

**ML-8000 MULTI-LINK INTERCOM
TECHNICAL INSTRUCTIONS
DOCUMENT #13-100317 REV. Q
AUGUST 1987**

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1. GENERAL INFORMATION

Description of Product

1.01 The ML-8000 Multi-Link Intercom provides dial selection from five to 80 stations on one to four private talkpaths. It is tone and rotary dial selective and can be accessed from a single line set or from one button on a multiple key set.

1.02 System features of the ML-8000 include:

- **CALL PROGRESS TONE SELECTION**

- Dial Tone

- Called Station Busy Tone

- Ringback Tone

- System Busy Tone

- **CALLING FEATURE SELECTION**

- Camp-on Calls

- Conference Calls

- **SYSTEM BUSY INDICATION**

- **SELECTIVE STATION SIGNALING**

- **SELECTOR PER LINK**

- **MIXED DIALING CAPABILITY**

1.03 Options for the ML-8000 include:

- **OUTSIDE LINE CONFERENCING**

- **PAGING ACCESS**

- **OFF-HOOK BUSY INDICATION**

- **LONG LINE CAPABILITY**

- **EMERGENCY ALERT ALARM**

- **HANDS-FREE CAPABILITY**

1.04 The ML-8000 has been designed to keep installation time to a minimum. A standard 25-pair connectorized cable is required for each 10-station group. When the calling rate increases, link capacity can be expanded up to four talkpaths.

1.05 Stations are added in five-station increments (to a maximum of 80 stations) by installing plug-in circuit cards. No modification of the basic system is necessary for the extra circuits or for additional options.

Federal Communications Commission (FCC) Regulations

1.06 To comply with FCC regulations, the following requirements must be met:

- Upon installation, the FCC registration number of this system must be reported to the telephone company. That number is AH19V9-69763-KX-N.
- This system must be installed by telephone company personnel or agents authorized under Part 68 of FCC Rules and Regulations.
- This system must not be installed on coin lines or party lines.
- If this system malfunctions, the telephone company may disconnect service temporarily. If disconnection is necessary, the telephone company must attempt to notify the user in advance. Otherwise, they must notify the user as soon as they are able.
- Repair work on this system must be done by TCS.

FCC, Part 15

"WARNING: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. As temporarily permitted by regulation it has not been tested for compliance with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference."

Manual Changes

1.07 This revision is issued to correct the Interdigital Time specification and to delete references to off-premise extensions in the CP-854 description.

ML-8000**1. GENERAL INFORMATION (cont'd.)****Manual Changes****Service Information**

1.08 Limited troubleshooting is possible on the ML-8000 (see Troubleshooting Guide). However, if the system requires more than card replacement, contact:

**CUSTOMER SERVICE DEPARTMENT
TONE COMMANDER SYSTEMS, INC.
Box 97039
4320 150th Avenue N.E.
Redmond, Washington 98073-9739 USA
Telephone: (206) 883-3600
Telex: 15-2246**

Refer to: ML-8000 Multi-Link Intercom

Warranty Information

1.09 Tone Commander Systems, Inc. warrants this product to be free from defects in materials and workmanship for 24 months from date of shipment. Damage to products resulting from physical abuse or electrical misuse voids this warranty. All units will be stamped on the day they are shipped with the date of shipment.

1.10 Out-of-warranty units will be returned to full working order for a nominal handling charge plus parts, labor and transportation. A 90-day warranty covers repairs made on out-of-warranty units. A \$15.00 handling charge will be assessed on all units, in- or out-of-warranty, that are returned and found to be free of defects. **NOTE: To maintain full warranty, do not ship cards in housing when returning for repair.** All cards should be shipped in anti-static bags as a precaution against accidental damage due to static.

IMPORTANT!

Tone Commander equipment/circuits were designed to be connected to the station side of CO/PABX 1A2 line cards (a.k.a. key telephone units, KTUs). Under no circumstances should they be directly connected to central office lines (i.e., outside plant). Any reference to "outside lines" mentioned in the affected paragraphs or figures of this document should be construed to mean "the station side of a 1A2 CO/PABX line card."

2. PRODUCT IDENTIFICATION**Applications**

2.01 The ML-8000 is suitable for large and small installations that require private talkpaths and is easily expanded as needs increase. The system allows simultaneous dialing on all equipped links.

System Features

2.02 The main card file of the ML-8000 measures 34.3 cm (13 1/2 inches) H by 31.2 cm (12 5/16 inches) W by 23.7 cm (9 5/16 inches) D. Expansion card file measures 34.3 cm (13 1/2 inches) H by 11.4 cm (4 1/2 inches) W by 23.7 cm (9 5/16 inches) D.

Operating temperature: 0° C to 50° C.

Storage temperature: -20° C to +80° C.

Operating relative humidity level: 0% to 95% noncondensive.

2.03 Call Progress Tone Selection - The call progress tones supplied by the ML-8000 (dial tone, ringback, called station busy and system busy) can be individually enabled or disabled by means of a DIP switch located on the signal card. Each tone is independently selectable so that any combination of tones is available in a system.

2.04 Dial Tone - (similar to C.O. dial tone) - is generated when the selector is seized.

2.05 Ringback - confirms signaling of the called station.

2.06 Called Station Busy Tone - is generated when the called station is busy.

2.07 Calling Feature Selection - Camp-on (call waiting) and dial conferencing calling features may be selectively enabled or disabled by means of a DIP switch located on the link card. Each feature is independently selected so that any combination of features is possible. **NOTE: As this feature is optional per link, all link cards within the same system must have the same options selected.**

ML-8000**2. PRODUCT IDENTIFICATION (cont'd.)****System Features (cont'd.)**

2.08 Camp-on - The camp-on feature will notify the called party of a waiting intercom call by flashing the intercom lamp without audible signaling as long as the calling party waits. The calling party will hear a busy tone. Audible signaling to the called party will occur when the called station becomes idle.

NOTE: Call waiting signaling tone is available as an option. See "Call Waiting Tone" in Section 2.18.

2.09 Conference Calling - Any number of rotary dial and up to 8 tone dial stations can be brought into conference using this feature. (Access of more than 8 tone sets is possible, but line loss is significant above that number.) Once a station is accessed, all link features are available to that station. Any station can dial or leave the conference without affecting the conversation of the other stations.

2.10 System Busy Indication - The lamps at all idle stations will light steadily when all links are busy. Calls cannot be initiated during this time and any station going off-hook will receive a busy signal. Established conversations will not be disrupted. The busy tone signal is selectable on the DIP switch located on the CP-820/830 signal card.

2.11 Selective Station Signaling - Station signaling may combine bells and buzzers within a system.

2.12 Selection Per Link - Each link controller is equipped with an individual tone and rotary dial register which allows simultaneous dialing on all supplied links.

2.13 Mixed Dialing - Each dial selector is capable of decoding tone and rotary dial. This feature allows use of a mixture of tone and rotary dial sets.

Optional Features

2.14 The ML-8000 can be provided with the following options:

2.15 Outside Line Conferencing (CP-852 Series) - This option provides the capability to conference outside (central office) lines through the intercom (available in five-line increments).

2.16 Paging Access (CP-853 Series) - Five zones of paging access are available in this option. Each zone is accessed by a separate code and controlled by the calling party. An accessed zone provides audio coupling to the originating station's link and a dry relay contact closure for paging equipment control.

2.17 Long Line Capability (CP-854 Series) - The long line card provides increased current for extended line loops. In addition, the card can provide audible signaling over tip and ring on a per station basis, eliminating the need for a separate signaling pair. This card can replace a standard station card.

2.18 Call Waiting Tone - The call waiting tone feature signals the called party that a call is camped-on via a single short tone burst on the talkpath (heard only by the station that has a call waiting). This feature is available as an option on the long line card (CP-854A-01) or on the deluxe station card (CP-856-01).

2.19 Hands-Free Capability - By using the appropriate adapter and the hands-free station card (CP-856), the Western Electric 2A Transmitter/Receiver H.F.A.I. or ITT K174 Call Announcer can be interfaced to the ML-8000. The HF-40 Hands-Free Adapter is required for interfacing one Western Electric Transmitter/Receiver to the system. The HF-450 Hands-Free Adapter interfaces five ITT Call Announcers to the system.

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2. PRODUCT IDENTIFICATION (cont'd.)

Optional Features (cont'd.)

2.20 Emergency Alert Alarm - The Emergency Alert Alarm feature enables a station user to call every station in the system by dialing 91. All answering stations are connected in conference and are able to hear the emergency message at the same time. Ringing stops at a station when it goes off-hook or the initiating station hangs up. This feature requires a CP-830 signal card and the exclusive use of CP-852 or CP-856 station cards.

Design Features

2.21 The ML-8000 consists of the following components:

2.22 Main Card File (CF-880) - A main housing (which can be rack or wall mounted) that is prewired and totally 25-pair connectorized. This unit houses the power regulator card, the signal card, four link cards and eight station cards. It provides an input power termination strip and fusing for "A" battery, "B" battery, lamp battery and two audible supply voltages (normally 110 VAC for bells and 10 or 18 VAC for buzzers) and associated grounds. Each 10-station group requires one 25-pair connectorized cable. The 20's through 50's dial access codes are pre-assigned by equipment location.

2.23 Expansion Card File (CF-840) - Adds 20 stations to the 40 provided in the main card file. The unit mounts next to the main card file in the standard rack or wall mount. It is prewired to accept up to four station cards (or equivalent option cards). Station set wiring is the same as the basic unit. Connection from the first expansion unit to the main housing is made with a 50-conductor flat cable provided with the expansion card file. The first expansion unit is preassigned to the 60's and 70's dial codes. The second expansion unit connects to the first with another 50 wire flat cable (provided) and is preassigned to the 80's and 90's dial codes.

2.24 Power Regulator Card (CP-810 Series) - Supplies regulated system operating voltages from the -20 to -28 VDC "B" battery. The CP-810A also contains the lamp triggering circuitry necessary for the proper operation of all station lamps. **NOTE:** Each system requires one regulator card and it must be in position before the intercom system can function.

2.25 Signal Card (CP-820 Series) - Provides the basic system clock timing, generates all call progress tones, signaling rates for lamps and all audible ringing. It also contains the station decoder which sets preassigned dial codes. One signal card is required per system.

2.26 Link Card (CP-840 Series) - Provides link supervision, call sequence control logic and the tone and rotary dial detector register. Each link card is dedicated to a unique talkpath assigned by equipment location. Each system requires at least one link card for operation and up to four may be used.

2.27 Station Card (CP-850 Series) - Provides control capability for five stations and also the interface logic between the four link cards and the station sets on a five-station-per-card basis. The CP-850-Type also contains off-hook detection circuitry, link access and synchronization circuitry and provides station lamp and audible signal control. Each station circuit provides an individual battery feed for the station set's tip and ring. One station card is required to service five stations and cards may be added for expansion up to 80 stations (16 cards).

ML-8000**2. PRODUCT IDENTIFICATION (cont'd.)****Option Cards**

2.28 The following option cards can be used in the ML-8000 system:

2.29 Emergency Alert Alarm Signal Card (CP-830 Series) - Provides the basic system clock timing, generates all call progress tones, signaling rates for lamps, and all audible ringing. It contains the station decoder which sets preassigned dial codes including the emergency alert alarm dial code. One signal card is required per system.

2.30 Outside Line Conferencing Card (CP-852 Series) - Plugs into any station card slot. It allows any intercom station to access an outside line that is on hold by dialing the assigned dial code. Each conference card contains circuitry to conference five C.O. lines and interfaces to a key system line circuit through the tip, ring, lamp and "A" lead. On CP-852A tie line capability and dial pulse transmission are available.

2.31 Paging Access Card (CP-853 Series) - Also plugs into any station card position. This option provides dial selective access to any one of five paging zones. In the circuit, a 600-ohm balanced talkpath audio output is switched to the selected zone. The other four call zones remain shorted and any attempted access to these zones will result in a busy tone.

2.32 Long Line Station Card (CP-854 Series) - Operates with up to 700 ohms of loop resistance (at 20V A Bat.), permits bridged ringing over the tip and ring pair for single line phones on extended intercom lines and can be ordered with a call waiting tone. Bridged ringing is selectable on a per station basis (each card contains five stations) as is audible signaling (bell/buzzer) for standard key line stations. The CP-854A can directly replace the CP-850A station card. On the CP-854A Long-Line card, unused station busy-out and single burst ring-out features are included on a per-station basis.

2.33 Deluxe Station Card (CP-856) - Contains all the basic station card features as well as Long-Line and Off-Hook Busy features. Bridged ringing, separate bell/buzzer signaling or hands-free station set interface can be selected on a per station basis. In addition, each of the five stations can be set up for single burst ring-out or unused station busy-out.

2.34 Adapters (separate tech practices available upon request)

HF-450 Hands-free Adapter (for ITT K174)
 HF-40 Hands-free Adapter (for WE 2A)
 AR-100 Auxiliary Relay Unit
 PA-270 2-Zone Paging Amp

2.35 Electrical Specifications

Operating Voltage (B Battery):
 -20 to -28 VDC

Operating Current at 24 VDC:
 600 mA operating; 300 mA idle

Lamp Battery:
 10 VAC at .05 amp per station

Signaling Contacts:
 1 amp

Talk Voltage (A Battery):
 -20 to -28 VDC (filtered) at 40 mA per station maximum

Rotary Dial Selector:
 Pulse Speed: 10 PPS \pm 3 PPS
 Pulse Ratio: 60/40% \pm 10%

Tone Receiver:
 Detect Time: 40 ms maximum
 Interdigital Time: 67 ms minimum
 Input Level: -10dB to +6dB (each tone)
 Bandwidth: \pm 2%
 Twist: 6dB

Loop Length:
 470 ohms at 20V A Bat. (CP-850 Series, CP-851 Series, CP-855)
 700 ohms at 20V A Bat. (CP-854 Series CP-856)

NOTE: Loop length indicates wire resistance to station set.

Talk Path Loss:
 Station to Station: 6dB (maximum)
 Station to Outside Line: 6dB (maximum)
 Max. Stations Per Tip and Ring Pair: 2 phones

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3. INSTALLATION INSTRUCTIONS

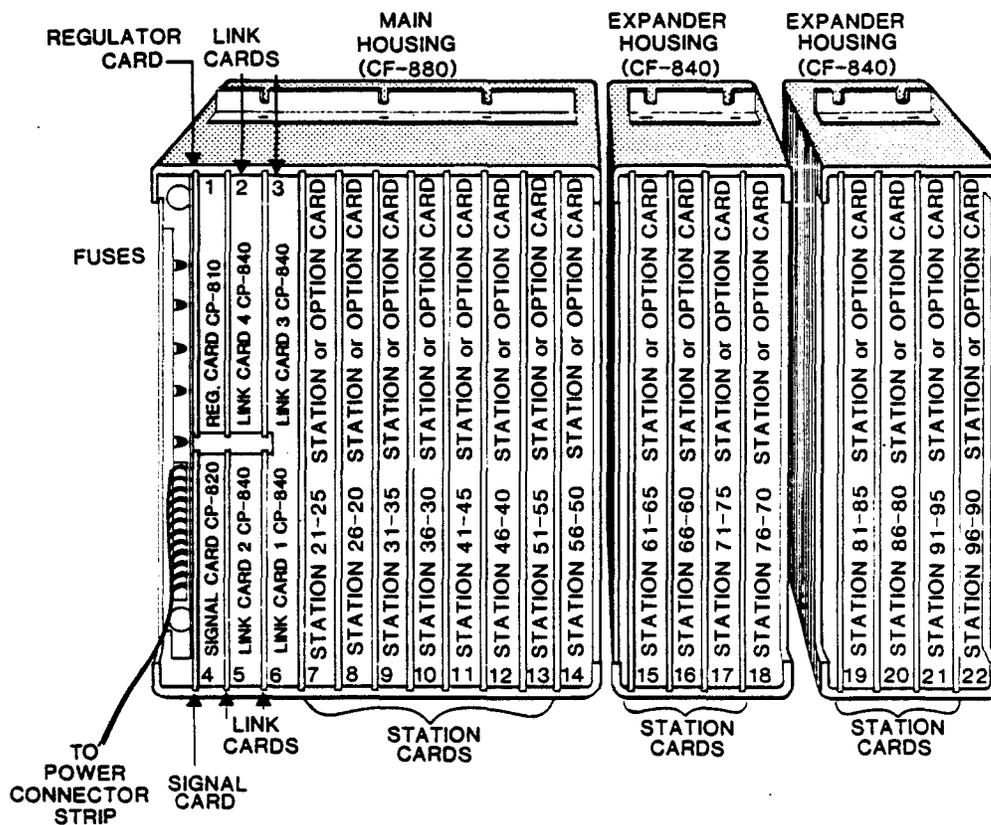
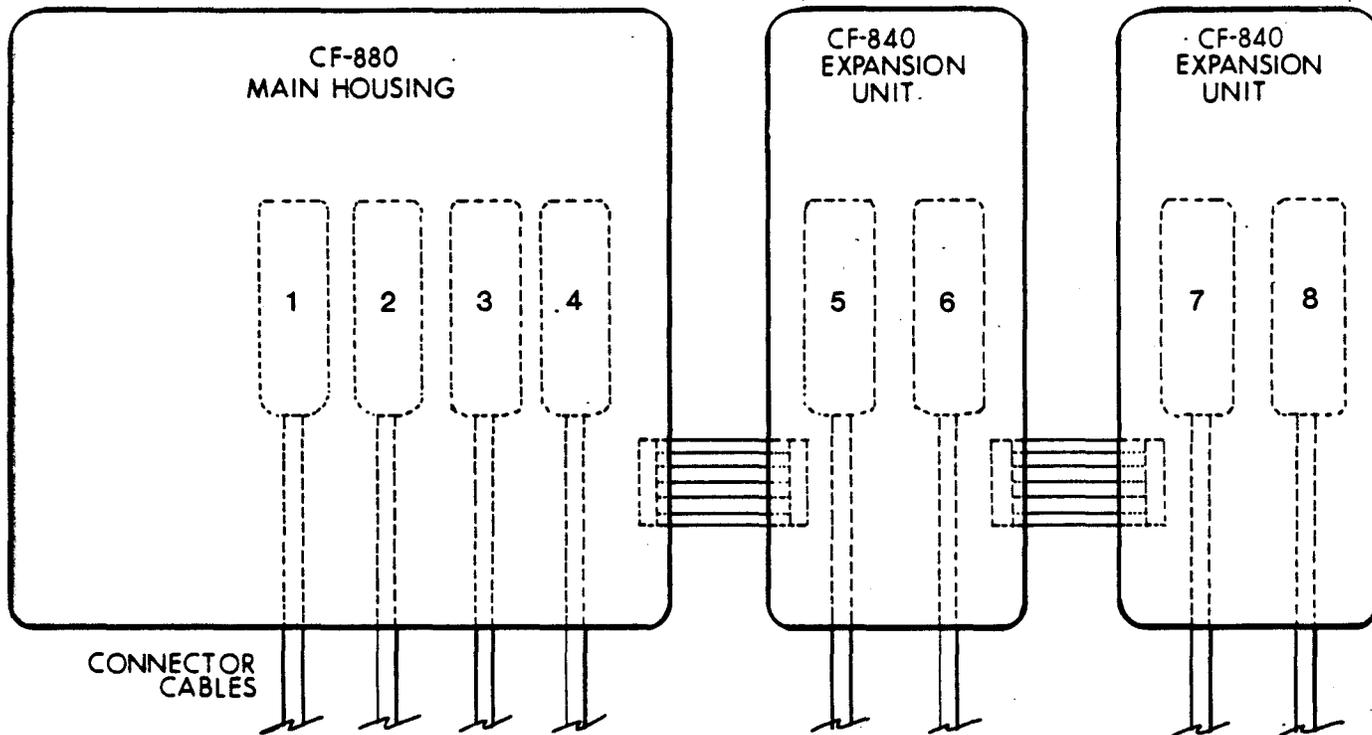


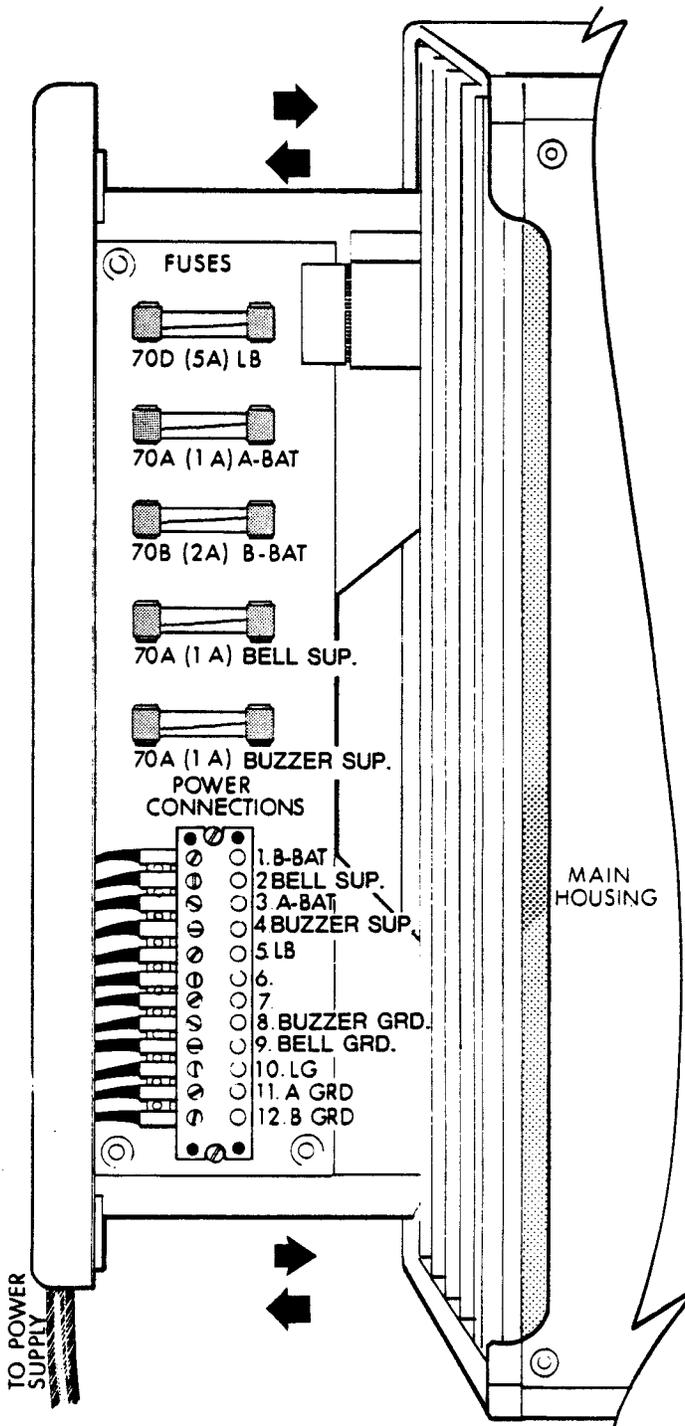
Fig. 1 -- Connector Cable and Card Positions

ML-8000

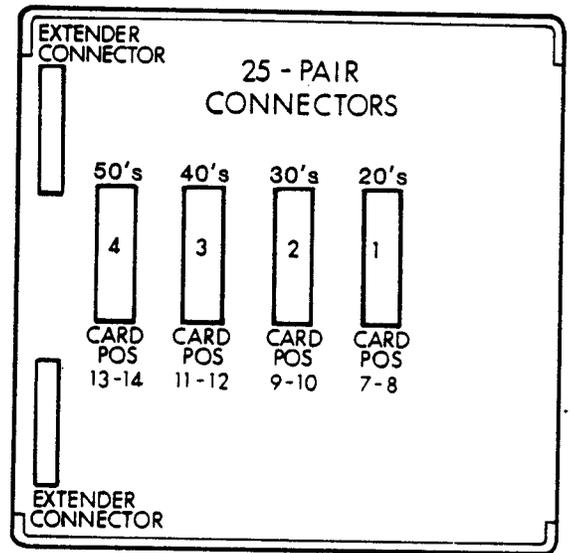
3. INSTALLATION INSTRUCTIONS (cont'd.)

Introduction

3.01 Determine the number of stations, links and to be used in the system. Refer to Figs. 1 and 3 for proper connections for the desired system configuration.



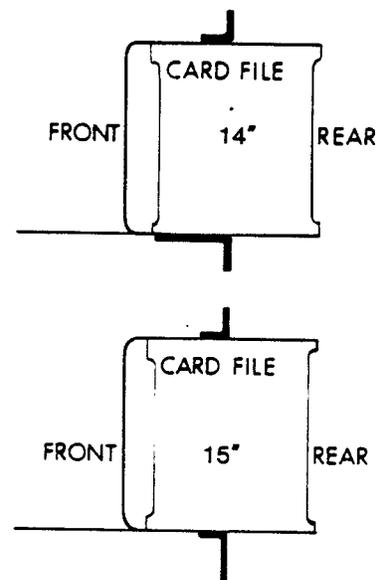
Fusing and Power Connections
Fig. 2



Rear Connector Diagram
(Standard Dial Plan)
Fig. 3

Main Card File and Expansion Card File Installation:

3.02 The ML-8000 card files are provided with a bottom bracket that has two sizes of tabs that can be mounted two ways to provide mounting of either 14 or 15 inches as needed. (See Fig. 4.)

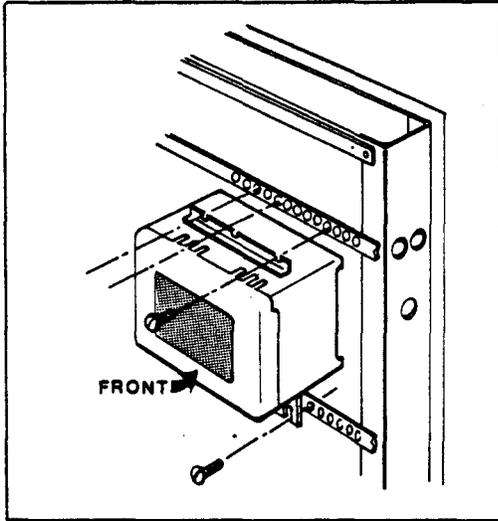


Card File Mounting Bracket Positions
For 14" or 15" Mounting Racks
Fig. 4

ML-8000

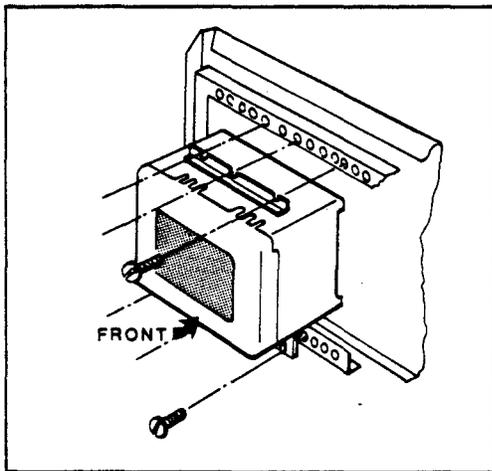
3. INSTALLATION INSTRUCTIONS (cont'd.)

3.03 KTS Rack Mount - place cross bars on 14-inch centers. Rotate the bottom bracket on the CF-880 card file so that the wide tab is mounted to the cabinet. Refer to top drawing in Fig. 4. Use six #12-24 screws to install the card file in the rack as shown in Fig. 5.



**Mounting for Standard
23" KTS Rack
Fig. 5**

3.04 16-C Type Swing Mount - remove the center support from the gate of the swing mount if it is provided. Use six #12-24 x 1/4 inch screws as shown in Fig. 6.

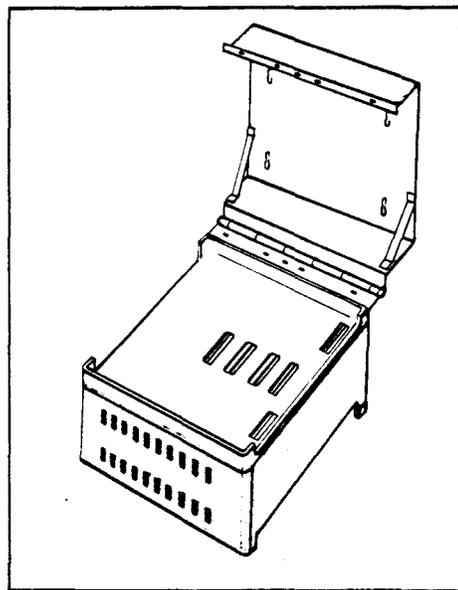


**Mounting for 16-C
Type Swing Gate
Fig. 6**

3.05 Rack Mount With 15" Centers - rotate the bottom bracket on the card file as shown in bottom drawing of Fig. 4. Attach the unit to the rack using the provided hardware.

3.06 SM-400 Swing Mount - for best results, mount the SM-400 to a piece of plywood, then attach the plywood to the wall with hardware suitable for the wall surface. Place the swing mount in the desired position on the plywood. Mark the four screw locations of the keyhole slots on the wood. Remove the SM-400 and screw the hardware into the marked locations. Leave the heads standing out about 1/4 inch. Slip the SM-400 onto the plywood using the keyhole slots. Tighten the screws firmly. Move the top and bottom brackets on the card file to the rear of the unit, using the provided screw holes. The wide tab of the bottom bracket should be attached to the card file.

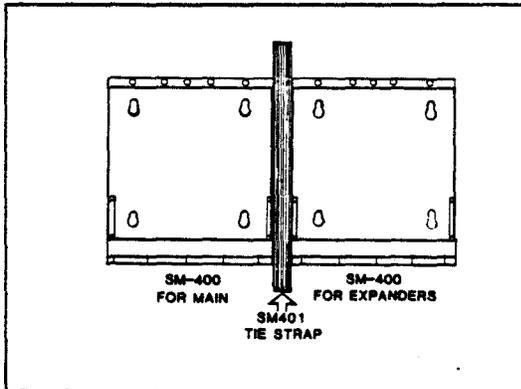
3.07 If there are no expander units, attach the card file to the swing mount with three screws on the hinges. See Fig. 7. Carefully swing the card file into place and insert the remaining three screws through the bracket slots into the corresponding holes at the top of the swing mount.



**SM-400 Swing Mount
Fig. 7**

ML-8000**3. INSTALLATION INSTRUCTIONS (cont'd.)**

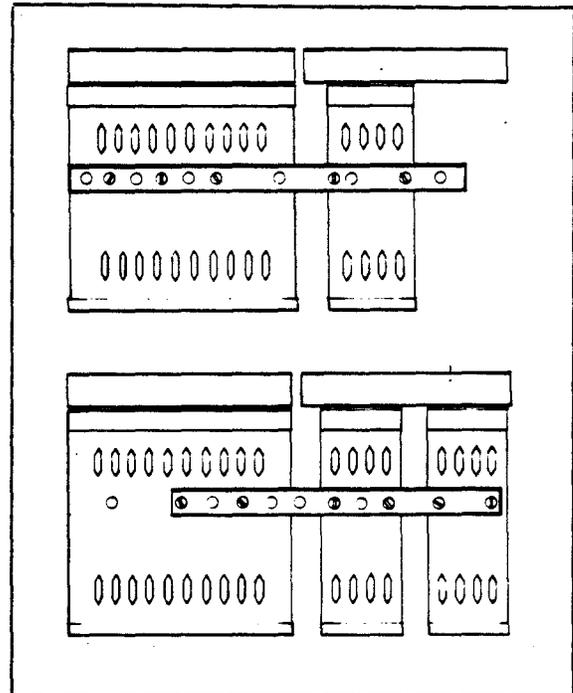
3.08 If an expander file is required, another SM-400 swing mount and an SM-401 tie strap are needed. Place both swing mounts on the plywood with the tie strap in between (see Fig. 8). This will give the exact spacing needed between the units. Remove the tie strap after marking the screw locations and proceed as in step 3.06.



Mounting Swing Mounts to Plywood
Fig. 8

3.09 At this point, attach the main card file to the first swing mount at the hinge. Install the expander file to the second swing mount hinge. Install the tie strap by placing it across the tops of the card files. Insert screws through the tie strap and hole where the bracket had been located. Refer to Fig. 9 for locations with 1 or 2 expanders. Attach the interconnect cable from the expander unit to the main unit. Lift the units together and insert screws through the top bracket slots into the corresponding holes of the swing mounts.

3.10 Wall Mount - the ML-8000 also can be mounted directly to a wall, using hardware suitable for the wall material. Move the brackets to the rear of the card file. Place the unit against the wall and mark the screw locations to match the slots on the brackets. Screw the hardware for the bottom bracket only into the wall, leaving the heads standing out 1/4 inch. Slip the card file onto the screws, using the bracket slots. Tighten the screws securely. Install the remaining screws through the top bracket slots and tighten them.



SM-401 Tie Strap Installation
Fig. 9

3.11 If an expander unit is required, connect it to the main card file with the tie strap in the bracket holes on top of the units. Attach the interconnect ribbon from the expander unit to the main unit. Proceed as in step 3.10.

Power Wiring

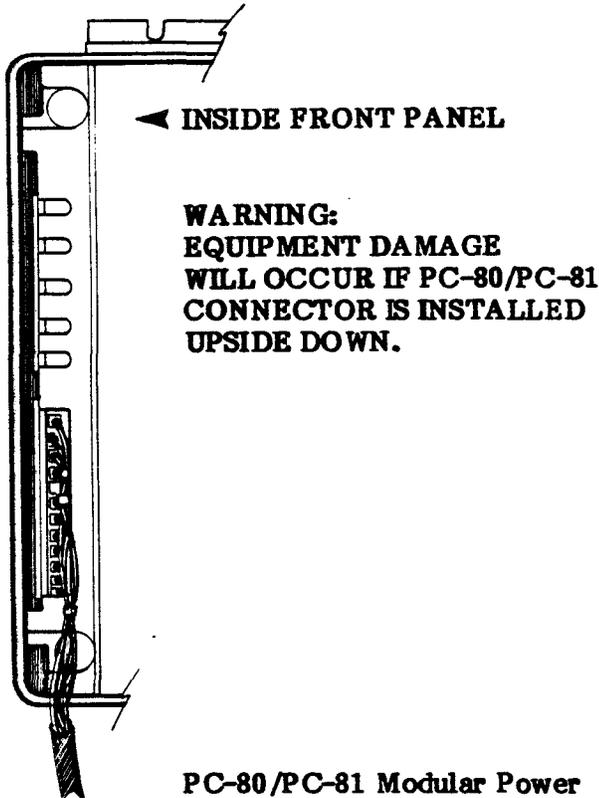
3.12 Either modular or discrete power wiring may be used:

3.13 Modular Wiring - The PC-80 is a pre-connectorized 10-foot cable that has a keyed connector at one end and a 12-pin connector at the other. The keyed connector allows errorless connection to the power termination strip and the 12-pin connector provides direct connection to the Western Electric Co. 79B1, 79B2 or 90B1 power supplies. Fig. 10 shows proper installation.

WARNING: Be sure to install the plug with the cord at the bottom. Improper installation can cause equipment damage.

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3. INSTALLATION INSTRUCTIONS (cont'd.)



**PC-80/PC-81 Modular Power Cable Installation
Fig. 10**

**TABLE I
Power Cable
Terminal Location Index**

TERMINAL #	COLOR	POWER STRIP CONNECTION
1	GREEN	"B BATTERY"
2	BLUE	BELL SUPPLY"
3	BLACK	"A BATTERY"
4	-	"BUZZER SUPPLY"
5	RED	"LAMP BATTERY"
6	-	-
7	-	-
8	-	"BUZZER GROUND"
9	-	"BELL GROUND"
10	BROWN	"LAMP GROUND"
11	ORANGE	"A GROUND"
12	WHITE	"B GROUND"

NOTE: Bell (110VAC) ground is connected to LB ground in the ML-8000. Pins 4 and 5 are connected together on PC-80/PC-81.

3.14 The PC-81 is a 10-foot cable with a keyed connector at one end. Install the connector on the ML-8000 as shown in Fig. 10. Cut the other end to the length needed. Reference Table I and connect the power supply using the wiring arrangement shown in Table L.

3.15 Discrete Wiring - Connect power sources to the power termination strip on the CF-880 cabinet. (Refer to Table L)

NOTE: The power termination strip is a special screw-down clamp-type connector. The clamp terminates single or multiple wires of 10 to 24 AWG or equivalent.

3.16 For the following connections in steps A through D, strip ¼ inch of insulation from wire end and insert it into the connector body (bare wires should not be seen). Tighten clamp screw securely. Refer to Fig. 2 for wiring connection.

A. Connect "B BATTERY" and "B GROUND" to KTS power supply signal (unfiltered) -24VDC outputs.

B. Connect "A BATTERY" and "A GROUND" to power supply talk (filtered) -24VDC outputs.

C. Connect "BUZZER SUPPLY" and "BUZZER GROUND" to power supply 10VAC or 20 VAC.

D. Connect "L BATTERY" and "L GROUND" to power supply lamp 10 VAC outputs.

E. Connect "BELL SUPPLY" and "BELL GROUND" to power supply ringing generator.

F. COMMON ALL GROUNDS AT POWER SUPPLY.

3.17 Grounding - Connect power supply ground to earth ground (Telco ground or cold water pipe). The earth ground should not vary from Central Office ground by more than 3 volts.

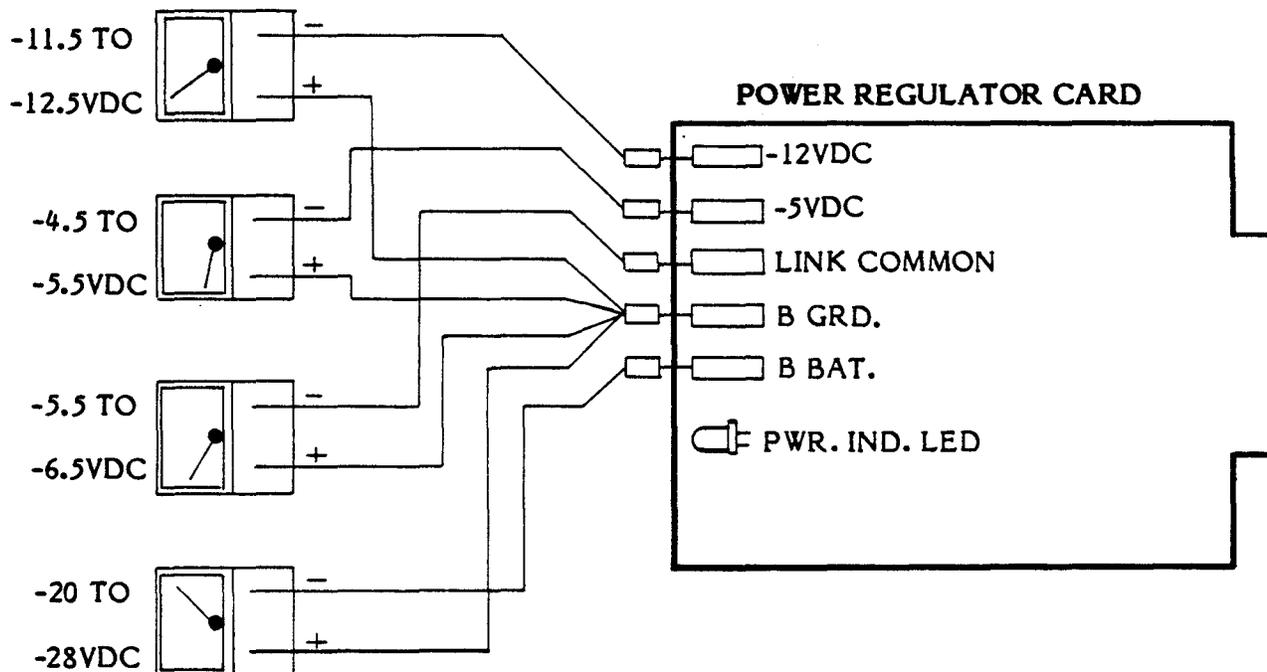
Cable Installation

3.18 Refer to Fig. 3.

A. Plug each cable into the ML-8000. Secure with the connector retainers provided.

B. Identify and terminate each cable in standard sequence on a 66MI-50 connecting block.

C. Label each block. See Tables I through

ML-8000**3. INSTALLATION INSTRUCTIONS (cont'd.)****3.19 CP-810-Type Power Regulator Card**

CP-810-Type Power Regulator Card Test Points
Fig. 11

Description: The power regulator card is necessary for operation of the ML-8000 intercom system. It provides regulated operating voltages to the system. The lamp triggering circuitry that enables all of the station lamps to operate properly is also on the card.

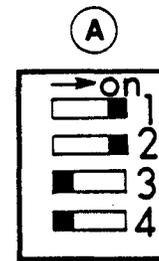
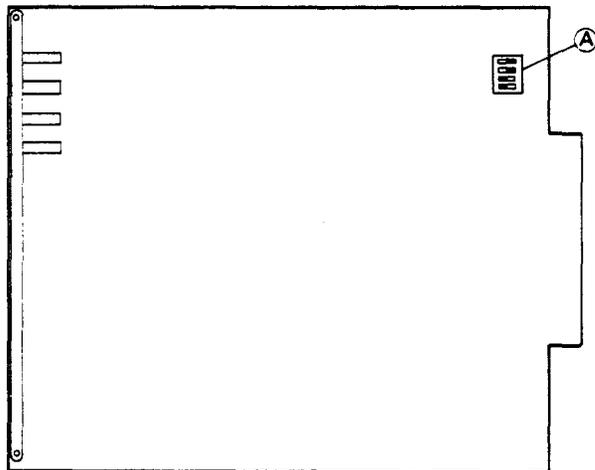
To install:

- A) If the power regulator card is not already installed, place it in card position 1 as marked on the card file diagram (Fig. 1).
- B) Verify that the voltage indicator (red LED) lights when power is on. If the LED does not light, refer to the Troubleshooting Guide.
- C) Using a voltmeter on the test points at the edge of the card, verify that the voltages present are within the limits shown in Fig. 11. If voltages are not acceptable, refer to the Troubleshooting Guide.

ML-8000

3. INSTALLATION INSTRUCTIONS (cont'd.)

3.20 CP-820/830-Type Signal Card



TONES

- 1. System busy enable
- 2. Station busy enable
- 3. Audible ringback disable
- 4. Dial Tone disable

NOTE:

Diagram shows all tones enabled.

**CP-820/830-Type Signal Card
Option Setting
Fig. 12**

Description: The signal card generates the four call progress tones for the system. It also provides the basic system clock timing, signaling rates for lamps and the station decoder which sets preassigned dial codes. One signal card is required for operation of the ML-8000 intercom system.

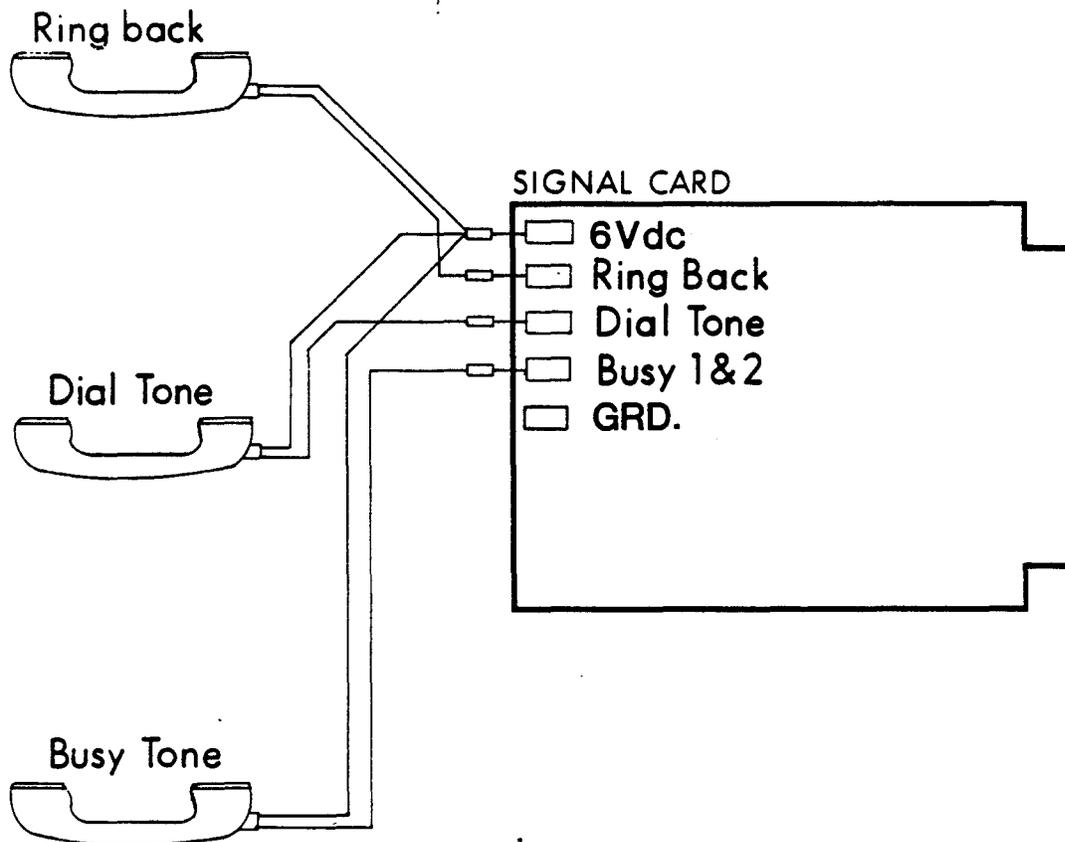
To install:

- A) Set the call progress tone switches on the DIP switch for desired functions (dial tone, ringback, called station busy and system busy). Each call progress tone is independently selectable; therefore, a system can be equipped with any combination of tones. See Fig. 12 for proper settings.
- B) Install the signal card in position 4 as shown on the card file diagram. See Fig. 1.
- C) Using an installer's handset, verify that the selected call progress tones are present. Refer to Fig. 13 for proper test points on the card. Refer to the Troubleshooting Guide if the tones selected do not work after checking switches.

ML-8000

3. INSTALLATION INSTRUCTIONS (cont'd.)

CP-820/830 Type Signal Cards

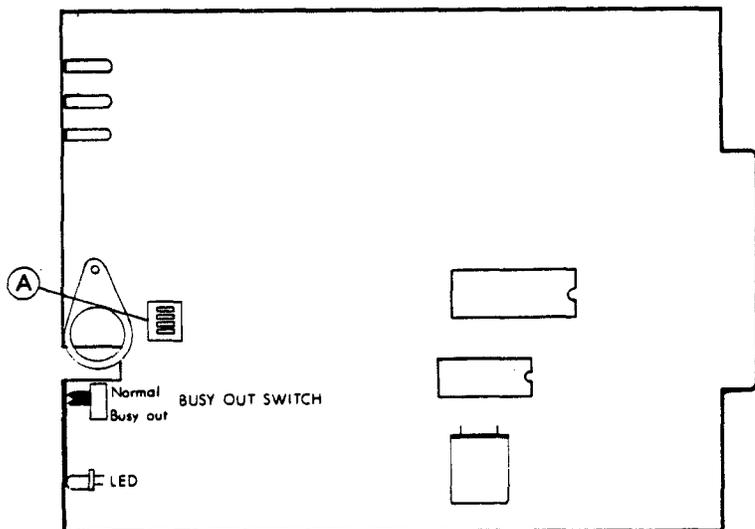


**CP-820/830-Type Signal Card Test Points
Fig. 13**

ML-8000

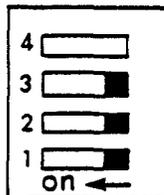
3. INSTALLATION INSTRUCTIONS (cont'd.)

CP-840B, CP-840C, CP-840D Link Cards



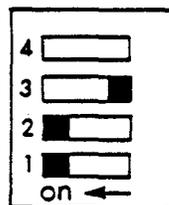
A

Switch Settings



4 Not used
3 Must be off
2 Camp-on disable
1 Conference disable

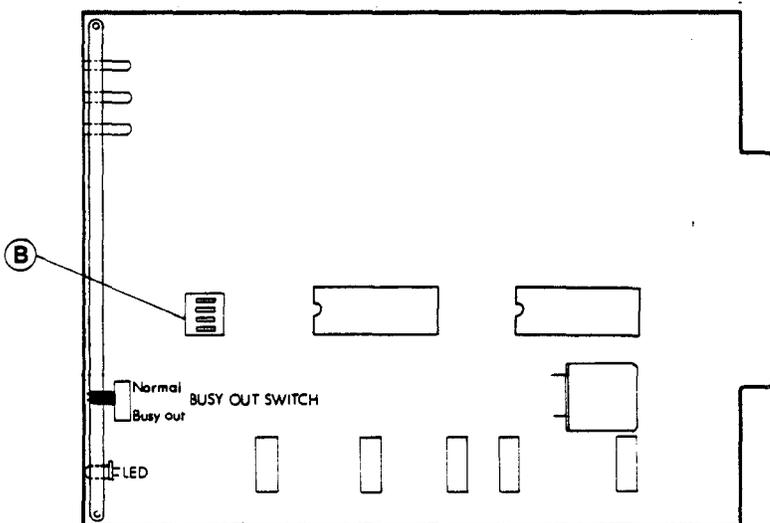
Shows Camp-on and Dial Conference enabled.



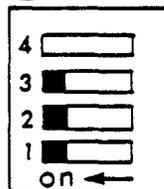
Shows Camp-on and Dial Conference disabled.

WARNING: Switch 3 must be OFF for proper link operation.

CP-840 & CP-840A Link Cards

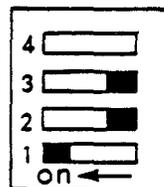


B



4 Not used
3 Dial Conference
2 Camp-on
1 Must be on

Shows Camp-on and Dial Conference enabled



Shows Camp-on and Dial Conference disabled

WARNING: Switch 1 must be ON for proper link operation.

CP-840-D Link Card

Fig. 14

ML-8000**3. INSTALLATION INSTRUCTIONS (cont'd.)****3.21 CP-840-Type Link Card**

Description: A link card in the ML-8000 system contains the control logic for call sequence and link supervision. It also provides the tone and rotary dial detector register and the DIP switch which controls the camp-on and dial conferencing options.

One link card is required and up to four may be used in the ML-8000 system.

To install CP-840-Type Link Card:

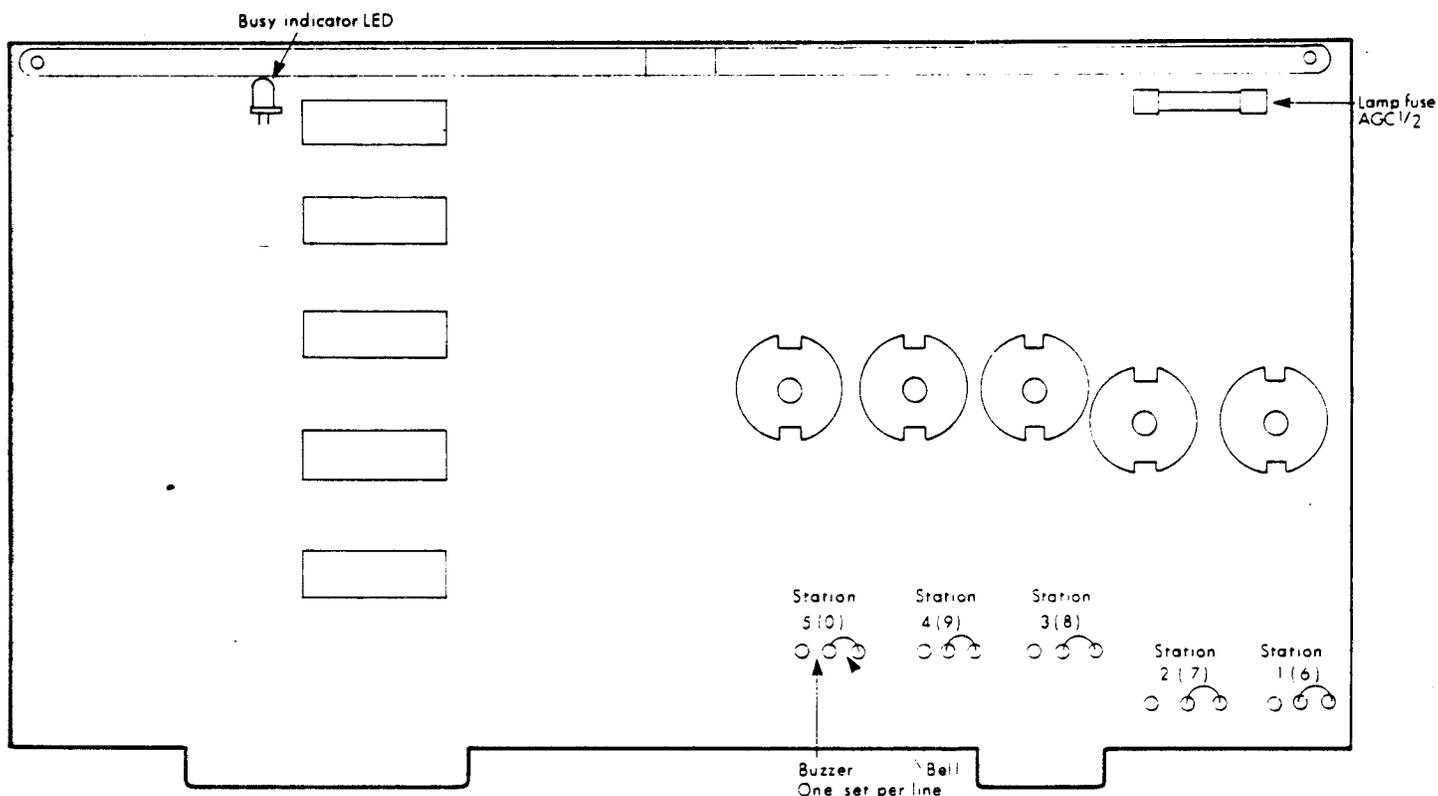
- A) Set the switches on the DIP switch for desired features (camp-on, conference calling) per Fig. 14. Features can be selected independently so that any combination is possible but all links must have the same features selected.
- B) For one link, install the link card in either position 5 or position 6 as indicated on the card file diagram. For two links, install cards in both 5 and 6. For three and four links, place link cards in slots 2 and 3 in addition to those in 5 and 6.
- C) Verify that each link card can be busied out (shown by flashing LED) by using the "busy out" switch provided on the front edge of the card. Push the busy out switch down for busy out, up for normal operation. When the link is accessed, the LED will light steadily.

NOTE: Busy-out switches must be set for normal operation when link card is inserted or when system power is turned on. Failure to follow this precaution may inhibit normal busy-out and link access.

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3. INSTALLATION INSTRUCTIONS (cont'd.)

3.22 CP-850A Station Card



**CP-850A Station Card
Fig. 15**

Description: The CP-850A is the standard station card for the ML-8000. It provides five station control capability and the interface logic between the link card(s) and the station telephone sets on the basis of five stations per card. The unit contains link access, off-hook detection circuitry and synchronization circuitry. Each station circuit on the card interfaces the tip and ring of the station's set through an individual battery feed termination. Audible signaling and station lamp control are also included on the station card. Each station has a separate ringing lead for standard 6-wire key system connection. Station signaling is selected on a per-station basis. Up to 16 station cards (80 stations) may be used in an ML-8000 system.

ML-8000**3. INSTALLATION INSTRUCTIONS (cont'd.)**

TABLE II
CP-850-TYPE STATION CARD
CONNECTOR PIN OUT INDEX

<u>PIN OUT</u>	<u>COLOR</u>	<u>FUNCTION</u>
26	WHT-BLU	T-X1
1	BLU-WHT	R-X1
27	WHT-ORN	L-X1
2	ORN-WHT	B-X1
28	WHT-GRN	T-X2
3	GRN-WHT	R-X2
29	WHT-BRN	L-X2
4	BRN-WHT	B-X2
30	WHT-SLT	T-X3
5	SLT-WHT	R-X3
31	RED-BLU	L-X3
6	BLU-RED	B-X3
32	RED-ORN	T-X4
7	ORN-RED	R-X4
33	RED-GRN	L-X4
8	GRN-RED	B-X4
34	RED-BRN	T-X5
9	BRN-RED	R-X5
35	RED-SLT	L-X5
10	SLT-RED	B-X5
36	BLK-BLU	T-X6
11	BLU-BLK	R-X6
37	BLK-ORN	L-X6
12	ORN-BLK	B-X6
38	BLK-GRN	T-X7
13	GRN-BLK	R-X7
39	BLK-BRN	L-X7
14	BRN-BLK	B-X7
40	BLK-SLT	T-X8
15	SLT-BLK	R-X8
41	YEL-BLU	L-X8
16	BLU-YEL	B-X8
42	YEL-ORN	T-X9
17	ORN-YEL	R-X9
43	YEL-GRN	L-X9
18	GRN-YEL	B-X9
44	YEL-BRN	T-X0
19	BRN-YEL	R-X0
45	YEL-SLT	L-X0
20	SLT-YEL	B-X0
46	VIO-BLU	AUD-LAMP GRD.-X1
21	BLU-VIO	AUD-LAMP GRD.-X2
47	VIO-ORN	AUD-LAMP GRD.-X3
22	ORN-VIO	AUD-LAMP GRD.-X4
48	VIO-GRN	AUD-LAMP GRD.-X5
23	GRN-VIO	AUD-LAMP GRD.-X6
49	VIO-BRN	AUD-LAMP GRD.-X7
24	BRN-VIO	AUD-LAMP GRD.-X8
50	VIO-SLT	AUD-LAMP GRD.-X9
25	SLT-VIO	AUD-LAMP GRD.-X0

NOTE:

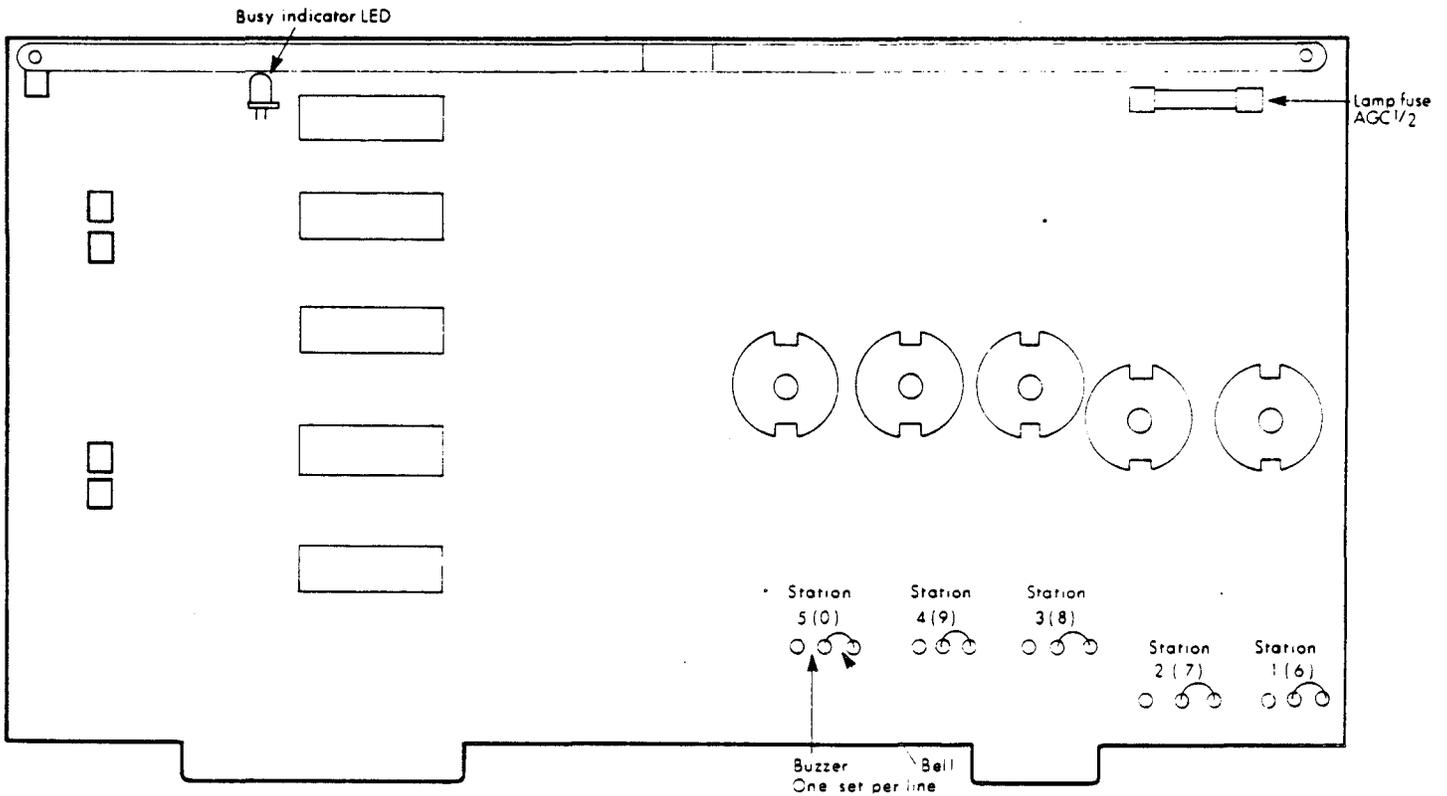
X=2 for 20's Group
X=3 for 30's Group
X=4 for 40's Group
ETC.

ML-8000

3. INSTALLATION INSTRUCTIONS (cont'd.)

Option Card Installation

3.23 CP-851A Off-Hook Busy Card

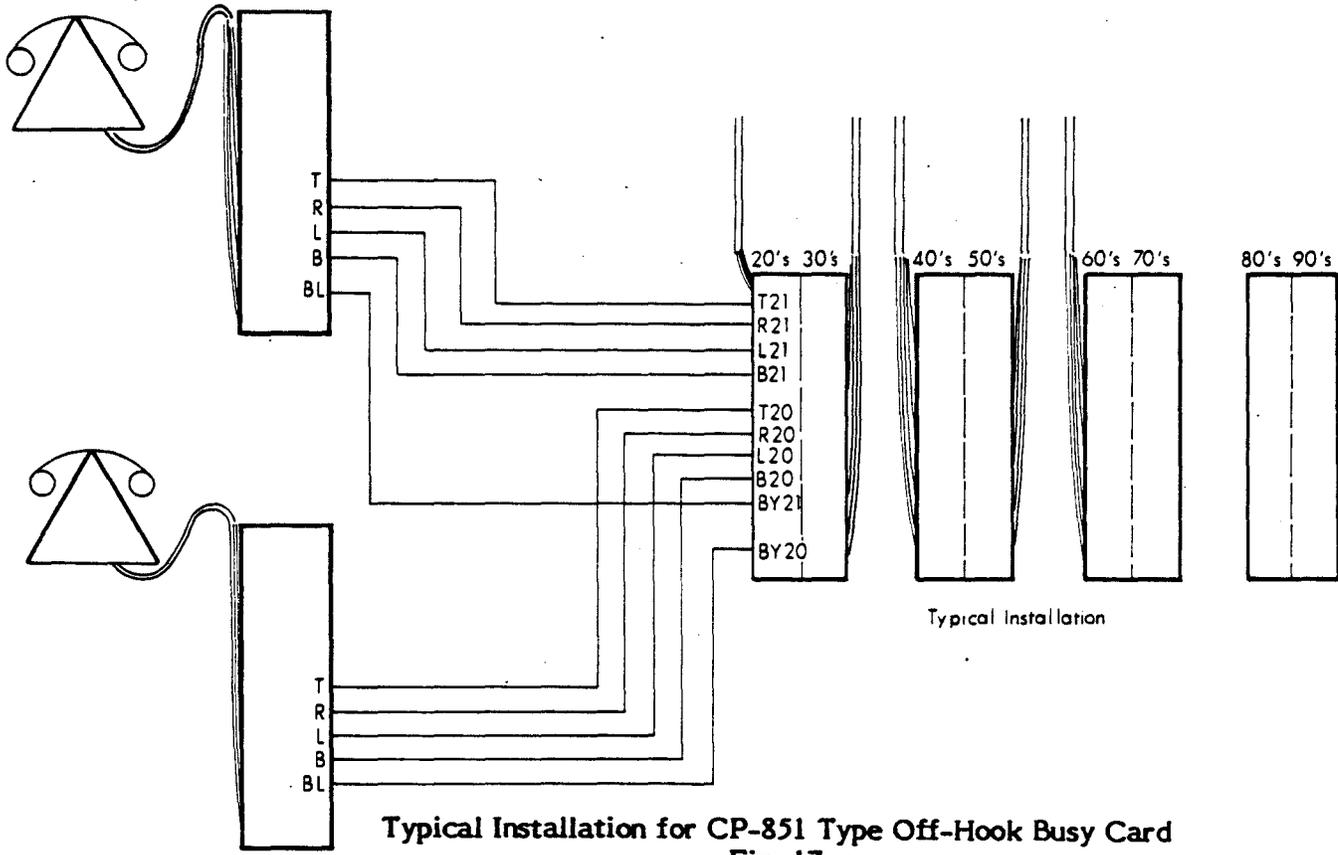


CP-851A Off-Hook Busy Card
Fig. 16

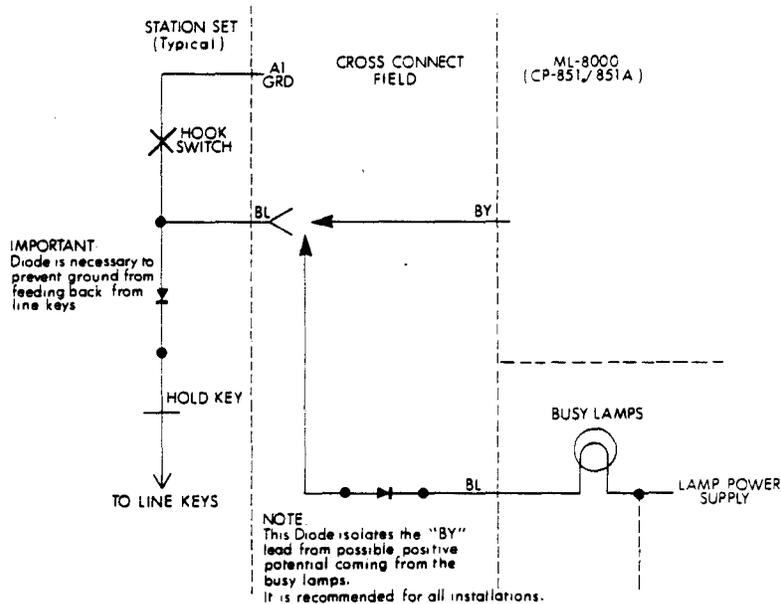
Description: The CP-851A can replace the standard CP-850-Type station cards and provides the Off-Hook Busy feature for five stations. This feature causes a calling station to receive a busy signal (on an intercom call) anytime the called station's receiver is off-hook. This card can plug into any station card slot. Station signaling is selectable on a per station basis.

ML-8000

3. INSTALLATION INSTRUCTIONS (cont'd.)



**Typical Installation for CP-851 Type Off-Hook Busy Card
Fig. 17**



**Station Wiring for CP-851-Type Off-Hook Busy Card
Fig. 18**

ML-8000

3. INSTALLATION INSTRUCTIONS (cont'd.)

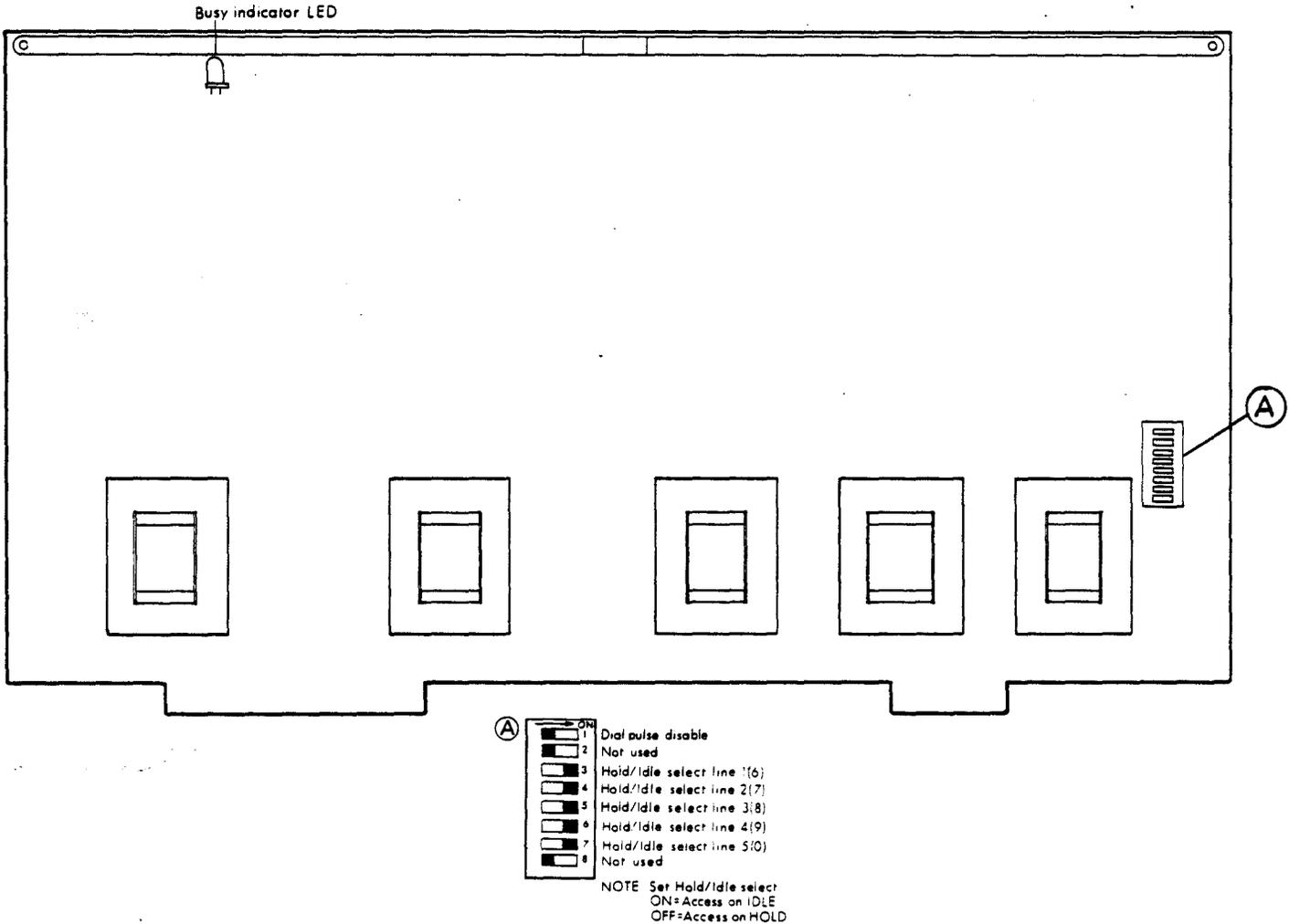
**TABLE III
CP-851-TYPE OFF-HOOK BUSY STATION CARD
CONNECTOR PIN OUT INDEX**

<u>PIN OUT</u>	<u>COLOR</u>	<u>FUNCTION</u>		
26	WHT-BLU	T-X1	NOTE: X=2 for 20's Group X=3 for 30's Group X=4 for 40's Group ETC.	
1	BLU-WHT	R-X1		
27	WHT-ORN	L-X1		
2	ORN-WHT	B-X1		
28	WHT-GRN	T-X2		
3	GRN-WHT	R-X2		
29	WHT-BRN	L-X2		
4	BRN-WHT	B-X2		
30	WHT-SLT	T-X3		
5	SLT-WHT	R-X3		
31	RED-BLU	L-X3		
6	BLU-RED	B-X3		
32	RED-ORN	T-X4		
7	ORN-RED	R-X4		
33	RED-GRN	L-X4		
8	GRN-RED	B-X4		
34	RED-BRN	T-X5		
9	BRN-RED	R-X5		
35	RED-SLT	L-X5		
10	SLT-RED	B-X5		
36	BLK-BLU	T-X6		
11	BLU-BLK	R-X6		
37	BLK-ORN	L-X6		
12	ORN-BLK	B-X6		
38	BLK-GRN	T-X7	* NOTE: On CF-880 units prior to Rev.E note irregularity of cut down on off-hook busy leads (BY) wiring. Check revision level on warranty label located on the inside lower right hand corner of CF-880 housing. This note is for prior CF-880's only and does not pertain to any CF-840 housings.	
13	GRN-BLK	R-X7		
39	BLK-BRN	L-X7		
14	BRN-BLK	B-X7		
40	BLK-SLT	T-X8		
15	SLT-BLK	R-X8		
41	YEL-BLU	L-X8		
16	BLU-YEL	B-X8		
42	YEL-ORN	T-X9		
17	ORN-YEL	R-X9		
43	YEL-GRN	L-X9		
18	GRN-YEL	B-X9		
44	YEL-BRN	T-X0		
19	BRN-YEL	R-X0		
45	YEL-SLT	L-X0		
20	SLT-YEL	B-X0		
46	VIO-BLU	BY-X1		BY-X2 *
21	BLU-VIO	BY-X2		BY-X1
47	VIO-ORN	BY-X3	BY-X4	
22	ORN-VIO	BY-X4	BY-X3	
48	VIO-GRN	BY-X5	BY-X5	
23	GRN-VIO	BY-X6	BY-X6	
49	VIO-BRN	BY-X7	BY-X8	
24	BRN-VIO	BY-X8	BY-X7	
50	VIO-SLT	BY-X9	BY-X0	
25	SLT-VIO	BY-X0	BY-X9	

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3. INSTALLATION INSTRUCTIONS (cont'd.)

3.24 CP-852A Outside Line Conferencing Card



CP-852A Outside Line Conferencing Card

Fig. 19

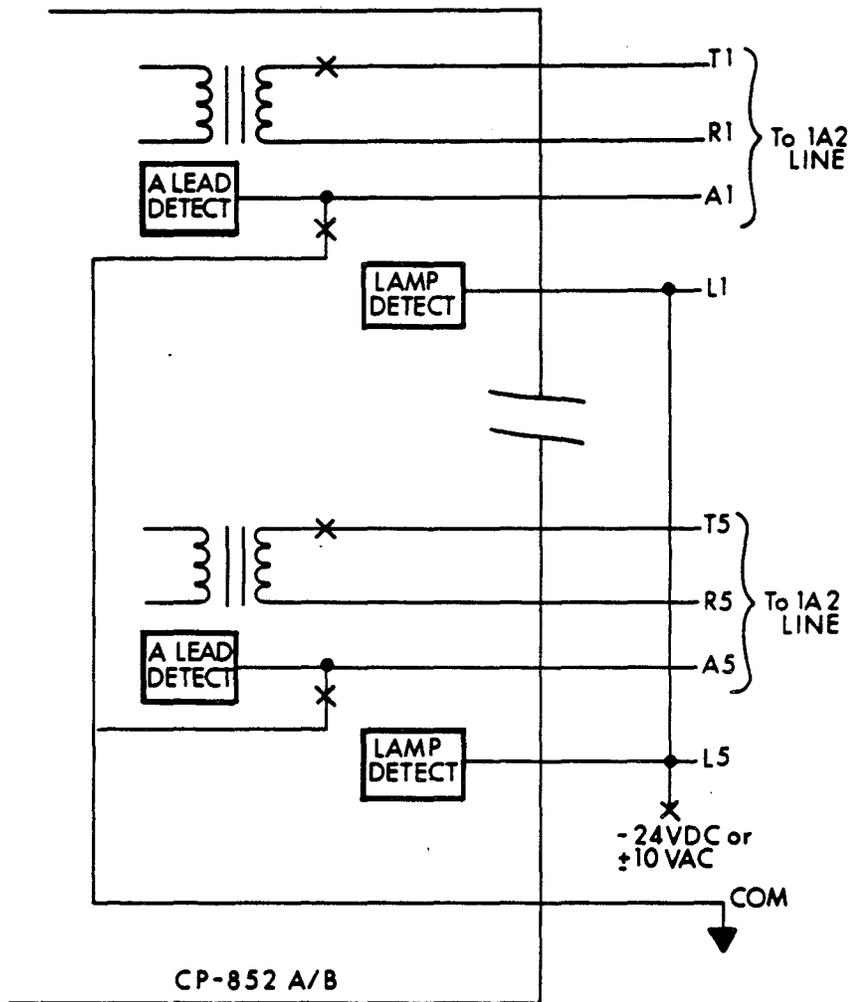
Description: The Outside Line Conferencing Card can be installed in any station circuit card position. The CP-852A card allows any intercom station to access an outside line by dialing the assigned dial code. Three access options are selectable on a per-line basis:

- o Restricted Access on Held Line: The outside line may be accessed only when it is on hold. If access is attempted when the line is in a mode other than hold, the caller will receive a busy tone. The hold mode is determined by either a steady or a winking lamp with the A lead open. (Refer to B on next page.)
- o Restricted Access on Idle Line: The outside line may be accessed only when it is idle. If access is attempted when the line is busy, on-hold, or ringing, the caller will receive a busy tone. The idle line condition is established when the lamp is off. (Refer to C on next page.)
- o Non-Restricted Access: The outside line can be accessed any time the access circuit is free when the assigned code is dialed. This option is intended for use in tie-line applications. (Refer to D on next page.)

For rotary dial installations, each CP-852A card has an option switch that can be set to transmit dial pulses to the outside line (selectable per card).

ML-3000

CP-852 INSTALLATION FOR ACCESS TO HELD, IDLE AND RINGING 1A2 KEY LINES



**CP-852 Schematic
Fig. 20**

ML-8000**3. INSTALLATION INSTRUCTIONS (cont'd.)**

NOTE: The ML-8000 must be equipped with a CP-840A link card for operation of this option. A lock-out timer on the dial pulse transmitter circuit prevents dial pulse transmission after a 10-second enable period. The timer will reset if a dial pulse is transmitted before the 10 second lock-out. This allows up to a 10-second delay between dialing digits.

To install the CP-852A:

NOTE: 10VAC LB must be provided to ML-8000 power connector for proper operation of the CP-852A.

A) For proper connection, refer to Table IV (C.O. Line Conferencing Connector Pin Out Index). A basic circuit diagram is provided in Fig. 21.

Set the option DIP switches. Option switches 2 and 8 are unused. (Refer to detail on Fig. 19.)

B) For normal operation (Restricted Access on Hold only), Access Select switches 3 through 7 should be in the OFF position.

- 1) Verify that none of the associated C.O. lines are on hold.
- 2) Dial each outside line access number. Verify that busy tone is received on each line.
- 3) Put each outside line on hold (one at a time). Place an intercom call to each line. Verify that the line is seized and goes off hold. Hang up intercom and verify that C.O. line is released after a 1 second delay.

C) For idle line access (Restricted Access on Idle only), Access Select switches 3 through 7 should be in the ON position.

- 1) Put the outside lines on hold.
- 2) Dial each outside line access number. Verify that busy tone is received on each line.
- 3) Release the outside lines (return them to the idle state). Place an intercom call to each line. Verify that the line is seized. Hang up intercom and verify that the C.O. line is released after a 1 second delay.

D) For tie-line operation (Non-Restricted Access), Access Select switches 3 through 7 should be in the ON position. Connect the lamp lead (L1 - L5) to L Grd.

- 1) Dial each outside access line number. Verify that each line is seized.
- 2) Hang up and verify that the C.O. line is released after a 1 second delay.

E) For an unused outside line circuit, set the appropriate Access Select switch to OFF. Connect the A lead of the unused circuit to A1-COM.

- 1) Dial the outside line access code.
- 2) Verify that busy tone is returned regardless of the line state.

F) For outside line dial pulse transmission, set switch 1 (Dial Pulse Disable) to OFF. For each outside line, perform the following test:

- 1) Access the outside line.
- 2) With a rotary dial telephone, dial one digit. Verify that it is transmitted on the C.O. line (C.O. dial tone is broken).
- 3) Hang up. Verify that the line is released after a 1 second delay.
- 4) Re-access the outside line. This time, wait approximately 15 seconds before dialing. Dial one digit. Dial pulses should not be transmitted (C.O. will not respond).

NOTE: This option is functional only when the ML-8000 is equipped with CP-840A link cards.

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CP-852 A/B Outside Line Conference Card (cont'd.)

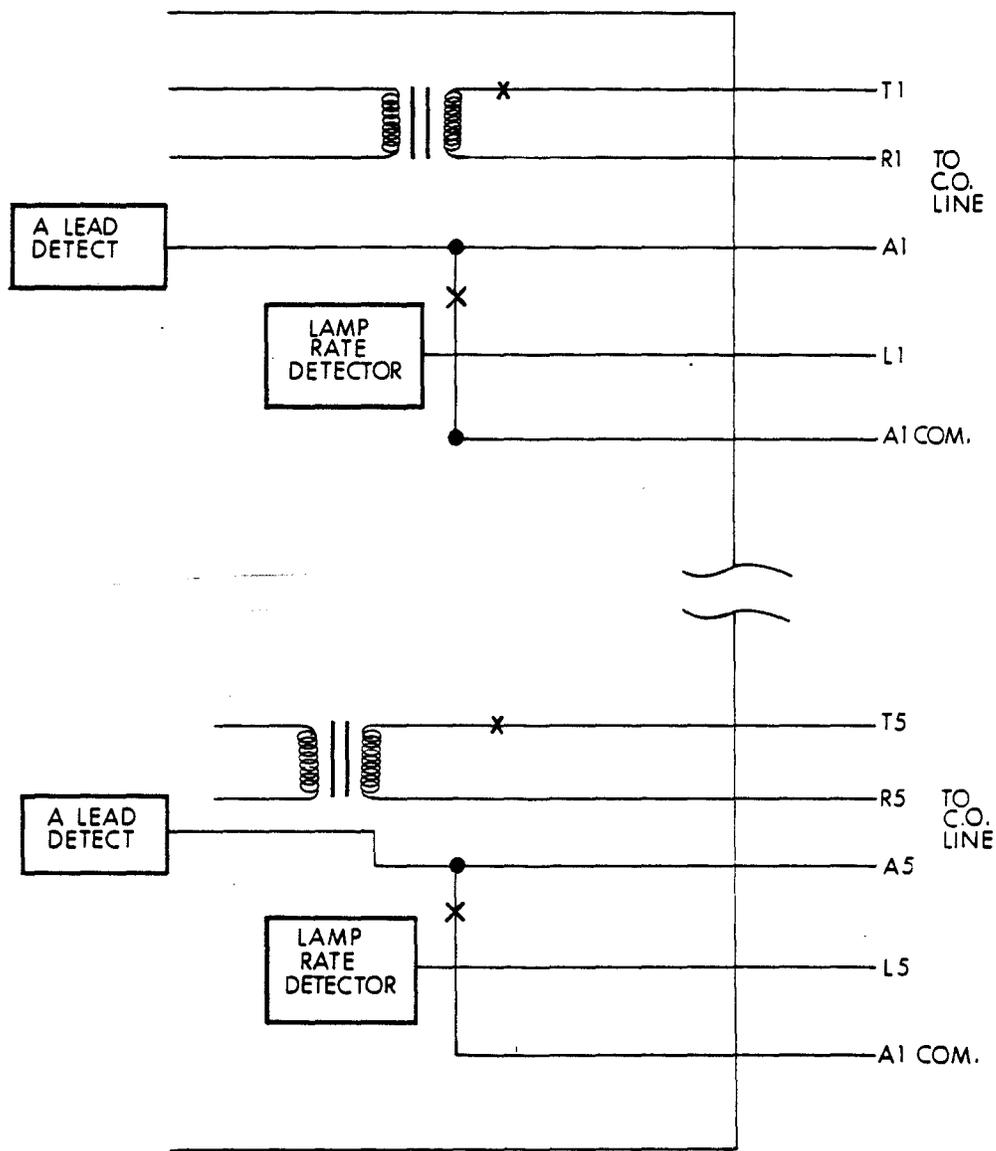
G) ACCESS TO HELD, IDLE, AND RINGING 1A2 KEY LINES

Normally access to 1A2 Key System lines is restricted only to those lines on hold. However, some wish to access lines in all states except during conversation. To accomplish this option, switches 3 through 7 must be in the OFF (hold) position. Connect the T, R & A leads to the associated key system lines. The lamp leads from the Add-on Conference Card DO NOT CONNECT to the key system, but are connected to -24VDC or 10 VAC instead. (See figure 20.)

- 1) On a key system phone, place a call on the line to be tested. From an intercom station, try to access the line through the Add-on Conference Card. The intercom station should receive a busy. Hang up the intercom station.
- 2) From the key phone, place the call on-hold. The intercom station should now be able to access the line through the Conference Card. The key system line will be lighted steady as long as the call is up. Hang up the intercom station. The key system line lamp will extinguish.
- 3) Now with the line idle, confirm that the line can still be accessed through the intercom.
- 4) If desired, place an incoming call to the line under test, and answer it by access through the Conference Card.
- 5) Repeat test for all lines configured in this manner.

NOTE: For proper operation of the CP-852A Card, 10 VAC must be wired to the ML-8000 system.

3. INSTALLATION INSTRUCTIONS (cont'd.)



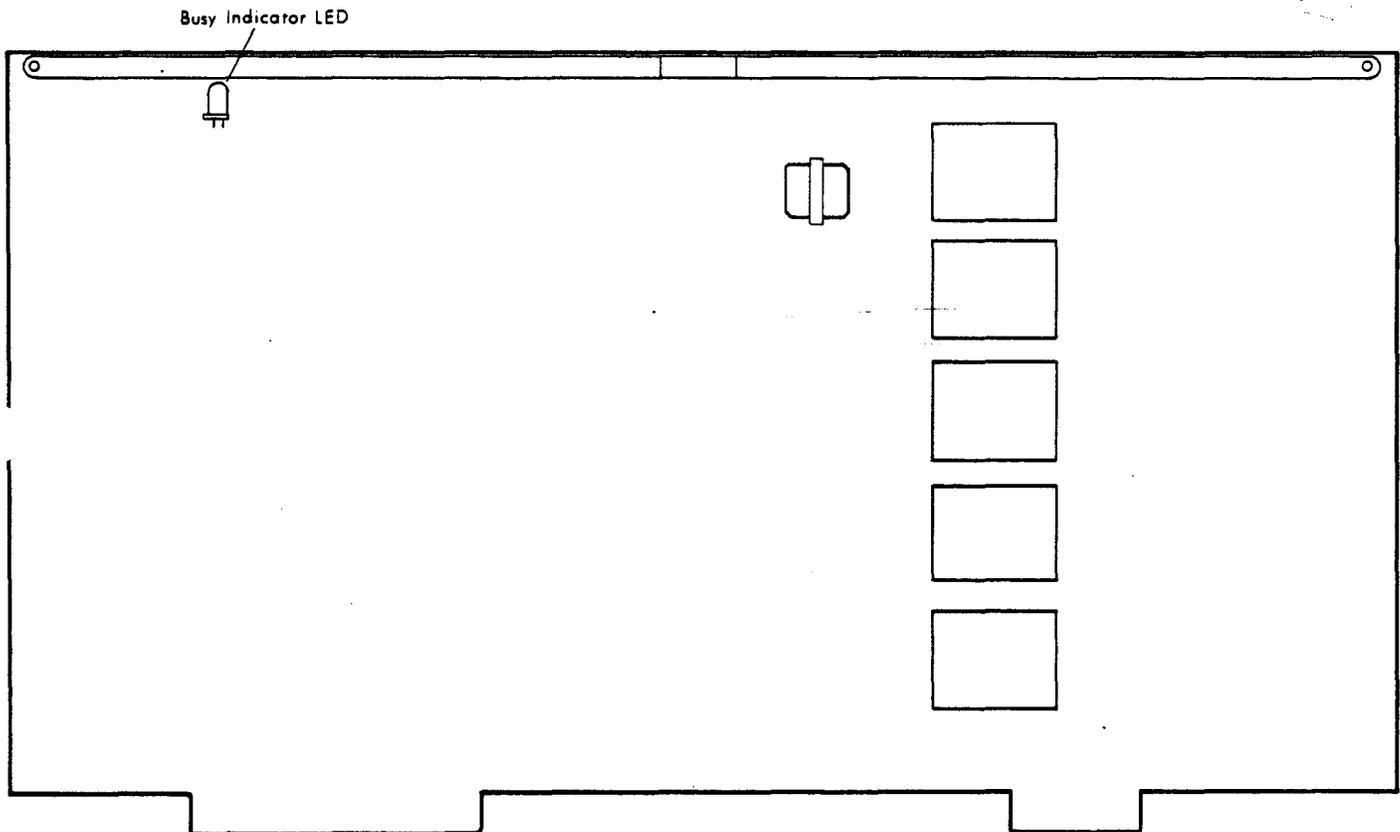
CP-852-Type Outside Line Access Circuitry
Fig. 21

ML-8000

3. INSTALLATION INSTRUCTIONS (cont'd.)

**TABLE IV
CP-852-TYPE OUTSIDE LINE CONFERENCING CARD
CONNECTOR PIN OUT INDEX**

<u>PIN OUT</u>	<u>COLOR</u>	<u>FUNCTION</u>		
26	WHT-BLU	T-X1	NOTE: X=2 for 20's Group X=3 for 30's Group X=4 for 40's Group ETC.	
1	BLU-WHT	R-X1		
27	WHT-ORN	A-X1		
2	ORN-WHT	L-X1		
28	WHT-GRN	T-X2		
3	GRN-WHT	R-X2		
29	WHT-BRN	A-X2		
4	BRN-WHT	L-X2		
30	WHT-SLT	T-X3		
5	SLT-WHT	R-X3		
31	RED-BLU	A-X3	CARD POSITION 7, 9, 11, 13 (15, 17, 19 & 21)	
6	BLU-RED	L-X3		
32	RED-ORN	T-X4		
7	ORN-RED	R-X4		
33	RED-GRN	A-X4		*NOTE: On CF-880 units prior to Rev.E note irregularity of cut down on A1 leads. Check revision level on warranty label located on the inside lower right hand corner of CF-880 housing. This is for CF-880's only and does not pertain to any CF-840 housings.
8	GRN-RED	L-X4		
34	RED-BRN	T-X5		
9	BRN-RED	R-X5		
35	RED-SLT	A-X5		
10	SLT-RED	L-X5		
36	BLK-BLU	T-X6	CARD POSITION 8, 10, 12, 14 (16, 18, 20 & 22)	
11	BLU-BLK	R-X6		
37	BLK-ORN	A-X6		
12	ORN-BLK	L-X6		
38	BLK-GRN	R-X7		
13	GRN-BLK	R-X7		
39	BLK-BRN	A-X7		
14	BRN-BLK	A-X7		
40	BLK-SLT	T-X8		
15	SLT-BLK	R-X8		
41	YEL-BLU	A-X8	CARD POSITION 7, 9, 11, 13 (15, 17, 19 & 21)	
16	BLU-YEL	L-X8		
42	YEL-ORN	T-X9		
17	ORN-YEL	R-X9		
43	YEL-GRN	A-X9		
18	GRN-YEL	L-X9		
44	YEL-BRN	T-X0		
19	BRN-YEL	R-X0		
45	YEL-SLT	A-X0		
20	SLT-YEL	L-X0		
46	VIO-BLU	A1-X1	CARD POSITION 7, 9, 11, 13 (15, 17, 19 & 21)	
21	BLU-VIO	X2 A1-X1		
47	VIO-ORN	X3 A1-X4		
22	ORN-VIO	X4 A1-X3		
48	VIO-GRN	X5 A1-X5		
23	GRN-VIO	X6 A1-X6		
49	VIO-BRN	X7 A1-X8		
24	BRN-VIO	X8 A1-X7		
50	VIO-SLT	X9 A1-X0		
25	SLT-VIO	A1-X0 A1-X9		

ML-8000**3. INSTALLATION INSTRUCTIONS (cont'd.)****3.25 CP-853-Type Paging Access Card****CP-853-Type Paging Access Card****Fig. 22**

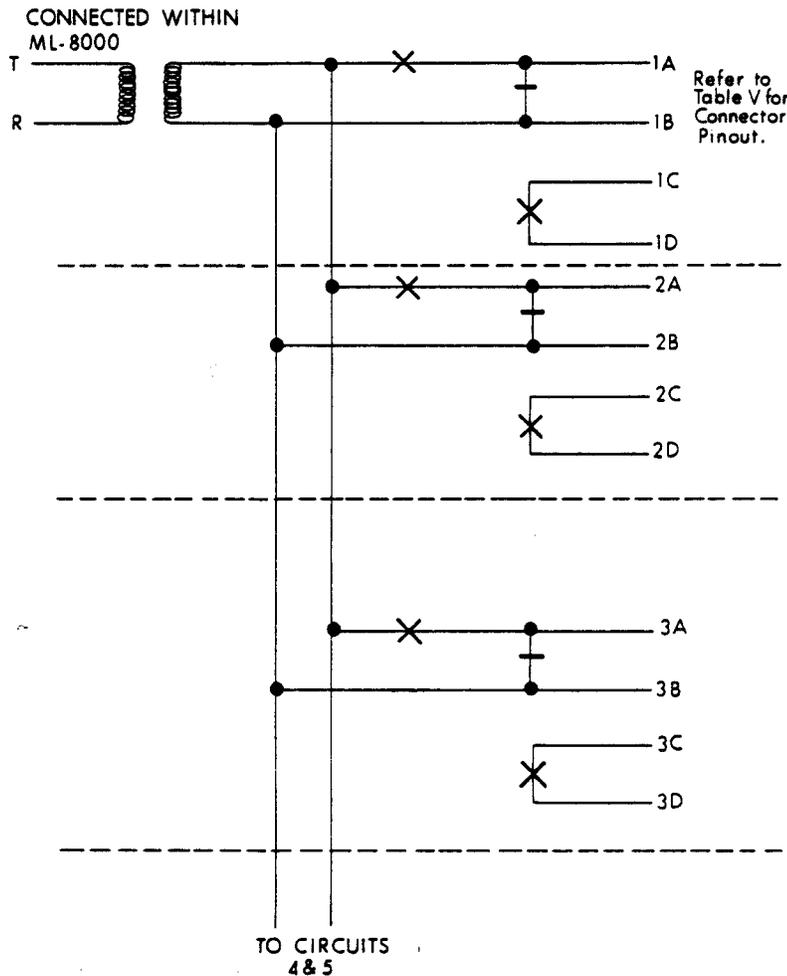
Description: The Paging Access card can be installed in any standard station circuit card position, and provides dial-selective access to five-paging zones. The circuit also provides a 600-ohm balanced audio output that switches to the selected zone. The other four zones then appear busy if access is attempted at that time.

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3. INSTALLATION INSTRUCTIONS (cont'd.)

To install:

(See Fig. 23 for simplified circuit schematic.)

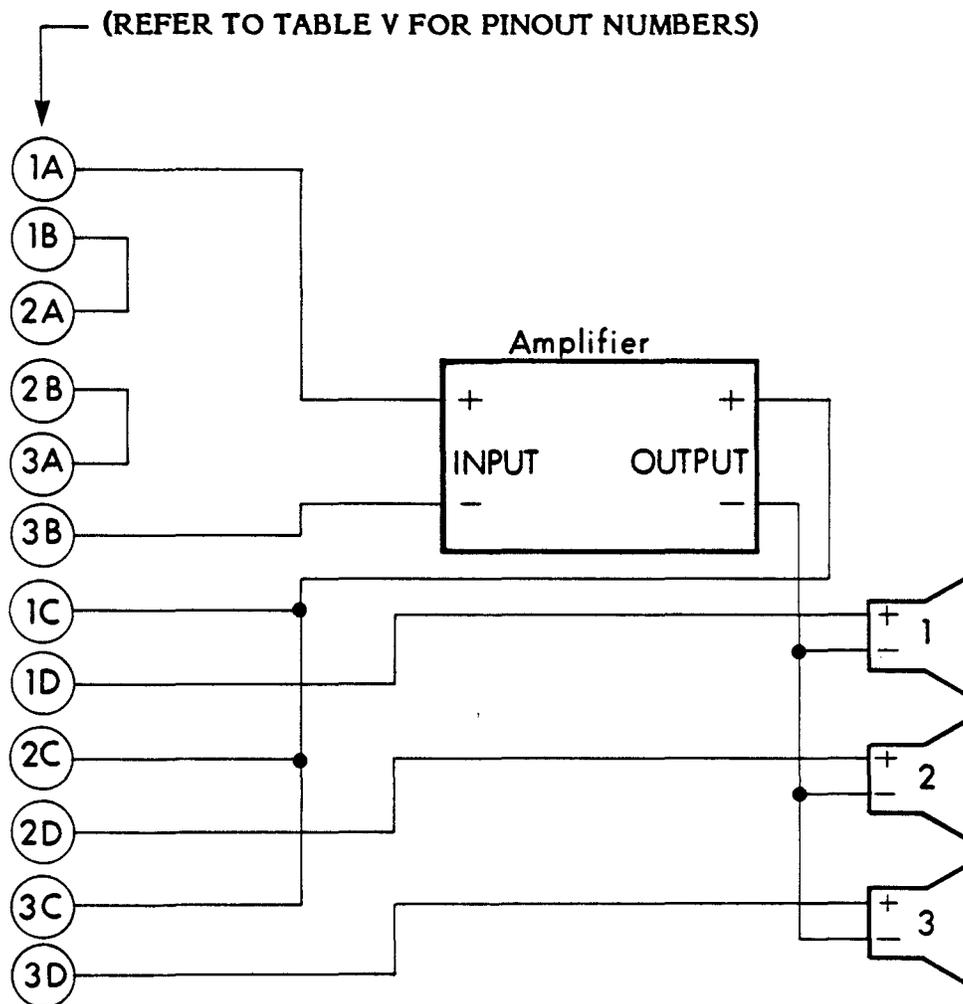


**CP-853-Type-Paging Access Card
Simplified Circuit Schematic
Fig. 23**

- A) Table V provides connector pin out index for paging access card. Figs. 23 - 26 provide typical wiring diagrams using single or multiple amplifiers.
- B) Install card into the designated station slot.
- C) Dial each valid access number. Verify that the paging circuit is accessed.
- D) Hang up phone. Verify that paging circuit is released.

ML-8000**3. INSTALLATION INSTRUCTIONS (cont'd.)**

- E) Place a paging call from any intercom station. Do not hang up.
- F) Place a paging call to any of the 5 zones from another intercom station and verify that a busy tone is received. Hang up first phone. Verify that the busy tone to second phone stops and a paging call is now accessed from the second phone. If any failures occur in steps C through F, refer to the Troubleshooting Guide .

CP-853-TYPE PAGING ACCESS CARD CONNECTIONS

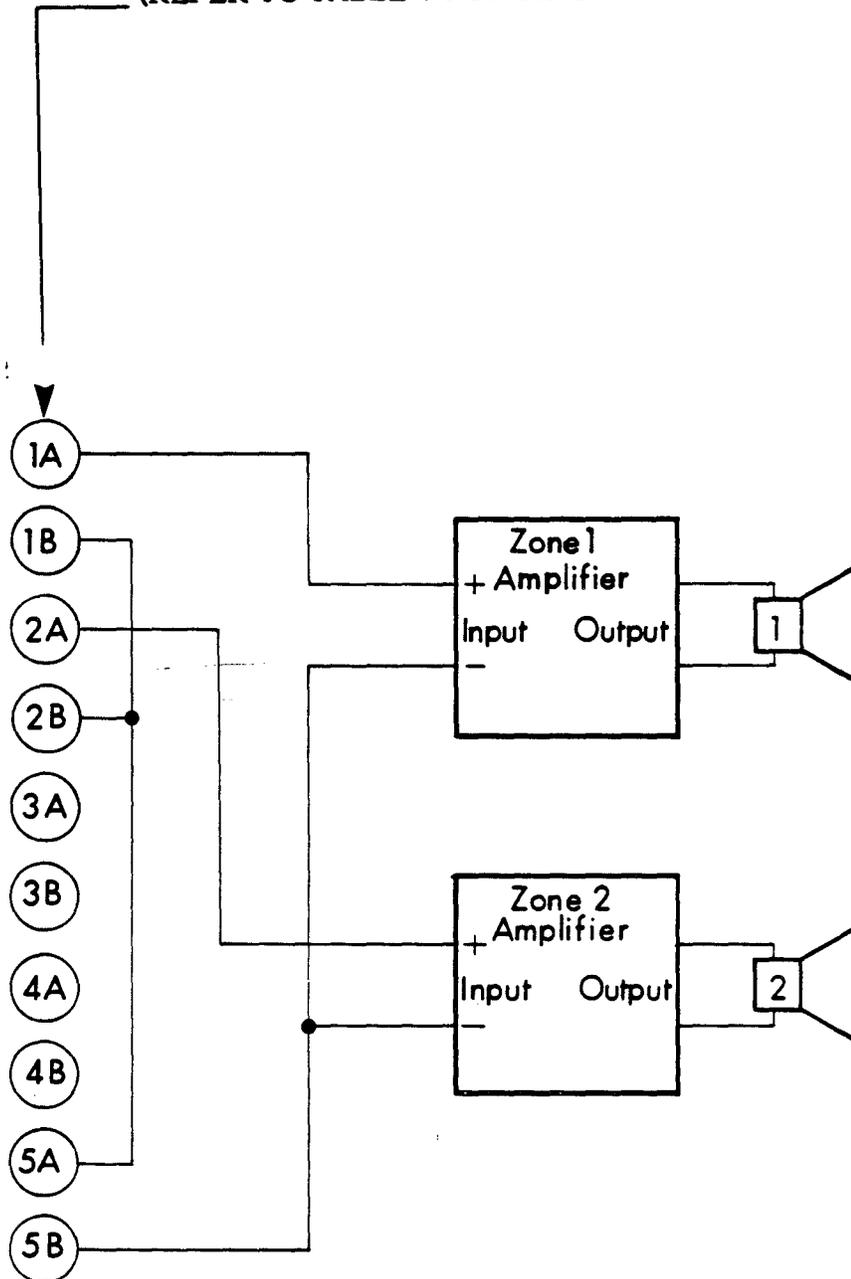
Three-Zone Paging Using One Amplifier
Fig. 24

ML-8000

3. INSTALLATION INSTRUCTIONS (cont'd.)

CP-853-TYPE CONNECTIONS

(REFER TO TABLE V FOR PINOUT NUMBERS)



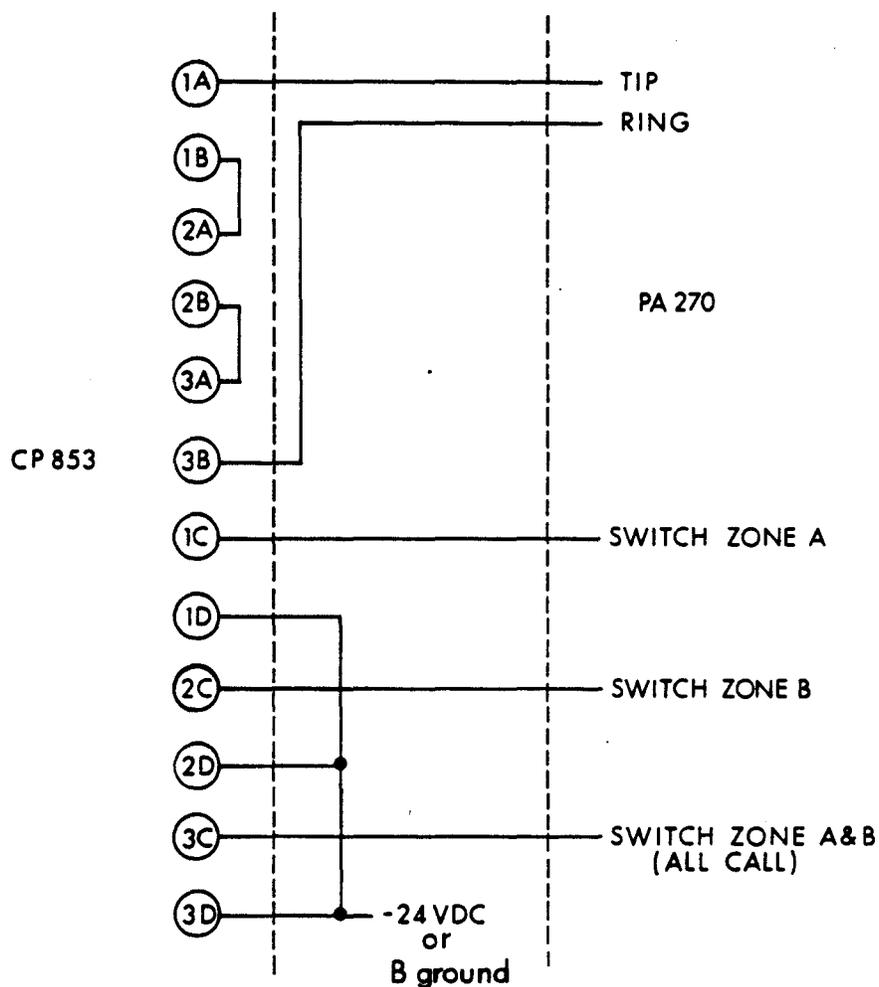
NOTE: 5A and 5B are used for "all-call".

Fig. 25
Two-Zone Paging Using Two Amplifiers

ML-8000

TWO-ZONE PAGING USING PA-270

NOTE: This figure shows how to connect the CP-853-type Paging Access Card with the PA-270, a TCS two-zone paging adapter/amplifier. (See technical instructions on PA-270.)



Two-Zone Paging Using PA-270
Fig. 26

ML-8000

3. INSTALLATION INSTRUCTIONS (cont'd.)

TABLE V

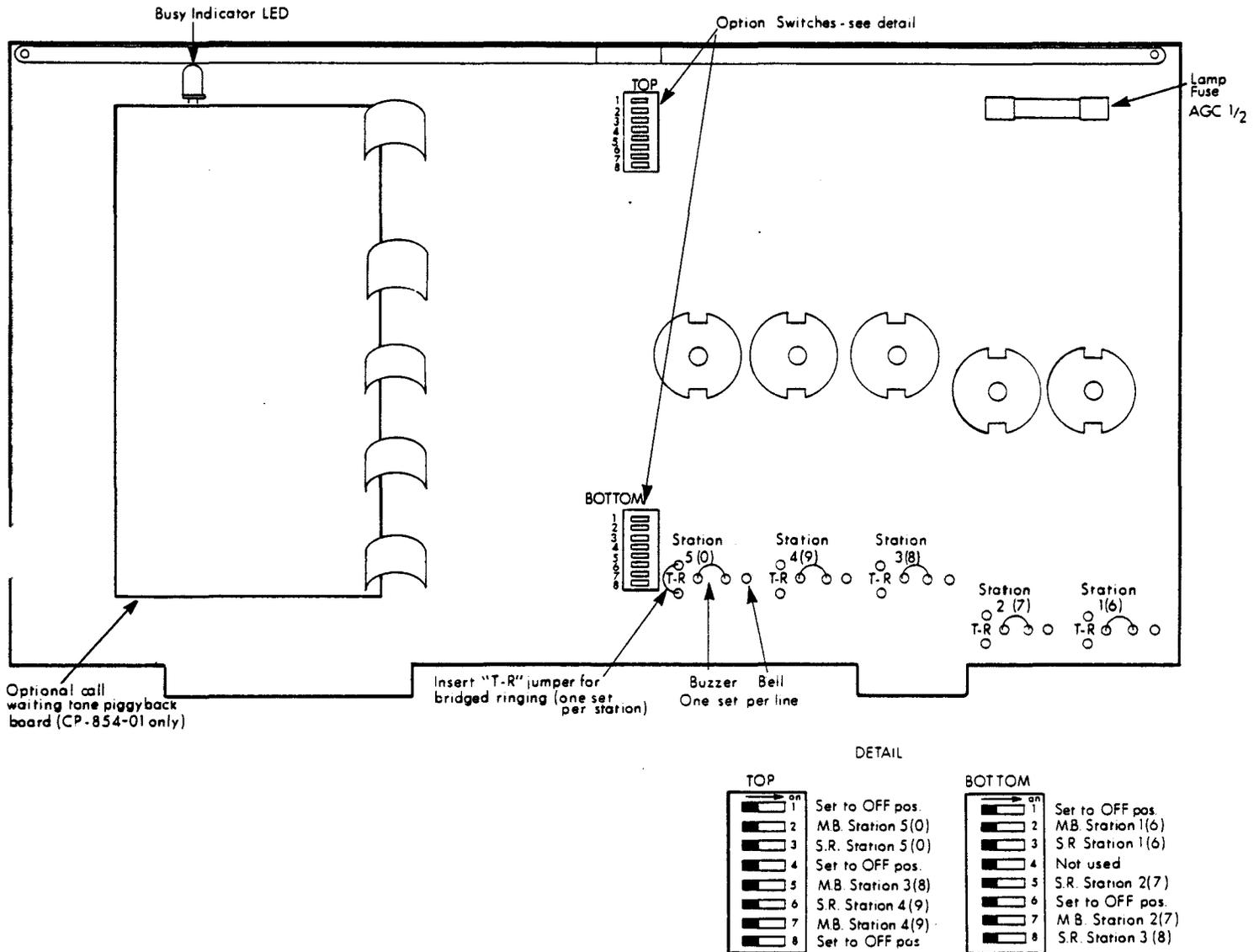
CP-853-TYPE PAGING ACCESS CARD
CONNECTOR PIN OUT INDEX

<u>PIN OUT</u>	<u>COLOR</u>	<u>FUNCTION</u>	
26	WHT-BLU	OUTPUT-X1A	<p>NOTE: X=2 for 20's Group X=3 for 30's Group X=4 for 40's Group ETC.</p>
1	BLU-WHT	OUTPUT-X1B	
27	WHT-ORN	X1C	
2	ORN-WHT	X1D	
28	WHT-GRN	OUTPUT-X2A	
3	GRN-WHT	OUTPUT-X2B	
29	WHT-BRN	X2C	
4	BRN-WHT	X2D	
30	WHT-SLT	OUTPUT-X3A	
5	SLT-WHT	OUTPUT-X3B	
31	RED-BLU	X3C	<p>CARD POSITIONS 7, 9, 11, 13 (15, 17, 19 & 21)</p>
6	BLU-RED	X3D	
32	RED-ORN	OUTPUT-X4A	
7	ORN-RED	OUTPUT-X4B	
33	RED-GRN	X4C	
8	GRN-RED	X4D	
34	RED-BRN	OUTPUT-X5A	
9	BRN-RED	OUTPUT-X5B	
35	RED-SLT	X5C	
10	SLT-RED	X5D	
36	BLK-BLU	OUTPUT-X6A	<p>CARD POSITIONS 8, 10, 12, 14 (16, 18, 20 & 22)</p>
11	BLU-BLK	OUTPUT-X6B	
37	BLK-ORN	X6C	
12	ORN-BLK	X6D	
38	BLK-GRN	OUTPUT-X7A	
13	GRN-BLK	OUTPUT-X7B	
39	BLK-BRN	X7C	
14	BRN-BLK	X7D	
40	BLK-SLT	OUTPUT-X8A	
15	SLT-BLK	OUTPUT-X8B	
41	YEL-BLU	X8C	
16	BLU-YEL	X8D	
42	YEL-ORN	OUTPUT-X9A	
17	ORN-YEL	OUTPUT-X9B	
43	YEL-GRN	X9C	
18	GRN-YEL	X9D	
44	YEL-BRN	OUTPUT-X0A	
19	BRN-YEL	OUTPUT-X0B	
45	YEL-SLT	X0C	
20	SLT-YEL	X0D	

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3. INSTALLATION INSTRUCTIONS (cont'd.)

3.26 CP-854A Long-Line Station Card



CP-854A Long-Line Station Card
Fig. 27

Description: The Long-Line Station card can be used in place of a CP-850-Type Card providing all of the basic station card features. Selectable bridged ringing or a separate ringing lead are available on a per station basis. The long line capability features increased current for extended line loops. Single burst ring-out and station busy-out (for unused stations) can also be selected on a per station basis.

An optional call-waiting tone piggyback board is available on this card (order CP-854A-01).

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3. INSTALLATION INSTRUCTIONS (cont'd.)

To install the CP-854A

- A) For proper connection refer to Table VI (Long Line Station Card Connector Pin Out). For stations that require bridged ringing, connect tip to "T" and ring to "B" (R2) (refer to Fig. 28.) For standard key line interconnection, refer to Fig. 29.
- B) Insert option jumpers and set option switches as follows: **NOTE:** Any combination of these options may be accommodated on this card.

For two-wire interconnection:

- 1) Insert jumpers for bridged ringing (one per station) in positions marked T and R (See Fig. 27.) Use 24 - 26 AWG solid wire if jumpers are not supplied.
- 2) Insert bell/buzzer jumpers in BELL positions (one per station).
- 3) Set option switches (refer to Detail on Fig. 27) as follows:
 - a) Set the hands-free (H-F) switch for all stations to OFF.
 - b) For unused stations on the card, set the make busy (MB) switch to ON. Set the make busy (MB) switch to OFF for all used stations.
 - c) If single-burst ring-out feature is desired, set single ring (SR) switch to ON (for each station).

NOTE: Lamps may be used with bridged ringing by connecting a separate pair to "L" and "Aud.-Lamp Grd."

For standard key line interconnection:

- 1) Do not insert jumpers into T-R positions (see Fig. 27).
 - 2) Select bell or buzzer on a per station basis and insert jumpers in desired audible supply position.
 - 3) Set option switches (refer to detail on Fig. 27) as follows:
 - a) Set the hands-free (H-F) switch for all stations to OFF.
 - b) For unused stations on the card, set the make busy (MB) switch to ON. Set the make busy (MB) switch to OFF for all used stations.
 - c) If single-burst ring-out feature is desired, set single ring (SR) switch to ON (for each station).
- C) Install card into desired station card slot.
- D) Perform station test listed in Section 3.28 D). In addition, perform the following test:

ML-8000**3. INSTALLATION INSTRUCTIONS (cont'd.)****For stations with single-burst ringing:**

- 1) Dial each single-burst station. Verify that station rings for a single one second burst. Caller will continue to receive ringback and lamp (when used) will continue to flash as long as station is being called. **NOTE:** Station will not ring out until a complete ring cycle occurs. Hence a partial ringback on the first ring cycle may be heard before the station rings.

For stations that are busied-out:

- 1) Dial each busied-out station. Verify that busy tone is received.

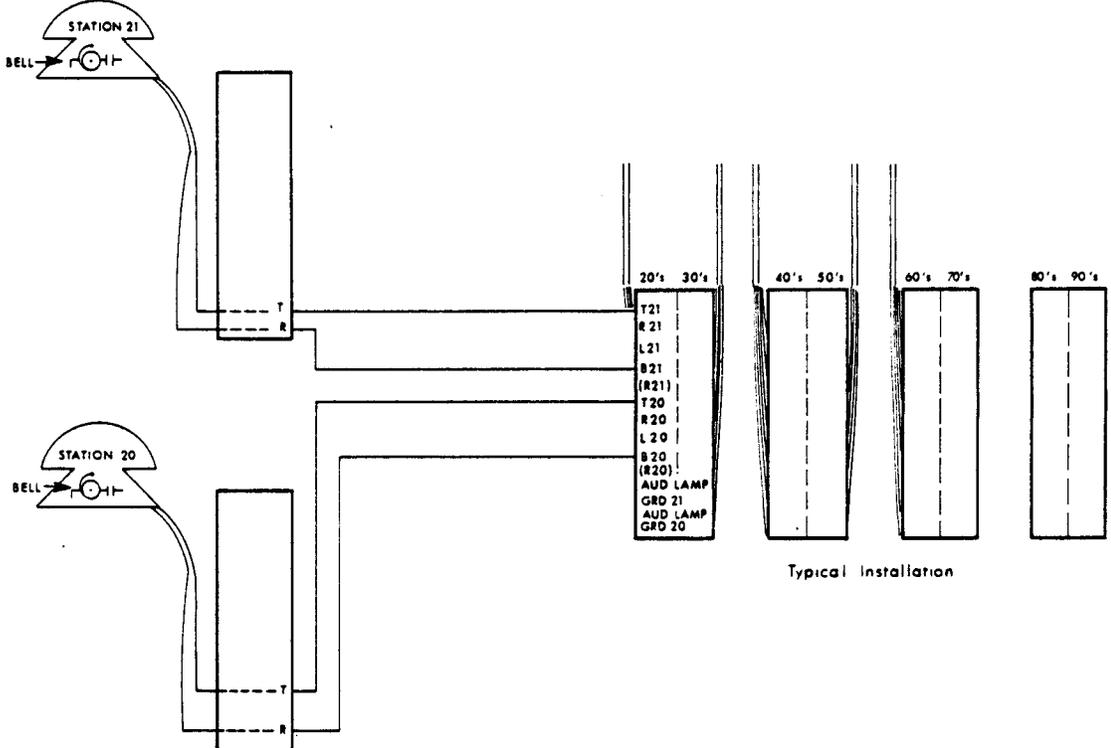
For Long Line Card with Call Waiting Tone Option (CP-854A-01)

- 1) Take equipped station (station 1) off-hook. Flash hookswitch to eliminate dial tone.
- 2) Call station 1 from another (station 2). Verify that camp-on tone is received at station 1.
- 3) Hang up Station 1 phone. Verify ring at station 1 and ringback at station 2.
- 4) Go off-hook on station 1 and verify connection with station 2.

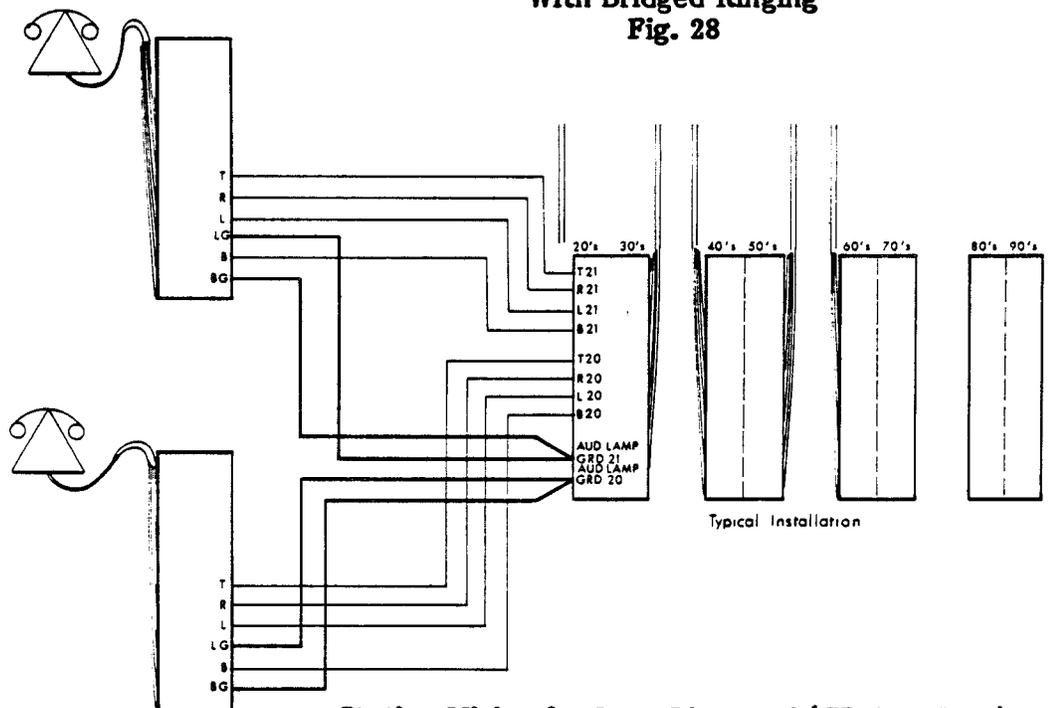
NOTE: For key line stations, lamp will flash at station 1 when that station is called and will light steadily when off-hook or all links are busy.

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3. INSTALLATION INSTRUCTIONS (cont'd.)



**Station Wiring for Long Line Card (CP-854-Type)
With Bridged Ringing
Fig. 28**



**Station Wiring for Long Line card (CP-854-Type)
With 3 Pair Wiring (Standard Key Line)
Fig. 29**

ML-8000

3. INSTALLATION INSTRUCTIONS (cont'd.)

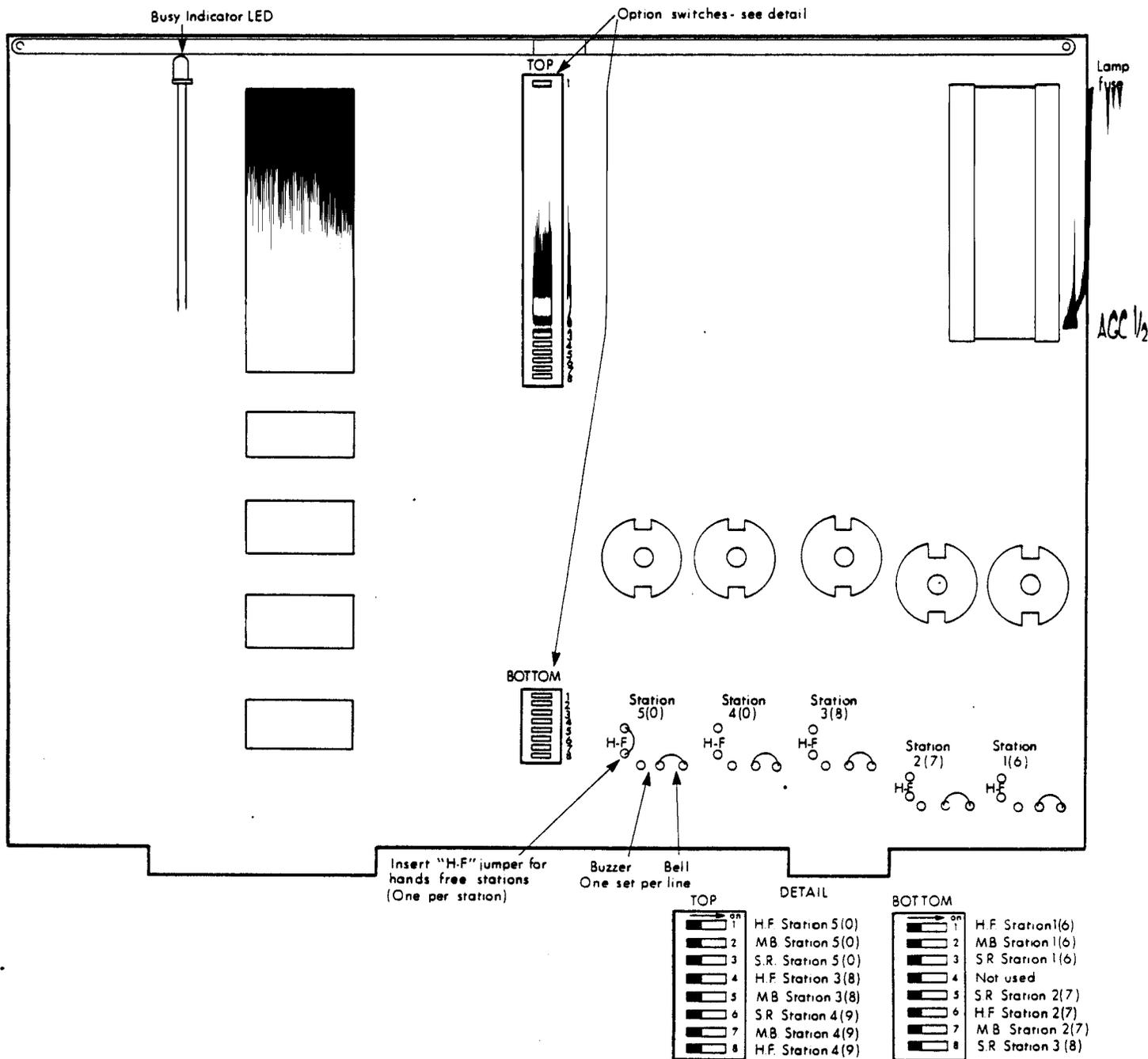
TABLE VI
CP-854-TYPE LONG LINE STATION CARD
CONNECTOR PIN OUT INDEX

<u>PIN OUT</u>	<u>COLOR</u>	<u>FUNCTION</u>	
26	WHT-BLU	T-X1	NOTE: X=2 for 20's Group X=3 for 30's Group X=4 for 40's Group ETC.
1	BLU-WHT	R-X1	
27	WHT-ORN	L-X1	
2	ORN-WHT	B-X1 (R-X1)	
28	WHT-GRN	T-X2	
3	GRN-WHT	R-X2	
29	WHT-BRN	L-X2	
4	BRN-WHT	B-X2 (R-X2)	
30	WHT-SLT	T-X3	
5	SLT-WHT	R-X3	
31	RED-BLU	L-X3	
6	BLU-RED	B-X3 (R-X3)	
32	RED-ORN	T-X4	
7	ORN-RED	R-X4	
33	RED-GRN	L-X4	
8	GRN-RED	B-X4 (R-X4)	
34	RED-BRN	T-X5	
9	BRN-RED	R-X5	
35	RED-SLT	L-X5	
10	SLT-RED	B-X5 (R-X5)	
36	BLK-BLU	T-X6	
11	BLU-BLK	R-X6	
37	BLK-ORN	L-X6	
12	ORN-BLK	B-X6 (R-X6)	
38	BLK-GRN	T-X7	
13	GRN-BLK	R-X7	
39	BLK-BRN	L-X7	
14	BRN-BLK	B-X7 (R-X7)	
40	BLK-SLT	T-X8	
15	SLT-BLK	R-X8	
41	YEL-BLU	L-X8	
16	BLU-YEL	B-X8 (R-X8)	
42	YEL-ORN	T-X9	
17	ORN-YEL	R-X9	
43	YEL-GRN	L-X9	
18	GRN-YEL	B-X9 (R-X9)	
44	YEL-BRN	T-X0	
19	BRN-YEL	R-X0	
45	YEL-SLT	L-X0	
20	SLT-YEL	B-X0 (R-X0)	
46	VIO-BLU	AUD-LAMP GRD.-X1	
21	BLU-VIO	AUD-LAMP GRD.-X2	
47	VIO-ORN	AUD-LAMP GRD.-X3	
22	ORN-VIO	AUD-LAMP GRD.-X4	
48	VIO-GRN	AUD-LAMP GRD.-X5	
23	GRN-VIO	AUD-LAMP GRD.-X6	
49	VIO-BRN	AUD-LAMP GRD.-X7	
24	BRN-VIO	AUD-LAMP GRD.-X8	
50	VIO-SLT	AUD-LAMP GRD.-X9	
25	SLT-VIO	AUD-LAMP GRD.-X0	

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3. INSTALLATION INSTRUCTIONS (cont'd.)

3.27 CP-855 Hands-Free Station Card



CP-855 Hands-Free Station Card
Fig. 30

Description: The CP-855 Hands-Free Station Card is intended to interface hands-free station sets to the ML-8000. The card is set up for standard 4-wire key system connection and can be used in place of a CP-851-Type Off-Hook Busy Card. Either bell/buzzer selection or hands-free station set interface are available on a per station basis. (NOTE: An adapter is required to complete the hands-free interface.) The Off-Hook Busy feature, which provides a busy signal to the caller whenever the handset at the called station is off-hook, is also provided on the CP-855. Option switches on the card allow single handset interface.

ML-8000**3. INSTALLATION INSTRUCTIONS (cont'd.)****To install CP-855:**

- A) Wire the designated station equipment for busy lamp field operation. This will supply a ground on the busy lamp lead (BL or equivalent) of the station telephone when the receiver is off the hookswitch. Refer to Figs. 17 and 18 for proper wiring.
- B) Designate the stations to be equipped for hands-free operation. For those stations, locate and install jumpers in H-F positions. (Use 24-26 AWG solid wire if jumpers are not supplied.) For any remaining stations where hands-free operation is not desired, locate and install the audible signaling straps (using 24-26 AWG solid wire) for bell or buzzer at each station.
- C) Set the option switches on the DIP switch for desired features (hands-free capability, single burst ringing, unused station busy-out). Refer to detail on Fig. 31 as follows:
 - 1) Set the hands-free switch (H-F) to ON for the designated hands-free stations, OFF for all others.
 - 2) For unused stations on the card, set the make busy (MB) switch to ON.
 - 3) For single burst ringing, set single ring (SR) switch to ON for each designated station. (This applies to non-hands-free stations.)
- D) For proper connection, refer to Table VII (Hands-Free Connector Pin Out Index) and the Technical Instructions for the HF-40 2A Transmitter/Receiver H.F.A.I. Adapter (TCS document #13-100517) or HF-450 Hands-Free Adapter for the ITT K174 Call Announcer (TCS document #13-100525).
- E) Install the card into the designated station card slot.
- F) Conduct the following station tests:
 - 1. Verify that all phones get dial tone. **NOTE:** Make sure during this step that all links are available and not busied out.
 - 2. Verify that all stations are on-hook. Using a handset, select a station and connect to tip and ring, (note dial code).
 - 3. Verify that the station busy LED for the associated station card is lit.
 - 4. Dial the selected station's own code and verify that a busy tone is received. Repeat operation for each equipped link card by busying out all but the desired link. Unbusy all links.
 - 5. Go to each equipped station, take phone off-hook and verify that dial tone is received and the intercom lamp is steadily lit.
 - 6. Dial another hands-free equipped station and verify that audible signaling tone is heard and the unit turns on. Hang up and verify that the hands-free unit turns off. For stations not equipped with hands-free, dial and verify that audible ringback is received and that the station dialed is ringing.

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3. INSTALLATION INSTRUCTIONS (cont'd.)

7. If CP-840 link cards are being used, flash hookswitch and verify silence. Flash hookswitch once more and verify dial tone. If CP-840A link cards are in the system, flash hookswitch only once to receive dial tone. After receiving dial tone, dial the station's own code and verify busy tone and flashing intercom lamp. Repeat steps 5, 6, & 7 for each station in the system. **NOTE:** In this step, "Flash" means to depress and release in approximately 1/3 second.
8. Busy out all links and verify that all station lamps light steadily (indicating system busy).
9. Pick up one station phone and verify a system busy tone (if provided).
10. Unbusy all link cards.
11. Select one phone and dial all the others to verify that audible signaling is received by all equipped phones.
12. Select a phone equipped with off-hook busy. Take receiver off the hookswitch.
13. Select any other intercom phone and dial the code of the phone taken off-hook. Verify a busy tone.
14. Leave the phone in a camp-on mode and return to first phone. The intercom lamp should be flashing. There should be no ringing or buzzing.
15. Hang up phone. Hands-free unit should turn on and give tone alert signal. For non-hands-free stations, ringing or buzzing should now begin.
16. Return to phone originating the call. Verify completed hands-free connection. For non-hands-free stations, verify ringback.

If the system fails any of these test steps, refer to the Troubleshooting Guide.

G) Conduct the following option tests:

For hands-free stations — Refer to Technical Instructions for the HF-40 2A Transmitter/Receiver H.F.A.L Adapter (TCS document #13-100517) or HF-450 Hands-Free Adapter (TCS document #13-100525) for installation verification checks.

For stations with single burst ringing — Dial each single burst station. Verify that station rings for a single one second burst. Caller will continue to receive ringback and lamp (when used) will continue to flash as long as station is being called. **NOTE:** Station will not ring out until a complete ring cycle occurs. Therefore, a partial ringback on the first ring cycle may be heard before the station rings.

For stations that are busied-out — Dial each busied-out station. Verify that busy tone is received.

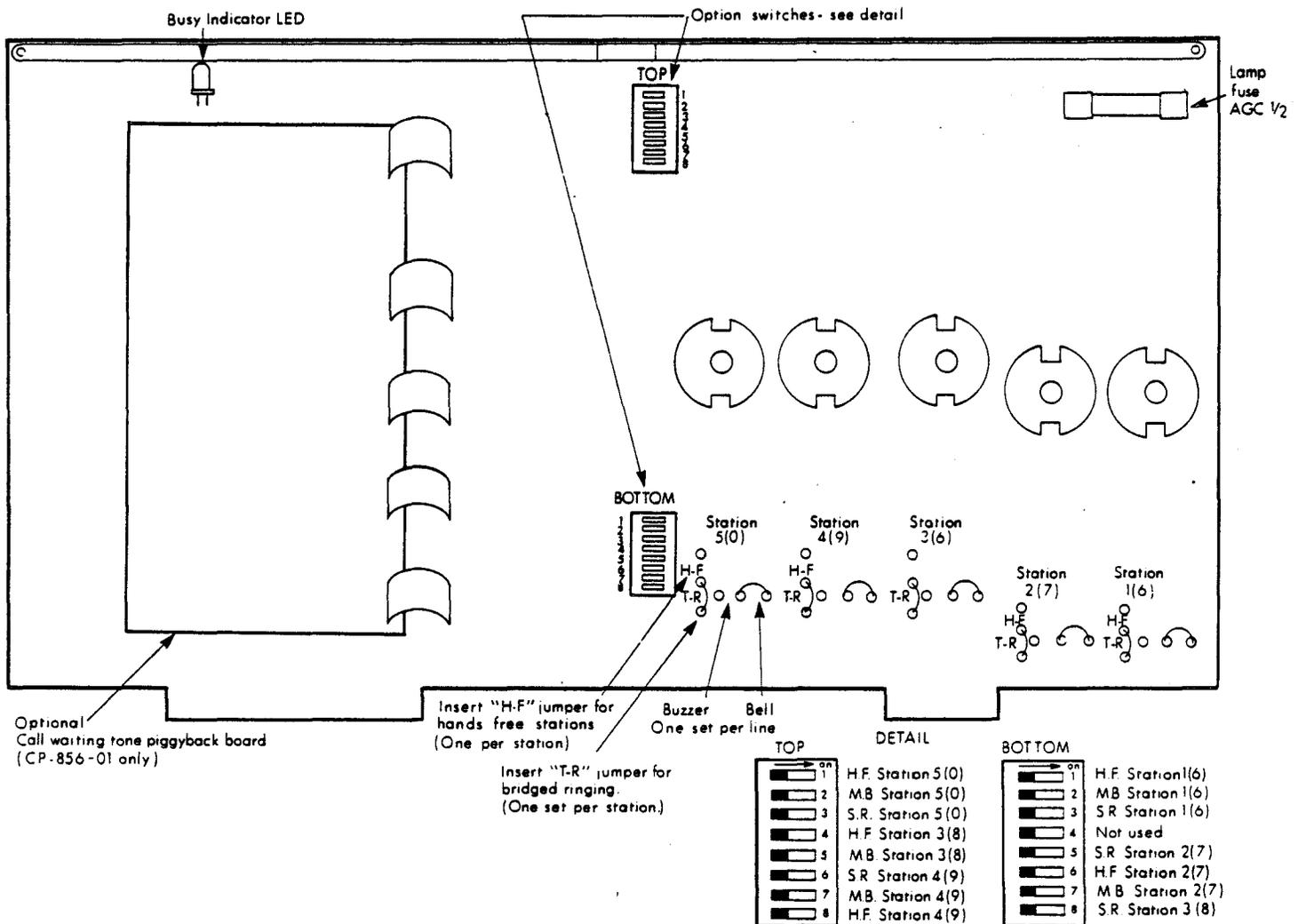
ML-8000**3. INSTALLATION INSTRUCTIONS (cont'd.)****TABLE VII****CP-855 HANDS-FREE STATION CARD
CONNECTOR PIN OUT INDEX**

<u>PIN OUT</u>	<u>COLOR</u>	<u>FUNCTION</u>	
26	WHT-BLU	T-X1	NOTE: X=2 for 20's Group X=3 for 30's Group X=4 for 40's Group ETC.
1	BLU-WHT	R-X1	
27	WHT-ORN	L-X1	
2	ORN-WHT	B-X1	
28	WHT-GRN	T-X2	
3	GRN-WHT	R-X2	
29	WHT-BRN	L-X2	
4	BRN-WHT	B-X2	
30	WHT-SLT	T-X3	
5	SLT-WHT	R-X3	
31	RED-BLU	L-X3	
6	BLU-RED	B-X3	
32	RED-ORN	T-X4	
7	ORN-RED	R-X4	
33	RED-GRN	L-X4	
8	GRN-RED	B-X4	
34	RED-BRN	T-X5	
9	BRN-RED	R-X5	
35	RED-SLT	L-X5	
10	SLT-RED	B-X5	
36	BLK-BLU	T-X6	
11	BLU-BLK	R-X6	
37	BLK-ORN	L-X6	
12	ORN-BLK	B-X6	
38	BLK-GRN	T-X7	* NOTE: On CF-880 units prior to Rev.E note irregularity of cut down on off-hook busy leads (BY) wiring. Check revision level on warranty label located on the inside lower right hand corner of CF-880 housing. This note is for prior CF-880's only and does not pertain to any CF-840 housings.
13	GRN-BLK	R-X7	
39	BLK-BRN	L-X7	
14	BRN-BLK	B-X7	
40	BLK-SLT	T-X8	
15	SLT-BLK	R-X8	
41	YEL-BLU	L-X8	
16	BLU-YEL	B-X8	
42	YEL-ORN	T-X9	
17	ORN-YEL	R-X9	
43	YEL-GRN	L-X9	
18	GRN-YEL	B-X9	
44	YEL-BRN	T-X0	
19	BRN-YEL	R-X0	
45	YEL-SLT	L-X0	
20	SLT-YEL	B-X0	
46	VIO-BLU	BY-X1	BY-X2 *
21	BLU-VIO	BY-X2	BY-X1
47	VIO-ORN	BY-X3	BY-X4
22	ORN-VIO	BY-X4	BY-X3
48	VIO-GRN	BY-X5	BY-X5
23	GRN-VIO	BY-X6	BY-X6
49	VIO-BRN	BY-X7	BY-X8
24	BRN-VIO	BY-X8	BY-X7
50	VIO-SLT	BY-X9	BY-X0
25	SLT-VIO	BY-X0	BY-X9

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3. INSTALLATION INSTRUCTIONS (cont'd.)

3.28 CP-856 Deluxe Station Card



CP-856 Deluxe Station Card
Fig. 31

Description: The CP-856 Deluxe Station Card can also be used in place of a CP-851-Type Off-Hook Busy Card. Besides the standard station features, the CP-856 can be wired for a) selectable bridged ringing, b) separate bell/buzzer signaling or c) hands-free station set interface on a per station basis. **(NOTE:** Hands-free stations require an adapter to complete the hands-free interface.) The Deluxe Station Card includes the off-hook busy feature as well as Long Line capability.

Both single burst ring-out and station busy-out are available for each of the five stations. An optional call-waiting tone "piggy-back" board (CP-856-01) is available with the CP-856.

ML-8000**3. INSTALLATION INSTRUCTIONS (cont'd.)****To install CP-856:**

A) For proper connection refer to Table VIII (Deluxe Station Card Connector Pin Out Index). For stations that require bridged ringing, connect tip to "T" and ring to "B" (R2) (refer to Fig. 32). For standard key line interconnection, refer to Fig. 33. For hands-free connection, refer to the Technical Instructions for the HF-40 2A Transmitter/Receiver H.F.A.I. Adapter (TCS document #13-100517) or HF-450 Hands-Free Adapter (TCS document #13-100525).

B) Insert option jumpers and set option switches as follows:

NOTE: Any combination of these options may be accommodated on this card.

For two-wire interconnection:

- 1) Insert jumpers for bridged ringing (one per station) in positions marked T and R (see Fig. 31). Use 24 - 26 AWG solid wire if jumpers are not supplied.
- 2) Insert bell/buzzer jumpers in BELL positions (one per station).
- 3) Set option switches (refer to detail on Fig. 31) as follows:
 - a) Set the hands-free (H-F) option switch to OFF.
 - b) If single burst ring-out feature is desired, set single ring (SR) switch to ON.
 - c) Set make busy (MB) switch to OFF.

NOTE: Lamps may be used with bridged ringing by connecting a separate pair to "L" and "Aud.-Lamp Grd."

For standard key line interconnection:

- 1) Do not insert jumpers into T-R or H-F positions (see Fig. 31).
- 2) Select bell or buzzer on a per station basis and insert jumpers in desired audible supply position (see Fig. 31).
- 3) Set option switches (refer to detail on Fig. 31) as follows:
 - a) Set the hands-free (H-F) option switch to OFF.
 - b) If single burst ring-out feature is desired, set single ring (SR) switch to ON.
 - c) Set make busy (MB) switch to OFF.

For hands-free interconnection:

- 1) Insert jumpers for hands-free operation (one per station) in positions marked H-F (see Fig. 31).
- 2) Set the hands-free (H-F) switch to ON.
- 3) Set the make busy (MB) switch to OFF.

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3. INSTALLATION INSTRUCTIONS (cont'd.)

- C) For unused stations on the card, set the make busy (MB) switch to ON. Check that MB switches for all used stations are OFF.
- D) Conduct the following station tests:
1. Verify that all phones get dial tone. **NOTE:** Make sure during this step that all links are available and not busied out.
 2. Verify that all stations are on-hook. Using a handset, select a station and connect to tip and ring, (note dial code).
 3. Verify that the station busy LED for the associated station card is lit.
 4. Dial the selected station's own code and verify that a busy tone is received. Repeat operation for each equipped link card by busying out all but the desired link. Unbusy all links.
 5. Go to each equipped station, take phone off-hook and verify that dial tone is received and the intercom lamp is steadily lit.
 6. To test hands-free stations, dial access code from another station and verify that audible signaling tone is heard at the hands-free station and the unit turns on. Hang up and verify that the hands-free unit turns off. For stations not equipped with hands-free, dial and verify that audible ringback is received and that the station dialed is ringing.
 7. If CP-840 link cards are being used, flash hookswitch and verify silence. Flash hookswitch once more and verify dial tone. If CP-840A link cards are in the system, flash hookswitch only once to receive dial tone. After receiving dial tone, dial the station's own code and verify busy tone and flashing intercom lamp. Repeat steps 5, 6, & 7 for each station in the system. **NOTE:** In this step, "Flash" means to depress and release in approximately 1/3 second.
 8. Busy out all links and verify that all station lamps light steadily (indicating system busy).
 9. Pick up one station phone and verify a system busy tone (if provided).
 10. Unbusy all link cards.
 11. Select one phone and dial all the others to verify that audible signaling is received by all equipped phones.
 12. Select a phone equipped with off-hook busy. Take receiver off the hookswitch.
 13. Select any other intercom phone and dial the code of the phone taken off-hook. Verify a busy tone.
 14. Leave the phone in a camp-on mode and return to first phone. The intercom lamp should be flashing. There should be no ringing or buzzing.
 15. Hang up phone. For hands-free stations, hands-free unit should turn on and give tone alert signal. For non-hands-free stations, ringing or buzzing should now begin.

ML-8000**3. INSTALLATION INSTRUCTIONS (cont'd.)**

16. Return to phone originating the call. Verify completed hands-free connection. For non-hands-free stations, verify ringback.

If the system fails any of these test steps, refer to the Troubleshooting Guide.

E) Conduct the following option tests:

For hands-free stations — Refer to Technical Instructions for the HF-40 2A Transmitter/Receiver H.F.A.L Adapter (TCS document #13-100517) or HF-450 Hands-Free Adapter (TCS document #13-100525) for installation verification checks.

For stations with single burst ringing — Dial each single burst station. Verify that station rings for a single one second burst. Caller will continue to receive ringback and lamp (when used) will continue to flash as long as station is being called. **NOTE:** Station will not ring out until a complete ring cycle occurs. Therefore, a partial ringback on the first ring cycle may be heard before the station rings out.

For stations that are busied-out — Dial each busied-out station. Verify that busy tone is received.

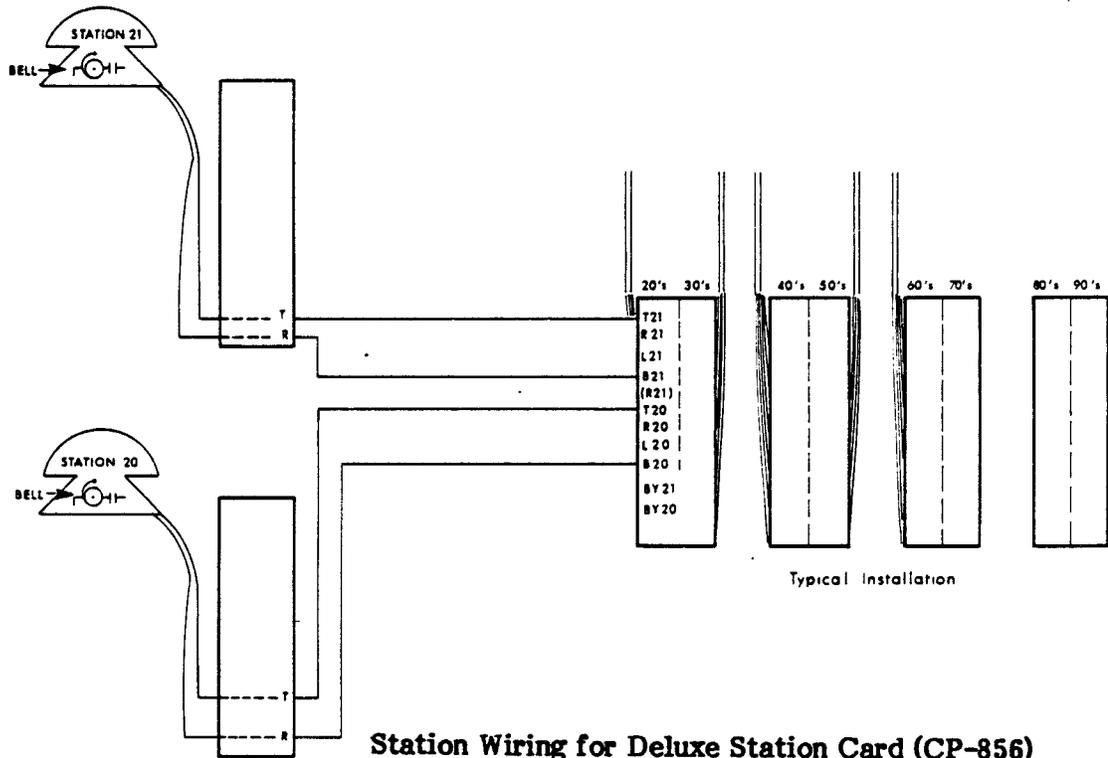
For Deluxe Station Card with Call-Waiting Option (CP-856-01) perform the following tests:

1. Take equipped station (station 1) off-hook. Flash hookswitch to eliminate dial tone.
2. Call station 1 from another (station 2). Verify that camp-on tone is received at station 1.
3. Hang up Station 1 phone. Verify ring at station 1 and ringback at station 2.
4. Go off-hook on station 1 and verify connection with station 2.

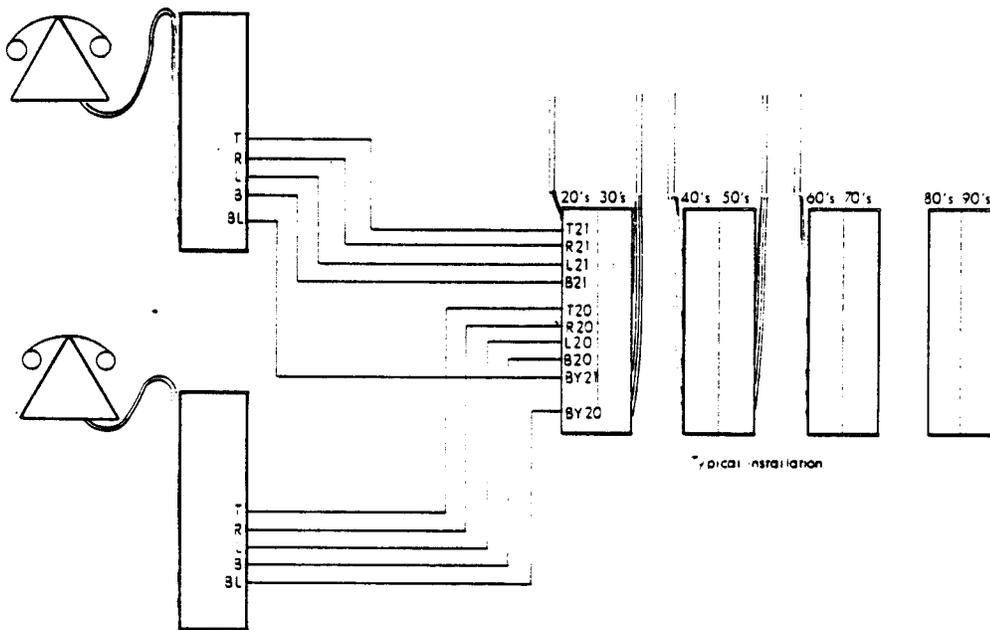
NOTE: For key line stations, lamp will flash at station 1 when that station is called and will light steadily when off-hook or all links are busy.

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3. INSTALLATION INSTRUCTIONS (cont'd.)



**Station Wiring for Deluxe Station Card (CP-856)
With Bridged Ringing
Fig. 32**



**Station Wiring for Deluxe Station Card (CP-856)
With 3-Pair Wiring (Standard Key Line)
Fig. 33**

ML-8000**3. INSTALLATION INSTRUCTIONS (cont'd.)****TABLE VIII****CP-856 DELUXE STATION CARD
CONNECTOR PIN OUT INDEX**

<u>PIN OUT</u>	<u>COLOR</u>	<u>FUNCTION</u>		
26	WHT-BLU	T-X1	NOTE: X=2 for 20's Group X=3 for 30's Group X=4 for 40's Group ETC.	
1	BLU-WHT	R-X1		
27	WHT-ORN	L-X1		
2	ORN-WHT	B-X1 (R-X1)		
28	WHT-GRN	T-X2		
3	GRN-WHT	R-X2		
29	WHT-BRN	L-X2		
4	BRN-WHT	B-X2 (R-X2)		
30	WHT-SLT	T-X3		
5	SLT-WHT	R-X3		
31	RED-BLU	L-X3		
6	BLU-RED	B-X3 (R-X3)		
32	RED-ORN	T-X4		
7	ORN-RED	R-X4		
33	RED-GRN	L-X4		
8	GRN-RED	B-X4 (R-X4)		
34	RED-BRN	T-X5		
9	BRN-RED	R-X5		
35	RED-SLT	L-X5		
10	SLT-RED	B-X5 (R-X5)		
36	BLK-BLU	T-X6		
11	BLU-BLK	R-X6		
37	BLK-ORN	L-X6		
12	ORN-BLK	B-X6 (R-X6)		
38	BLK-GRN	T-X7		
13	GRN-BLK	R-X7		
39	BLK-BRN	L-X7		
14	BRN-BLK	B-X7 (R-X7)		
40	BLK-SLT	T-X8		
15	SLT-BLK	R-X8		
41	YEL-BLU	L-X8	*NOTE: On CF-880 units prior to Rev. E note irregularity of cut down on off-hook busy leads (BY) wiring. Check revision level on warranty label located on the inside lower right hand corner of CF-880 housing. This note is for prior CF-880's only and does not pertain to any CF-840 housings.	
16	BLU-YEL	B-X8 (R-X8)		
42	YEL-ORN	T-X9		
17	ORN-YEL	R-X9		
43	YEL-GRN	L-X9		
18	GRN-YEL	B-X9 (R-X9)		
44	YEL-BRN	T-X0		
19	BRN-YEL	R-X0		
45	YEL-SLT	L-X0		
20	SLT-YEL	B-X0 (R-X0)		
46	VIO-BLU	BY-X1		BY-X2 *
21	BLU-VIO	BY-X2		BY-X1
47	VIO-ORN	BY-X3	BY-X4	
22	ORN-VIO	BY-X4	BY-X3	
48	VIO-GRN	BY-X5	BY-X5	
23	GRN-VIO	BY-X6	BY-X6	
49	VIO-BRN	BY-X7	BY-X8	
24	BRN-VIO	BY-X8	BY-X7	
50	VIO-SLT	BY-X9	BY-X0	
25	SLT-VIO	BY-X0	BY-X9	

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4. OPERATING INSTRUCTIONS

Intercom Calls

4.01 To make an intercom call, first take receiver off-hook. Depress the intercom key. The lamp should light steadily and dial tone should occur. Dial the code of the station to be called. A busy tone indicates that the called station is busy. If the called station is free, ringback will occur at the calling station. The intercom light at the called station will flash and the bell or buzzer will sound.

System Busy Indication

4.02 A steady intercom light at all stations indicates that all available intercom system links are in use. A party attempting to originate a call will receive a system busy tone. The system cannot be accessed until a link becomes available. The party must hang up and wait for a link to become available. System accessibility is indicated by the station lamps going out.

Camp-on

4.03 To camp-on, maintain the connection when calling a busy station. When the called party goes back on-hook, the call will automatically go through. The called party will see the intercom light flash when the call camps on. When the called party hangs up, ringing will be extended to that station and the calling party will receive ringback. The called party can then answer the new call.

Conferencing

- 4.04** Follow these steps to add other parties to a call that is already established.
- A) Flash the hookswitch or recall button for 1/3 second.
 - B) Listen for dial tone (the original parties are still in communication).
 - C) Dial the station to be added to the conference. If the station is idle, ringback will occur.
 - D) All parties will be connected and ringback tone will cease when the called station answers. If the called station does not answer, ringback will continue. A busy tone will be produced if the called station is busy.
 - E) Remove the busy tone or unanswered ringback by flashing the hookswitch. The original call(s) will remain established.
 - F) Individual parties may hang up without affecting the remaining conversations in the conference. All parties in the conference retain full signaling capabilities.

Re-Dial

4.05 A call to a busy or unanswered ringing station may be discontinued by flashing the hookswitch for 1/3 second. On the CP-840 link card, the link will become silent. To re-dial a call, flash the hookswitch again. On the CP-840A, however, flash the hookswitch only once. Dial tone will be heard and dialing may proceed in the normal manner.

ML-8000**4. OPERATING INSTRUCTIONS (cont'd.)****Paging Access**

4.06 To page, dial the access code assigned to the appropriate paging zone. If the paging access circuit is available, the connection is made immediately upon dialing the access code. If any of the 5 zones on the paging unit is busy, the calling party will hear a busy tone. The calling party can campon until the paging card becomes available. When the line is free, busy tone is removed and the camped on call has immediate access to the zone dialed (meaning caller is "on the air" with no further action necessary).

Outside Line Conferencing

4.07 Restricted Access on Held Line: To add a caller on an outside line to a conference, place the outside line on hold. Dial the access code for the outside line and the line will be seized.

4.08 Restricted Access on Idle Line: Dial the access code for the outside line. If the line is not being used it will be seized. If the line is busy, a busy tone will be heard.

4.09 Non-Restricted Access: Dial the outside line access code. (It does not matter what mode the outside line is in.) The line will be seized.

4.10 For dial pulse transmission: Rotary digits may be dialed immediately following access to the outside line and the dial pulses will be transmitted to the C.O. line. If no digit is dialed within 10 seconds of access or 10 seconds after the last digit was dialed, the transmit circuit will lock-out. This prevents any subsequent dial pulses or hookflashes to be transmitted to the outside line.

NOTE: The ML-8000 must be equipped with CP-840A Link cards for proper operation of dial pulse transmission.

Hands - Free Operation**Using a Western Electric 2A Transmitter/Receiver Hands-Free Answer-Back Intercom (H.F.A.L.)**

4.11 Place a call to the hands-free equipped station. The microphone in the adjunct turns on when dialing is completed (indicated by the "MIKE ON" LED). Both parties receive a single 1/2 second tone burst.

4.12 After hearing the tone, start speaking. The called station then answers via the microphone in the adjunct.

4.13 To stop incoming calls, depress the do-not-disturb (DND) button located on the Transmitter/Receiver. Both parties will then hear a double tone burst when the station is called. To allow incoming calls, depress the DND button again. This will release it.

4.14 To prevent the calling party from hearing local conversation or noise, depress the MIKE-OFF button. The LED will go out. To return to hands-free answering, release the MIKE-OFF button.

4.15 To use the handset at the hands-free station, depress the intercom button on the station key set and go off-hook. Once the called station is off-hook, the hands-free feature is canceled for the duration of that call.

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4. OPERATING INSTRUCTIONS (cont'd.)

4.16 To return to hands-free operation from handset operation, dial the station's own access code. When busy tone is heard, hang up. Hands-free unit will turn on again.

NOTE: To use this feature, dial conferencing must be enabled in the system.

Hands-Free Operation

Using An FTT K174 Call Announcer

4.17 Place a call to the hands-free equipped station. Both parties will hear a one second tone and the red LED on the Call Announcer will light. After hearing the tone, start speaking. The hands-free party can then answer back. The called party will remain on and hands-free conversation may continue until the calling party hangs up.

4.18 To prevent the calling party from overhearing local conversation, depress the privacy control button located on top of the Call Announcer. To release, depress the button again.

4.19 To use the handset during a conversation, go off-hook. The hands-free feature will be canceled for the duration of that call.

4.20 To return to hands-free operation from handset operation, dial the station's own access code. When busy tone is heard, hang up. Hands-free unit will turn on again.

NOTE: To use this feature, dial conferencing must be enabled in the system.

Emergency Alert Alarm Operation

4.21 Dial 91 on the intercom line to initiate the alarm. A 700Hz tone is heard for one second followed by a short 700Hz burst every 5 seconds as long as the alarm is ringing out. Every station in the system begins ringing one second on, four seconds off until answered or the alarm is canceled. Answering stations are connected in conference to the initiating station. The initiating station should be repeating an emergency message. When more than 8 stations are connected to the initiating station, audible transmission loss becomes significant. When the loss is unacceptable, the initiating station must instruct some stations to hang up until others have received the emergency instructions.

The alarm is discontinued when the initiating party hookflashes or hangs up. Answering stations begin ringing after hanging up. Stations that are off-hook when the emergency is initiated begin ringing after hanging up.

ML-8000**5. ORDERING GUIDE**

This Ordering Guide is provided to aid in the ordering of new systems as well as expansion or replacement parts for existing systems. The following table contains the information required when ordering parts for the ML-8000 Multi-Link Intercom System. Be certain to include the item name provided on the chart to ensure that you will receive the correct part. See Equipment Revision Table for part number status.

PART NUMBER	ITEM	DESCRIPTION
<u>HOUSINGS:</u>		
CF-880	Main Card File (Empty)	40 station main housing: Includes upper & lower mounting brackets, power termination, fusing strip
CF-800	Main Card File with Signal and Power Regulator cards	40 station main housing: Includes CP-810, CP-820, upper and lower mounting brackets, power termination, fusing strip.
CF-840	Expansion Card File	20 station expansion housing: Includes upper and lower mounting brackets, connector retaining bracket, connector cable. (2 maximum in a system)
<u>CIRCUIT PACKS (CARDS)</u>		
CP-810 Series	Power Regulator Card	One only required for system
CP-820/Series	Signal Card	One CP-820 or CP-830 required for system
CP-830/Series	Emergency Alert Alarm Signal Card	One CP-820 or CP-830 required for system
CP-840 Series	Link (Selector) Card	One required per link (4 in system)
CP-850 Series	Station Card	5 stations per card; up to 8 cards possible in main housing, 4 cards in each expansion housing (16 maximum)
CP-851 Series	Off-Hook Busy Card	5 stations per card
CP-852 Series	Outside Line Conferencing Card	5 lines per card; occupies station card slot
CP-853 Series	Paging Access Card	5 paging zones; occupies station card slot

5. ORDERING GUIDE (Cont'd.)

PART NUMBER	ITEM	DESCRIPTION
CP-854 Series	Long Line Station Card	5 stations per card
CP-854A-01	Long Line Card with Call Waiting Tone	5 stations per card
CP-855	Hands-Free Station Card	5 stations per card
CP-856	Deluxe Station Card	5 stations per card; can directly replace CP-851A, CP-854A or CP-855 in system
CP-856-01	Deluxe Station Card with Call Waiting Tone	Same as above with Call Waiting Tone Option piggyback card
<u>PARTS FOR CF-880:</u>		Replacement parts for main card file.
04-100252-01	Fuse Cover	
04-100243-01	Top Bracket	Mounting hardware
04-100242-01	Bottom Bracket	Mounting hardware
04-100358-01	Connector-Retaining Bracket Cover	Connector hold down
<u>PARTS FOR CF-840:</u>		Replacement parts for expansion card file
04-100264-01	Top Bracket	
04-100269-01	Bottom Bracket	Mounting hardware
04-100358-01	Connector-Retaining Bracket Cover	Connector hold down

5. ORDERING GUIDE (Cont'd.)

PART NUMBER	ITEM	DESCRIPTION
<u>OPTIONAL EQUIPMENT:</u>		
SM-400	Swing Mount	An optional swing frame for ease in wall mounting the ML-8000.
SM-401	Tie Bracket	Secures one or two expansion housing (CF-840) to the main card file (CF-880) when using Two SM-400 swing mounts.
PC-80	Modular Power Cable	Allows quick power connection between the ML-8000 and 79B1, 79B2 or 90B1 power units.
PC-81		
HF-40	Hands-Free Adapter (used with Western Electric 2A Transmitter/Receiver H.F.A.L)	Provides hands-free operation with the ML-8000 intercom.
HF-450	Hands-Free Adapter (used with ITT K174 Call Announcer)	
AR-100	Aux. Relay & Paging Adapter	Provides two 3 FC relays tripped during ringing.
PA-270	Two-zone Paging Adapter	Provides 6 watts/channel into an 8 ohm load for Paging.

Order the ML-8000 Multi-Link Intercom System and replacement parts through:

TONE COMMANDER SYSTEMS, INC.
 Box 97039
 4320 150th Avenue N.E.
 Redmond, Washington 98073-9739 USA
 Telephone: (206) 883-3600
 Telex: 15-2246

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6. TROUBLESHOOTING GUIDE

6.01

- A) Verify that all input voltages are within the limits shown on Fig. 11.
- B) Check all fuses on input power board of the main card file and those on individual station cards.
- C) Check voltages on power regulator card (see Fig. 11).
- D) Verify that the option switches on the signal and all link cards have been set to obtain desired features (refer to Figs. 12 and 14).
- E) If problems occur after performing the preceding steps, locate the appropriate problem area in the Troubleshooting Guide and follow the prescribed test procedures and corrective action.

TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
<u>SYSTEM POWER</u> Power regulator card LED does not light. System has no power.	Faulty power connections.	Shut off power. Check wiring connections at the power input board of the main card file.	Repair, reconnect or replace wiring.
	Blown fuse.	Check fuses on the power input board of the main card file.	Replace open fuses.
	Incorrect voltages into the power regulator card, improper polarity.	Check voltages going into the system at the power input board of the main card file with a voltmeter. Check all power supply inputs for correct input voltage and polarity.	Rewire; change power supply.
	Faulty power regulator card, system short.	Remove all but the power regulator card. Verify that it is in position 1 and properly seated. Turn power on.	If LED does not light, replace power regulator card.
		Insert all remaining cards one at a time. If LED goes out, that board has a short.	Replace card that causes LED to go out.
LED on power regulator card comes on but system is inoperative.	No link card; no signal card.	Check that at least one link card is installed in position 5 or 6 and that a signal card is installed in position 4.	Install cards in proper positions.
<u>STATION OPERATION</u>			
Station LED is lit on station card when all phones are on-hook and system is idle.	Faulty station wiring.	Check for incorrect wiring.	Replace or reconnect faulty wiring.
	Faulty station card.	Remove station card and replace with another. Verify that LED goes out and station can be accessed.	Replace faulty station card.

STATION OPERATION (Cont'd.)

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
Station cannot access any link (station is dead).	Faulty wiring.	Check wiring for proper connections. Refer to Table I for correct wiring.	Replace or reconnect faulty wiring.
	Incorrect option switch setting.	Check MB switch (on station cards equipped with option switches).	MB switch should be OFF for all used stations.
	Faulty station card.	Replace station card containing problem. Verify that the station can now access link.	Replace faulty station card.
	Faulty signal card.	Busy out all links. If system busy indication does not occur, replace signal card.	Replace faulty signal card.
One link cannot be accessed by any station.	System power was turned on with link busy-out ON.	Turn busy-out switch OFF.	
	Faulty link card.	Busy out suspected link card. Verify that other link cards can be accessed. Busy out all link cards but that one. If it still cannot be accessed, replace it with a good unit and check for access.	Replace faulty link card.
System does not respond to hookflashes.	Faulty link card.	Correct hookflash is approximately 1/3 second in duration. If installer is able to correctly hookflash on all but suspected link, replace link card and retest.	Replace faulty link card.
	Faulty station card.	If problem occurs only on one station, remove and replace station card.	Replace faulty station card.

TROUBLESHOOTING GUIDE

PROBLEM <u>DIALING</u>	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
Link does not accept rotary dialing.	Faulty station card.	If problem occurs only on one station remove and replace station card.	Replace faulty station card.
Link does not accept tone dialing.	Faulty link card. Faulty link card.	If problem occurs on one link, remove and replace link card.	Replace link card. Replace link card.
Busy tone is received after dialing first digit.	Incorrect option switch positioning. Faulty link card.	Check that option switch 3 on link card (CP-840A) is OFF. (For CP-840 link card, option switch 1 should be ON.) If option switch is correct, replace link card.	Set option switch to correct position. Replace faulty link card.
Station is on-hook but caller receives busy tone.	Faulty wiring. Incorrect option switch setting. Faulty station card.	Check BY leads for correct wiring (if equipped.) Check MB switch (on station cards equipped with option switches). Replace station card and retest.	Replace or reconnect faulty wiring. MB switch should be OFF for all used stations. Replace faulty station card.
	Faulty link card.	If problem occurs on only one link card, replace suspected link card and verify that the problem is corrected.	Replace faulty link card.
	Faulty signal card.	If problem is not corrected by re- placement of station or link card, re- place signal card. Verify that problem is corrected.	Replace faulty signal card.

TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
<u>DIALING (Cont'd.)</u>			
Incorrect station ring-out.	Faulty wiring.	Check for incorrect wiring.	Replace or reconnect faulty wiring.
	Faulty station card Faulty signal card Faulty link card	Replace station card containing the faulty stations. If problem is not corrected, replace signal card. If problem still persists, remove all link cards from system. Plug one link card into position 5 or 6 and test system with that link. Repeat for all link cards until fault occurs.	Replace faulty station or signal card. Replace faulty link card.
Multiple station ring-outs when one station is dialed.	Faulty wiring.	Check for incorrect wiring.	Replace or reconnect faulty wiring.
	Faulty station card Faulty signal card	If problem occurs in groups of five stations, replace the station card containing that group. If problem is not corrected replace signal card.	Replace faulty station or signal card.
<u>AUDIBLE RINGING</u>			
No audible ringing at all stations.	Blown fuse. Faulty wiring.	Check fuses on the power input board of the main card file. Check for correct wiring.	Replace blown fuse. Replace or reconnect faulty wiring.
No audible ringing in five station groups.	Missing or faulty audible ringing straps. Faulty station card.	Check option strap(s) on station card containing that five station group. (CP-850, and CP-851, have one strap per 5 station group. All other station cards have one strap per station.) If ringing still does not occur, replace station card.	Add or replace audible ringing strap(s). Replace faulty station card.

TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
<u>AUDIBLE RINGING (Cont'd.)</u>			
No audible ringing at individual stations.	Missing or faulty audible ringing strap. Faulty station card.	Check for option strap for that particular station. Replace station card that contains the problem station.	Add or replace audible ringing strap. Replace faulty station card.
Ringing stops after one ring.	Incorrect option switch setting.	Check SR switch (on station cards equipped with option switches).	S.R. switch should be OFF for multiple ring stations.
Ringing continues after calling party hangs up or;	Faulty link card	Busy out all but one link card. Test for continued ringing on each link card. If problem persists and is not related to one link card, remove one station card at a time and repeat test until problem is corrected.	Replace faulty link card or station card.
Ringing continues after called party answers (for all stations).	Faulty station card		
Station answers itself without ringing; no ringback heard by calling party.	Incorrect option switch setting.	Check H-F switch (on station cards equipped with option switches).	H-F switch should be OFF (except for properly equipped hands-free stations).
<u>CALL PROGRESS TONES</u>			
Loss of call progress tones.	Faulty signal card.	Check signal card test points with a test set (refer to Fig.12).	If signals are not present, replace signal card.
	Incorrect option switch setting.	Check that the option switches on the signal card are set according to Fig. 11.	Set option switches to correct positions.

TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
<u>TALK PATH (Cont'd.)</u> Distorted audio or call progress tones. (Cont'd.)	Faulty link card.	If tones are correct, plug in one station card and one link card. Go off-hook on one station (access link). Check for distortion. Repeat test for each link card.	If distortion occurs on one link, replace defective link card.
	Faulty station card.	If the distortion occurs on all links, replace the station card. If distortion does not occur during link test, plug in the other station cards one at a time and retest until distortion occurs. Replace defective station card.	Replace faulty station card.
Distorted audio on individual station.	Faulty station card. Faulty wiring.	Replace station card and retest. If problem persists, check wiring to the station.	Replace faulty station card.
Excessive crosstalk.	One or more faulty station cards.	Go off-hook on one link. Using a test set connected to the link test point, check each of the three other links for dial tone from the link that is off-hook. If crosstalk is found, remove one station card at a time. The crosstalk will disappear when the defective station card is removed. Repeat this procedure successively for each of the other three links until all crosstalk problems are found.	Replace or reconnect wiring.
<u>LINE LAMPS</u>			
Line lamps do not light at any station.	Faulty power connection. Blown lamp fuse on power input board of main card file. Faulty regulator card.	Check power connections and lamp fuse on power input board of main card file. Remove and replace power regulator card.	Replace faulty station card(s). Replace or reconnect faulty wiring. Replace blown fuse.

TROUBLESHOOTING GUIDE

PROBLEM <u>LINE LAMPS (Cont'd.)</u>	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
Flickering or dim line lamps at all stations.	Improper lamp battery wiring.	Verify that wire going to lamp battery ground is common to "B" ground at power supply.	Replace or reconnect wiring.
System busy lamp indicators do not work (on all stations).	Faulty power supply.	Check lamp supply voltage.	If voltage is incorrect, replace power supply.
System busy lamp indicator does not work (on one station).	Faulty signal card.	Replace signal card and retest.	Replace faulty signal card
Line lamps do not light in five station groups.	Faulty station card.	Replace station card and retest.	Replace faulty station card.
Line lamps do not light at one station.	Open lamp fuse on station card.	Check fuse on station card containing the five station group.	Replace blown fuse.
	Faulty station card.	Replace station card and retest.	Replace faulty station card.
System will not allow camp-on.	Incorrect option switch setting.	Check that camp-on option switch is in correct position on link card (refer to Fig. 13).	Set option switch to correct position.
System will not allow conferencing.	Faulty link card.	If option switch is correct, replace link card.	Replace faulty link card.
	Incorrect option switch setting.	Check that conference option switch is in correct position on link card (refer to Fig. 13).	Set option switch to correct position.
	Faulty link card.	If option switch is in correct position, replace link card.	Replace faulty link card.

SYSTEM FEATURES

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TECHNICAL INSTRUCTIONS

**Tone Commander Systems, Inc.
Box 97039
4320 150th Avenue NE
Redmond, WA 98073-9739 USA
Telephone: (206) 883-3600
Telex: 15-2246**