off switches for microphone and DND

- LED indicator that turns on when microphone amplifier is turned on by incoming call
- Freestanding, pedestal-type case similar to transmitter of 4A speakerphone
- Connects to terminals inside associated station telephone set by way of D8U-87 cord
- Requires a 268A adapter if used with wall sets. The 268A adapter replaces F-60576.

**Note:** When the 268A adapter is used to mount the 683A (MD) or the 683AE transmitter at a wall set installation, a 468B KTU must be used or a 468A (MD) must be replaced to reduce feedback from loudspeaker to transmitter. If the wall telephone set is adjusted for maximum volume, speech distortion may occur. The station volume should be reduced until the distortion disappears. The 683A (MD) and the 683AE are functionally and physically the same; however, the 683AE does provide better static discharge protection than the 683A (MD).

### B. 33A Voice Coupler

#### 5.02 33A Voice Coupler:

- Interconnecting unit providing a point of connection for customer-provided music source used for music-on-hold and background music on paging system
- Wall mounted
- Potentiometer for adjusting background music level
- Two fuses for protection against hazardous voltages from music source.

### C. KS-21880L1 Loudspeaker

#### 5.03 KS-21880L1 Loudspeaker:

- Indoor speaker used for paging (cabinet type)
- 11 inches high, 10 inches wide, 6-1/2 inches deep
- Volume control potentiometer

- 45-ohm impedance
- Walnut finish cabinet
- Intended for wall mounting.

#### D. **KS-21939L2 Loudspeaker**

##### 5.04 **KS-21939L2 Loudspeaker:**

- For use at indoor or outdoor locations with paging (horn type)
- 7-1/2 inches in diameter, 7 inches deep, weight 3-1/4 pounds
- Volume control potentiometer
- Provides armoured protection.

#### E. **20A Apparatus Unit**

##### 5.05 **20A Apparatus Unit:**

- Provides for connecting a customer-owned and maintained (COAM) or a separate telephone company paging system to the COM KEY 2152
- Mounted external to the system
- Potentiometer for volume control.

#### F. **260A Adapter**

**5.06 260A Adapter:** This adapter is a vertical jumper clip which consists of a series of 50 terminals connected in a vertical column and covered by a plastic housing. The terminals are designed to mate with the 66-type terminals used on the option blocks (blocks 1 and 2) of the connecting units. The adapter strip can be cut with standard diagonal pliers to any desired length. If a given flexible line is to be multipled to 10 stations, the system should be configured with those 10 stations in numerical order. Then, the T, R, L, and A leads from that line should be connected to the T, R, L, and A leads of the first or last station in the group. The 260A adapters can then be cut to length and used to multiple the other stations in the group. If the stations involved in a large line multiple cannot be arranged in numerical order, then they should be grouped as much as possible to permit the use of the 260A adapter within the

group. The group should then be connected by jumpers from corresponding terminals at the beginning of one group to the other.

#### 6. **ORDERING GUIDE**

**6.01** The components required for COM KEY 2152 depend on the number of CO/PEX lines, the number of stations, and the size of the stations—that is, whether 10- or 20-button telephone sets. Table D can be used as a general guide in determining the major components required.

**6.02** Table E lists the equipment and the assigned USOCs for all common apparatus and related items.

**6.03** Table F lists the equipment that will be used at the station locations, such as telephone sets and consoles and their related items.

##### **6.04 Replaceable Components—Common Equipment**

###### (a) **121B Apparatus Box:**

- Kit of Parts, D-180675 (for rack mounting bulb-angle type).
- Kit of Parts, D-180865 (for rack mounting channel type).

###### (b) **34-Type Cabinet:**

- Kit of Parts, D-180780 (casters for 34C)
- 197A Backboard
- 154-Type Cover
- Kit of Parts, D-180700 (casters for 34B).

###### (c) **702-Type Feature Panel:**

- Fuse, 70A (1-1/3 amperes)
- Label, L-179222
- Units, Telephone, Key—400-type, 424C, 440A, 444-type, 452A, 453B, 454B, 455A, 460B, 473A, 474A, 478B, 457C, 481A, 451-type, or 498A/116A1 CM on 702B only
- Pack, Circuit, PY1B (polarity guards)

- Pack, Circuit, PY2 (selector counter relay networks).
- (d) **703-Type Panel:**
- Fuse, 70A (1-1/3 amperes)
  - Label, L-179223
  - Units, Telephone, Key—444-type, 452A, 453A, 468-type, 474A, 457C, 481A, 451-type, or 498A/116A1 CM
  - Pack, Circuit, PY1B (polarity guards).
- (e) **100- or 101-Type Connecting Unit:**
- Diode, 456F.
- (f) **2A Power Panel:**
- Fuse, 70A (1-1/3 amperes)—fuseboard
  - Fuse, 24C (2 amperes)—19C3 and 215C1 power units
  - Fuse, 24F (5 amperes)—19C3 power unit.
- (g) **2B Power Panel:**
- Fuse, 70A (1-1/3 amperes)—fuseboard
  - Fuse, 70B (2 amperes)—fuseboard
  - Fuse, 24B (3 amperes)—29E1 power unit
  - Fuse, 24C (3 amperes)—29E1 power unit
  - Fuse, 24F (5 amperes)—29E1 power unit.
- (h) **2C Power Unit:**
- Fuse, 70A (1-1/3 amperes)—fuseboard
  - Fuse, 70B (2 amperes)—fuseboard
  - Fuse, 24B (3 amperes)—29E1 power unit
  - Fuse, 24C (2 amperes)—29E1 power unit
  - Fuse, 24F (5 amperes)—29E1 and 67E1 power unit.
- (i) **2D Power Unit:**
- Fuse, 24F (5 amperes)—67E1 power unit.
- (j) **33A Voice Coupler:**
- Fuse, 35P (3/4 amperes).
- 6.05 Replaceable Components—Telephone Sets**
- (a) **832- and 2832-Type Sets:**
- Housing, 832A-50 (desk-type sets)
  - Housing, 6C1-50 (wall-type sets)
  - Faceplate, 832B-† (11-button rotary)
  - Faceplate, 833A-† (13-button rotary)
  - Faceplate, 2832B-† (11-button TOUCH-TONE dial)
  - Faceplate, 2833A-† (13-button TOUCH-TONE dial)
  - Dial, 8C (rotary sets)
  - Dial, 35AF3A (TOUCH-TONE sets)
  - Key, 647G5 (10-button)
  - Key, 651F (Recall)
  - Key, 647S5 (Recall, Privacy Release, and Ring Transfer)
  - Handset, G15A-50
  - Cord, H4DU-50
  - Lamp, 51A.
- (b) **833- and 2833-Type Sets:**
- Housing, 832A-50 (desk-type sets)
  - Housing, 6C1-50 (wall-type sets)
  - Faceplate, 833A-† (rotary sets)

† Add color suffix from Table B.

- Faceplate, 2833A-† (TOUCH-TONE dial)
- Dial, 8C or 8CA (rotary sets)
- Dial, 35AF3A (TOUCH-TONE sets)
- Key, 647K5 (lower key)
- Key, 647N5C or 647P5C (upper key)
- Handset, G15A-50
- Cord, H4DU-50
- Lamp, 51A.

#### 6.06 *Replaceable Components—Selector Consoles*

##### (a) *6B1 Console:*

- Faceplate, 6A2-†
- Cord, D50AD-50
- Housing, 6A1-50
- Key, 647AF5 or 647C5
- Lamp, 51A.

##### (b) *6C1 Console:*

- Faceplate, 6A2-†
- Cord, D150AD-50
- Cord, D6AJ-50
- Housing, 6A1-50
- Key, 647AC5C
- Lamp, 51A.

##### (c) *7B1 Console:*

- Faceplate, 7A2-†
- Cord, D100J-50
- Housing, 6A1-50
- Key, 647AF5 or 647C5

- Lamp, 51A
- Fuse, 70P (1/5 ampere).

##### (d) *7C1 Console:*

- Faceplate, 7A2-†
- Cord, D200AG-50
- Cord, D6AJ-50
- Housing, 6B1-50
- Key, 647AC5C
- Key, 647AB5C
- Lamp, 51A

- Fuse, 70P (1/5 ampere).

##### (e) *128A6Y Console:*

- Faceplate, 128C-†
- Housing, 840649503
- Cord, D150AH-50
- Cord, D200AH-50
- Key, 635CB5C
- Key, 635CC5C
- Lamp, 51A
- Fuse, 70P (1/5 ampere).

##### (f) *138A6Y Console:*

- Faceplate, 238D-† (lower section)
- Faceplate, 238E-† (upper section)
- Housing, 840494504
- Cord, D200AH-50
- Cord, D150AH-50
- Cord, D150AG-50

†Add color suffix from Table B.

- Key, 647C5
- Key, 635CB5C
- Key, 635CC5C
- Lamp, 51A
- Fuse, 70P (1/5 ampere).

### 6.07 *Replaceable Components—Telephone Consoles*

#### (a) *128A3-Type Console:*

- Faceplate, 128E-† (rotary dial)
- Faceplate, 128D-† (TOUCH-TONE dial)
- Cord, D100AC-50
- Key, 635BP5C
- Key, 635CG5C
- Key, 635BW5C
- Key, 635BU5C
- Handset, G15A-50
- Housing, 840649503
- Dial, 8CA (rotary dial)
- Dial, 35AF3A (TOUCH-TONE sets)
- Amplifier, 241B
- Tab, Key, Self-designating, 840711642
- Tab, Key, 840157259
- Lamp, 51A.

#### (b) *128A4-Type Console:*

- Faceplate, 128B-† (rotary dial)
- Faceplate, 128A-† (TOUCH-TONE dial)
- Cord, D150AE-50
- Key, 635CA5C

- Key, 635BY5C
- Key, 635BW5C
- Key, 635BU5C
- Handset, G15A-50
- Cord, H4DU-50
- Housing, 840649503
- Dial, 8R (rotary)
- Dial, 35F3A (TOUCH-TONE sets)
- Amplifier, 241B
- Tab, Key, Self-designating, 840711642
- Tab, Key, 840157259
- Lamp, 51A.

#### (c) *138A4-Type Console:*

- Faceplate 238A-† (lower section, TOUCH-TONE dial)
- Faceplate, 238B-† (lower section, rotary dial)
- Faceplate, 238C-† (upper section, TOUCH-TONE dial and rotary dial)
- Cord, D150AF-50
- Key, 647C5
- Key, 647AE5
- Key, 635CA5C
- Key, 635BY5C
- Key, 635BW5C
- Key, 635BU5C
- Handset, G15A-50
- Cord, H4DU-50

†Add color suffix from Table B.

- Housing, 840691505
- Dial, 8R (rotary)
- Dial, 35AF3A (TOUCH-TONE sets)
- Amplifier, 840501696
- Tab, Key, Self-designating, 840711642
- Tab, Key, 840157259
- Lamp, 51A.

†Add color suffix from Table B.

## 7. BASIC FEATURES

### A. Multiline Pickup

**7.01** Each station will have either 7 or 14 buttons which may be used for line appearances. Button location are given in Fig. 15 for telephone sets.

**7.02** The station with 7 line buttons (832- or 2832-type) will have 5 buttons dedicated to common lines (square lines) and 2 buttons (7 and 8) called flexible buttons. In the 702A or 703A feature panels, these buttons can be used for common lines, personal lines, private lines, or an automatic signaling intercom. Refer to Part 8, OPTIONAL FEATURES, for detailed applications and restrictions in the use of these buttons. Button 8 may also be used for a third intercom line, but only when all 832-type telephone sets in the system are so equipped. Buttons 9 and 10 of the 832- or 2832-type telephone set are dedicated to two common intercom paths, and the first button on the telephone set is the HOLD button. Some 832- or 2832-type sets are equipped with 13 buttons. Buttons 11, 12, and 13 are dedicated to RECALL, PRIV RLS, and RING TR, respectively.

**7.03** The stations with 14-line buttons (833- or 2833-type) will have 12 buttons (2 through 6 and 14 through 20) dedicated to common lines (square lines) and 2 buttons (7 and 13) called flexible buttons. The flexible buttons may be used for common lines, personal lines, private lines, or an automatic signaling intercom. Button 7 can also be used as a multiple appearance of the third intercom path for conferencing purposes. Buttons 8 through 10 are dedicated to 3 common intercom

paths. The first button is the HOLD button, and button 11 is dedicated to RECALL and button 12 to RING TRANSFER or PRIVACY RELEASE.

### B. Hold and Illumination

**7.04** The COM KEY 2152 has the same CO/PBX HOLD operation and button illumination as a standard key telephone system, including wink hold. See paragraph 7.07 for intercom lamp signals.

### C. Multipath Intercom

**7.05** The intercom has either 2 or 3 paths. A path is selected by depressing one of the intercom buttons on the telephone set. There is no privacy on any path and any station may break into an existing conversation.

**7.06** The intercom can individually signal up to 55 codes, 52 of which can be stations and 3 for paging or preset conferencing. The number of codes available for stations may vary; for instance, if 3 paging and 3 preset conferencing codes are both required, only 49 station codes are available. The system can also be equipped for configurations that permit 18 stations with one paging zone (424C selector only) or 34 stations with three paging zones. If a third intercom link is installed, all telephone sets must be equipped with this feature. A 494A KTU may be used to replace the 424C and the 440A KTU when TOUCH-TONE dialing on intercom is desired. When the 494A KTU is used, all intercom stations in the system must be equipped with TOUCH-TONE dials.

**7.07** The selector used to select and alert the called stations is shared by all intercom paths. The alerting signal at the called station is tone burst (500-Hz for approximately 0.5 second) followed by a voice signal from the calling station. The lamp signals on the intercom are as follows: When the selector has seized a path, the lamp associated with the path will flash on all telephone sets. This shows the called party which path to answer. No other intercom path can seize the selector while the lamp is flashing. When the called party answers, the flashing intercom lamps change to steady. When an intercom path is idle, the associated lamp is off.



**7.08** To place an intercom call:

- (a) Select idle intercom and depress associated button. None of the intercom buttons can be flashing (only one selector is supplied for station-to-station intercom calls).
- (b) Lift telephone handset.
- (c) Listen for intercom dial tone.
- (d) Dial selected station-tone burst signals called station.
- (e) Calling station makes announcement to called party. When called party answers by depressing flashing intercom button, the lamp associated with that button changes to steady.

**7.09** Intercom is factory-wired and each intercom code is determined by the column on blocks 5 through 10 of the connecting units.

#### **D. Tone and Voice Signaling**

**7.10** The CO/PBX signaling is a distinctive warbling tone (900-1100 Hz) heard through a speaker in the telephone set. Voice signaling is used in conjunction with tone signaling (500 Hz—approximately 0.5 second) when calling a station on the intercom. When the attendant receives incoming CO/PBX tone signals and is simultaneously signaled on the intercom, the intercom signal is given preference (see Table G).

#### **E. Recall**

**7.11** Every telephone set used with COM KEY 2152, except intercom-only sets, is equipped with a RECALL button. The momentary operation of the RECALL button simulates the switchhook flash without restoring depressed line buttons to normal.

#### **F. Multiline Conferencing**

**7.12** Two or more CO/PBX lines may be conferenced together by simultaneously depressing the line buttons of the lines to be conferenced. When lines are conferenced using this manner of conferencing, transmission levels will be reduced and transmission is not guaranteed.



***The CO/PBX and the third intercom path can only be conferenced when the third intercom path appears on one of the flexible buttons or at an attendant's position with IC/CO conferencing. If the system is equipped with the third intercom path, it must appear at all stations.***

**7.13** All lines that are conferenced together may be put on hold simultaneously by depressing the HOLD button except when more than one station is off-hook on the same line.



***Intercom lines cannot be placed on hold.***

**7.14** Conferencing is a mechanical function of the telephone set and requires no wiring.

**7.15** To make a call during a conference:

- (a) Depress HOLD button—all buttons restored.
- (b) Select an idle line.
- (c) Dial call.
- (d) If it is desired to add this call to the conference, hold this CO/PBX line button down and depress the conference CO/PBX line buttons.
- (e) If not to be a conferee, for instance an attendant who has set up conference call, restore handset.
- (f) To reenter conference again after call is completed, simultaneously depress conferenced line buttons again.

**7.16** If it is desired to add another call to the conference, while holding the conferenced CO/PBX line buttons down, depress button of CO/PBX line to be added. To prevent dropping one of the participants when setting up a conference, ensure that the conference line buttons are held down when adding another line.

**G. Automatic Button Restoration (ABR)**

**7.17** Automatic button restoration is a feature on all 832-, 833-, 2832-, and 2833-type telephone sets used with COM KEY 2152. The ABR is not available on the 128A3, 128A4 or 138A4 answering positions, or intercom-only sets. When the handset is placed on the cradle, all depressed buttons return to the unoperated position. This prevents inadvertent intrusion on calls in progress and insures that multiple buttons will not be left depressed on a set causing an undesired conference from the idle set.

**7.18** The ABR is a mechanical function of the telephone set; no wiring is required and field adjustment of the mechanism is not to be done.



***The CO/PBX lines may be disabled (lines bridged) if multiple CO/PBX buttons of a line in operation are depressed at an idle station.***

**H. Ring Transfer**

**7.19** Ring transfer permits switching the incoming CO/PBX signaling from the answering position(s) to an alternate location(s). If an 832-, 833-, 2832-, or 2833-type telephone set or a 128A3-type console is used at the attendant position, one button is provided for ring transfer. If a 128A4- or 138A4-type console is used, up to three choices of ring transfer can be supplied.

**7.20** To effect ring transfer, the ring transfer button on the attendant telephone set or console must be depressed. To transfer ringing back to the attendant station, the ring transfer button is depressed again, allowing it to return to normal. During the time the button is depressed, the button will be illuminated. More than one station can receive transferred calls as long as the total does not exceed 10.

**7.21** Additional ring transfer is also optionally available and is described under OPTIONAL FEATURES (paragraphs 8.58 and 8.59).

**8. OPTIONAL FEATURES****A. Privacy**

**8.01** Privacy prevents a station from bridging into a CO/PBX call in progress. If a system has privacy, all stations must be equipped. Privacy is a station feature and each station that is to be excluded (locked out) must be equipped with a privacy circuit board.

**8.02** The 832/2832CM, 832/2832EM, 833/2833BM, and 833/2833DM telephone sets are wired at the factory with the privacy circuit operational.

**8.03** The privacy circuit operates only when the telephone set is off-hook. The circuit monitors the "A" lead to determine the status of the line. Ground (or positive potential) on the "A" lead indicates the line is busy, operates the privacy circuit, and the station attempting to bridge is excluded. A negative potential on the "A" lead causes the privacy circuit not to operate and the set is not excluded. There is no privacy on the intercom paths.

**Note:** Because of a conflict in the use of "A" lead control, a system equipped with a 471A (MD) KTU cannot have privacy and toll restriction at the same time. Systems equipped with a 471B KTU can provide both these features.

**B. Privacy Release**

**8.04** Privacy release, when operated at a station already off-hook, releases the privacy circuit in a privacy equipped (locked-out) telephone, permitting the locked-out telephone to bridge into a call on a CO/PBX line.

**Note:** When privacy release is provided, all stations in the system must be equipped.

**8.05** The 832/2832CM, 832/2832EM, 833/2833BM, and 833/2833DM telephone sets are factory-equipped with a PRIV RLS button.

**8.06** When a station is off-hook with CO/PBX line button depressed, any other station equipped with a privacy circuit will be locked out from that

CO/PBX line. To permit a second station that is privacy-equipped to bridge into a call:

- (a) Depress (and hold down) the PRIV RLS button at first station.
- (b) Observe that line lamp changes from steady to wink (indicating the line has gone on hold). The privacy-equipped station may now bridge into the call.
- (c) Observe the line lamp changes from wink to steady (indicating station has entered the call).
- (d) Release the PRIV RLS button at the first station.

**8.07** To allow a third privacy-equipped station to bridge into the call, both stations must depress their PRIV RLS buttons simultaneously. The line lamp will change from steady to wink. As the third station bridges into the call, the line lamp will become steady. The PRIV RLS buttons can then be released, and all three stations are bridged.

#### C. TOUCH-TONE Adapter

**8.08** If TOUCH-TONE dial sets are used with the 21A Communication System, a 440A or 478B KTU (TOUCH-TONE adapter) must be supplied. Install the KTU in J12A and J12B of the 702-type panel. A 440A or 478B KTU is not needed when the 494A KTU is provided.

**Note:** When supplying TOUCH-TONE adapter, the RS1-CG1 strap must be removed from between 36A and 37A on block 2 of the 100A1, 101A1, or 101A2 connecting unit.

#### D. CO/PBX-Intercom/Line Conferencing

**8.09** Intercom/line conferencing is a feature of the telephone sets and answering positions used in the system. Since there is no amplification involved, this type of conferencing is limited. Distant parties on the CO/PBX lines may have difficulty hearing each other.

**8.10** Conferencing is accomplished by simultaneously depressing the CO/PBX line button(s) and the third intercom path button.



**The CO/PBX lines and the third intercom path can only be conferenced when the third path appears on one of the flexible buttons.**

#### E. Personal Lines

**8.11** This feature permits a personalized arrangement of nonsquare CO/PBX lines to flexible buttons. Refer to paragraph 2.04 for a full explanation of feature.

**8.12** The T, R, L, and A leads of the 7th and 8th pickup buttons of the 10-button set, or the 7th and 13th buttons of the 20-button set are terminated on block 1 of the connecting unit, depending on the station code assigned. As factory-wired, there will be nothing wired to these buttons and they may be wired as required to pick up a personal line, square line, automatic signaling intercom, private line, or third intercom path.

**8.13** If a personal CO/PBX line is to appear on one of the flexible buttons, the T, R, L, and A leads of the line appearance on block 1 of the connecting units must be cross-connected to the proper button(s). Personal lines can appear on more than one telephone set. Where more than two consecutive station codes are to be multipled, the 260A adapter may be used. The adapter can be cut to provide as many multiples as required.

**8.14** At installations having only a 702-type panel (7-line capacity), lines 6 and 7 may be used as personal lines. At installations also equipped with a 703-type panel, lines 8 through 21 can be used as personal lines if the system is equipped with 10-button sets **only**. If **any** 20-button sets are used, only lines 13 through 21 can be personal lines because lines 1 through 12 appear on all 20-button sets as square lines.

#### F. Station Line Ringing

**8.15** The CO/PBX lines can be arranged to ring at one to four stations (maximum of two in addition to the two attendants) by strapping the RC lead from the CO/PBX line to the station CO lead on block 2 of the connecting unit. If two lines are to ring at a station other than the attendant, neither of the two lines can ring **alone** at another station, that is, both lines must also ring at the second station. Also, if it is desired that one of the two lines not ring at the attendant

station, neither of the lines can ring at the attendant station; ie, both common audible diodes would have to be removed.

An example would be where a personal line is to ring at station codes 7 and 8 but not at the attendant. In this case, the RC lead of the CO/PBX line must be strapped to the CO lead of station codes 7 and 8 and the common audible diode for the CO/PBX line removed on block 4 of the 100A1, 101A1, or 101A2 connecting unit.

**8.16** If two personal lines are to ring at station codes 7 and 8 but not at the attendant, the above procedure must be completed for both lines.

**Note:** Both lines must ring at the attendant or neither line can ring at the attendant. Both diodes must be removed or both must be left in place.

#### G. Common Audible Ringing

**8.17** The 21A Communication System is factory-wired so that intercom code 0 receives tone ringing on all CO/PBX calls. The attendant answers all incoming calls and either takes a message or forwards the call to the desired party using the intercom or, if so equipped, on the console dedicated link (DSS).

**8.18** Common audible is derived through diodes located on block 4 of the 100A1, 101A1, or 101A2 connecting unit. There is one diode per CO/PBX line. To remove a CO/PBX line from the common audible group, remove the corresponding diode on block 4.

**8.19** Other stations besides or rather than code 0 may be arranged for common audible ringing by running a strap from the common audible terminals (22F or 22G on block 2) to the station CO lead. Connections in the 101A1, 101A2, and 101B1 connecting unit are made in a similar manner except the station code terminals appear in a slightly different manner. The maximum number of stations that can be signaled at the same time is 10. If code 0 is not to receive CO/PBX calls, remove the factory-wired strap. The limitations outlined under **Station Line Ringing** must also be observed.

#### H. Power Failure Transfer

**8.20** This feature provides an audible indication of incoming CO/PBX calls any time commercial power is lost to the 21A Communication System. The tip and ring of all CO/PBX lines are wired through normally made contacts of one of the 452A KTUs. The relays in the KTU are operated as long as power is being supplied by the power panel. If this power is lost, the relays are released and the CO/PBX line is cut through to an external ringer at the desired station(s). The ringer(s) (EIC) or auxiliary signal device are not part of the station sets and must be externally provided.

**8.21** To provide power failure transfer, a 452A KTU (one per 7 CO/PBX lines) is required. For lines 1 through 7, install in J5A of the 702-type panel; for lines 8 through 14, in J5A of the 703-type panel; and for lines 15 through 21, in J10A of the 703-type panel. In addition, the EIC ringer or auxiliary signal device must be connected to the EXT and EXR leads of the line involved using separately run quad wire or cable.

#### I. Hands-Free Answer on Intercom (HFAI)

**8.22** This optional station feature requires the installation of a 683A (MD) or 683AE transmitter at any station having the feature, including attendant stations. Each wall-type telephone set having HFAI also requires a 268A adapter which is used to mount the transmitter on the wall set adapter. When 268A adapters are used, a 468B KTU must be used or a 468A (MD) must be replaced to reduce feedback between the loudspeaker and transmitter. In addition, a 473A KTU must be installed in J10 of the 702-type panel. It permits HFAI stations to:

- Answer incoming intercom calls without going off-hook with 2-way conversation
- Respond to intercom call while engaged in a CO/PBX call
- Disable the HFAI feature if desired
- Activate the do not disturb (DND) feature
- Answer dedicated link call (DSS).

**8.23** Also required are the 474A KTUs installed as follows:

- 1st one in J8 of 702-type panel for stations 2 to 18 in a 702A panel or 0 to 17 in a 702B panel
- 2nd one in J9 of 702-type panel for stations 21 to 36 in a 702A or 702B panel
- 3rd one in J12 of 703-type panel for stations 35 to 52.

This unit is the DSS diode matrix and preempts tone generator which allows the attendant to preempt an HFAI call with a dedicated link call.

**8.24** The HFAI is connected by terminating the cord from the 683A (MD) or 683AE transmitter on the telephone set terminals and modifying the set.



*Option strap on the 468A KTU or option plug on the 468B must be removed.*

**8.25** When an HFAI-equipped station is called over the intercom selector, the station is signaled by the normal tone burst, and the HFAI microphone and LED are activated. The called station can now hear over the set loudspeaker and answer "hands free" until the calling station goes on-hook or the called station goes off-hook. Operating the OFF control disables all HFAI features, and the station operates like any intercom station until the ON control is operated. If the DND control is operated, stations calling an HFAI station over the multipath intercom will receive the DND tone. The DSS console will receive a DND lamp indication on the busy lamp field. Releasing the DND control permits incoming calls and signals to be received in the normal manner (see paragraph 8.26).

**Note:** The HFAI calls placed through the selector tie up the selector for the duration of the call.

#### J. Do Not Disturb (DND)

**8.26** This feature prevents all incoming dial intercom and DSS signals from entering the speaker and from turning on the microphone. The DND is available only on stations that are equipped

for HFAI, as the DND activation button is located on the 683A transmitter unit. There are *two* DND signals in COM KEY 2152 as follows.

- (a) The *first* is a **visual signal** on the station busy lamp associated with the DSS button on the attendant console. This permits the attendant to instantly see which station does not want to be disturbed.
- (b) The *second* is an **audible signal** which is sent to any station that is calling another station that does not want to be disturbed. The audible signal is continuous 500-Hz tone which the calling party will hear in the telephone set receiver.

#### K. Intercom-Only Station

**8.27** At locations that will only be making internal calls and do not require access to the CO/PBX lines, a 575AM or 2575AM telephone set may be installed. With this arrangement, only the two or three intercom paths can be accessed. All other buttons are mechanically blocked including the red one which is equipped with a lamp for message waiting where required. The 20-conductor mounting cord is equipped with a plug which permits mating with a standard A25B connector cable. As supplied, the set is not wired for the third intercom path and the mounting cord leads must be terminated in the set to provide access. The pickup buttons and lamps operate in the same manner as for the intercom paths of a full service station.

#### L. Acces to Supplementary Ringing Devices

**8.28** Where external signaling devices (such as bells, gongs, chimes, lights, or buzzers) are to be connected to the 21A Communication System, a 22A-49 apparatus unit must be provided. The 22A-49 apparatus unit is externally mounted and connections are made to the 21A Communication System with inside wire. Also, an external power supply must be provided to operate the signaling devices. The 22A-49 apparatus unit may be used to activate external signal devices that are operated by an open circuit (through a relay break contact) or that are operated by a circuit closure (through a relay make contact).

**Caution:** *The 22A-49 apparatus unit contains a nonadjustable, mercury-wetted*

***sealed contact relay and must be mounted in a vertical upright position.***

**8.29** The 22A-49 apparatus unit is used to activate external signaling devices that are connected for:

- Station codes
- Common audible
- CO/PBX ringing
- Ring transfer.

**Note:** When an external signaling device is operated by a station code, the device will sound continuously until the calling party hangs up or a second station goes off-hook on the intercom path.

**8.30** One 22A-49 apparatus unit is required for each station code or each CO/PBX line equipped with an external signaling device. The maximum resistance of each lead between the 21A Communication System and the 22A-49 apparatus unit is 25 ohms.

**8.31** The KS-16301 type auxiliary signals are recommended as external signaling devices for use with COM KEY 2152. Refer to Section 463-110-100 for identification, installation, operation, maintenance, and ordering information on the KS-16301 type signals.

**8.32** The external power supply used to operate the signaling devices must be properly fused and have the capacity to adequately power the signaling devices.

**8.33** Information found in Section 167-416-201, 167-440-201, or 167-446-101 may be used as a guide toward selecting an appropriate power supply. Do not use a power supply that exceeds the contact rating of the 22A-49 apparatus unit which is 130 volts, 1.5 amps, 25 volts/amps.

#### **M. Automatic Private Line**

**8.34** A 415A KTU can be used to supply private line circuits (with optional hold and visual indication) for appearance in the following CO/PBX

line positions if the system is equipped with music-on-hold:

- 702-type feature panel—J4A
- 703-type feature panel—J1B, J2A, J2B, J3A, J3B, or J4A.

If the system does not have music-on-hold, the 415A KTU can be put in any connector of a 702-type or 703-type feature panel used for a CO/PBX line. A 415A KTU or equivalent is required at the distant end.

**8.35** To provide the private line circuit, install the 415A KTU in place of a 400-type KTU in the proper jack and connect the T and R to the distant end on the normal CO/PBX incoming line termination. If the appearance is on one of the flexible buttons, cross-connection must be made on block 1 in the same manner as for a personal line appearance. The private line can appear at other stations by the use of vertical bridging on block 1 of the connecting units. In addition to these connections, the connection to the music-on-hold circuit, if so equipped, must be removed from the line position being used by the 415A KTU.

**8.36** Line positions 7, 9, 10, 11, 12, 13, and 14 have provision for removing music-on-hold circuit. If a 415A KTU is used in any one of these positions, the corresponding factory-provided strap on block 2 of the 100A1 or 101A1 connecting unit must be removed. It should be noted that if a block of 7 line positions is to be equipped with 415A KTUs, the music-on-hold feature can be eliminated by removing the 451B KTU associated with those 7 lines. Removal of the 451B KTU eliminates the requirements for removing any straps on block 2.

#### **N. Music-On-Hold**

**8.37** Music-on-hold requires one 33A voice coupler per system and a customer-provided music source. In addition, KTUs are required as follows.

- 702A or 703A feature panel—one 451B KTU per each 7 CO/PBX lines.
- 702B or 703B feature panel—one 498A KTU (maximum of 4 circuits) equipped with a 116A1 CM (3 additional circuits) for each 7 CO lines.

**Note:** The 451B and 498A KTUs are not electrically compatible and cannot be interchanged between A-coded and B-coded feature panels.

**Note:** To reduce feedback, no speaker should be closer than 60 feet to any station used for paging.

**8.38** The customer-provided music source must have an output impedance low enough to drive an 8-ohm load without distortion. The music source must also be adjustable so the listening level of the music-on-hold may be adjusted.

**Caution:** *The output of the CP music source must furnish ac coupling only, thus blocking all direct current to the input terminals of the 33A voice coupler. The CP music source should be able to deliver up to one watt into an 8-ohm load. The 33A voice coupler will accept input from any customer-provided apparatus that does not blow the fuses in the voice coupler. If the customer wants a copy of the technical reference covering the 33A voice coupler, contact the local Telephone Company Business Office or the Marketing Representative. If a service call is caused by a malfunction of the customer-provided equipment, billing should be made in accordance with Section 660-101-312.*

#### O. Loudspeaker Paging and Background Music

**8.39** Paging may be provided in up to three separate zones with each zone having up to seven indoor or outdoor speakers. The system has the flexibility of allowing all paging amplifiers or any combination of amplifiers to be activated by dialing one of the codes (usually 37, 38, or 39). In an 18-station system, code 19 is used for paging. Only one paging call may be made at a time since paging uses the intercom selector. If any station picks up the intercom path, paging will be interrupted. The paging option straps must be placed before the amplifiers will operate.

**8.40** A paging system should be loud enough to be heard, but not loud enough to annoy those working near speakers. The paging amplifiers (475C KTU) has a peak power output of 3 watts. The number and location of the speakers are influenced by the environment in which the speakers are used. Several samples of speaker placement are shown in Fig. 18. It may be necessary to experiment with speaker placement on site for proper results. General information on loudspeaker paging systems can be found in Section 981-251-100.

**8.41** In COM KEY 2152, the paging amplifiers can be activated in three combinations as determined by the placement of the zone straps. Each amplifier can drive up to seven speakers. If more than seven speakers are required in a particular zone, additional amplifiers must be wired to be activated by that zone code. In addition, if combinations of zones are required to make up a zone, combinations of amplifiers must be activated by the same code. As an example, the first zone could include speakers 1 and 2 driven by the first amplifier and activated by dialing code 37. The second zone could include speakers 3, 4, and 5 driven by the second amplifier and activated by code 38. The third zone could include speakers 1, 2, 3, 4, and 5 driven by the first and second amplifiers and activated by code 39. Install the KTUs only in option slots J7A and J7B of the 702-type panel and J10B of the 703-type panel. **Do not use the other two option slots in the 703-type panel** for a 457C KTU. Straps are factory-wired to the usable jacks for the PT, PR, PA, and PC leads but straps must be added to activate the desired zones. In addition, straps must be added to wire the PC1, PC2, and PC3 leads to the proper intercom code.

**8.42** On a DSS console, if provided, the location of the paging button(s) will not change regardless of the code assigned. Paging code 1 (PC1) will always appear on the first paging button, paging code 2 (PC2) on the second, and paging code 3 (PC3) on the third. When paging is provided, the 812365948 button stop, if provided, must be removed from the associated paging button of the DSS console.

**8.43** If a code other than 37, 38, or 39 (code 19 in an 18-station system) is assigned for paging, an 812365948 button stop must be placed in the corresponding button of the DSS console to prevent depression. For instance, if code 6 is assigned for paging, the DSS button assigned to code 6 must have a button stop.

**8.44** When one or more of the paging buttons on a DSS console is depressed, those buttons will flash. This notifies other attendants in a system having multiple consoles that paging is in use. Only one DSS console may page at a time,

even if the system has more than one paging zone. Simultaneous operation of paging buttons from one DSS console is permissible. This results in paging connections to the associated zones. A page from a DSS console will preempt a page originating over the intercom.

**8.45** Speakers used for paging in the 21A Communication System must be 45-ohm impedance. Use KS-21880L1 loudspeaker for indoor locations and KS-21239L2 loudspeakers for indoor or outdoor locations where a horn-type speaker is required. The KS-21880L1 can be wall-mounted or hung over an outlet box. The KS-21880L1 and KS-21239L2 speakers are both equipped with an internal volume control.



*Speaker volume level will be affected by changes in room content. The addition of furniture, draperies, carpeting or wall covering may necessitate increasing speaker volume.*

When using outdoor speakers, the speaker leads must be protected in accordance with local instructions or Section 460-100-400.

**8.46** Background music requires the installation and connection of a 33A voice coupler. If music-on-hold is also provided, the same music source and coupler are used.

#### P. External Paging System Access

**8.47** A COAM paging system or a separate telephone company-provided paging system is connected to the 21A Communication System through a 20A-49 apparatus unit. The 20A-49 apparatus unit is mounted externally to the 21A Communication System. It does not provide contact closure to the customer-owned paging system.



*The 20A-49 apparatus unit provides a nominal 300-ohm output to a customer-owned paging system. It does not provide a means to activate the customer's equipment; therefore, customer equipment must be in the ON mode at all times.*

#### Q. Preset Conference on Intercom

**8.48** Preset conference on intercom allows up to three groups of preselected stations (maximum

of five stations per group) to be alerted simultaneously. Individual stations can appear in only one group. Normally, codes 37, 38 and/or 39 are used for conferencing; but if these codes are used for paging, any other codes may be assigned but must be sacrificed for station use.

**8.49** To connect preset conference, a strap must be run from the C1, C2, or C3 terminal to the preset conference terminal for the code assigned on block 2 in the 100A1, 101A1, or 101A2 connecting unit. Another strap must be run from the PC1 to PC5 terminals to the preset conference terminals of the station codes in the group.

**8.50** To use preset conference:

- (1) Lift handset.
- (2) Select idle intercom path and depress associated button.
- (3) Dial code assigned to signal desired group of stations.
- (4) Announcement is made to select stations simultaneously. If stations are equipped with HFAI, they may reply to caller but other stations will not hear reply and cannot converse with each other. If an HFAI station has the DND feature operated, the station will not receive the tone and voice signaling, and the calling party will not receive the DND tone. If any station goes off-hook, the intercom line is seized and voice signaling stops at all other sets.

**Note:** The attendant will **NOT** have preset conference capability from a DSS console. If a preset conference code other than 37, 38, or 39 is used and the system is equipped with HFAI option, an 812365948 button stop must be placed under the DSS button of the preset conference code to prevent button depression.

#### R. Speakerphone

**8.51** Full speakerphone service can be provided at all stations in the system using either 3B (MD) or 4A speakerphone components.

**Note:** Speakerphone does not prevent normal operation of the telephone set for originating or receiving calls.



If 4A speakerphone is provided, order a D-180508 Kit of Parts for each speakerphone location to provide the color-coded parts for the 4A components.

**8.52** To originate a call using a speakerphone:

- (1) Depress CO/PBX button associated with an idle line.
- (2) Momentarily depress transmitter ON button. ON lamp lights and dial tone is heard through the loudspeaker.
- (3) Dial number in normal manner.
- (4) When called party answers, transmitter and loudspeaker are used to carry on the conversation. Adjust volume level as desired.

**8.53** To answer an incoming call using speakerphone:

- (1) When audible tone signals an incoming call, depress CO/PBX or intercom key associated with flashing lamp.
- (2) Momentarily depress transmitter ON button. Audible signal is silenced and the speakerphone is connected to the line.
- (3) Answer call using transmitter and loudspeaker to carry on conversation.

**8.54** To disable transmitter when it is desired not to transmit conversation from the surrounding area to the distant station:

- (1) Depress transmitter ON button during entire period transmitter is to be disabled.

**Note:** With transmitter disabled, conversation will not be transmitted to the distant station; however, the distant party may be heard over the loudspeaker.

- (2) Release transmitter ON button and system is restored to hands-free operation.

**8.55** To transfer from handset to speakerphone operation:

- (1) Put line on hold
- (2) Hang up handset

- (3) Turn speakerphone on

- (4) Depress line button.

**8.56** To transfer from speakerphone to handset operation, lift handset during speakerphone operation to automatically transfer to handset operation. When it is necessary to transfer back to speakerphone, refer to paragraph 8.55 to prevent disconnect. To terminate a call on speakerphone, momentarily depress transmitter OFF button. In the case of a 128A4 or 138A4 console, the release button must also be depressed.

**Note:** Restore any depressed line buttons. While line switch flashing, hold line button depressed to avoid dropping the line. If sets are equipped with RECALL, it is not necessary to depress the line switch.

## 5. Additional Ring Transfer

**8.57** Additional ring transfer employs the use of a separately mounted 6041G key in conjunction with the ring transfer button on the attendant position(s) telephone set or console. The 6041G can be wired to permit transfer of incoming CO/PBX calls to one of up to five choices of station(s). The hold button of the key is used as a release button. This feature adds flexibility to ring transfer feature. Where only one button is available on 11-, 13-, and 20-button answering positions or three available on the 138A4 and 128A4 type consoles.

**8.58** To effect additional ring transfer, the preferred button on the 6041G is depressed, locking it down, then the ring transfer button on the attendant station telephone set or console is depressed which also locks down. To return calls to the attendant, the ring transfer button is again depressed, releasing it, and the hold button on the 6041G key is depressed, releasing its button.

## T. Toll Restriction

**8.59** The toll restriction circuit used [471 (MD) or 471B KTU] **requires that the CO line reverse the battery on the tip and ring of the line when a toll call is attempted.** Two arrangements can be provided:

- Restriction on a square line with all stations including attendants restricted

- Restriction on a personal line with some stations restricted and others unrestricted.

**Note:** Toll restriction and privacy cannot be offered at the same time if the 471A (MD) is used, both features can be provided with the 471B KTU.

**8.60** Either arrangement requires a 471-type KTU per restricted line and a suitable mounting external to the 21A Communication System. A 620A modular panel should be used to mount the first eight 471-type KTUs and a 642A panel for each four additional KTUs. A 19B2 power unit and a 92A connecting block are required to power the panels, and additional 66-type connecting blocks may be required to provide sufficient multiples.

**8.61** In both arrangements, the CO/PBX line is taken first to the T(CO) and R(CO) input of the 471A KTU and the T(STA) and R(STA) from the 471A KTU to the normal line input of the 21A Communication System.

#### U. Automatic Signaling Intercom

**8.62** Automatic signaling intercom supplements the dial intercom circuitry in the COM KEY 2152 to provide a private voice and tone path between two stations such as a boss and secretary. Where required, the arrangement can also serve several stations to one station, for instance, where more than one boss shares the same secretary. In this instance, however, the secretary can only signal one boss. Signaling can optionally be one-way in either direction or two-way.

**8.63** Installation of each of the automatic signaling intercoms requires use of one of the two flexible button positions at each of the stations involved and a 481A KTU per automatic signaling intercom circuit installed in the optional connectors of the 702- or 703-type panel. If automatic signaling intercom is supplied, the factory-placed paging straps to the connector used must be removed and the wiring for the automatic signaling intercom placed. It is preferable to use option slots 4 or 5 (Fig. 9) to provide this feature.

**8.64** The intercom operates as follows.

- The originating station goes off-hook and depresses the button associated with the automatic signaling intercom circuit.

- The associated button lamp will flash at all stations on the circuits and the called station will receive a tone alert in the set speaker the same as for dial intercom.

**Note:** Other stations calling the called station by dial intercom will receive a steady preempt tone.

- The calling station may now voice signal the called station. If 2-way conversation is required, the called station goes off-hook and depresses the flashing button which turns to steady. Conversation is now possible using the handsets.

**Note:** Automatic signaling intercom provides voice and tone signaling even if the station is equipped with HFAL.

- If only two stations are in the circuit, operation is exactly the same in the other direction.

#### V. Station Restriction

**8.65** This feature prevents any outgoing CO/PBX calls from being made at a restricted station. The restricted station may receive CO/PBX calls or place and receive intercom calls, but cannot call out on CO/PBX lines. This is accomplished by adding a diode (rotary dial sets only) and reversing one or two leads in the telephone set.

**Note:** Station restriction and CO/PBX intercom conferencing cannot be provided at the same station.

#### W. Answering Positions

**8.66** The 21A Communication System provides terminations for two designated answering or attendant positions. As factory-wired, intercom code 0 is the first attendant and code 10 would normally be the second. Other stations may be designated if desired. The telephone set or console to be used at these positions will be dependent on the capacity of the system and the system features required. Each of the attendant positions will require one of the following for handling CO/PBX lines:

- Maximum 7 lines—832/2832CM or EM telephone set

- Maximum 14 lines—833/2833CM or EM telephone set and 128A3R or 128A3T telephone console
- Maximum 21 lines—128A4R, 128A4T, 138A4R, or 138A4T telephone console.

**8.67** The **832C or 2832C** telephone sets have a hold, 7 line pickups (2 flexible), 2 intercom pickups, recall, privacy release, and ring transfer. In systems without privacy, the privacy circuit must be disabled. The **833C or 2833C** telephone sets have hold, 14 line pickups (2 flexible), 3 intercom pickups, recall, and ring transfer. In systems with privacy, a D-180486 Kit of Parts must be installed in the 833C- or 2833C-type telephone sets.

**8.68** The **128A3-type** console has the following (Fig. 16): hold, 12 line pickups, 3 intercom pickups, 2 flexible line pickups, a release button, ring transfer, recall, and privacy release on the left side of the faceplate. On the right side of the faceplate is an intercom/line conferencing key field consisting of 12 line pickups, 2 flexible line pickups, 3 intercom pickups, and a status lamp which indicates when a call set up through the conferencing field has been terminated. The consoles are provided with two sets of jacks for a head telephone set or handset which must be separately ordered. The handset cradle is inoperative. Also supplied is a privacy circuit which must be connected in systems with privacy.

**8.69** The **128A4** console has the following (Fig. 16): hold, 21 line pickups, 3 intercom pickups, 2 flexible line pickups, a release button, 3 ring transfers, privacy release, and recall. The **138A4** has the same key layout on the lower portion but, in addition, has an upper intercom/line conferencing key field which contains 21 line pickups, 3 intercom pickups, and a status lamp which indicates when a conferencing call is completed. The consoles are equipped with jacks for a headset or handset which must be separately ordered. The handset cradle is inoperative. These consoles are supplied with a privacy circuit which must be connected in systems with privacy.

**8.70** In addition to one of the line handling telephone sets or consoles listed above, another console may be required, the type depending on whether direct station selection with dedicated link (DSS/DL), station busy (SB), and/or message

waiting (MW) are to be supplied. One of the following should be used:

- 6B1 console—MW control and SB lamps, maximum 18 stations
- 7B1 console—MW control and SB lamps, maximum 34 stations
- 6C1 console—DSS with SB, maximum 17 stations
- 7C1 console—DSS with SB, maximum 34 stations
- 128A6Y console—DSS with SB, maximum 52 stations
- 138A6Y console—DSS and MW with SB, maximum 52 stations.



***If there is only one DSS console in the system, it must be cut down as console 1 on all outdown blocks.***

**8.71** The **6B1** console (Fig. 17) contains a 20-button lamp field (two spare). The lamp under the buttons light when the associated station is off-hook. The locking type buttons are used to light the MW (Hold) lamp at the stations. The 7B1 console performs the same functions but has 40 buttons (six spare) for a system up to 34 stations.

**8.72** The **6C1** console is a 20-button console made up of 17 DSS/SB buttons, one paging, one restore, and one reenter button (Fig. 13). The **7C1** console contains 40 buttons—34 DSS/SB, three paging, one restore, one reenter, and one spare. Any combination of DSS buttons may be depressed simultaneously for multistation signaling, but this feature should not be used for conferencing since the console is tied up for the duration of the call. Preset conferencing is not allowed from the DSS console. After a CO/PBX pickup button is depressed on the line answering telephone set or console, depressing any DSS button on the 6C1 or 7C1 console will automatically put that line on hold. The line pickup button does not restore and, if desired, the attendant can reconnect to the line by depressing the reenter button. When the attendant depresses a DSS button on a 6C1 or 7C1 console, the signaling path is over the dedicated link and does not involve the intercom selector,

leaving it available for station-to-station calls. The restore button is used to mechanically release any DSS button(s) locked down.

**Note:** In systems using a 444B and a 6C1 console, 19 and 20 can be converted to 2 and 3 by moving the two option straps on the 444B to the storage position. In addition, on block 2 of the 100A1, 101A1, or 101A2 connecting unit, move the factory-provided straps on 24F-25F and 24G-25G to 23F-24F and 23G-24G, respectively.

**8.73** The **128A6Y** console (Fig. 13) offers the same features as the 6C1 or 7C1 but has a capacity of 52 stations. The **138A6Y** console has the same features as the 128A6Y and, in addition, has a field of 52 MW buttons. If both MW and SB are provided, the SB lamps are in the DSS field.

**8.74** Terminations are provided in the 21A Communication System for two answering positions. These terminations appear on blocks 3, 4, 5, and 6 of the 100A1 and 101A1/A2 connecting units, blocks 5 and 6 of 100B1 connecting unit, and blocks 3 and 4 of 101B1 connecting unit.

**Caution:** *Since multiple connector cables may be involved in supplying consoles, care should be taken to identify binder groups to assure terminations in the proper order. If a DSS console is used and the distance between the console and the KTU is over 100 feet, the leads in binders 3 and 5 must be run in separate cables to prevent noise pickup.*

#### X. Third Answering Position/Console Capability

**8.75** Terminations are provided in the connecting units for two answering positions (codes 0 and 10). One additional answering position can be added but requires that the terminations be external to the connecting units. If a third console is required, the terminations for code 10 are used to provide the terminations for the cabling to the external connecting blocks. The connector cables from the second and third answering positions are then terminated on the external blocks.

**8.76** Any code may be assigned to the third answering position, but the code assigned will not be available as a station code.

**8.77** As factory-wired, the 21A Communication System furnishes common audible ringing at station code 0. All incoming lines will ring at that station unless otherwise arranged (see information on common audible and additional station ringing). The calls are answered by lifting the handset (if using telephone set) and depressing the flashing line pickup button. The method of forwarding the call may vary depending on the equipment at the answering station, as follows.

(a) With all arrangements, the answered call can be placed on hold using the HOLD key on the telephone set or console at which time the steady lamp will change to wink. The attendant then selects an idle intercom path, dials the desired station, and voice-signals that there is a call on a particular CO/PBX line. If necessary to reenter the conversation, the pickup button must be depressed again.

(b) If equipped with a DSS console, the attendant can voice signal the desired station by depressing the associated locking DSS button. When the DSS button is depressed, the CO/PBX line is automatically put on hold. Using the DSS does not require accessing an intercom path since the attendant uses the dedicated link which does not require the selector. If the intercom station is equipped with HFAI, 2-way conversation is possible. A call from a DSS console will preempt an automatic signaling intercom call, dial intercom call, or CO/PBX ringing. The attendant may then go back to the held line by depressing the REENTER button on the DSS console, leaving the held line to be picked up by the station, or may pick up another CO/PBX line by depressing the associated button after depressing RESTORE button to clear DSS console.

(c) At positions having an intercom/line conferencing console (128A3/138A4), incoming calls are answered using the 14/21 line pickup buttons on the lower field. Calls can be forwarded in the usual manner by holding and using an intercom path or by DSS if equipped. In addition, the intercom/line conferencing field can be used to connect a line that does not appear at a station, such as a nonsquare line, as follows:

(1) Answer flashing line by depressing button on lower panel, place line on hold.

(2) Select idle intercom path (button dark) and signal desired station using dial intercom.

(3) When station answers, depress buttons in intercom/line conferencing field associated with held CO/PBX line and selected intercom link which will connect outside party with station.

(4) Operate RLS button on lower field to remove attendant from conversation.

(5) When the intercom station goes on-hook, the status lamp in the intercom/line conferencing field will light indicating the connection can be released by depressing the push-to-operate, push-to-release buttons. **Only one call at a time can be processed through the intercom/line conferencing field.**

**8.78** The intercom/line conferencing field can also be used to set up a preset conference call. The procedure is the same as above except the attendant dials the preset conference code on the intercom. Once the conference stations are on the line, the CO/PBX line button in the intercom/line conferencing field is depressed. A third option permits the attendant to make a CO/PBX call for stations unable to do so, ie, an intercom-only station. To do this, the attendant first completes the CO/PBX call by depressing button in the lower field and dialing the desired number. The attendant then places that call on hold and calls the station on dial intercom using an idle path on the lower button field. The attendant then operates the intercom button, then the CO/PBX line button in the intercom/line conferencing field corresponding to the two parties. After operating the RLS button, the attendant is free to make other calls.

#### Y. Station Telephone Set Options

**8.79** All telephone sets used with the 21A Communication System are modular in design. Refer to Table B for faceplate colors.

**8.80** The following sets can be used as station telephone sets:

- 832/2832BM, CM, DM, and EM
- 833/2833BM, CM, DM, and EM

- 575/2575AM.

**8.81** The 10- and 20-button telephone sets can be intermixed in COM KEY 2152, depending on the connecting unit(s) used as follows:

- 100A1—up to 34 stations (twenty-eight 10-button and six 10- or 20-button)
- 100B1—additional 18 stations (10- or 20-button)
- 100B1—additional 18 stations (10- or 20-button)
- 101A1 or 101A2—up to 28 stations (10- or 20-button)
- 101B1—additional 24 stations (10- or 20-button)

**Note:** The number of 20-button sets served from a 100B1 connecting unit can be increased by 10 or 12 sets by installing two 66R1 connecting blocks in the blank spaces of the connecting unit. The blocks provide terminations for the second binder of the additional 20-button sets. The maximum growth of 10 or 12 sets is dependent on whether the station used to provide the multiple is fed by a 50- or 25-pair connector cable, respectively. Refer to Section 518-450-111 for connection information. Power supply requirements should also be reviewed and added capacity provided if required.

Table C lists the features supplied with the telephone sets. All stations in a mixed system must have the same number of intercom paths.

**8.82** Options for the station telephone sets should be provided as follows:

#### (a) **Recall**

- All 832-, 833-, 2832-, and 2833-type telephone sets are factory-wired for recall.

#### (b) **Privacy**

- 832/2832BM, DM—available (optionally)
- 832/2832CM, EM—factory-wired
- 833/2833BM, DM—factory-wired
- 833/2833CM, EM—available (optionally).

(c) **Privacy Release**

- 832/2832BM, DM—not available
- 832/2832CM, EM—factory-wired
- 833/2833BM, DM—factory-wired
- 833/2833CM, EM—not available.

(d) **Ring Transfer**

- 832/2832BM, DM—not available
- 832/2832CM, EM—factory-provided, field-wired
- 833/2833BM, DM—not available
- 833/2833CM, EM—factory-provided, field-wired.

(e) **Speakerphone**

- 832-, 833-, 2832-, and 2833-type telephone sets—require addition of separately ordered 3B (MD) or 4A speakerphone components.

(f) **HFAI**

- 832-, 833-, 2832-, and 2833-type telephone sets—refer to paragraph 8.22. Wall-type telephone sets also require use of a 268A adapter.

**Z. Satellite Wiring Plan**

**8.83** The 21A Communication System is designed for Home-Run Cabling (direct cabling) from each telephone set to the 100- or 101-type connecting unit. Where it is more practical to serve a group of stations from a secondary location, a satellite wiring plan can be used. The satellite wiring plan is a connecting block arrangement for station terminations and is served by a cable or cables from the 100- or 101-type connecting unit. Two methods are covered for providing the proper amounts of terminations and leads at a satellite location. One method employs prewired 14A1-type terminal blocks. The second uses standard 66-type connecting blocks and a nomograph which help to determine the number of extra lamp and lamp ground leads required.

**Note:** Leads that are not common to all stations must be brought to the satellite

location. This includes individual station code control leads such as A1, A GRD, VS, -24C, CO, DNDL, SB, L-, ET, and ER. In addition, each personal line involved in the satellited stations must be brought to the satellite location. If a personal line is multiplied to more than one satellite station, only one appearance is necessary.



**The total distance from KSU to satellite field to furthest station, for fully loaded satellite block, is not to exceed 667 feet.**

**8.84 Satellite Plan Using 14A1-Type Terminal Blocks:**

The 14A1-type terminal blocks consist of a 66-type connecting block factory-wired to KS connectors. Connector cables are used from the connectors to the KSU—the station telephone set cables being fed from the satellite are terminated on the 66-type connecting block. Each 14A1-type terminal block will accommodate eight 25-pair station cables. One 14A1-100 terminal block is required for the first binder of each eight satellite stations, and one 14A1-75 is required for the second binder. Station codes assigned to group A and group B can be intermixed; or, if enough stations are fed from the satellite, group A stations can be bunched on one set of terminal blocks and group B on another.

**8.85 Satellite Plan Using Nomograph:**

The same basic rules apply for satellites using standard 66-type connecting blocks as with the 14A1-type terminal blocks. Sufficient conductors must be run to the satellite to provide a one-time appearance of all common station leads, individual code leads, and enough L and LG multiples. The number of additional conductors required per L and LG lead is determined using the nomograph shown in Section 518-450-111.

**8.86 Lamp leads in the 21A Communication System are wired as follows.**

- (a) 100A1 and 100B1: Lamp leads for lines 1 to 5 of station codes 0 to 28 and lamp leads for lines 8 to 12 of station codes 33 to 36 are wired directly from the 400-type KTUs. This is group A. Lamp leads for lines 1 to 5 of station codes 29 to 59 and lamp leads of lines 8 to 12 of station codes 42 to 59 are wired from the 453B KTUs. This is group B. Lines 1 to 5 are in the first binder of the station connector

cable (10- and 20-button sets) and lines 8 to 12 are in the second binder (20-button sets only).

(b) 101A1/A2 and 101B1: Lamp leads for station codes 0 to 28 are wired from the 400D KTUs (group A). Codes 29 to 36 and 42 to 59 are wired from the 453B KTUs (group B).

(c) The lamp leads for the first two intercom paths are wired so that codes 0 to 28 are on one fuse and 29 to 36 and 42 to 59 are on a second fuse for each circuit. The third intercom path lamps are wired to terminals IL31 and IL32 on block 1 of the 100A1 and 101A1/A2 connecting units.

Where possible, a station grouping arrangement should be used when satelliting. Station codes from group A and group B can be intermixed in the same satellite arrangement as long as the lamp leads from groups A and B are brought out to the satellite location independently and the station codes are wired to the leads depending on their group assignment. For instance, station code 21 should have its lamp leads connected to the group A lamp leads.

**8.87** The limiting factors of a satellite type wiring plan are keeping the voltage drop in the lamp loop to less than 2 volts and maintaining a low resistance A lead.

#### **AA. Adjunct Services**

**8.88** Miscellaneous services that can be provided at COM KEY 2152 stations include SPOKESMAN® loudspeaker, telephone answering sets, and repertory dialers. For information on these services, refer to Section 518-450-111 and/or the sections listed below.

- SPOKESMAN Loudspeaker—Section 463-221-100
- Telephone Answering Sets—514 Division
- KS-16844 Rapidual‡ (MD)—Section 512-115-100
- KS-19594 Magical‡ (MD)—Section 512-125-100, -200, -400, -410
- TOUCH-A-MATIC® Adjunct Automatic Dial—Section 501-164-201.

‡Registered trademark of McGraw-Edison Co.

TABLE A  
KEY TELEPHONE UNITS

KTU	FUNCTION	QUANTITY	SD/CD
400D or 400G	CO/PBX pickup, hold, release, and related services in 702A (MD) or 703A (MD) feature panel.	1 per CO/PBX line	69513-01 69651-01
400H	CO/PBX pickup, hold, release, and related services in 702B or 703B feature panel.	1 per CO/PBX line	69942-01
415A	Automatic private line circuit.	1 per private line	69559-01
424C	Dial intercom 19-code selector circuit; basic selector required in all dial intercom systems.	1 per intercom system	69567-01
440A or 478B	TOUCH-TONE® adapter circuit; required when TOUCH-TONE dialing is used in intercom.	1 per intercom system	69906-01 69931-01
444-Type	Selector extender circuit; required in addition to 424C KTU for dial codes 1 to 39.	1 per intercom system up to 34 stations; 2 per intercom with 35 to 52 stations	69636-01
451A/B	Music-on-hold circuit; used with externally mounted 33A voice coupler and customer-provided music source. Use with 400D, G only in 702A (MD) or 703A (MD) feature panels.	1 per 7 CO/PBX lines	69652-01
498A	Music-on-hold circuit; used with externally mounted 33A voice coupler and customer-provided music source. Use with 400H only in 702B or 703B feature panels.	1 per 7 CO/PBX lines when equipped with 116A1 CM	69922-01
452A	Power failure ringing circuit; automatically "cuts through" up to seven external ringers.	1 per 7 CO/PBX lines	69652-01
453B	Lamp driver; supplements lamp driving capacity of 400D KTUs; operates up to 26 lamps; 7 circuits per unit.	1 per 7 lines in excess of 26 lamps per line	69653-01
454B	3-path intercom access; provides stations with talk battery and access to selector.	1 per 3-path intercom system	69653-01
455A	Tone-ringing signal generator; supplies CO/PBX incoming line tone ringing.	1 per installation	69652-01
457C	Paging amplifier; drives up to seven 45-ohm paging loudspeakers.	1 per paging zone (max. 3)	69652-01
460B	2-path intercom access; provides stations with talk battery and access to selector.	1 per 2-path intercom system	69652-01



TABLE A (Contd)  
KEY TELEPHONE UNITS

KTU	FUNCTION	QUANTITY	SD/CD
468A/B	Voice and tone alerting on intercom; supplies ringing tone to calling party, tone alerting and voice signaling to called party, input to paging amplifier; also supplies do-not-disturb tone (468B must be used if wall mounted 483AE transmitter is being installed).	1 per installation	69652-01
471A (MD) 471B	Battery Reversal Toll Restriction.	1 per line to be restricted	69921-01
473A	Voice operated switch (VOX) for HFAI.	1 per intercom system equipped with HFAI	69930-01
474A	DSS diode matrix and preempt tone generator; allows attendant to preempt an HFAI call with a dedicated link call.	1 per 18 stations†	69930-01
479B	Toll Restriction—digit absorption rotary only	1 per line to be restricted	69921-01
481A	Automatic signaling intercom; provides for direct intercom between two stations.	1 per pair of stations connected*	69930-01

\* Can also be used between one station and a group of stations. Maximum 5 per system.

† In 702A 2 are required if HFAI and DSS features are both provided.

TABLE B  
COLOR CODES FOR FACEPLATES,  
TELEPHONE SETS, AND CONSOLES

CODE	COLOR
-100	Avocado
-108	Teak (wood grained)
-109	Walnut (wood grained)
-111	Gold
-112	Orange
-113	Brown
-114	Red
-115	Blue
-118	Black

**TABLE C**  
**TELEPHONE SET FEATURES**

FEATURES	METHOD OF PROVIDING	11-BUTTON	13-BUTTON	20-BUTTON TEL SETS	
		832BM 2832BM 832DM 2832DM	832CM 2832CM 832EM 2832EM	833BM 2833BM 833DM 2833DM	833CM 2833CM 833EM 2833EM
RECALL	Factory Provided— Factory Connected	•	•	•	•
PRIVACY CIRCUIT	Factory Provided— Factory Connected		(Note 1) •	•	
	Field Provided Field Connected				(Note 2) •
PRIVACY RELEASE	Factory Provided— Factory Connected		•	•	
RING TRANSFER	Factory Provided		•		•
	Field Connected		(Note 3) •		(Note 3) •

*Note 1:* Must be disabled when used as an answering position in system without privacy.

*Note 2:* When used as answering position in systems with privacy.

*Note 3:* Must be connected at all answering positions.

TABLE D

EXAMPLE OF SYSTEM COMPONENTS AS RELATED TO SIZE OF SYSTEM (SEE NOTE 5)

SYSTEMS (NOTE 6)		1	2	3	4	5	6	7	8	9	10
MAX. LINEX		7	7	7	7	7	7	21	21	21	21
MAX. STATIONS		18 (NOTE 1)	18 (NOTE 1)	34 (NOTE 2)	28 (NOTE 2)	52 (NOTE 2)	52 (NOTE 2)	34 (NOTE 2)	28 (NOTE 2)	52 (NOTE 2)	52 (NOTE 2)
MAX. 20-BUTTON SETS		2	18	6	28	24*	52	6	28	24*	52
SYSTEM COMPONENTS	121 App Box or 34-Type Cabinet	1	1	1	1	2	2	1	1	2	2
	154A Cover	1	1	1	1	2	2	1	1	2	2
	Connecting Unit	100A1	101A1 or 101A2	100A1	101A1 or 101A2	100A1 & 100B1	101A1, 101A2 & 101B1	100A1	101A1 or 101A2	100A1, 100A2 & 100B1	101A1, 101A2 & 101B1
	Panel	702-Type	702-Type	702-Type	702-Type	702- and 703-Type	702- and 703-Type	702- and 703-Type	702- and 703-Type	702- and 703-Type	702- and 703-Type
	Power Panel	2A	2A	2B	2B	2C	2C	2B	2C	2C	2C & 2D
	455A KTU	1	1	1	1	1	1	1	1	1	1
	453B KTU	None	None	(Note 3)	(Note 3)	(Note 3)	(Note 3)	(Note 4)	(Note 4)	(Note 4)	(Note 4)

Note 1: Station capacity is reduced by 1 for each paging zone and preset conference group in excess of 1.

Note 2: Station capacity is reduced by 1 for each paging zone and preset conference group in excess of 3.

Note 3: One (1) required if system has more than 26 stations.

Note 4: One (1) required if system has more than 26 stations; second 453B required if system has more than 7 square lines and more than 26 stations.

Note 5: Exact system components required will be determined by the USOCs listed on the service order.

Note 6: Complies with sales ordering guide.

\* If 7C (34 station) DSS console is installed with more than six 20-button sets, 100A1 connecting unit cannot be used. Use 101A1 connecting unit.

TABLE E

## ORDERING GUIDE FOR COMMON EQUIPMENT AND ASSOCIATED ITEMS

USO CODE	EQUIPMENT CODE	REMARKS
K21	Feature Panel 702B	Consists of one 702B feature panel. Order 1 per system for up to 7 lines and 34 stations (702A feature panel MD).
	Box, Apparatus, 121B	Order 1 for each 100- or 101-type connecting unit to be wall or relay rack mounted. Also order one 197A backboard for wall mounted only applications.
	Cabinet, 34-Type	Order 1 for each 100- or 101-type connecting unit to be floor mounted.
	Cover, 154-Type	Order 1 if required for each 121B apparatus box or 34-type cabinet.
	Kit of Parts, D-180675	Order 1 for each 121B apparatus box to be mounted on bulb-angle relay rack.
	Kit of Parts, D-180865	Order 1 for each 121B apparatus box to be mounted on channel-type relay rack.
	Kit of Parts, D-180780 (MD)	Casters for 34C cabinet—order as required.
	Kit of Parts, D-180700	Casters for 34B cabinet (MD)—order as required.
K2X	Feature Panel 703B	Consists of one 703B feature panel. Order 1 per system to add 8 to 21 CO/PBX lines or when more than 34 stations are required—703A feature panel MD.
K1Q	Unit, Connecting, 100A1	Order 1 for up to 21 CO/PBX lines and 34 station codes. Provides terminations for up to twenty-eight 7-line and six 14-line sets. Order one 444-type KTU per connecting unit.
K1S	Unit, Connecting, 100B1	Order 1 to add up to eighteen 14-line sets to above. Order one 444-type KTU per connecting unit.
K1U	Unit, Connecting, 101A1 or 101A2	Order 1 for up to 21 CO/PBX lines and 28 station codes. Terminations for up to twenty-eight 14-line sets. Order one 444-type KTU per connecting unit.
K1V	Unit, Connecting, 101B1	Order 1 to add up to twenty-four 14-line sets to above. Order one 444-type KTU per connecting unit.

TABLE E (Contd)

## ORDERING GUIDE FOR COMMON EQUIPMENT AND ASSOCIATED ITEMS

USO CODE	EQUIPMENT CODE	REMARKS
K1A	Panel, Power, 2A	Order 1 to power 702-type panel and 100A1 CU capacity of 7 lines, two 14-line and sixteen 7-line sets.
		Order 1 to power 702-type panel and 101A1/A2 CU capacity of 7 lines and eighteen 14-line sets.
K1B	Panel, Power, 2B	Order 1 to power 702-type panel and 100A1 CU capacity of 7 lines, six 14-line and twenty-eight 14-line sets.
K1C	Panel, Power, 2B	Order 1 to power 702-type and 703-type panel and 100A1 CU capacity of 21 lines, six 14-line and twenty-eight 7-line sets.
K1D	Panel, Power, 2C	Order 1 to power 702-type and 703-type panel and 100A1 and 100B1 CU capacity for 21 lines, twenty-four 14-line and twenty-eight 7-line sets.
K1E	Panel, Power, 2B	Order 1 to power 702-type panel and 101A1/A2 CU capacity of 7 lines and twenty-eight 14-line sets.
K1F	Panel, Power, 2C	Order 1 to power 702-type and 703-type panel and 100A1 and 100B1 CU capacity of 7 lines, twenty-four 14-line and twenty-eight 7-line sets.
		Order 1 to power 702-type and 703-type panel and 101A1/A2 and 101B1 CU capacity of 7 lines and fifty-two 14-line sets.
K1G	Panel, Power, 2C	Order 1 to power 702-type and 703-type panel and 101A1/A2 CU capacity for 21 lines and twenty-eight 14-line sets.
K1H	Panel, Power, 2D	Order 1 in addition to K1G to power 702-type and 703-type panel and 101A1/A2 and 101B1 CU capacity with K1G of 21 lines and fifty two 14-line sets.
	Unit, Key Telephone 468-type	Voice and Tone Signaling Circuit—order 1 per system.
	Unit, Key Telephone 424C	Intercom Selector Circuit—order 1 per system.
	Unit, Key Telephone 444B	Selector Extender Circuit—order 1 for each 100- or 101-type connecting unit.
	Unit, Key Telephone 454B	Order 1 per system equipped with 3-path intercom—intercom access circuit.

TABLE E (Contd)

## ORDERING GUIDE FOR COMMON EQUIPMENT AND ASSOCIATED ITEMS

USO CODE	EQUIPMENT CODE	REMARKS
K2M	Unit, Key Telephone 460B	Order 1 per system equipped with 2-path intercom—intercom access circuit.
K2N	Unit, Key Telephone 457C	Order 1 per paging amplifier required; drives up to 7 paging loudspeakers (max. 3 per system).
K2U	Unit, Key Telephone 440A or 478B	Order 1 per system equipped with TOUCH-TONE dialing on intercom.
	Unit, Key Telephone 494A	Order 1 per system equipped with TOUCH-TONE dialing on intercom.
K3T	Unit, Key Telephone 455A	Tone Ringing Generator—order 1 per system.
K5Z	Unit, Key Telephone 471-type	Order 1 per line to be toll restricted.
K20	Unit, Key Telephone 481A	Order 1 per automatic signaling intercom—maximum of 2 per system.
K22	Unit, Key Telephone 400-type	Order 1 for each CO/PBX line.
K23	Unit, Key Telephone 451B or 498A/116A1 CM	Order 1 for each 7 CO/PBX lines equipped with music-on-hold. (702A (MD) or 703A only).
K25	Unit, Key Telephone 452A	Order 1 for each 7 CO/PBX lines equipped with power failure ringing.
K26	Unit, Key Telephone 453B	Lamp Driver—order 1 for each 7 lines having more than 26 lamps per line (systems having station codes 30 or higher).

TABLE E (Contd)

## ORDERING GUIDE FOR COMMON EQUIPMENT AND ASSOCIATED ITEMS

USO CODE	EQUIPMENT CODE	REMARKS
K27	Unit, Key Telephone 473A	Order 1 per system equipped with HFAl-voice operated switch.
K28	Unit, Key Telephone 474A	DSS diode matrix and preempt tone generator. If using 702A or 703A, order 2 for up to 34 stations and 1 additional for up to 52 stations. If using 702B or 703B, order 1 for up to 7 stations, 2 for up to 34 stations or 3 for up to 52 stations. Required when system has both HFAl and dedicated link DSS console.
K62		Common equipment for restricting first 8 lines—consists of one 620A modular panel, one 19B2 power unit, and one 92A connecting block.
K63		Common equipment for restricting 4 additional lines—consists of one 642A modular panel and one 92A connecting block.
FTP	Coupler, Voice, 33A	Order 1, per system equipped with music-on-hold and/or paging background music.
KPA	Unit, Apparatus, 20A	Order 1 per system when connecting customer-provided paging system to 21A.

TABLE F

## ORDERING GUIDE FOR TELEPHONE SETS, CONSOLES, AND ASSOCIATED ITEMS

USO CODE	EQUIPMENT CODE	REMARKS
K51†K	Set, Telephone, 832BM-50	Order as required — rotary desk-type tel set. Also order 1 Plate, Face, 832B-* and 1 Cable, Connector, A25B per tel set.
K53†K	Set, Telephone, 832CM-50	Order as required — rotary desk-type tel set. Also order 1 Plate, Face, 833A-* and 1 Cable, Connector, A25B per tel set. Equipped with privacy/privacy release.
K51†B	Set, Telephone, 832DM-50	Order as required — rotary wall-type tel set. Also order 1 Plate, Face, 832B-* and 1 Cable, Connector, A25B per tel set.
K53†B	Set, Telephone, 832EM-50	Order as required — rotary wall-type tel set. Also order 1 Plate, Face, 833A-* and 1 Cable, Connector, A25B per tel set. Equipped with privacy/privacy release.
K54†K	Set, Telephone, 833BM-50	Order as required — rotary desk-type tel set. Also order 1 Plate, Face, 833A-* and 1 Cable, Connector, A50B per tel set. Equipped with privacy/privacy release.
K52†K	Set, Telephone, 833CM-50	Order as required — rotary desk-type tel set. Also order 1 Plate, Face, 833A-* and 1 Cable, Connector, A50B per tel set.
K54†B	Set, Telephone, 833DM-50	Order as required — rotary wall-type tel set. Also order 1 Plate, Face, 833A-* and 1 Cable, Connector, A50B per tel set. Equipped with privacy/privacy release.
K52†B	Set, Telephone, 833EM-50	Order as required — rotary wall-type tel set. Also order 1 Plate, Face, 833A-* and 1 Cable, Connector, A50B per tel set.
K51†6	Set, Telephone, 2832BM-50	Order as required — TOUCH-TONE desk-type tel set. Also order 1 Plate, Face, 2832B-* and 1 Cable, Connector, A25B per tel set.
K53†6	Set, Telephone, 2832CM-50	Order as required — TOUCH-TONE desk-type tel set. Also order 1 Plate, Face, 2833A-* and 1 Cable, Connector, A25B per tel set. Equipped with privacy/privacy release.
K51†4	Set, Telephone, 2832DM-50	Order as required — TOUCH-TONE wall-type tel set. Also order 1 Plate, Face, 2832B-* and 1 Cable, Connector, A25B per tel set.
K53†4	Set, Telephone, 2832EM-50	Order as required — TOUCH-TONE wall-type tel set. Also order 1 Plate, Face, 2833A-* and 1 Cable, Connector, A25B per tel set. Equipped with privacy/privacy release.



TABLE F (Cont)

## ORDERING GUIDE FOR TELEPHONE SETS, CONSOLES, AND ASSOCIATED ITEMS

USO CODE	EQUIPMENT CODE	REMARKS
K54†6	Set, Telephone, 2833BM-50	Order as required — TOUCH-TONE desk-type tel set. Also order 1 Plate, Face, 2833A-* and 1 Cable, Connector, A50B per tel set. Equipped with privacy/privacy release.
K52†6	Set, Telephone, 2833CM-50	Order as required — TOUCH-TONE desk-type tel set. Also order 1 Plate, Face, 2833A* and 1 Cable, Connector, A50B per tel set.
K54†4	Set, Telephone, 2833DM-50	Order as required — TOUCH-TONE wall-type tel set. Also order 1 Plate, Face, 2833A-* and 1 Cable, Connector, A50B per tel set. Equipped with privacy/privacy release.
K52†4	Set, Telephone, 2833EM-50	Order as required — TOUCH-TONE wall-type tel set. Also order 1 Plate, Face, 2833A-* and 1 Cable, Connector, A50B per tel set.
K56†K	Set, Telephone, 575AM-50	Order as required — rotary desk-type tel set for intercom-only station. Also order 1 Cable, Connector, A25B per tel set.
K56†6	Set, Telephone, 2575AM-50	Order as required — TOUCH-TONE desk-type tel set for intercom-only station. Also order 1 Cable, Connector, A25B per tel set.
K57†K	Set, Telephone, 832CM-50	Order 1 for each rotary dial, 7-line answering position. Also order 1 Plate, Face, 833A-* and 1 Cable, Connector, A25B per tel set.
K57†6	Set, Telephone, 2832CM-50	Order 1 for each TOUCH-TONE, 7-line answering position. Also order 1 Plate, Face, 2833A-* and 1 Cable, Connector, A25B per tel set.
K58†K (Note)	Set, Telephone, 833CM-50	Order 1 for each rotary dial, 14-line answering position. Also order 1 Plate, Face, 833-* and 1 Cable, Connector, A50B per tel set.
K58†6 (Note)	Set, Telephone, 2833CM-50	Order 1 for each TOUCH-TONE, 14-line answering position. Also order 1 Plate, Face, 2833A-* and 1 Cable, Connector, A50B per tel set.
K5H	Console, Selector, 6B1-50	18-station MW console with station busy lamps. Also order 1 Plate, Face, 6A2-* and 1 Cable, Connector, A25B per console.

TABLE F (Contd)

## ORDERING GUIDE FOR TELEPHONE SETS, CONSOLES, AND ASSOCIATED ITEMS

USO CODE	EQUIPMENT CODE	REMARKS
K5L	Console, Selector, 6C1-50	17-station DSS console with dedicated attendant intercom link and station busy lamps. Also order 1 Plate, Face, 6A2-* and 1 Cable, Connector, A50B per console.
K5M	Console, Selector, 7B1-50	34-station MW console with station busy lamps. Also order 1 Plate, Face, 7A2-* and 1 Cable, Connector, A50B per console.
K5N	Console, Selector, 7C1-50	34-station DSS console with dedicated attendant intercom link and station busy lamps. Also order 1 Plate, Face, 7A2-* and 1 Cable, Connector, A100C per console.‡
K5O	Console, Telephone, 128A6Y-50	52-station DSS/SB console with dedicated attendant intercom link. Also order 1 Plate, Face, 128C-*; 1 Cable, Connector, A75A; and 1 Cable, Connector, A100C per console.‡
K5Q	Console, Telephone, 138A6Y-50	52-station DSS/SB with dedicated attendant intercom link and MW. Also order 1 Plate, Face, 238D-*; 1 Plate, Face, 238E-*; 2 Cable, Connector, A75A; and 1 Cable, Connector, A100C per console.‡
K9G†K	Console, Telephone, 128A3R-50	Rotary dial, 14-line attendant console with intercom/line conferencing. Also order 1 Plate, Face, 128E-* and 1 Cable, Connector, A50B per console.
K9G†6	Console, Telephone, 128A3T-50	TOUCH-TONE, 14-line attendant console with intercom/line conferencing. Also order 1 Plate, Face, 128D-* and 1 Cable, Connector, A50B per console.
K5F†K	Console, Telephone, 128A4R-50	Rotary dial, 21-line attendant console. Also order 1 Plate, Face, 128B-* and 1 Cable, Connector, A75A per console.
K5F†6	Console, Telephone, 128A4T-50	TOUCH-TONE, 21-line attendant console. Also order 1 Plate, Face, 128A-* and 1 Cable, Connector, A75A per console.
K5G†K	Console, Telephone, 138A4R-50	Rotary dial, 21-line attendant console with intercom/line conferencing. Also order 1 Plate, Face, 238B-*; 1 Plate, Face, 238C-*; and 1 Cable, Connector, A75A per console.
K5G†6	Console, Telephone, 138A4T-50	TOUCH-TONE, 21-line attendant console with intercom/line conferencing. Also order 1 Plate, Face, 238A-*; 1 Plate, Face, 238C-*; and 1 Cable, Connector, A75A per console.

TABLE F (Contd)

## ORDERING GUIDE FOR TELEPHONE SETS, CONSOLES, AND ASSOCIATED ITEMS

USO CODE	EQUIPMENT CODE	REMARKS
K29	Diode, 446F	Order 1 for each rotary tel set to be restricted from dialing.
K5U	Key, 6041G-50	Order 1 per location equipped with additional ring transfer.
	Ringer, E1C or Equiv. Signaling Device	Order 1 for each CO/PBX line to be equipped for power failure ringing
K5Y	Loudspeaker, KS-21939, L2	Order 1 for each indoor or outdoor speaker location (horn-type).
K5X	Loudspeaker, KS-21880, L1	Order 1 for each indoor speaker location (cabinet type).
K5S	Transmitter, 683A-50 (MD) or 683AE-50	Order 1 for each station including attendants to be equipped with HFAI. Also requires a 268A adapter when used with wall sets.
KAS	Unit, Apparatus, 22A-49	Order 1 for each location where signal devices external to the tel set are to be used. External signals and power supply must be separately ordered.
	Speakerphone, 3B (MD)	Refer to Section 512-620-100 for ordering information.
	Speakerphone, 4A	Refer to Section 512-700-100 for ordering information.
K5R	Block, Connecting, 66B3-50	Order as required for third answering position console capability.
KG5	Block, Connecting, 66B3-50	Order as required for third 52-station console capability.

TABLE F (Contd)

## ORDERING GUIDE FOR TELEPHONE SETS, CONSOLES, AND ASSOCIATED ITEMS

USO CODE	EQUIPMENT CODE	REMARKS
K5V		Wiring modification for station line ringing.
K5W		Wiring modification for preset conference on intercom.

*Note:* Order (1) D-180486 Kit of Parts for each tel set of this type when system is equipped with privacy.

\* Add color suffix from Table B.

† To be provided by Telephone Company Marketing.

‡ If distance between KSU and DSS console is over 100 feet, leads in binders 3 and 5 must be run in separate cables to prevent noise pickup.

TABLE G

## SIGNAL PRIORITIES IN STATION SPEAKERS

PRIORITY	TYPE CALL
First	Direct Station Selection (DSS)
Second	Automatic Signaling Intercom
Third	Dial Intercom
Fourth	CO Tone Ringing

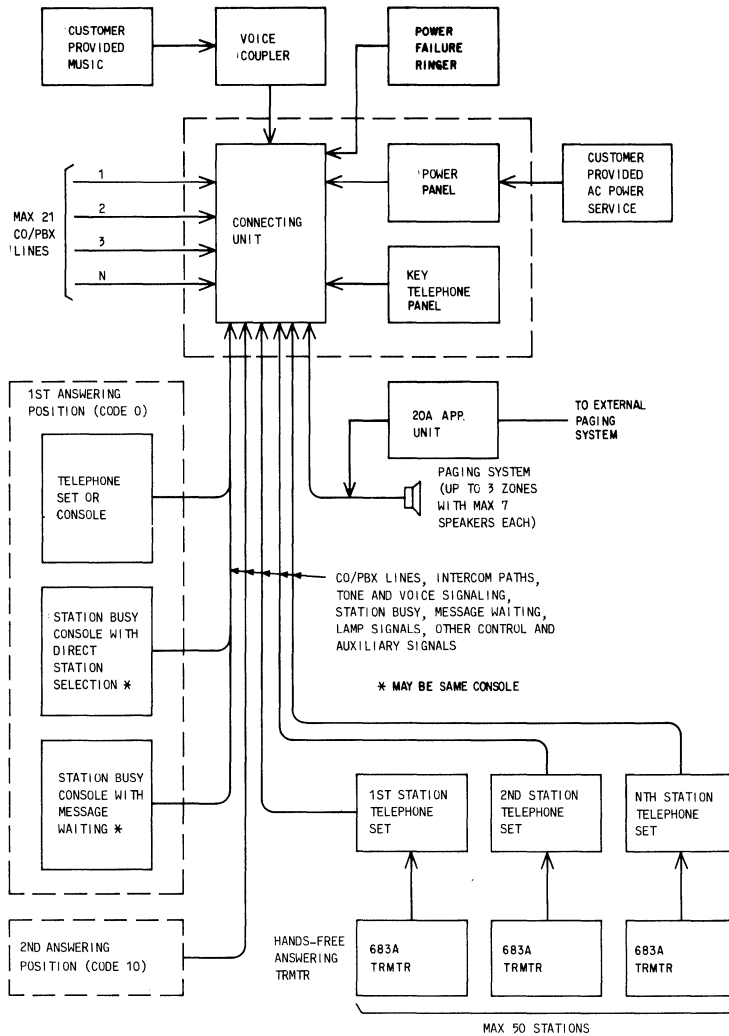


Fig. 1—Block Diagram of 21A Communication System

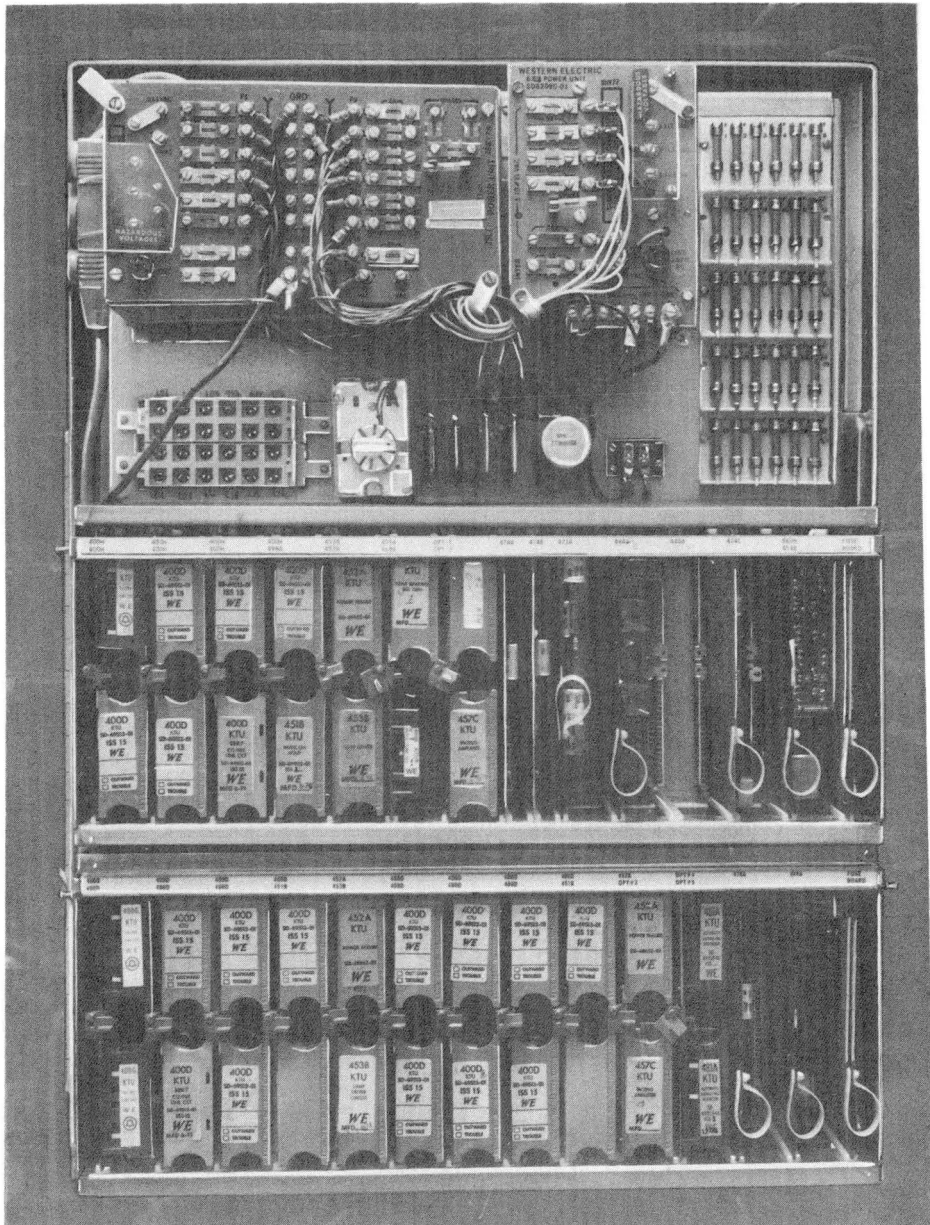


Fig. 2—121B Apparatus Box, Equipped With 2-Type Power Panel, 702- and 703-Type Feature Panels

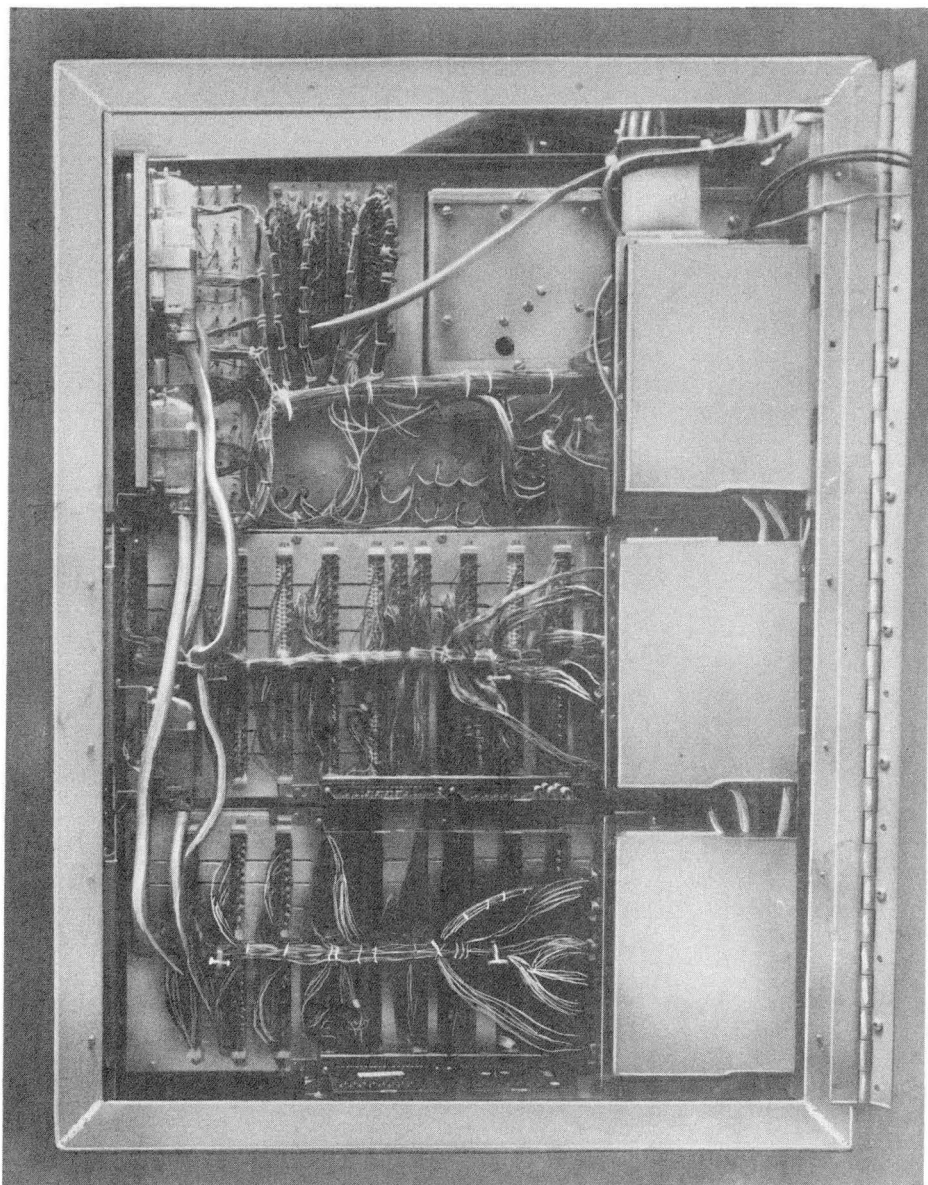


Fig. 3—121B Apparatus Box, Rear of Gate Assembly

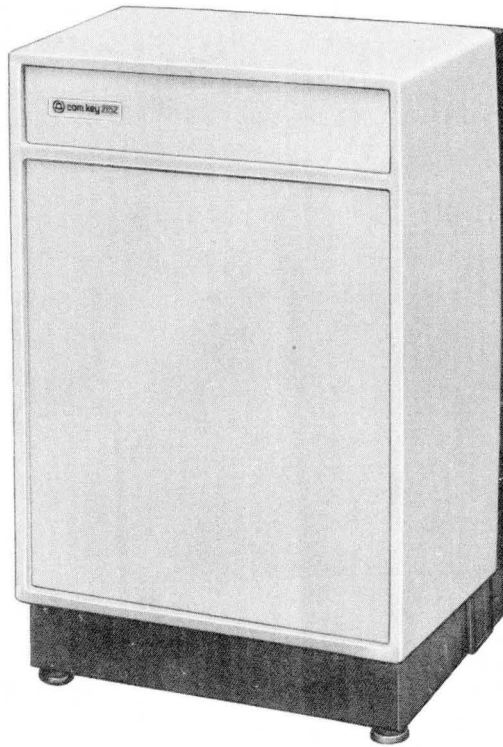


Fig. 4—154-Type Cover



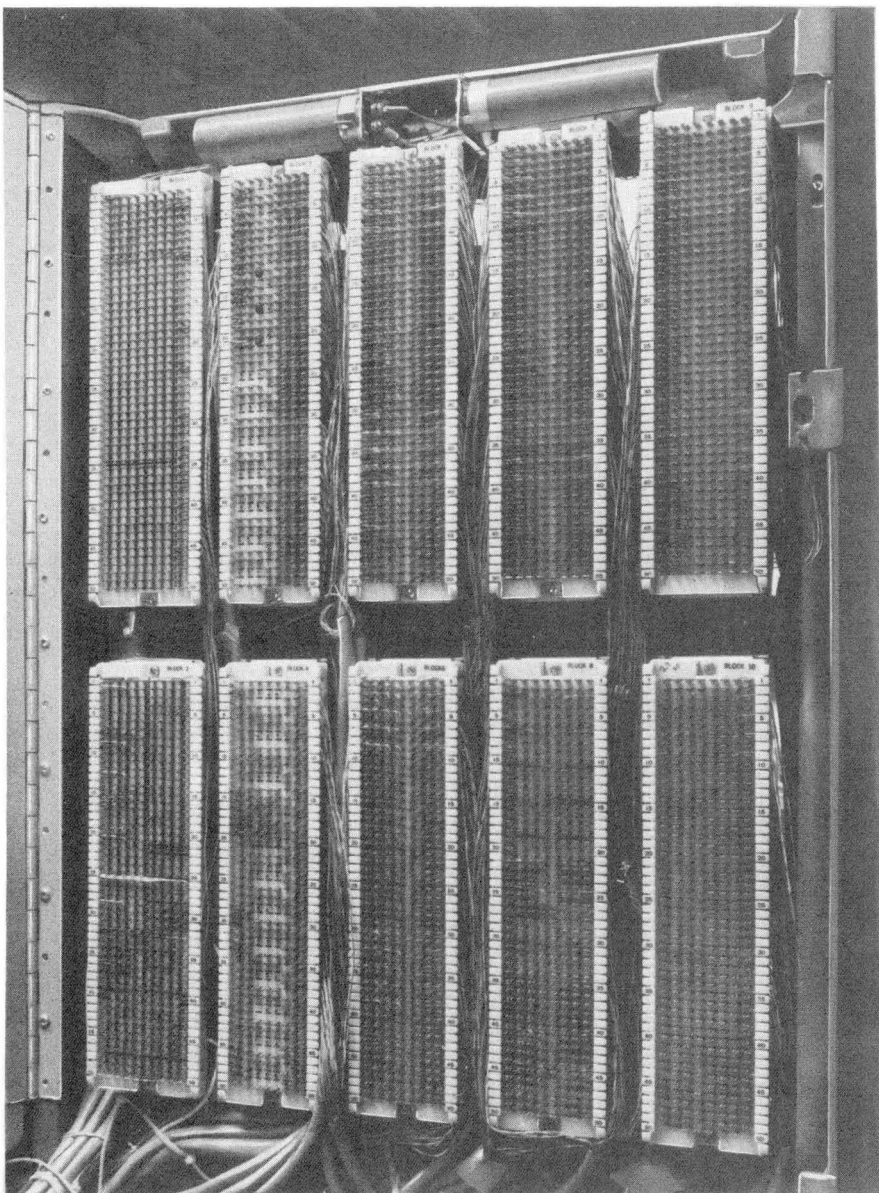


Fig. 5—100A1 Connecting Unit Mounted in 121B Apparatus Box

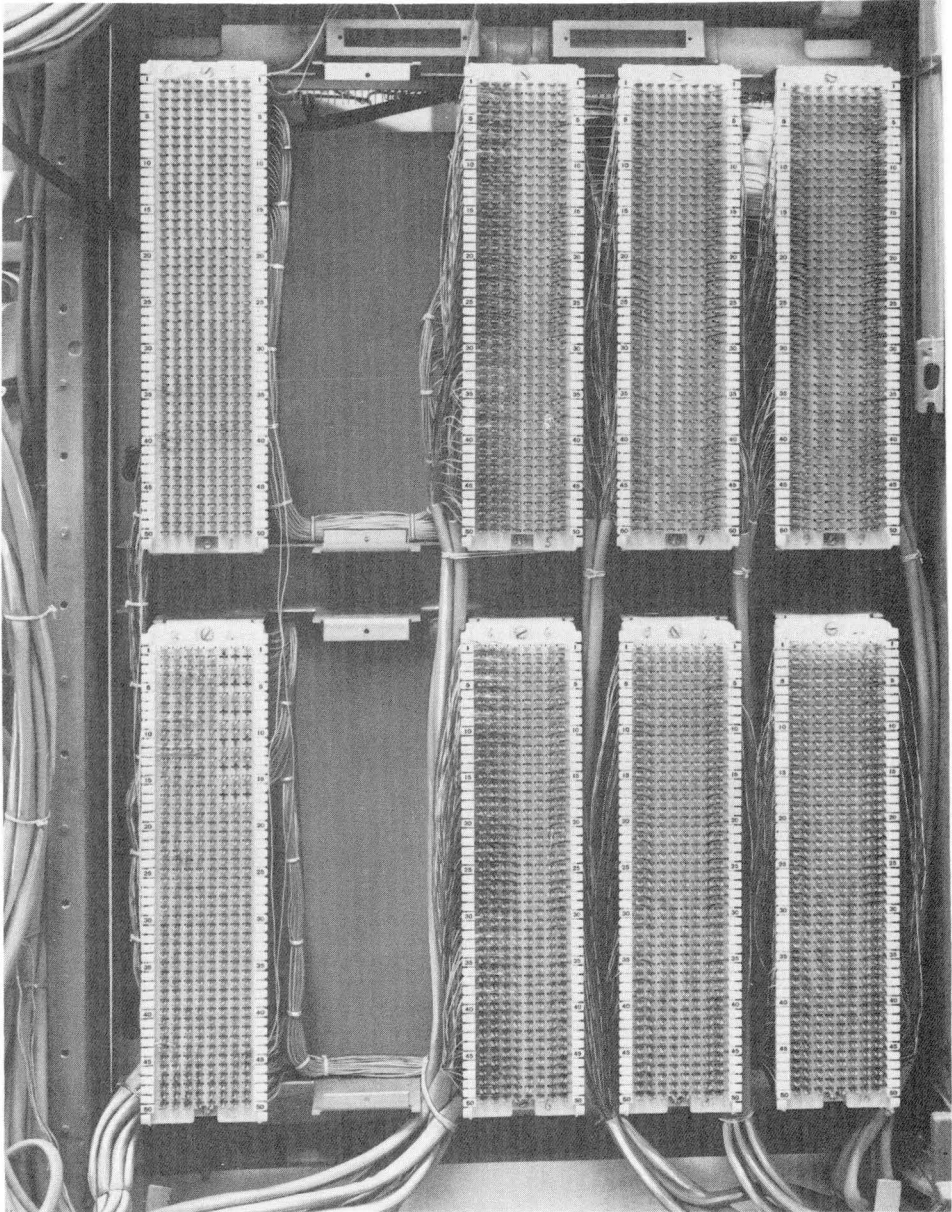


Fig. 6—100B1 Connecting Unit Mounted in 121B Apparatus Box

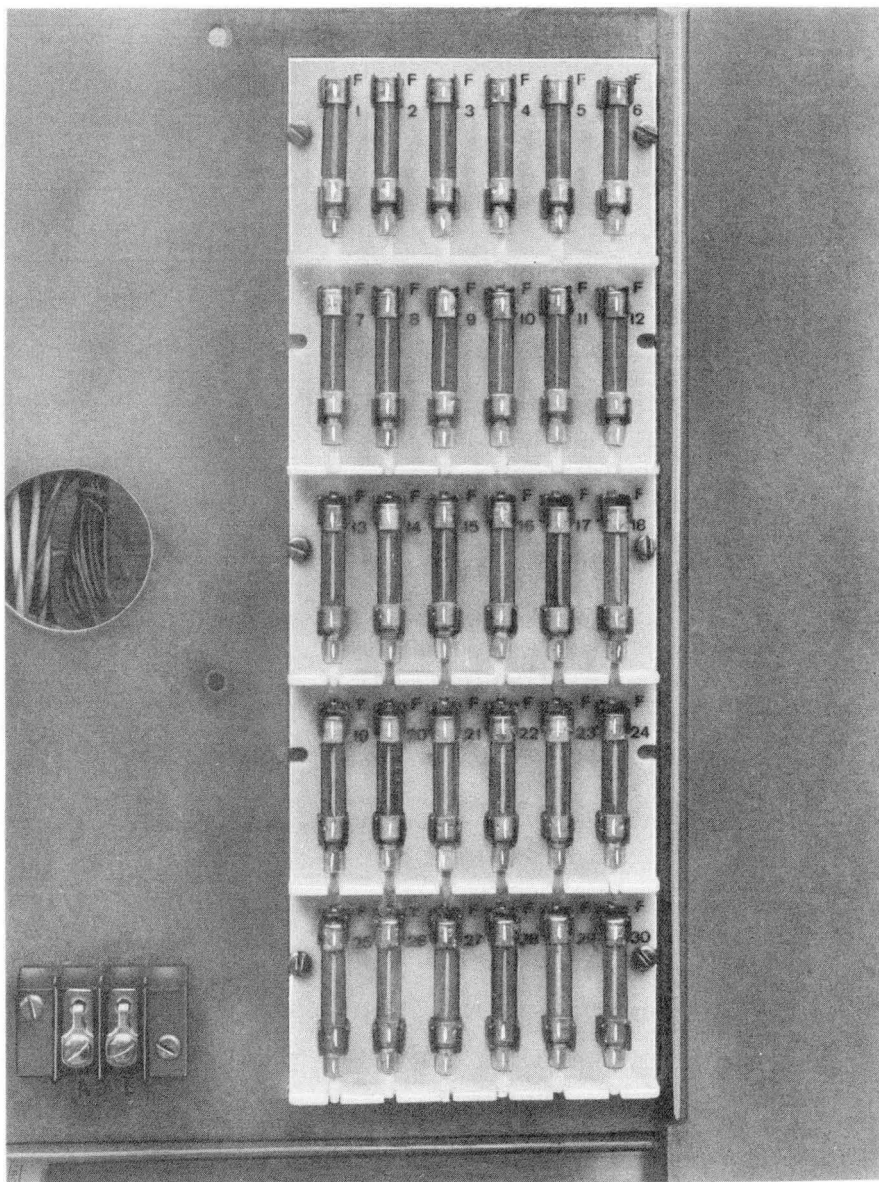


Fig. 7—Fuse Panel on 2-Type Power Panel

A. 702A PANEL (SEE NOTE)

J1A 400* (#1) 415A†	J2A 400* (#3) 415A†	J3A 400* (#5) 415A†	J4A (#7) 415A†	J5A 452A	J6A 455A	J7A OPT =1	J8A	J9A	J10A	J11A	J12A 440A OR 478B	J13A 424C	J14A 460B OR 454B	F U S E R D
400* (#2) 415A† J1B	400* (#4) 415A† J2B	400* (#6) 415A† J3B	451 TYPE J4B	453B J5B	468B J6B	OPT =2 J7B	474A J8B	473A J9B	473B J10B	473B J11B	J12B	J13B	J14B	

C. 702B PANEL (SEE NOTE)

J1A 400- TYPE (#1) 415A†	J2A 400- TYPE (#3) 415A†	J3A 400- TYPE (#5) 415A†	J4A 400- TYPE (#7) 415A†	J5A 452A	J6A 455A	J7A OPT =1	J8A	J9A	J10A	J11A	J12A 440A OR 478B	J13A 424C OR 494A	J14A 460B OR 454B	F U S E R D
400- TYPE (#2) 415A† J1B	400- TYPE (#4) 415A† J2B	400- TYPE (#6) 415A† J3B	498A J4B	453B J5B	468B J6B	OPT =2 J7B	474A J8B	473A J9B	473A J10B	444B J11B	J12B	J13B	J14B	

- |                                  |  |  |
|----------------------------------|--|--|
| 400* - CO/PBX LINE               | 454B - 3-PATH INTERCOM ACCESS                  | 474A - DSS DIODE MATRIX AND PREEMPT TONE GENERATOR |
| 415A - AUTOMATIC PRIVATE LINE    | 455A - TONE RINGING GENERATOR                  | 478B - TOUCH-TONE ADAPTER                          |
| 424C - INTERCOM 19-CODE SELECTOR | 457C - PAGING AMPLIFIER                        | 481A - AUTOMATIC SIGNALING INTERCOM                |
| 440A - TOUCH-TONE ADAPTER        | 460B - 2-PATH INTERCOM ACCESS                  | 494A - TOUCH-TONE INTERCOM SELECTOR                |
| 444B - SELECTOR EXTENDER         | 468B - VOICE AND TONE ALERTING (WITH DND TONE) | 498A/116A1 CM - MUSIC-ON-HOLD                      |
| 451B - MUSIC-ON-HOLD             | 473A - VOICE OPERATED SWITCH (HFAI)            | OPTION SLOTS - 457C, 481A                          |
| 452A - POWER FAILURE TRANSFER    |  |  |
| 453B - LAMP DRIVER               |  |  |

\* WITH MUSIC-ON-HOLD, USE 400D OR G KTU WITH 451B KTU (MOH); NOT 400H. WITHOUT MUSIC-ON-HOLD, USE 400D, G, OR H KTU WITH 451B KTU (MOH).

† IN SYSTEM WITH MUSIC-ON-HOLD, USE 415A KTU IN CONNECTOR POSITION 7 OR 9 THROUGH 14.

NOTE:

USE 451 TYPE KTU ONLY IN A 702A PANEL OR A 498A I./116A1 CM IN A 702B PANEL

Fig. 8—Jack and KTU Assignments—702-Type Feature Panel

J1A	J2A	J3A	J4A	J5A	J6A	J7A	J8A	J9A	J10A	J11A	J12A	J13A	J14A
400-TYPE #8	400-TYPE OR 415A #10	400-TYPE OR 415A #12	400-TYPE OR 415A #14	452A	400-TYPE #5	400-TYPE #17	400-TYPE #19	400-TYPE	452A	OPT #3			
											474A	444A	F U S E  B O A R D
400-TYPE OR 415A #9	400-TYPE OR 415A #11	400-TYPE OR 415A #13	400-TYPE OR 498A	453A	400-TYPE #16	400-TYPE #18	400-TYPE #20	451A OR 498A	OPT #4	OPT #5			
J1B	J2B	J3B	J4B	J5B	J6B	J7B	J8B	J9B	J10B	J11B	J12B	J13B	J14B

400-TYPE - CO/PBX LINE (NOTE 1)  
 415A - AUTOMATIC TIE LINE (NOTE 3)  
 444A - SELECTOR EXTENDER  
 498A - MUSIC ON HOLD (NOTE 2)  
 452A - POWER FAILURE TRANSFER  
 453A - LAMP DRIVER  
 474A - DSS DIODE MATRIX AND PRE-EMPT TONE GENERATOR  
 481A - AUTOMATIC SIGNALING INTERCOM  
 OPTION SLOTS - 457C, 481A

NOTES:  
 1. USE A 400H KTU ONLY, EQUIPPED WITH A 114A1 ON AS A LINE CIRCUIT IN A 703B PANEL.  
 2. USE A 451-TYPE KTU ONLY IN A 703A PANEL OR A 498A KTU ONLY IN A 703B PANEL.  
 3. THE 415A KTU CAN BE PUT IN ANY CONNECTOR USED FOR CO/PBX LINE (READ PARAGRAPHS ON AUTOMATIC PRIVATE LINE).

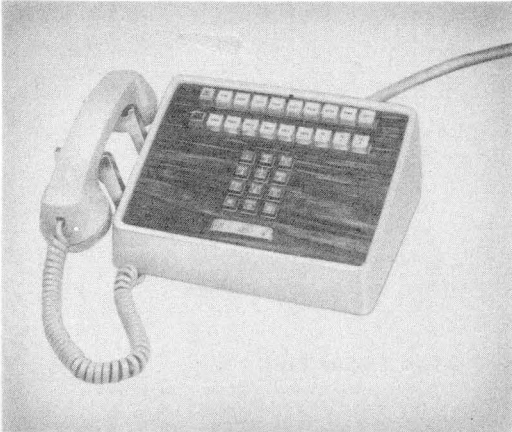
**Fig. 9—Jack and KTU Assignments—703-Type Feature Panel**



A. 832BM TELEPHONE SET



B. 2832CM TELEPHONE SET

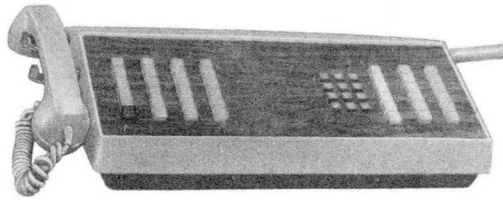


C. 2833CM TELEPHONE SET

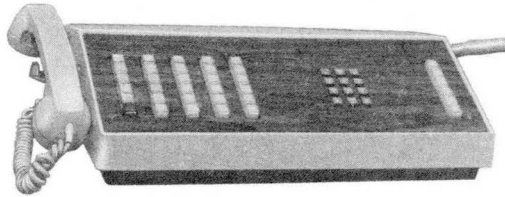


D. 832EM TELEPHONE SET

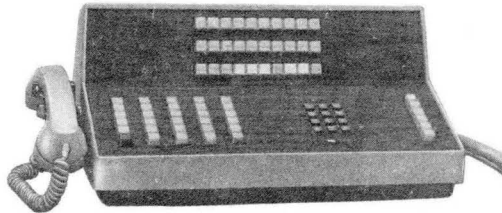
Fig. 10—Typical Telephone Sets Used With COM KEY 2152



A. 128A3 TYPE CONSOLE

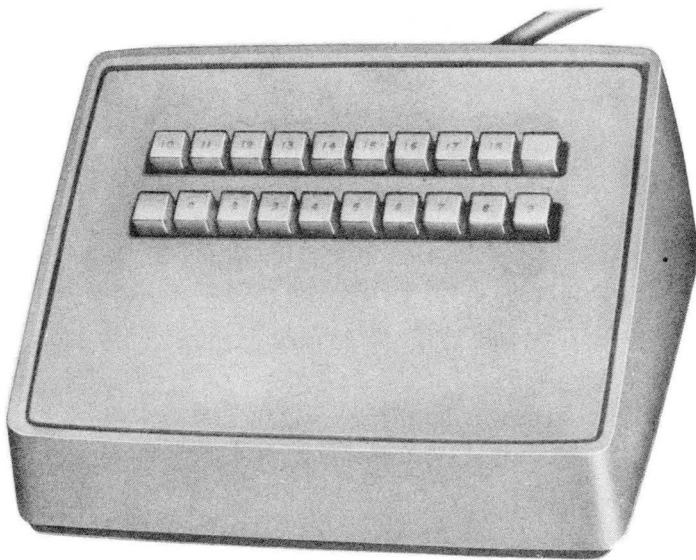


B. 128A4 TYPE CONSOLE



C. 138A4 TYPE CONSOLE

Fig. 11—128A3-, 128A4-, and 138A4-Type Consoles



A. 6B1 CONSOLE



B. 7B1 CONSOLE

Fig. 12—6B1 and 7B1 Consoles



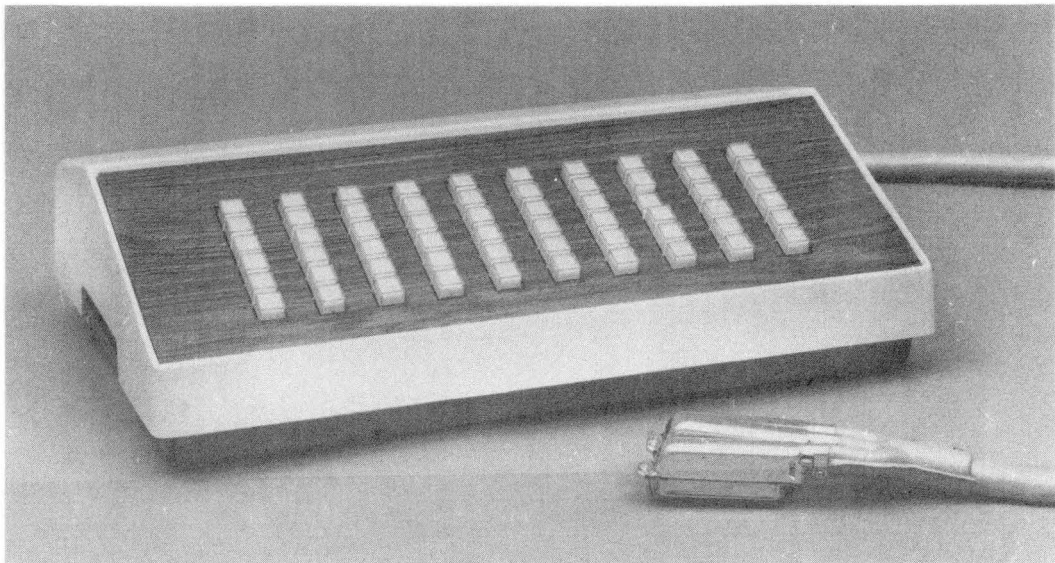


A. 6C1 CONSOLE

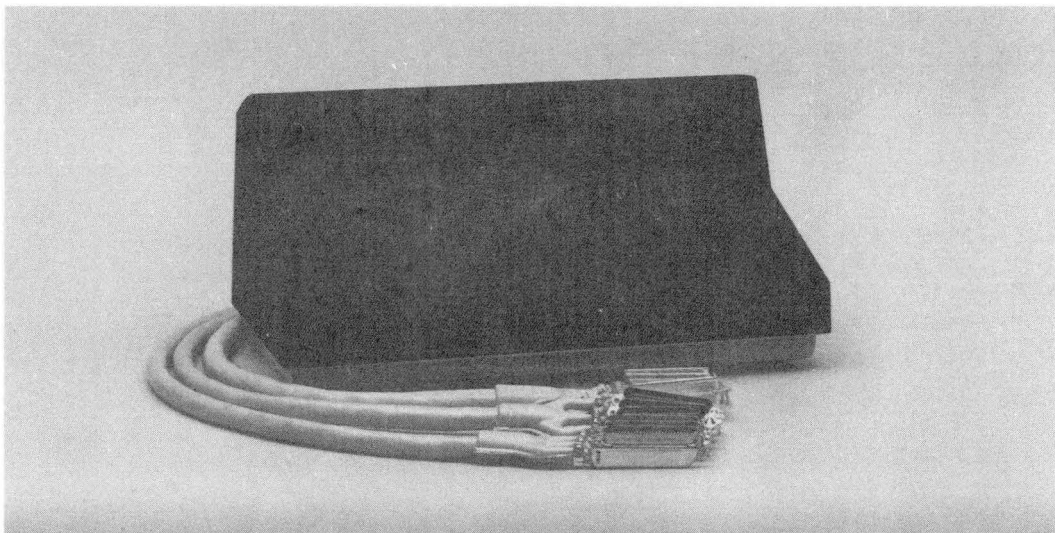


B. 7C1 CONSOLE

Fig. 13—6C1 and 7C1 Consoles



A. 128A6Y SELECTOR CONSOLE



B. 138A6Y SELECTOR CONSOLE

Fig. 14—128A6Y and 138A6Y Consoles

(1) HOLD	(2) LINE 1	(3) LINE 2	(4) LINE 3	(5) LINE 4	(6) LINE 5	(7) FLEX 1	(8) FLEX 2	(9) IC 1	(10) IC 2
-------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	----------------	-----------------

A. 832BM, DM, 2832BM, DM †

(11) RECALL	(12) PRIV RLS	(13) RING TR							
----------------	---------------------	--------------------	--	--	--	--	--	--	--

(1) HOLD	(2) LINE 1	(3) LINE 2	(4) LINE 3	(5) LINE 4	(6) LINE 5	(7) FLEX 1	(8) FLEX 2	(9) IC 1	(10) IC 2
-------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	----------------	-----------------

B. 832CM, EM, 2832CM, EM

(11) RECALL	(12) *	(13) FLEX 2	(14) LINE 6	(15) LINE 7	(16) LINE 8	(17) LINE 9	(18) LINE 10	(19) LINE 11	(20) LINE 12
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(1) HOLD	(2) LINE 1	(3) LINE 2	(4) LINE 3	(5) LINE 4	(6) LINE 5	(7) FLEX 1	(8) IC 1	(9) IC 2	(10) IC 3
-------------	------------------	------------------	------------------	------------------	------------------	------------------	----------------	----------------	-----------------

C. 833BM, CM, DM, EM, 2833BM, CM, DM, EM TELEPHONE SET

\* PRIVACY RELEASE (833BM, DM, 2833BM, DM) OR RING TRANSFER (833CM, EM, 2833CM, EM)

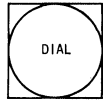
† THESE SETS ALSO EQUIPPED WITH SEPARATE RECALL BUTTON

NOTE:

NUMBERS IN PARENTHESIS INDICATE BUTTON NUMBER

**Fig. 15—Button Locations and Designations, Telephone Sets**

5	11	ICM 3	RECALL
4	10	ICM 2	
3	9	ICM 1	
2	8	FLEX 2	RING TR
1	7	FLEX 1	PRIV REL.
HOLD	6	12	REL.



REL - RELEASE  
 RING TR - RING TRANSFER  
 PRIV. REL - PRIVACY RELEASE  
 ICM - INTERCOM

5	11	ICM 3
4	10	ICM 2
3	9	ICM 1
2	8	FLEX 2
1	7	FLEX 1
LAMP	6	12

A. 128A3

12	13	14	15	16	17	18	19	20	21
2	3	4	5	6	7	8	9	10	11
ICM 1	ICM 2	ICM 3				LAMP			I



5	11	17		FLEX 2
4	10	16		FLEX 1
3	9	15	21	ICM 3
2	8	14	20	ICM 2
1	7	13	19	ICM 1
HOLD	6	12	18	REL



REL - RELEASE  
 RING TR - RING TRANSFER  
 PRIV. REL - PRIVACY RELEASE  
 ICM - INTERCOM

RING TR 3
RING TR 2
RING TR 1
PRIV. REL.
RECALL

B. 128A4 OR 138A4

Fig. 16—Button Locations, Telephone Consoles

10	11	12	13	14	15	16	17	18	
	0	2	3	4	5	6	7	8	9

**A. 6B1 (MESSAGE WAITING)**

RST	10	11	12	13	14	15	16	17	18
RE-ENT	PAGE	2	3	4	5	6	7	8	9

**B. 6C1 (DIRECT STATION SELECTION)**

30	31	32	33	34	35	36			
20	21	22	23	24	25	26	27	28	29
10	11	12	13	14	15	16	17	18	19
	0			4	5	6	7	8	9

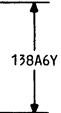
**C. 7B1 (MESSAGE WAITING)**

RST	28	29	30	31	32	33	34	35	36
18	19	20	21	22	23	24	25	26	27
8	9	10	11	12	13	14	15	16	17
RE-ENT	PAGE 1	PAGE 2	PAGE 3		0	4	5	6	7

**D. 7C1 (DIRECT STATION SELECTION)**  
RST - RESTORE

20	21	22	23	24	25	26	27	28	29
10	11	12	13	14	15	16	17	18	19
				0	6	7	8	9	

50	51	52	53	54	55	56	57	58	59
40	41	42	43	44	45	46	47	48	49
30	31	32	33	34	35	36			



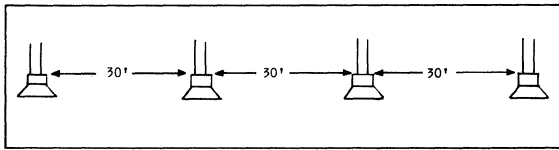
PAGE 3	10	16	22	28	34	43	49	55	
PAGE 2	9	15	21	27	35	42	48	54	59
PAGE 1	8	14	20	26	32	41	47	53	58
	7	13	19	25	31	40	46	52	57
	6	12	18	24	30	36	45	51	56
RE-ENT	0	11	17	23	29	35	44	50	RST



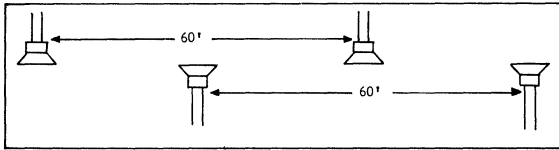
RST - RESTORE

**E. 128A6Y OR 138A6Y**

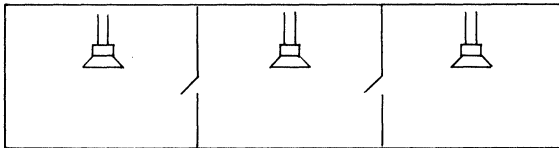
**Fig. 17—Button Locations, Selector Consoles**



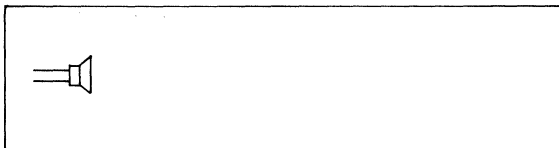
EXAMPLE A - SPEAKERS LOCATED ON ONE WALL OF ROOM (NOTES 1,2 AND 3)



EXAMPLE B - SPEAKERS LOCATED ON OPPOSITE WALLS OF ROOM (NOTES 1 AND 2)



EXAMPLE C - SPEAKERS LOCATED IN INDIVIDUAL ROOMS (NOTES 1,2 AND 4)



EXAMPLE D - OUTSIDE SPEAKER (HORN) LOCATION (NOTES 2 AND 5)

NOTES:

1. EXAMPLES A, B AND C ARE FOR QUIET OR OFFICE TYPE ENVIRONMENTS, LESS THAN 65 DB SOUND PRESSURE LEVEL (SPL). ALL SPEAKERS SHOULD BE LOCATED AT LEAST 60 FEET FROM ANY STATION USED FOR PAGING.
2. SPEAKER WIRING SHOULD BE RUN SEPARATELY, NOT PART OF A VOICE CABLE. QUAD CABLE SHOULD BE USED WITH BOTH PAIRS CONNECTED. SPEAKERS SHOULD BE HUNG AS CLOSE TO THE CEILING AS POSSIBLE. MAXIMUM SPEAKER DISTANCE FROM THE UNIT IS 580 FEET.
3. SPEAKERS REACH A DEPTH OF 30 FT. IF ROOM IS OVER 30 FT. WIDE, FACING SPEAKERS SHOULD BE USED.
4. ONE SPEAKER WILL SERVE A ROOM UP TO 25 FT. BY 25 FT.
5. ONE SPEAKER (HORN) MOUNTED 20 FT. ABOVE GROUND LEVEL WILL COVER AN AREA APPROXIMATELY 80 FT. BY 100 FT. IF THE HORN IS MOUNTED LESS THAN 20 FT. ABOVE GROUND LEVEL, TWO HORNS MUST BE USED. HORNS SHOULD NOT BE MOUNTED LESS THAN 15 FT. ABOVE GROUND LEVEL. IF MORE THAN ONE HORN IS USED, THEY SHOULD BE MOUNTED VERTICALLY, RATHER THAN SIDE-BY-SIDE.

Fig. 18—Example of Paging Speaker Locations