# MAX-824

# Communication System

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## When time is money.

Today more than ever, conducting your business in a cost-effective manner is a crucial ingredient to its success. If you or your employees are currently spending a significant amount of time on an inefficient telephone system, you're probably losing thousands of dollars each year in employee time, long distance abuse, and lost clients.

Melco's solution? The MAX-824—a communication system specifically designed to meet the special needs of small business. The MAX-824 provides for 4, 8 or 12 outside lines and 6, 12, 18 or 24 telephone extensions. Sophisticated custom calling features help streamline communications and increase productivity.

The MAX-824 is equally efficient in hotel/motel applications. By providing the services of a full-featured communication system, small hostelries can more effectively compete with large chain operations. And an optional Message Registration Unit is available to help increase revenues—local calls placed by each room can be easily counted, so that guests can be accurately billed for telephone usage.

## Meeting your needs today and tomorrow.

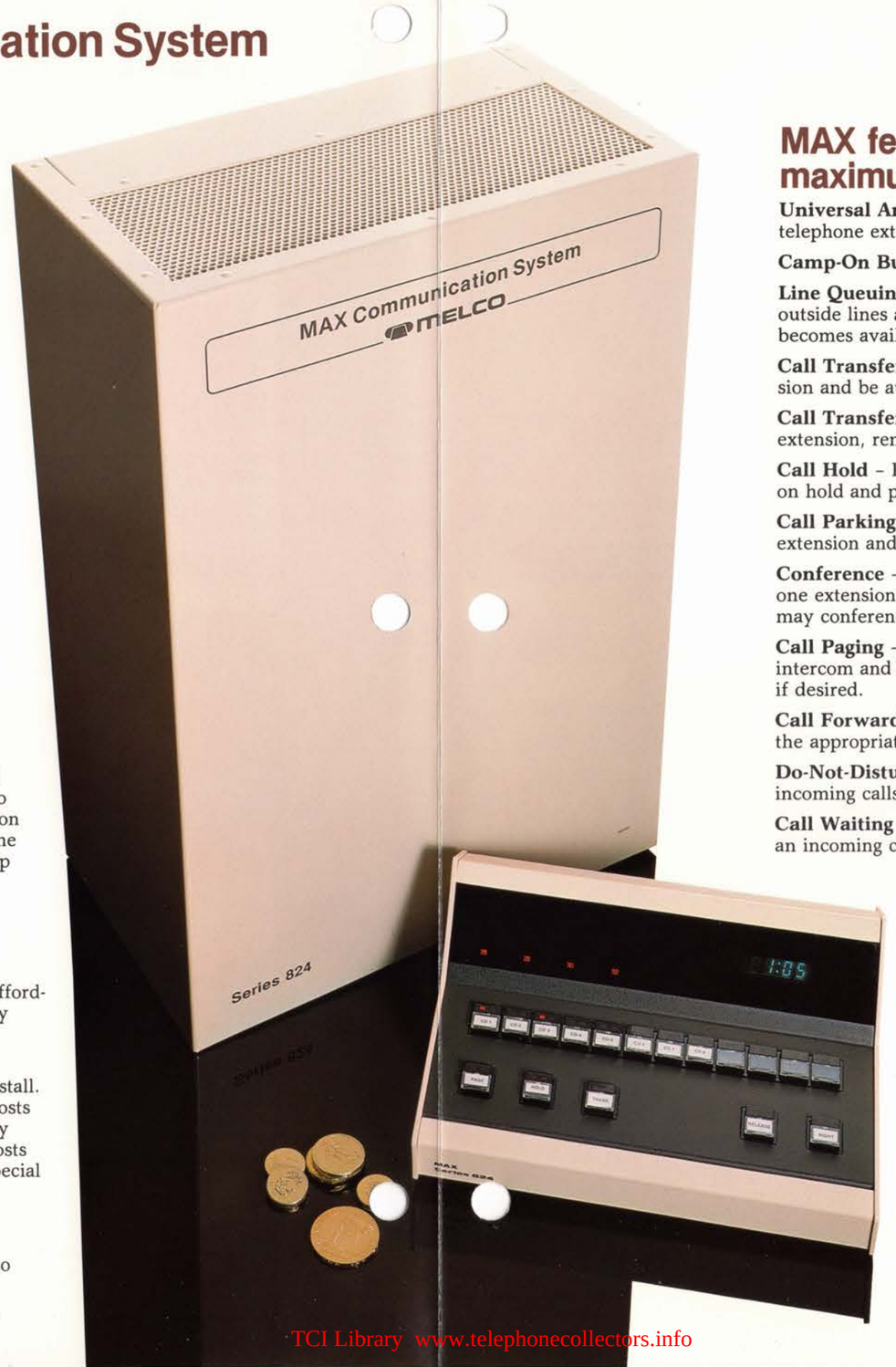
With the flexibility which accompanies a completely modular design, the MAX-824 allows you to purchase only those lines and extensions you currently require. That means you'll never have to buy more equipment than you need. Plus, you have the satisfaction of knowing that when your communication needs grow, so will the MAX-824—up to 8 outside lines and 24 telephone extensions or up to 12 outside lines and 18 extensions.

## The communication system you cannot afford to be without.

Sophisticated features, flexible design, and affordable too? Very affordable. In fact, the MAX-824 is considerably less expensive than any comparable small business communication system on the market today.

A simple two-wire system, the MAX-824 takes only minutes to install. And because the MAX operates from standard telephones, your costs are less and your existing equipment may be able to be used. Easy installation, flexible telephone connections, and low equipment costs add up to big savings for you! You even have the option to use special feature phones, or cordless phones at certain extensions to accommodate the specific needs of individual employees.

With our extensive warranty you can be confident the MAX-824 reflects the quality and reliability which are built into every Melco product. Just compare the MAX-824 to other small business communication systems. You'll find that the MAX-824 sells itself!




## MAX features mean maximum efficiency.

**Universal Answer** – Allows you to answer an incoming call from any telephone extension.

**Camp-On Busy** – Gives you automatic callback from any busy extension.

**Line Queuing** – Allows you to "get in line" to place the next call when all outside lines are busy and be automatically called back when a line becomes available.

**Call Transfer with Callback** – You may transfer a call to another extension and be automatically called back if the desired party does not answer.

**Call Transfer with Announcement** – You may transfer a call to another extension, remain on the line, and privately announce the caller.

**Call Hold** – By depressing the switchhook, you can place an outside call on hold and proceed to place another call, page or answer an incoming call.

**Call Parking** – Enables you to place an outside call on hold from one extension and retrieve the call from another extension.

**Conference** – Up to three extensions can conference with one outside line, one extension may conference with two outside lines, or five extensions may conference with each other.

**Call Paging** – External paging equipment may be accessed through the intercom and background music may be played through the paging system if desired.

**Call Forwarding** – You may forward calls to another extension by dialing the appropriate access code and extension number.

**Do-Not-Disturb** – Allows you to make your extension appear busy to incoming calls.

**Call Waiting** – A busy extension will receive a two-beep tone to indicate an incoming call is waiting.

**Message Waiting** – You can light a lamp on the telephone of an extension that does not answer your intercom call, and the extension can automatically return your call.

**Private Intercom** – Eight private talking paths are available for in-house calls.

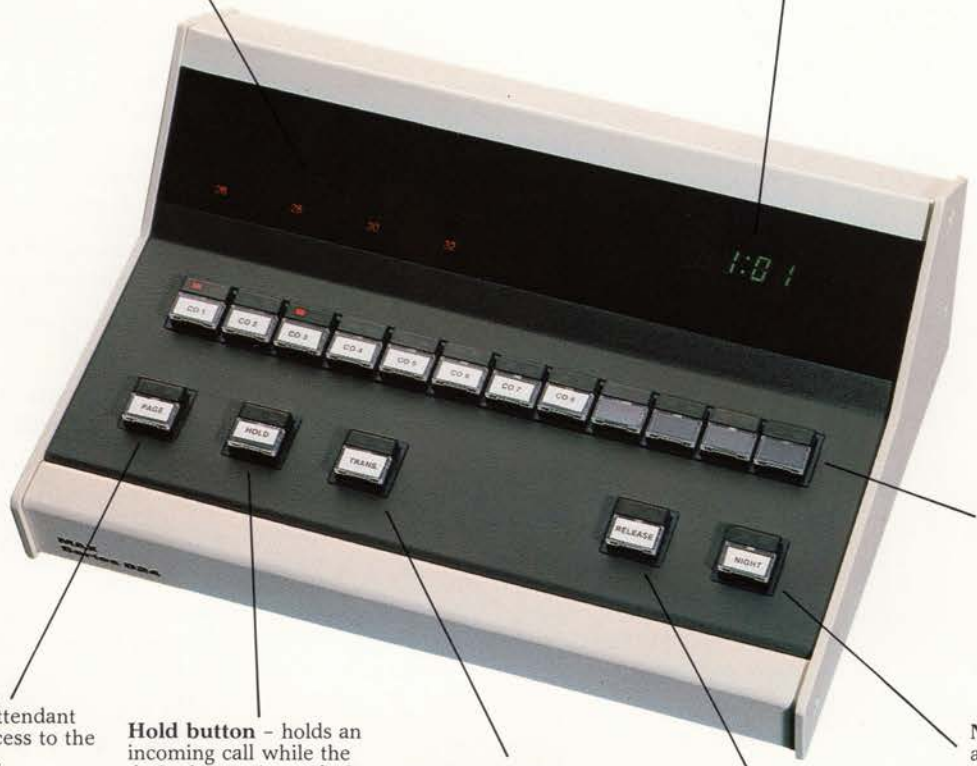
**Automatic Station Release (Lockout)** – An extension inadvertently left off-hook will be locked out of the system in order to free the system for processing calls. (Error tone will be issued prior to lockout.)

**Music on hold** – Assures outside callers left on hold that they are still connected. (External music source required.)

**Toll Restrictions** – May be applied to all or specific groups of telephone extensions to control use of WATS, Foreign Exchange, or long distance calling.

**Direct Inward System Access** – An optional feature which allows selected outside callers to bypass the attendant and dial directly into the system. (Especially great for accessing Company lines to make business calls when you are away from the office.)

# Attendant's console features




**Busy station display** - lets the attendant easily observe the status of each incoming call.

**Digital clock** - allows attendant to quickly and accurately note time on messages or other office memos.

**Line buttons** - allow the attendant to access and observe the status of outside lines.

**Page button**- provides the attendant with direct access to the paging system.

**Hold button** - holds an incoming call while the desired party is notified.

**Transfer button** - allows attendant to connect incoming calls to the desired party. If that party is either busy or doesn't answer, the call will be automatically rerouted to the attendant.

**Release button**- provides immediate attendant disconnect from any telephone extension or outside line.

**Night transfer button**- at night, this feature automatically transfers calls from the attendant's console to a night station.

For more information on the MAX-824, please contact:

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# MAX-824™ BUSINESS HOTEL/MOTEL COMMUNICATIONS SYSTEM

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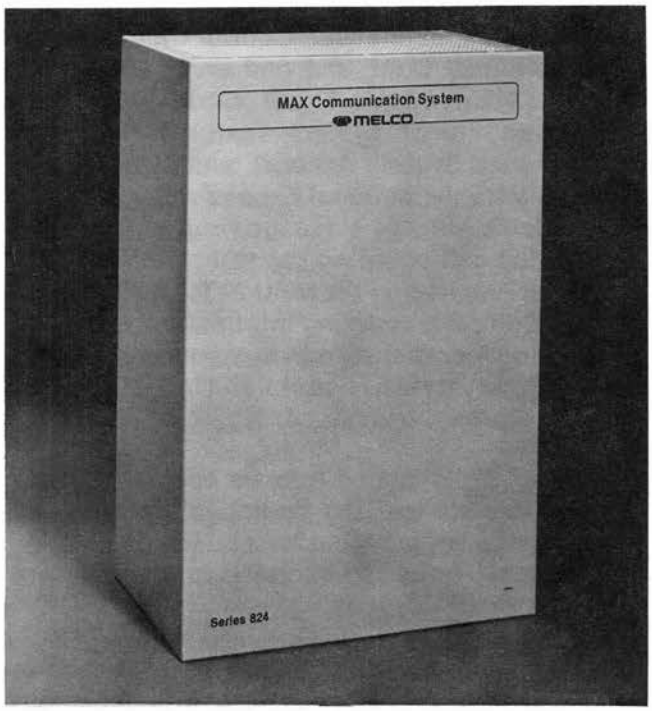



Fig. 1.

## 1. GENERAL

1.01 The MAX-824 has a capacity of 24 stations, 8 network lines and 8 intercom talk paths. Configurations with 12 network lines and a maximum of 18 stations are possible with an Expander CO Card. All connections to stations require only one cable pair for transmission and signaling. An additional cable pair is required when message waiting is used. Network accesses may be grouped, enabling assignment of local, toll, WATS and FX lines.

1.02 MAX-824 systems may be ordered equipped for 6, 12, 18 or 24 stations and 4 or 8 network lines. The Expander CO Card allows for additional system configurations of 12 network lines and 6, 12 or 18 stations. (When the Expander CO Card is used, 4 talk paths are available for intercom calls.) Additional station circuit packs (6 station circuits per pack) may be ordered to be used for spares or for expanding an existing system up to 24 stations. An attendant's console, which provides one additional station (0), is optional.

1.03 MAX-824 systems shipped after December 1984 are equipped with several enhanced circuit cards which are readily identified by red ejector tabs (rather than clear). Enhanced systems include an enhanced Control Card, enhanced Links/Signal Card, and one or two enhanced Central Office Cards. These cards provide for several additional system features (including Direct Inward System Access), and provide compatibility with the optional Expander CO Card and with Melco's MRU-24 Message Registration Unit, which adds call counting capability. Refer to the Technical Practice on the MRU-24 for further information. Complete ordering information, including information for ordering new systems and upgrading existing systems, is contained in the MAX-824 Ordering Guide, Document 470323A.

1.04 MAX-824 systems may be operated in one of two modes. The operation and features in one mode are optimized for a business environment. Small hotel or motel applications are served by the other mode.

1.05 The MAX-824 may be used as a full feature intercom with a key system, with or without line circuits. Lamp supervision is not required.

1.06 The MAX-824 is completely packaged in an aluminum case. Installation consists of mounting on a backboard with four woodscrews and connecting stations, lines, and an external power supply. The circuit packs insert in connectors in the standard method.

## 2. FEATURES

2.01 The MAX-824 provides the following features as standard:

- Two-wire connections to stations
- Standard single-line telephones
- Tone and/or rotary dialing
- Loop or ground start network line compatibility
- Direct outward dialing
- Two network line groups
- Individual network line access
- Line queuing (automatic callback)
- Toll restriction
- Universal answer, day and night
- Predetermined night answering
- Night bell
- Three call processors
- Call transfer
- Call holding
- Call parking
- Three area paging access
- One network line/station conference
- Two network lines/one station conference
- Station conference
- Camp-on busy (automatic callback)
- Call waiting tone
- Do not disturb (make busy)
- Message waiting
- Call forwarding
- Reverting call
- Power failure transfer
- Automatic station release
- Background music access
- Music on hold access

- Switchhook flash timing that is compatible with automatic flash telephones
- Direct Inward System Acess (DISA)
- Standard call progress tones

2.02 The attendant's console provides:

- Busy station lamp field
- Visual indication of calling station number
- Line status indication
- Direct hold and transfer control
- Attendant camp-on with automatic recall
- Direct paging access
- Direct disconnect
- Direct outside line access
- Night answer control
- Connections for a single line telephone
- Digital clock
- Tone or rotary dialing
- Walnut end panels

2.03 Dial codes:

| DIAL CODE | FUNCTION |
|---|---|
| 0 | *Attendant |
| 9 | *Local Exchange |
| 8 | *Toll or Special Service Access: Idle Line Selection |
| 41, 42, 43, 44 45, 46, 47, 48 | Network Access: Individual Line Selection |
| 40 | *Line Queuing |
| 49 | *Reverting Call |
| 71, 72, 73, 74 75, 76, 77, 78 | *Call Pick-up (specific line) |
| 70 | Universal Incoming Call Answer |
| 58 | Call Parking |
| 60 | Call Transfer (with callback) |
| 56 | Message Waiting |
| 54 | *Station Camp-On (automatic callback) |
| 53 | Call Forwarding |
| 52 | Do Not Disturb (make busy) |
| 51 | Network/Local Conference (one network line + 3 stations) |
| 50 | *Local Conference (five stations) |
| 57 | Outside Conference (two network lines + 1 station) |
| 61, 62, 63 | Paging access, individual area |
| 64 | Paging access, all areas |
| 10 - 33 | *Station Numbers |
| 31, 32, 33, 34 | Network Access: Individual Selection of Network Lines 9 through 12 (when Expander CO Card is used) |
| 371, 372, 373, 374 | *Call Pick-up (specific incoming call pick-up of lines 9 through 12 (when Expander CO Card is used) |
| 59 | Busy Out Network Line or Processing Link |

*In the Hotel/Motel Mode, only these features may be accessed by ordinary stations. Other features may be accessed by the attendant or night station only.

## 3. GENERAL OPERATION

3.01 The operational descriptions in this section apply to systems operating in either the Business or Hotel/Motel Mode. Refer to Section 4 for specific operational procedures for the Hotel/Motel Mode and Section 5 for the Business Mode.

STATION-TO-STATION CALL

3.02 There are no unusual procedures for placing an in-house call. After receiving dial tone, the caller dials a two-digit number and receives ringback tone until the called station answers. After the conversation, either station returning on-hook will clear the talking path. Stations ring with single bursts of repeated ringing for station-to-station calls.

3.03 A call is first registered in one of the three processing links. Three calls can be initiated at the same time. If further call attempts are made, the callers will hear nothing, but may wait and will hear dial tone as soon as a link becomes available.

3.04 There are eight paths available for station-to-station calls in MAX-824 systems with a capacity of up to 8 network lines. In systems with a capacity for 12 network lines (when the Expander CO Card is used), four paths are available station-to-station calls. If all paths are in use, and an additional local call is attempted, the caller will receive fast busy tone after dialing. A station on a network call, incoming or outgoing, does not occupy one of the local paths. The local paths are used only on station-to-station calls.

AUTOMATIC STATION RELEASE

3.05 When a telephone is off-hook more than 15 seconds without dialing, the MAX-824 will place error tone on the talking path. After an additional 10 seconds the station is locked out and must go back on-hook to be reissued dial tone.

NETWORK LINE ACCESS AND RESTRICTIONS

3.06 Network lines are accessed as follows:

| DIAL | ACCESS |
|---|---|
| 9 | Local Exchange and Toll |
| 8 | Toll (or WATS, FX, etc.) |
| 41, 42, 43, 44<br>45, 46, 47, 48 | Individual Line Selection—Local or Special Service, as assigned. |
| 31, 32, 33, 34 | Individual Line Selection—Local or Special Service, as assigned (for network lines 9 through 12 when the Expander CO Card is used). |

3.07 Station access to network lines is determined by restriction class of service assignment shown in Tables D, E and G.

3.08 When a toll restricted or partially restricted station dials 9 and then attempts to dial a restricted digit, the network line is disconnected and the station is transferred to the attendant. Restricted stations may place toll calls through the attendant.

3.09 Station 10, or 10 and 11, may be assigned to night service. Night stations have full features and no restrictions any time. Stations 12 and 13 may each be assigned to any of the available classes of service. All other stations are either unrestricted or are in the restricted group. All stations in the restricted group have the same class of service.

3.10 The CO circuit pack #120209-3 or 120209-4 and the CO Expander circuit pack #120263-1 or 120263-2 are compatible with either loop or ground start lines. The network line mode selection is contingent upon central office equipment requirements.

LINE QUEUING

3.11 When all network circuits are busy, a station may "get in line" to place the next call. After receiving a busy signal, the station goes on-hook, then off-hook, receives dial tone. The station dials 40, hears another dial tone, then redials the access code of the busy group (line 8, 9, 41, etc.), and returns on-hook. When a line in the group becomes idle, the station will be rung. When the station answers, it is extended to the central office and dial tone. Any or all stations may wait in line for one of the "8" or "9" lines, or for a specific line (41, 42, etc.). However, each station can only be in one queue at a time. Answers back are queued in the order in which they were placed.

CAMP-ON BUSY (AUTOMATIC CALLBACK)

3.12 When a station is busy, a call may "camp-on" the busy station. To initiate a camp-on, lift the handset, dial 54, listen for dial tone, dial the desired number, listen for acknowledgment tone, and hang up. When the busy station becomes idle, the originating station is automatically called back. When it is answered, the camped-on station will ring. The call proceeds as a normal call. Up to 24 camp-ons may be in progress on the same station, with each camp-on queued in the order placed. Camp-on Busy is automatically deactivated if the originating station does not answer after three rings.

LOCAL CONFERENCE

3.13 As many as five stations may hold an in-house conference. To initiate a conference, one of the stations dials conference code 50, receives dial tone again, then dials the other stations to be included. After each station is dialed, dial tone is heard. After the last station is dialed, the initiator dials conference code 50 again. He hears a ringback tone and the other stations ring. Ringing continues for 15 seconds. Stations have an additional ten seconds to answer. Stations enter the common talking path as they answer. A

station may leave the conference any time by hanging up. If one of the stations is busy during the initiating period, the calling station may dial the next station over the busy signal without hanging up or may abandon the conference attempt.

**NOTE:** *When an incorrect number is dialed or more than five stations are called for conference, an error tone will be heard. Error tone cannot be dialed through.*

POWER FAILURE TRANSFER

3.14 If the 24V DC power source fails, the network circuits will automatically be switched to predetermined stations, bypassing the system equipment. Those stations will be directly connected to the network lines and will be the only stations able to receive and place calls during the power failure. To originate calls with a ground start network line during a power failure, it is necessary to equip the telephones of the power failure stations with grounding buttons. When the power is restored, line access control and other system functions are automatically restored to all stations.

3.15 Stations preselected for service during a power failure are the first station circuits of each line circuit pack (card). These are stations 10, 16, 22, 28, and the attendant's telephone. The stations are designated on the connecting block PFT and PFR. See Figure 8 for interconnecting of lines to stations.

REVERTING CALL

3.16 Any station may test its own transmission, dialing and ringing functions by dialing 49, hanging up and waiting for ringing. The station will ring three times.

CALL ANSWERING - NO ATTENDANT

3.17 The night transfer switch on the attendant's console transfers the ringing for incoming calls to the night station. The night station may be station 10 or both 10 and 11. See Table H. If the MAX-824 is not equipped with an attendant's console, the night station is always signaled for incoming calls. Night stations answer incoming calls directly, that is, without dialing a pick-up number.

3.18 When a night answer station is off-hook, a brief attention tone over the line indicates that an incoming call is waiting. When two night answer stations are off-hook, only station 10 will receive the attention tone.

3.19 If there are multiple incoming calls, the night transfer station may answer the first call, place it on hold, then answer the next. All available outside lines may be placed on hold.

3.20 Calls incoming to the night answer station and destined for other stations may be transferred by the method described in Paragraph 5.04 or 5.05. If it is desirable to answer night calls from a station or stations other than 10 and/or 11, it may be arranged by Call Forwarding, as described in Paragraph 5.13.

NIGHT BELL

3.21 A night bell may be installed to announce incoming calls. The night bell may be made to operate either when the console switch is in the NIGHT position or anytime there is an incoming call. This option is controlled by switch 28. See Table M. When a call comes in, audible signal supply will be placed on NB1 and NB2 on the connecting block (Figure 5). In the Business mode, any station hearing the night bell may answer the incoming call by dialing 70 for any line, or 71-78 or 371-374 (when the Expander CO Card is used) for a specific line. In the Hotel/Motel Mode, only the attendant or night station may answer.

ATTENDANT'S CONSOLE

3.22 The console is equipped with the following:

- Audible signals for incoming calls.
- An access button for each network circuit.
- A HOLD button to hold incoming calls while the desired station is notified.
- A PAGE button to provide direct access to the paging system (see Paragraph 5.08).
- A TRANSFER button to connect a waiting incoming call to a station.
- A RELEASE button to provide immediate attendant disconnect from a station or network line.

- A station busy lamp (LED) field.
- A network line status lamp field.
- A digital clock display.
- A night answer switch to provide for station processing of incoming calls.
- A flexible 25-pair, 6-foot console cord assembly for connections to the MAX-824, and a modular jack for connections to the attendant's telephone.

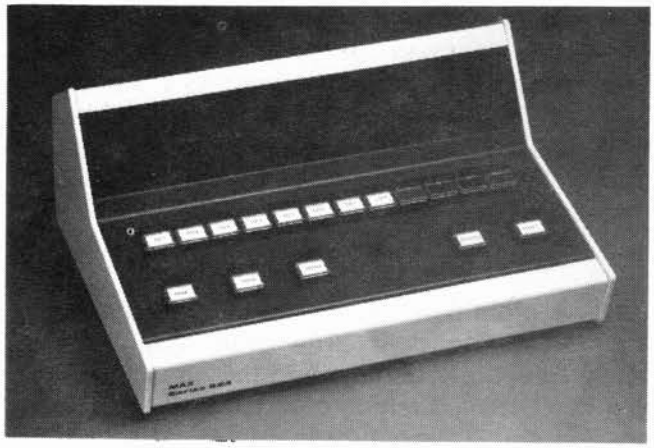


Fig. 2

OUTSIDE CALL ANSWERING—ATTENDANT

3.23 The attendant's console provides an audible signal in double bursts and a lighted outside line access button when the office receives an incoming call. The attendant lifts the handset and operates the access button for the line indicated by the flashing lamp. The attendant receives the caller's request for a station, checks the lamp field to assure that the station is not busy, and operates the hold button to place the call on hold. This automatically siezes a station-to-station talking path and provides dial tone. The incoming call can now be extended by one of three methods:

1. The attendant dials the desired station and informs that person of the incoming call. Attendant then operates first the transfer button and then the associated access button. The line is now extended to the station. The attendant, cleared of the connection, can replace the handset.

2. The attendant operates the transfer button and then the access button for the line on hold, then dials the desired station number. When ringback tone is heard, the attendant may disconnect or operate the access button of another incoming call. The station will ring with double bursts indicating an outside call. When the station answers, it will be connected directly to the incoming call. If the station does not answer within six rings, the attendant will be recalled. If the attendant presses the transfer button and dials a station without first pressing the desired line access button, the line most recently connected to the attendant will be transferred.

3. With the incoming call on hold, the attendant pages the person wanted and instructs him to dial 71, if the waiting call is on the first line, or 72 through 78 for the second through the eighth lines, or 371 through 374 for the ninth through the twelfth lines (when the Expander CO Card is used). The paged person can then answer the call by dialing the instructed pick-up code from any telephone on the system.

INSIDE CALL ANSWERING—ATTENDANT

3.24 The attendant's console provides an audible signal in single bursts when a station dials zero. The attendant may answer the call by lifting the handset. When connected to the console, the calling station is identified by its flashing lamp.

ATTENDANT CAMP-ON

3.25 The attendant may transfer an outside call to a busy station as if it were not busy. The attendant will hear ringback tone and the station will hear call waiting tone over the conversation. After receiving ringback tone, the attendant is free to handle other calls or to hang up. The outside party will remain on hold. If the busy station hangs up within 24 seconds, his telephone will ring and when answered will be immediately connected to the outside party. If the station does not discontinue his conversation within 24 seconds or answer after 6 rings, the attendant will be recalled.

ATTENDANT FORWARDING

3.26 When the attendant wants to receive calls at another station (A), he dials 53, receives a dial tone, dials the station number (A) to which the calls are to be forwarded, receives acknowledgment tone, then returns on-hook. The forwarding remains in effect untill the attendant station is again taken off-hook. While the forwarding is in effect, station A is unrestricted and may transfer outside calls. See Paragraphs 5.04 and 5.05. From station A, calls may be re-forwarded to yet another station (B) by again dialing 53 and then the station number for B. Attendant forwarding may be cancelled from the forward station by dialing 53 and then 0. The night station(s) forwarding feature also operates as described above. The forwarding feature for the other stations is described in Paragraph 5.13.

3.27 The attendant or night station(s) may be made busy to station calls by dialing 52. In night mode, or in systems with no console, calls to the attendant (0) will ring the night station(s) unless it is made busy. This feature is cancelled when the initiating station comes off-hook. Only the attendant or night station(s) may be made busy in the Hotel/Motel Mode.

3.28 Station features described in Sections 4 and 5 apply also to the attendant and night stations.

## 4. OPERATION - HOTEL/MOTEL MODE

4.01 The operational descriptions in this section apply to the Hotel/Motel Mode only. Refer to Section 5 for the Business Mode description.

4.02 A station other than the attendant or night station(s) may access all of the features described in Section 3. The features described in Section 5 are not available to Hotel/Motel stations except to the attendant or night station.

4.03 Cards imprinted with condensed dialing instructions and which clip to a tone or rotary dialing telephone are available for Hotel/Motel systems.

MESSAGE WAITING

4.04 The attendant or night station may activate a Message Waiting lamp at any station by dialing 56 and then the station number. The receiving station can obtain the message from the attendant and turn off the lamp by dialing zero.

## 5. OPERATION - BUSINESS MODE

5.01 The operational descriptions in this section apply to all stations in the Business Mode. Features described in this section also apply to the attendant or night station in the Hotel/Motel Mode.

5.02 Dial faceplates, imprinted with dialing instructions and designed to fit most tone-dialing telephones, are available for Business systems. The cards and faceplates are listed in the separate MAX-824 Ordering Guide.

HOLD

5.03 A switchhook flash places a network line on hold and also connects the station to a processing link and dial tone. The station is then able to place a call to an outside line or another station, page or answer an incoming call. A second switchhook flash will reconnect the network line. The attendant can access network lines placed on hold, using the network line access buttons on the console. The switchhook must be held down at least 1.5 seconds to disconnect a network line and prevent it from being put on hold.

**NOTE:** *A call can NOT be placed on hold by flashing the switchhook and hanging up. Refer to Paragraph 5.07 for Call Hold/Call Park instructions.*

CALL TRANSFER WITH CALLBACK

5.04 An incoming or outgoing call can be transferred from one station to another. The first station places the line on hold by flashing the switchhook, then dials 60, receives dial tone and dials the second station number. If there is no busy signal, the first station can hang up when ringback tone is heard. The second station will ring with double bursts indicating an out-

side call. When the second station answers, it will be connected to the call. The second station may transfer the call to a third station, and so on, any number of times. If the station to which a call is transferred does not answer after seven rings, the call will be automatically re-routed to the attendant or night station.

### CALL TRANSFER WITH ANNOUNCEMENT

5.05 Call transfer may also be made by switchhook flash to place the line on hold, dialing the second station number and announcing the call. When the first station hangs up, the second station receives the call.

### CONSULTATION

5.06 A station can hold a private consultation with a second station while on a network call by first placing the call on hold (see Paragraph 5.03), then proceeding with a normal station-to-station call. The network line can be retrieved with a switchhook flash.

### CALL HOLD/CALL PARKING

5.07 A network call can be placed on hold and picked up at another station. The switchhook is flashed, code 58 is dialed, then the telephone is placed on-hook. The call can then be retrieved at any other station by dialing 58, followed by the originating station number.

**NOTE:** *If, after flashing the switchhook, code 58 is not dialed before hanging up, the call on hold will be disconnected. However, a call may be placed on hold by the switchhook flash method alone as long as the telephone is not hung up.*

### PAGING

5.08 Paging equipment is accessed from stations by dialing 64 for all areas or 61, 62, or 63 for a specific area. This feature does not utilize any of the local talking paths. The attendant may access the all-area page directly when off-hook by operating the page button. The paging connection is cleared only when the person paging returns on-hook. External paging apparatus is required.

### ONE NETWORK LINE/STATION CONFERENCE

5.09 Up to three stations can confer with a network circuit. The conference may be initiated by any station. To initiate a conference, a station first establishes the network call—incoming or outgoing—then places it on hold, receives dial tone and dials conference code 51. Calling the other members of the conference is the same as for a local conference (see Paragraph 3.13). The initiator controls the network connection with the conference and can include or exclude it by flashing the switchhook. If the attendant initiates this type of conference, the network line is included by pressing the desired line access button. When all stations hang up, the network and conference connections are released.

### TWO NETWORK LINES/ONE STATION CONFERENCE

5.10 Any station may confer with two outside lines by placing them on hold, then dialing 57. The station establishes the first outside call (incoming or outgoing) in the usual manner. The station places this call on hold and establishes a second which is also placed on hold. At this point, dialing 57 will connect the station and both outside lines in a conference. The conference will end when the MAX station hangs up. If the station flashes the switchhook during the conference, both outside lines will be placed on hold. At this point, the conference can be re-established by dialing 57. A switchhook flash at this time will connect the station to only the last line placed on hold.

### DO NOT DISTURB (MAKE BUSY)

5.11 This feature causes a station to appear busy when called. When a station user does not wish to receive calls, he dials 52, receives acknowledgment tone and hangs up. A caller dialing that station will receive busy tone. This feature is cancelled when the initiating station comes off-hook.

### MESSAGE WAITING

5.12 Any station can activate a Message Waiting lamp at another station. If Station A wants to leave a Message Waiting signal for Station B, Station A dials the Message Waiting code, 56, then the station number B. If the Message Waiting is accepted, Station A will hear acknowledgment tone and the Message Waiting lamp at Station B will light. Station B answers a Message Waiting lamp by dialing code 56. Station A will ring and the lamp will go out. If Station A is

busy, the lamp remains on and Station B hears busy tone. Only one message can be left at a station at a time. A station user attempting to leave a second message from a different station will hear busy tone after dialing the station number. Message Waiting is cancelled by dialing 56, then the station number from the originating station.

CALL FORWARDING

5.13 When any station user wants to receive calls at another station, he dials 53, receives a dial tone, dials the station number to which his calls are to be forwarded, receives acknowledgment tone, then returns on-hook. To cancel Call Forwarding, he dials 53. This feature cannot be multipled except for the attendant and night stations. For example, if Station A has forwarded his calls to Station B and Station B has forwarded his calls to Station C, calls to Station A will ring Station B, not C.

UNIVERSAL CALL ANSWERING

5.14 Any station user hearing the incoming audible signal from the attendant's console, the night station or the night bell may answer the call by dialing 70. Individual network lines may be answered by dialing 71-78 respectively for lines 1-8. When the CO Expander Card is used, lines 9-12, if equipped, may be answered by dialing 371-374 respectively.

DIRECT INWARD SYSTEM ACCESS (DISA)

5.15 When a network line is assigned for DISA service, an outside caller may dial directly into the MAX-824 system, then dial a station number or access code. The caller, after dialing the telephone number assigned to DISA, hears central office ringback tone, then MAX dial tone. The caller may then tone dial a station number or any other access code.

BUSY OUT NETWORK LINE OR PROCESSING LINK

5.16 Code Number 59, dialed before the access code for a specific network line (41-48 for lines 1-8 and 31-34 for lines 9-12), will busy out the dialed network line. Lines are freed by dialing the same four numbers a second time. This feature may be activated only from the attendant or night station.

5.17 Code number 59 may be also dialed by the attendant or night station to busy out a processing link when it is thought to be defective. Indication of a defective link is detected by the inability to break MAX dial tone when attempting to initiate a call. Once the troublesome link is identified and busied out, it can remain "turned down" to allow for consistent call initiating until the Links/Signal circuit pack can be replaced. To busy out the first, second or third link, dial Code 59 followed by 71, 72 or 73. After dialing 59 + 71 to busy out the first link, try to break dial tone at another telephone. If the fault is still detected, free the first link by dialing 59 + 71 a second time. Acknowledgment tone verifies that the link has been released. Repeat the test on the second link by dialing 59 + 72, and so forth, until the troublesome link is identified and busied out.

**CAUTION**: *Be sure to release each link before testing the next one. Busying out all links will disable the entire system.*

## 6. INSTALLATION REQUIREMENTS

6.01 Certain central office line requirements are essential for good transmission and proper operation of all MAX-824 features. Following are several central office conditions which may be incompatible with the MAX-824 in certain applications:

1. The most important parameter is the central office loop limit. Melco's specifications require a loop length of no more than 1800 ohms for each central office line. Operation of the MAX-824 beyond these limits will result in unacceptable transmission to and from the station telephones as well as unreliable operation of advanced features such as DISA. If a MAX-824 is to be installed as a replacement for single or multiple line telephones, it is essential to check the loop length first, even if transmission is acceptable with the existing telephones.

   The loop length can be easily measured using a multimeter. First measure the open circuit voltage from tip to ring, then measure the short circuit current. The loop length in ohms is obtained by dividing the voltage in volts by the cur-

rent in amps. For example, if you have a voltage reading of 52 volts and a current reading of .052 amps, the formula would be 52 divided by .052 for a loop length of 1000 ohms. Note that having the central office increase the battery voltage alone will not affect the loop length.

If it proves impossible to obtain central office lines meeting the above requirements, a MAX-824 system should NOT be installed.

2. The toll restriction feature of the MAX-824 is only compatible with precise dial tone (350 + 440 Hz). All electronic central offices have precise tones, but many older central offices do not. Conventional dial tone (600 modulated by 120 Hz) interferes with the "1" DTMF tone preventing decoding by the MAX-824. This sometimes allows a restricted station to dial "1" and break CO dial tone without restriction. Therefore, if 1/0 toll restriction is required by a customer, and precise tones are not available from the central office, a MAX-824 should NOT be installed.

3. The MAX-824 does not provide any toll restriction or call accounting for calls placed through the '8' group. The '8' group is provided for use with unrestricted WATS lines in business applications or for HOBIC lines with no DDD capability in motel applications. HOBIC service is not available in all areas and consequently, external SMDR equipment (by others) may be required.

4. The MAX-824 1/O toll restrictions on the '9' group provide an adequate level of security for most business and motel applications. However, certain conditions on the central office line such as slow dial tone or decoding, combined with a station user repeatedly attempting to place calls over the restriction, can result in an occasional call getting through. Stations requiring absolute security should be fully restricted (Class 1). Tone telephones are recommended when toll restrictions are required.

5. The DISA feature of the MAX-824 requires the use of a ground start, loop disconnect central office line. If this service is not available from the central office and DISA is a customer requirement, do NOT install a MAX-824.

6. The DISA feature may be used for placing outgoing calls only if the last station card (station 28-33) is installed. If a CO Expander Card is installed, (12 by 18 configuration) then only station calls may be placed by the DISA party.

## 7. INSTALLATION

**CAUTION:** *Static charges can damage circuit packs. Do not handle unnecessarily. Keep in protective packing when not in use. Be certain that your body is discharged of static charge before handling a circuit pack and then handle only by the plastic ejectors. Do not walk about with unpackaged circuit packs. Do not insert or remove any circuit pack with the power on.*

7.01 Mount the MAX-824 and associated power supply in any standard relay rack or on a backboard. Do not install any circuit packs yet.

1. Program the desired line groupings, toll restrictions and other options using the switches on the control circuit pack. Refer to Figure 16 and Tables C through P. For your convenience a separate Switch Option Feature Worksheet is provided on page 34.

2. The line mode in use for each line, loop or ground start, must be selected on the central office circuit pack by placing two jumper plugs in the desired position for each line. The configuration for 1 and 2 ground start and 3 and 4 loop start is shown in Figure 17. The circuit pack is shipped with all plugs in the LOOP position.

3. When telephones are equipped with rotary dials, the break-make ratio delivered to the network line may be changed to meet the central office equipment requirements by the operation of Option Switch 26. See Table K. The per-

cent break indicates the proportion of time the dial impulse contacts are open during one pulse interval.

4. The length of time that a MAX-824 network circuit remains activated or seized after the ringing period (during the silent period) is determined by the setting of Switch 27. Variations among central offices in the length of the silent period make this selection necessary. This switch is usually left in the OFF position. However, if intermittent troubles occur, such as the attendant being connected to calls too slowly or error tone being received when the night bell is answered, then turn Switch 27 to the ON position. See Table L.

7.02 Complete the following connections:

**NOTE:** *Do not install any circuit packs until step 13.*

1. Connect tip and ring of each telephone to the appropriate terminals on the MAX-824 connecting block. See Figure 5.

2. If the Message Waiting feature is used, connect LAMP and LAMP GROUND of each telephone to the appropriate terminals on the MAX-824 connecting block. See Figure 4. Standard message waiting phones must be rewired to bring out the lamp connections separately.

3. Connect tip and ring of each network line to the assigned network circuits on the MAX-824 connecting block. Strap unused network terminals tip to ring (CO T to CO R).

4. If the DISA feature is to be used, one, two or four network lines may be selected for the DISA function. Each DISA line is assigned to a station number using one, two or four of station numbers 33, 32, 31 and 30. Assign the highest line number to the highest station number. In system configurations with 18 stations or less, no assignable station numbers are used, and station capacity is not decreased. However, in system configurations with 24 stations, station capacity is decreased by the number of lines assigned for the DISA function. The class of service for each DISA line is the same as the corresponding station number (30 to 33). DISA lines must be ground start or the lines cannot release. Telephone numbers assigned to DISA may be the listed number and/or any other line number assigned to the system, depending on the capabilities of the central office and the objectives of the customer. See Table O for switch settings.

5. To select stations for power failure transfer, refer to Paragraph 3.14, 3.15, and Figure 8. Connect CO T and CO R terminals to PFT and PFR terminals as required.

6. The MAX-824 utilizes an external power supply. Power supply requirements are given in Section 9. The Melco CA8 power cable assembly is available for convenient plug-in connection to a Melco MPS series power supply. Another power cable assembly, the CA7A is available for connection to an ELGIN EAK6 or similar supply with screw terminal connections. The EAK-41 supply may be used with either the CA-7 or CA-7A cables.

7. Connect the -24V DC battery and ground of the power supply to the MAX-824 power terminal strip. Connect the lamp supply to the LB and LG terminals. The lamp supply required will depend upon the Message Waiting lamp type. When using neon lamps and an EAK supply, connect LB to the audible (ringing) supply instead of 10V AC. Connect the audible signal supply. Note that terminals LG and AUD GRD are internally connected. Common all grounds on the supply and connect to a cold water pipe. (Ground start network lines will not operate if this is not done.) A gas tube surge protector is recommended on the AC line input to the supply, as lightning damage is not covered by warranty. See Figure 7.

8. Each paging area has an associated relay contact that closes for paging into that area. These are labeled PA1, PA2, PA3 and PA COM on the connecting

block. The contacts may be used to switch power to the paging amplifier(s) in the case of a single area or multiple area and amplifiers. The contacts may also be used to connect the output of a single amplifier to multiple areas. See Figures 11 through 13. If background music is required, see Figures 11B and 12B.

9. If the background music or music-on-hold features are to be used, connect a music source to the terminals marked MUS1 and MUS2 on the connecting block (Figure 10). Background music or music on hold must be enabled or disabled with program switches 9 and 10 (Ref. Figure 3 and Table F).
10. When an attendant's console is used, connect the CA-25B 6-foot console cord, furnished, to the console connector. Connect a B25A or equivalent 25-pair connector cable to the MAX-824 plug and join it to the console cord. A 25-foot extender cable, Number CA-25, is listed in the separate MAX-824 Ordering Guide. Connect the attendant's telephone to the modular jack or screw terminals of the console.
11. If a night bell is used, connect it to NB1 and NB2. This output supplies audible signaling voltage during incoming ringing in the night mode. Select the desired switch setting for "NIGHT" or "NIGHT and DAY" night bell operation. See Table M.
12. Verify that the switches for line groupings, toll restrictions and other options are programmed as desired. Refer to Tables C through P and the Switch Option Feature Worksheets on Page 34.
13. Install circuit packs one at a time and make the intermediate checks described in the Fault Isolation Procedure instructions on page 33. Always remove power before adding or removing circuit packs. All circuit packs are packaged separately and must be opened and installed in the proper connectors. Connector slots and corresponding packs are labeled with the same number. Circuit packs must be fully engaged and "clicked" into the connector. Installing a pack in the wrong position or orientation will most likely result in damage to the packs. Enhanced MAX-824 circuit pakcs are easily identified by red ejector tabs. Enhanced packs include an enhanced Control Card, an enhanced Links/Signal Card and one or two enhanced Central Office Cards. Note that when the optional CO Expander Card, for enhanced systems, is used to increase network line capacity to 12 lines, it is inserted into the position where the last station card (stations 28 through 33) is normally placed. See Figure 3 and Table C.

## 8. MAINTENANCE

**CAUTION:** *Static charges can damage circuit packs. Do not handle unnecessarily. Keep in protective packing when not in use. Be certain that your body is discharged of static charge before handling a circuit pack and then handle only by the plastic ejectors. Do not walk about with unpackaged circuit packs. Do not insert or remove circuit packs with the power on.*

8.01 The MAX-824 assembly includes the chassis and various circuit packs. If trouble occurs, it is recommended that the problem be isolated to a specific circuit pack. The circuit pack can then be replaced. A troubleshooting guide is provided on Pages 31 & 32 and Simplified Fault Isolation Procedures are provided on Page 33. When replacing circuit packs, the power must be turned off or damage to circuits will most likely result.

DESCRIPTION

8.02 The system is organized into 6 different circuit packs. An optional CO expander circuit pack is available to expand network line capacity to 12. A basic system consists of one each of the six types of packs plus additional station and network line circuit packs according to the number of stations and network lines desired. The descriptions and functions of each circuit pack are as follows:

1. Station circuit pack: contains talk battery feed, A-lead generating and bridged ringing circuits for 6 lines. One circuit

pack is required for each 6 lines to a maximum of 4 packs or 24 lines. MAX-824 systems using the Expander CO Pack have a maximum station capacity of 18 stations (3 station circuit packs).

2. CO circuit pack: contains incoming ring voltage detection, line seizing and holding, impedance matching, and signal conditioning for 4 loop or ground start network circuits. A maximum of 2 CO packs may be used in a system.

   **NOTE:** *The MAX-824 will detect bridged ringing voltages in the ranges 70 to 150V AC; 20 to 67 Hz. The CO circuit pack has 4 LED indicators on the edge which are lighted when the corresponding line is seized. See Figure 3.*

3. Control circuit pack: contains the timing and control circuits which govern and define the total operation of the unit. It contains the programming switches (Figure 16) which program trunk grouping, toll restriction and other selectable functions.

4. Switch Matrix circuit pack: contains the switching circuits which connect station and network audio signals as required for local and outside calls. The circuits are also used for connecting music and call-progress tones to the talking paths.

5. Links/Signal circuit pack: generates the call progress tones—dial, busy, ringback, error and call waiting tones. The circuits for the processing links which decode the rotary or tone digits dialed are also on this pack.

6. Voltage Regulator and Console Interface circuit pack: contains the circuits which interface directly with the attendant's console to monitor the switches, control the LEDs and provide battery feed, A-lead generation and signaling to the attendant's station.

7. Expander CO circuit pack: contains incoming ring voltage detection, line seizing and holding, impedance matching and signal conditioning for 4 additional loop or ground start network circuits. When this circuit pack is added, network line capacity is increased from eight to twelve lines.

8.03 The voltages used internally are regulated from the B battery input by the Voltage Regulator circuit pack. Test points on the card edge provided to monitor voltages are listed below:

| TEST POINT | VOLTAGE AT TEST POINT |
|---|---|
| Black | Ckt. common |
| White | +5V ± 0.5V |
| Yellow | +7.5V ± 0.5V |
| Green | +9V ± 1V |
| Blue | +15V ± 1V |
| Red | +20 to +28V |

**NOTE:** *All readings taken from Black test point, not earth ground.*

## WARRANTY AND SERVICE

8.04 No provision is made for field adjustment or repair. If defective, return the unit to the supplier for servicing. The MAX-824 is warranted against manufacturing and material defects. If it fails within the warranty period as a result of these defects, it will be repaired or replaced at no charge. See the Melco Warranty Service Policy for additional warranty and service information.

**NOTE:** *To maintain full warranty, cards should be shipped in antistatic bags and packed to prevent physical damage. It is suggested that cards to be returned be packed in the same shipping material containing their replacements.*

8.05 In the event of equipment malfunction, all repairs will be performed by Melco Labs, Inc. or an authorized agent of Melco Labs, Inc. It is the responsibility of users requiring service to report the need for service to Melco Labs, Inc. or to one of their authorized agents.

8.06 The MAX-824 has received Registration Number AQT9PZ-69952-MF-E under Part 68, FCC Rules and Regulations. The ringer equivalence is 0.2B (AC), 1.88B (DC). The required jack is RJ21X.

## 9. SPECIFICATIONS

External Power Supply Requirements:

Operating voltage . . . . . -24V DC nom
-20 to -28V DC
current -24V DC . . . . . 2.8 amps max
Ringing generator . . . . . 90 to 130V AC
20 to 67 Hz
current per station . . . . . 9 ma max
Lamp supply (message waiting) . . . . 10 to 130V AC
or DC depending on lamp type
current . . . . . depends on lamp type
(1 amp max)

Dialing Parameters
rotary dial input range:
percent break . . . . . 60% ± 20%
dial speed . . . . . 8 to 12 pps
interdigital time . . . . . 200 msec min
rotary dial output range::
percent break . . . . . see Table K
dial speed . . . . . 10 pps

DTMF:
input signal level . . . . . -7.5 to 4 dBm
bandwidth . . . . . ± 2% min
recognition time . . . . . 40 msec min
interdigital time . . . . . 40 msec min

Off-hook recognition time . . . . . 100 msec
Insertion loss, station to CO . . . . 1 dB max at 1KHz
Crosstalk, station to station . . . . . -75 dB max
Central office loop limit . . . . . 1800 ohms max
Station loop limit . . . . . 750 ohms tone
800 ohms rotary
CO line circuit impedance . . 600 or 900 ohms nom
Longitudinal balance . . . . . better than -60 dB min
300 Hz to 3 KHz
Network line seizure . . . . . loop or ground start
(280 ohms DC nom)
Network peak transient current . . . . . 500 amps for
20 microsec

Console lamp signals:
station off-hook . . . . . lamp steady
station connected to console . . . . . 0.2 sec on,
0.2 sec off
CO incoming . . . . . 0.5 sec on, 0.5 sec off
CO hold . . . . . 0.25 sec on, 0.25 sec off
Distance—console to MAX-824 . . . . . 250 ft. max
26 ga. cable (10 ohms)
Operating humidity . . . . . 0 to 95%
(noncondensing)
Operating temperature range . . . . . 0° to 50°C
32° to 122°F
Storage temperature . . . . . -30° to + 70°C
-22° to + 158°F
Dimensions . . . . . 8.00″ x 13.50″ x 20.00″
Housing . . . . . aluminum
Weight . . . . . 32 lbs. max

## 10. ORDERING

10.01 MAX-824 Systems can be ordered equipped for 0, 4 or 8 network lines and 6, 12, 18 or 24 stations. With the optional Expander CO card, additional configurations of 12 network lines and 6, 12 or 18 stations may be ordered. The attendant's console is optional. See the MAX-824 Ordering Guide (document number 470323) for detailed ordering information.

10.02 Order the MAX-824 from your local supplier or distributor. Further information or assistance on the MAX-824 or any Melco product is available from:

MELCO LABS, INC.
P.O. Box 6909
Bellevue, WA 98008-0909
(206) 643-3400
TWX: 910-443-3040

**TABLE A**
CALL PROGRESS TONES

| SIGNAL | TONES AND PERIODS | INDICATION |
|---|---|---|
| DIAL TONE | 350/440 Hz continuous | OK to dial |
| BUSY TONE | 480/620 Hz interrupted<br>0.5 sec on, 0.5 sec off<br>480/620 Hz Interrupted<br>.025 sec on, .025 sec off | Station, line, links or feature is busy<br><br>Line, links or feature is busy |
| RINGBACK TONE | 440/480 Hz interrupted<br>1 sec on, 4 sec off | Called station is ringing |
| ERROR TONE | 480/620 Hz consecutive<br>each 0.25 sec | Dialing inaccurate, incomplete or delayed more than 15 secs |
| ACKNOWLEDGMENT TONE | 350/440 Hz, three tones<br>0.1 sec on, 0.1 sec off | Indicates that a feature has been properly activated or canceled |
| CALL WAITING TONE | 440 Hz, two tones<br>0.1 sec on, 10 sec off | Indicates an incoming call for station 10 during "night" mode. Occurs once when a CO is camped-on a busy station. |

**TABLE B**
ATTENDANT'S SIGNALS

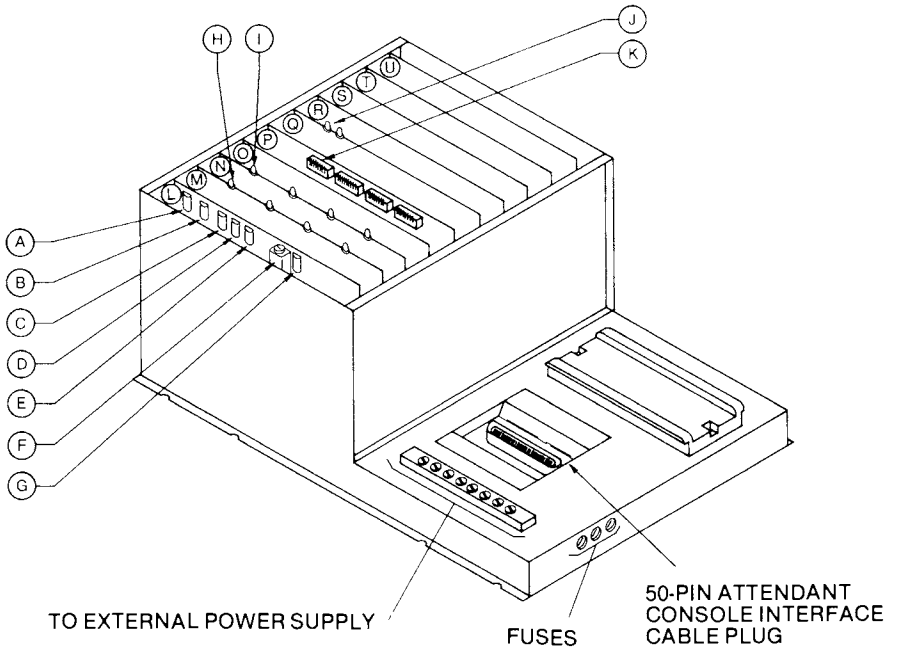
| SIGNAL | TONES AND PERIODS | INDICATION |
|---|---|---|
| BEEPER — HIGH TONE (1200 Hz) | One 125 msec beep every time any button is pressed | Action signal for console buttons |
| BEEPER — LOW TONE (600 Hz) | Two beeps every 4 sec,<br>0.3 sec on, 0.1 sec off<br><br>One beep every 4 sec,<br>1 sec on, 3 sec off | Outside call<br><br>Inside call |

**TABLE C**
CIRCUIT PACK POSITIONS AND FUNCTIONS

| 10 (L) | 3 (M) | 3 (N) | 11 (O) | 12 (P) | 13 (Q) | 6 (R) | 6 (S) | 6 (T) | 6(U) (Para. 7.02, #13) |
|---|---|---|---|---|---|---|---|---|---|
| Voltage Regulator & Console Interface 120221 | CO Interface 1-4 120209-3 or 120209-4 | CO Interface 5-8 120209-3 or 120209-4 | Switch Matrix 120219 | Control 120220-1 | Links/Signal Generator 120193-3 | Station 120191 | | | CO Expander 9-12 120263-1 or 120263-2 Only |
| | | | | | | 1 | 2 | 3 | 4 | |
| Voltage Regulators | CO Interface Circuits | CO Interface Circuits | Talk Path Switch Array | CPU, Memory & Control Logic | Dial, Ring Back & Busy Signal Generators | 10<br>11<br>12<br>13<br>14 | 16<br>17<br>18<br>19<br>20 | 22<br>23<br>24<br>25<br>26 | 28<br>29<br>30<br>31<br>32 | CO Interface Circuits<br><br>CO Busy LED's |
| Console Switch & LED Circuits | CO Busy LED's | CO Busy LED's | | System Clocks | Call Waiting Tone | 15 | 21 | 27 | 33 | |
| Station 0 | | | | Programming Option Switches | Tone & Rotary Decoding | | | | | (Note 1) |
| +5V Fuse | | | | | | | | | | |

**WARNING:** *Turn power off before removing cards.*

**NOTE 1:** Place CO expander card only in last position.




Ⓐ VOLT. TEST PT + 24V (RED)
Ⓑ VOLT. TEST PT + 15V (BLUE)
Ⓒ VOLT. TEST PT + 9V (GREEN)
Ⓓ VOLT. TEST PT COMMON (BLACK)
Ⓔ VOLT. TEST PT + 7.5V (YELLOW)
Ⓕ +5V FUSE (2 AMP)
Ⓖ VOLT. TEST PT + 5V (WHITE)
Ⓗ CO BUSY LED'S (1-4 TOP TO BOTTOM)
Ⓘ CO BUSY LED'S (5-8 TOP TO BOTTOM)
Ⓙ PROCESSING LINK BUSY LED'S
LINK 1-TOP
LINK 2-BOTTOM
Ⓚ PROGRAMMING SWITCHES (1-32)
Ⓛ VOLT. REG. CIRCUIT PACK
Ⓜ CO CIRCUIT PACK (1-4)
Ⓝ CO CIRCUIT PACK (5-8)
Ⓞ SWITCH MATRIX CIRCUIT PACK
Ⓟ CONTROL CIRCUIT PACK
Ⓠ LINK/SIG. GEN. CIRCUIT PACK
Ⓡ STATION CIRCUIT PACK (10-15)
Ⓢ STATION CIRCUIT PACK (16-21)
Ⓣ STATION CIRCUIT PACK (22-27)
Ⓤ STATION CIRCUIT PACK (28-33) OR 1218 EXPANDER CIRCUIT PACK (LINES 9-12) IN THIS POSITION ONLY

Fig. 3 — Front of MAX-824 Showing Card Positions.

**TABLE D**
CLASSES OF SERVICE

| STATION CLASS OF SERVICE CODES | STATION CAN DIAL 9 | RESTRICTED DIGITS AFTER 9 | STATION CAN DIAL 8 | STATION CAN DIAL 4X INDIVIDUAL LINE ACCESS |
|---|---|---|---|---|
| Class 1. Fully Restricted | No | -- | No | No |
| Class 2. Toll Restricted | Yes | Yes | No | No |
| Class 3. Partially Restricted | Yes | Yes | Yes | Business Mode Only |
| Class 4. Unrestricted | Yes | No | Yes | Yes |

**TABLE E**
CLASS OF SERVICE ASSIGNMENTS

| **STATION 12 CLASS IS:** | **1** | **2** | **3** | **4** |
|---|---|---|---|---|
| Switch No. 1<br>Switch No. 2 | Off<br>Off | On<br>Off | Off<br>On | On<br>On |
| **STATION 13 CLASS IS:** | **1** | **2** | **3** | **4** |
| Switch No. 3<br>Switch No. 4 | Off<br>Off | On<br>Off | Off<br>On | On<br>On |
| **NOTE:** Stations 14-33 are Class 4 unless placed in the restricted group below. All stations in the restricted group have a class determined by Switches 7 and 8. | | | | |
| **RESTRICTED GROUP IS:** | **NONE** | **14-15*** | **14-21*** | **14-33*** |
| Switch No. 5<br>Switch No. 6<br>*Station 11 if it is not selected as a night station. | Off<br>Off | Off<br>On | On<br>Off | On<br>On |
| **CLASS OF THE ENTIRE RESTRICTED GROUP IS:** | **1** | **2** | **3** | **4** |
| Switch No. 7<br>Switch No. 8 | Off<br>Off | On<br>Off | Off<br>On | On<br>On |

**TABLE F**
MUSIC ON HOLD

| | | |
|---|---|---|
| Switch No. 9 | On - Enables music on hold | Off - Disables music on hold |
| Switch No. 10 | On - Enables background music | Off - Disables background music |

**TABLE G**
SWITCH OPTIONS

| DIGITS RESTRICTED AFTER DIALING 9 (CLASSES 2 AND 3) | | |
|---|---|---|
| | **SWITCH OFF** | **SWITCH ON** |
| Switch No. 11* | 00 Not Restricted | 00 Restricted (0 allowed) |
| Switch No. 12 | 9 Not Restricted | 9 Restricted |
| Switch No. 13 | 1 Not Restricted | 1 Restricted |
| Switch No. 14 | 0 Not Restricted | 0 Restricted |

*Always off in U.S.

**TABLE H**
NIGHT STATION AND MODE SELECTION

| NIGHT STATION SELECTION | | |
|---|---|---|
| | **Station 10 and 11** | **Station 10 Only** |
| Switch No. 15 | Off | On |
| **MODE SELECTION** | | |
| | **Hotel/Motel** | **Business** |
| Switch No. 16 | Off | On |

## TABLE I
NETWORK LINE GROUPING

| CENTRAL OFFICE LINES (SELECT FROM 0-12) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **NONE** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| Switch No. 17 | Off | On | Off | On | Off | On | Off | On | Off | On | Off | On | Off |
| Switch No. 18 | Off | Off | On | On | Off | Off | On | On | Off | Off | On | On | Off |
| Switch No. 19 | Off | Off | Off | Off | On | On | On | On | Off | Off | Off | Off | On |
| Switch No. 20 | Off | Off | Off | Off | Off | Off | Off | Off | On | On | On | On | On |
| **UNRESTRICTED GROUP (DIAL 8, SELECT 0-8 LINES)** | | | | | | | | | | | | | |
| | **NONE** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| Switch No. 21 | Off | On | Off | On | Off | On | Off | On | Off | On | Off | On | Off |
| Switch No. 22 | Off | Off | On | On | Off | Off | On | On | Off | Off | On | On | Off |
| Switch No. 23 | Off | Off | Off | Off | On | On | On | On | Off | Off | Off | Off | On |
| Switch No. 24 | Off | Off | Off | Off | Off | Off | Off | Off | On | On | On | On | On |
| **NOTE:** Local and unrestricted groups start at the low network lines beginning with CO No. 1. | | | | | | | | | | | | | |
| **EXAMPLE:** | | | | | | | | | | | | | |
| **SWITCH NO. →** | **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** | Lines 6, 7, 8 Individual Access Only (46, 47, 48) | | | | |
| | On | On | Off | Off | Off | On | Off | Off | | | | | |
| | Dial 9 Group Lines 1, 2, 3 | | | | Dial 8 Group Lines 4, 5 | | | | | | | | |
| **SWITCH NO. →** | **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** | X = Switch Position Doesn't Matter | | | | |
| | Off | Off | Off | On | X | X | X | X | | | | | |
| | Dial 9 Group All Eight Lines | | | | Dial 8 Group No Lines | | | | | | | | |

## TABLE J
SWITCH SELECTION FOR LINE/STATION OPTION
(MAX-824 OR 1218 EXPANDER MODE)

| | **8 LINES/24 STATIONS** | **12 LINES/18 STATIONS** |
|---|---|---|
| Switch No. 25 | On | Off |

## TABLE K
DIAL PULSE CORRECTION - PERCENT BREAK

| **SWITCH NO. 26** | **INPUT TO MAX-824** | **OUTPULSE TO NETWORK** |
|---|---|---|
| Off (U.S.) | 60% ± 20% | 60% ± 3% |
| On (International) | 60% ± 20% | 67% ± 3% |

**TABLE L**
MAXIMUM NETWORK CIRCUIT HOLDING TIME

| SWITCH NO. 27 | OFF | ON |
|---|---|---|
| | 5 seconds | 10 seconds |

**TABLE M**
SELECTION FOR NIGHT BELL

| NIGHT BELL FUNCTION | NIGHT MODE ONLY | NIGHT OR DAY MODE |
|---|---|---|
| Switch No. 28 | Off | On |

**TABLE N**
SELECTION FOR MESSAGE REGISTRATION UNIT

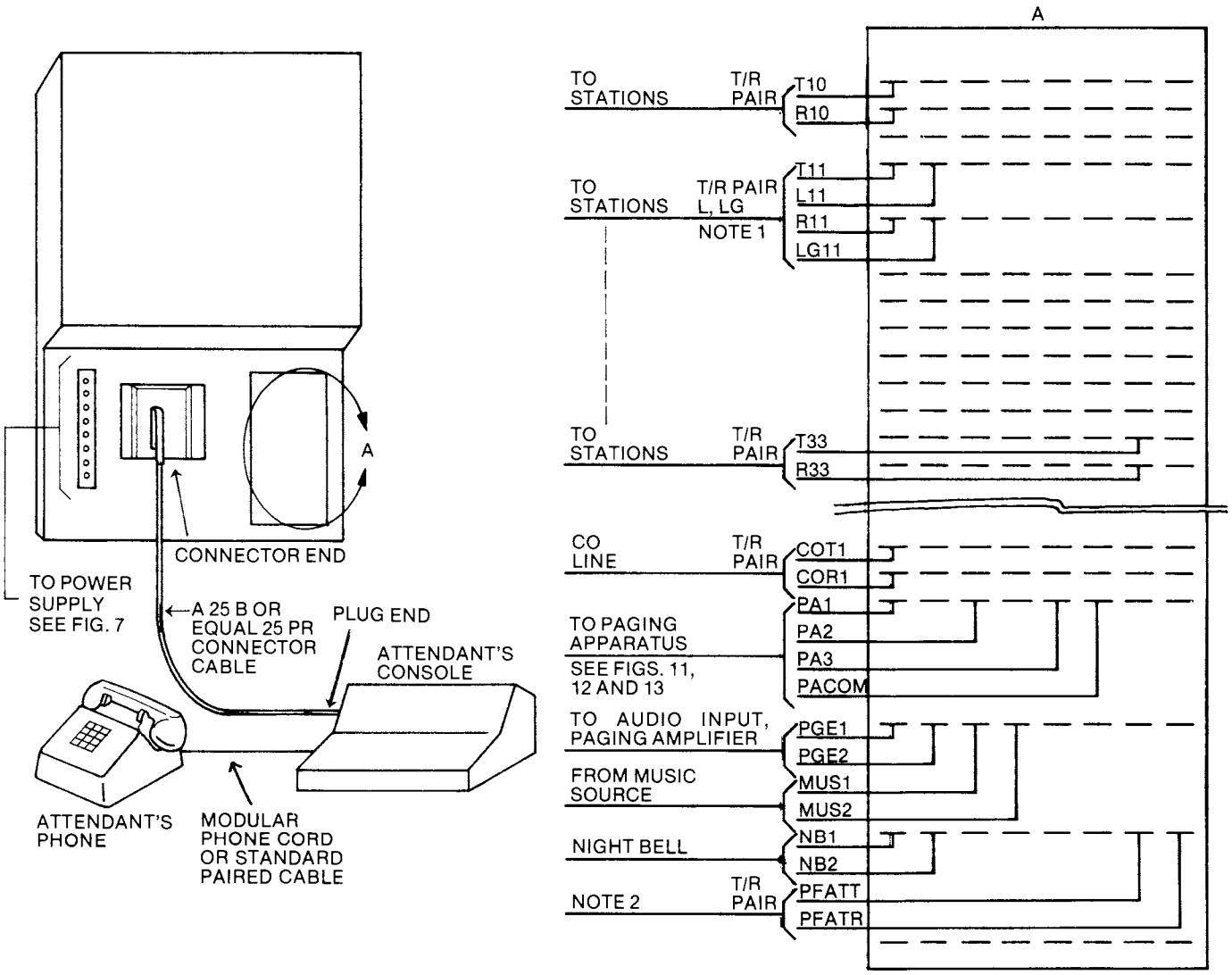
| MESSAGE REGISTRATION | STATION 10 LAMP OUTPUTS DATA TO MRU | STATION 10 LAMP OPERATES A MESSAGE WAITING LAMP |
|---|---|---|
| Switch No. 29 | On | Off |

**TABLE O**
DIRECT INWARD SYSTEM ACCESS

| D.I.S.A. GROUP - SELECT 0, 1, 2 OR 4 LINES | | | | | |
|---|---|---|---|---|---|
| NUMBER OF LINES | NONE | 1 | 2 | 4 | |
| Switch No. 30 | Off | On | Off | On | **NOTE:** D.I.S.A. Group starts at the high network lines beginning with CO No. 8 or 12. Tone dialing only. |
| Switch No. 31 | Off | Off | On | On | |

**TABLE P**
SYSTEM RESET

| | | |
|---|---|---|
| Switch No. 32 | Off (to run) | On Momentarily (to reset) |
| **NOTE:** Switch No. 32 must be off during normal operation. | | |




NOTES:
1. L AND G FOR MESSAGE WAITING LAMP WHEN REQUIRED.
2. ATTENDANT'S TELEPHONE CONNECTIONS ARE AT THE CONSOLE. CONNECT PFATT AND PFATR TO CO T AND CO R WHEN ATTENDANT'S TELEPHONE IS TO SWITCH DIRECTLY TO A LINE DURING A POWER FAILURE.

Fig. 4 — MAX-824 Connections.

**LEGEND:**

| | | |
|---|---|---|
| T10 | — | TIP FOR STATION 10 |
| R10 | — | RING FOR STATION 10 |
| L10 | — | LAMP FOR STATION 10 |
| LG | — | LAMP GROUND |
| COT1 | — | TIP FOR CO LINE 1 |
| COR1 | — | RING FOR CO LINE 1 |
| PFT10 | — | POWER FAILURE TRANSFER FOR TIP - STATION 10 |
| PFR10 | — | POWER FAILURE TRANSFER FOR RING - STATION 10 |
| PGE | — | OUTPUT TO PAGER AMPLIFIER |
| ATT | — | ATTENDANT STATION TIP |
| PFATT | — | POWER FAILURE TRANSFER FOR TIP - ATTENDANT STATION |
| PFATR | — | POWER FAILURE TRANSFER FOR RING - ATTENDANT STATION |
| BGM | — | BACKGROUND MUSIC INPUT - PAGE AND ON HOLD |
| MUS | — | INPUT FROM MUSIC SOURCE FOR BACKGROUND MUSIC AND MUSIC ON HOLD |
| NB | — | NIGHT BELL |
| COL1* | — | LOCAL SEIZURE FOR CO LINE 1 (ISOLATED N.O. CONTACT) |
| COLCOM* | — | LOCAL SEIZURE CONTACT COMMON |
| PA1 | — | PAGING AREA 1 (ISOLATED N.O. CONTACT). SEE FIG. 11, 12, AND 13. |

*FUTURE

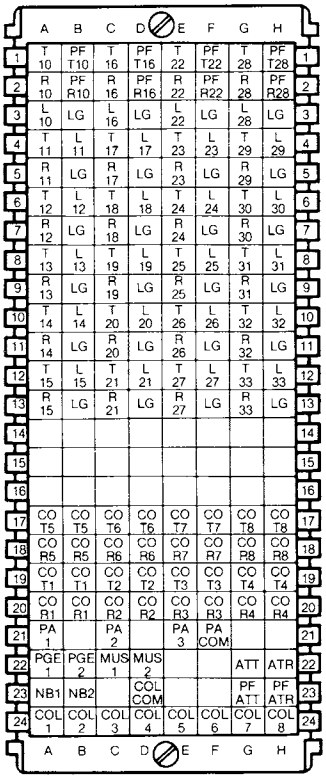



Fig. 5 — System Connecting Block.

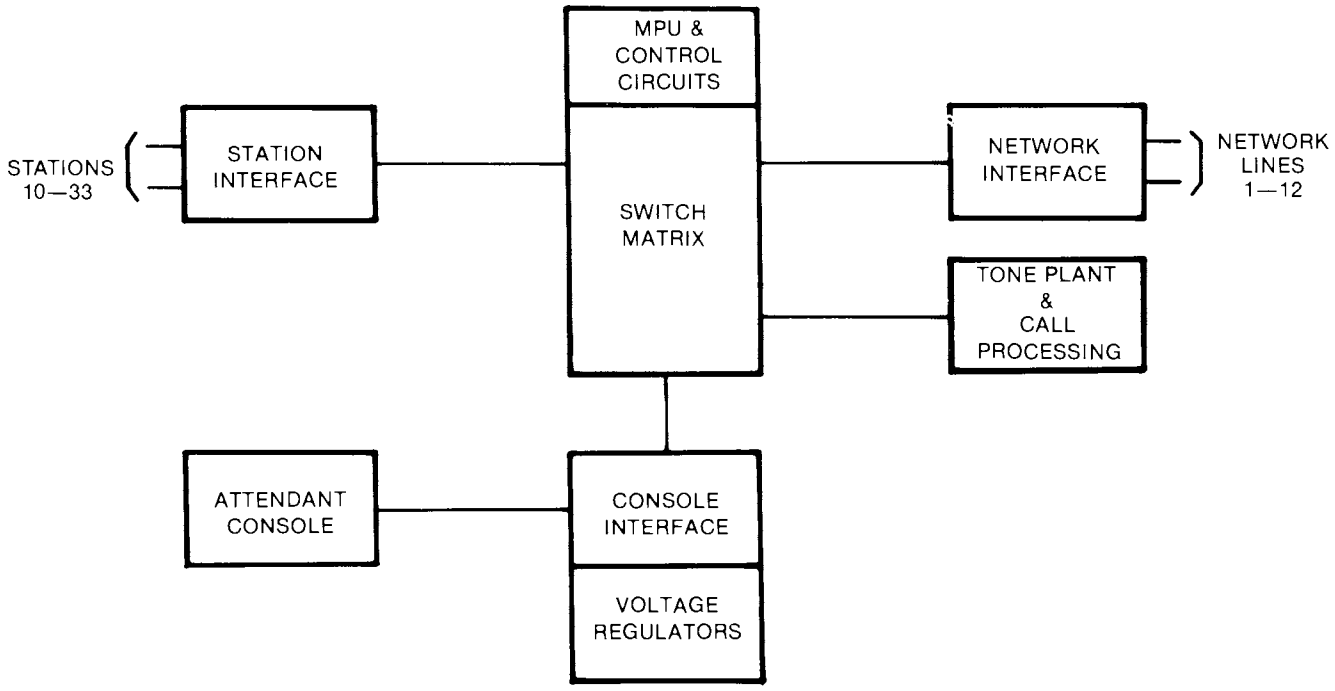
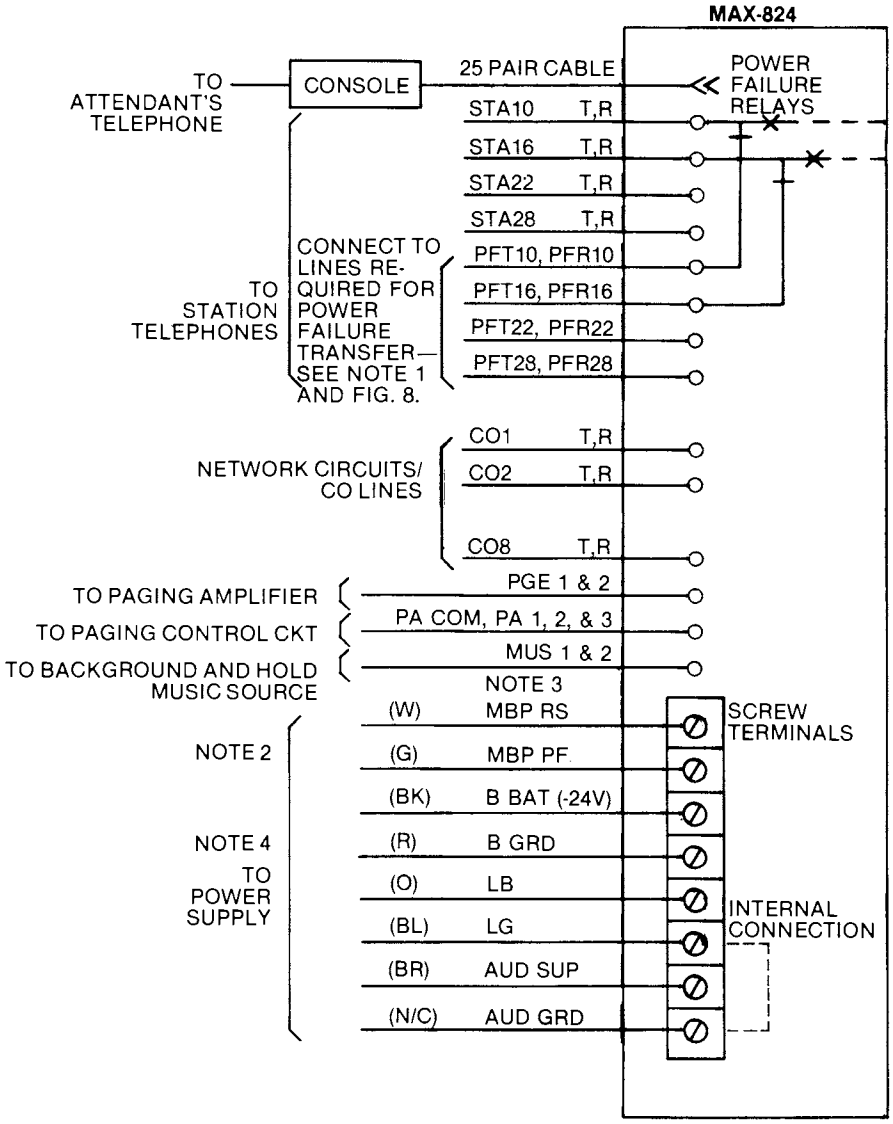



Fig. 6 — Functional Block Diagram.




NOTES:

1. STATIONS 10, 16, 22, 28 and 0, THE FIRST STATIONS OF EACH STATION CIRCUIT PACK AND THE ATTENDANT ARE TRANSFERRED BY THE MAX-824 FROM STATION CIRCUITRY TO PFT AND PFR TERMINAL BLOCK CONNECTORS WHEN POWER FAILS. TO PROVIDE UP TO FIVE DIRECT TWO-WAY NETWORK LINE ACCESSES AT THOSE STATIONS DURING POWER FAILURE, CONNECT JUMPERS FROM PFT AND PFR TO T AND R CONNECTORS OF LINES TO BE ACCESSED; THAT IS CO1, CO2, ETC.
2. WHEN MELCO CA-7, CA-7A OR CA-8 POWER CABLE ASSEMBLY IS USED, REFER TO CABLE ASSEMBLY WIRE COLORS WHEN CONNECTING POWER.
3. CONNECT RS AND PF ONLY WHEN MELCO MPS SERIES POWER SUPPLY IS USED.
4. WITH GROUND START TRUNKS, CONNECT B GROUND TO EARTH.

Fig. 7 — Applications Schematic.

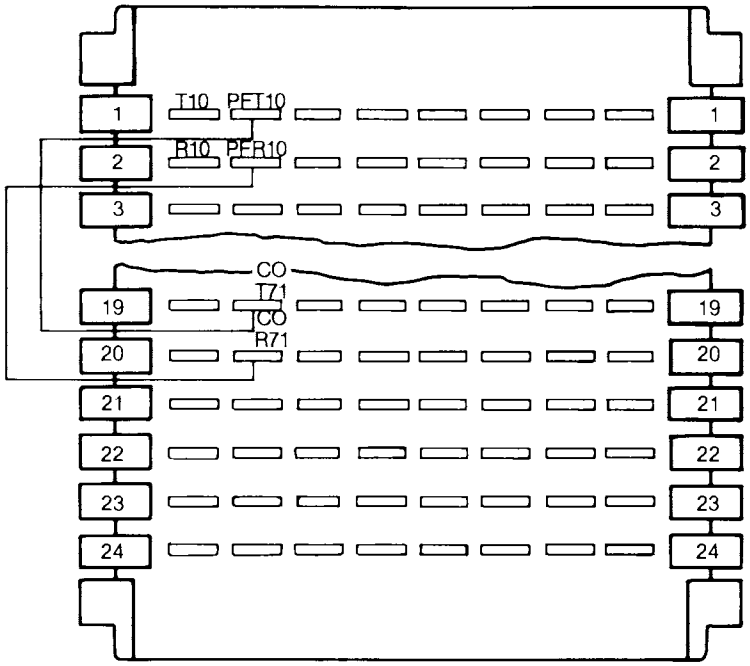



Fig. 8 — Power Failure Transfer Interconnection Station 10 to CO71 Typical.

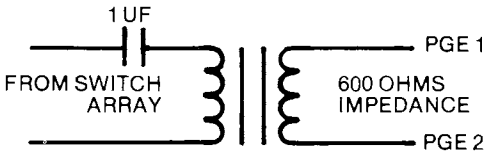



Fig. 9 — Paging Output Circuit.

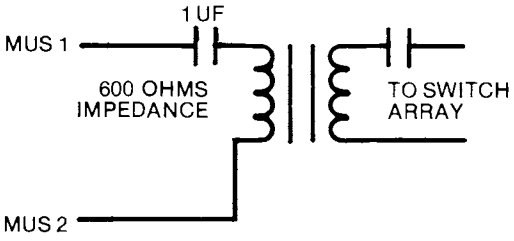



Fig. 10 — Music Input Circuit.

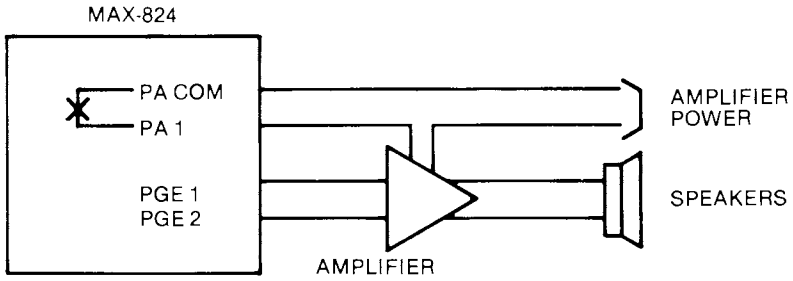
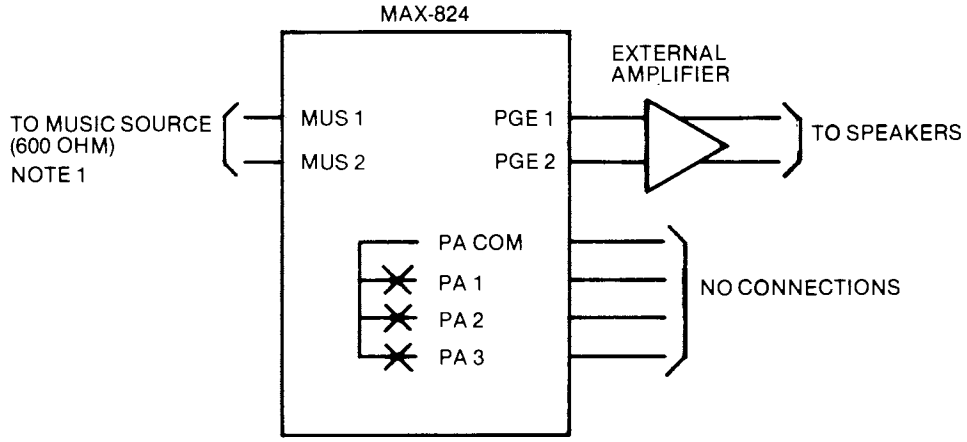



Fig. 11A — Paging Amplifier Connections for One Area.




NOTES:
1. MUSIC INPUT AT TERMINALS MUS 1 AND MUS 2 IS SOURCE FOR BOTH BACKGROUND MUSIC AND MUSIC ON HOLD.

Fig. 11B — Connections for One Paging Area with Background Music.

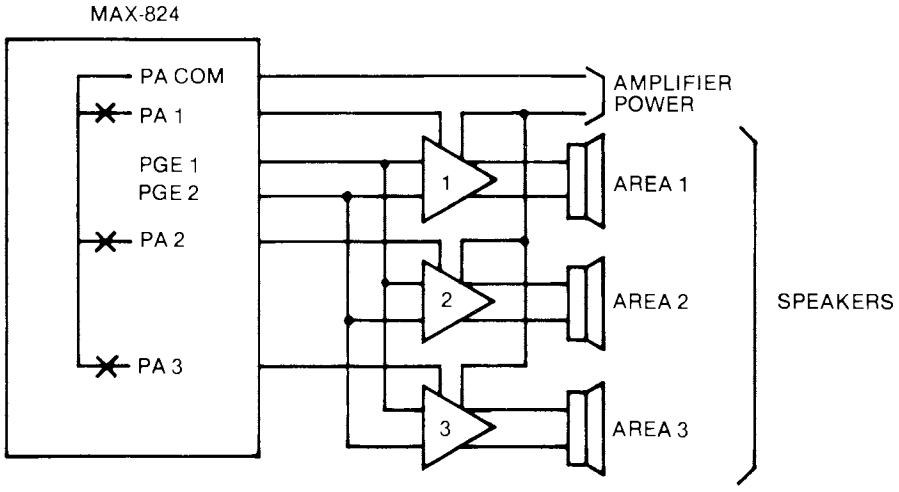
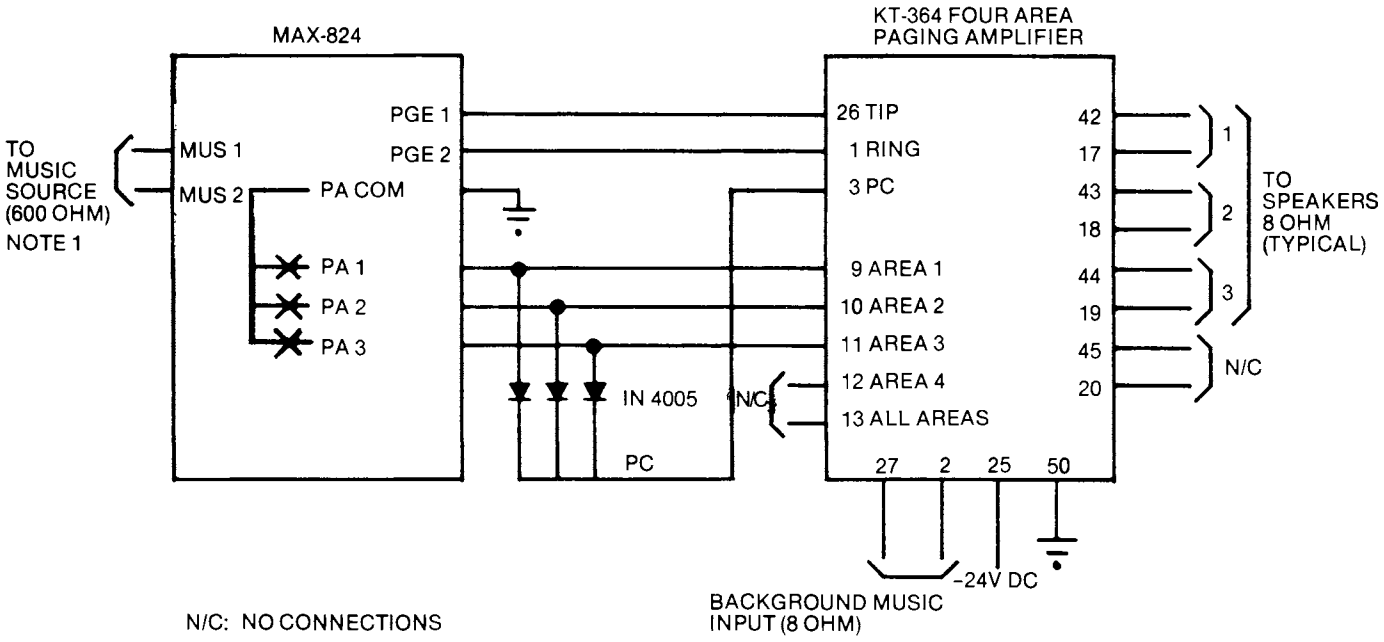



Fig. 12A — Paging Amplifier Connections for Three Areas and Three Amplifiers.




NOTES:
1. KT-364 PAGING AREA CONNECTIONS MAY BE MULTIPLED FOR SINGLE DIALING CODE CONTROL OF MORE THAN ONE AREA. SEE THE MELCO KT-364 PRACTICE.

Fig 12B — Paging Amplifier Connections for Three Areas with Background Music.

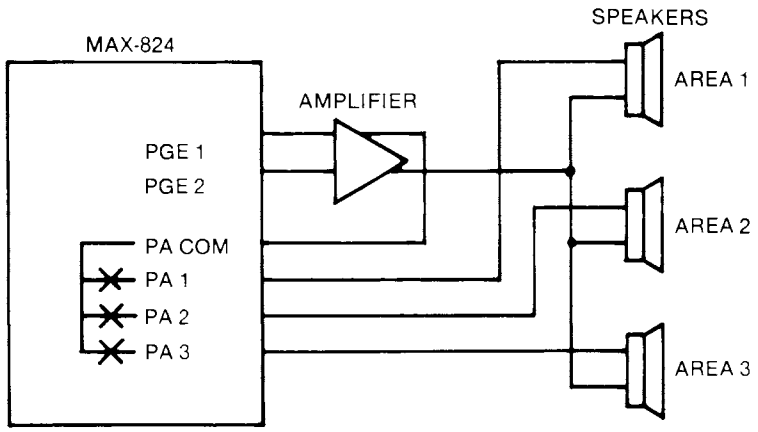



Fig. 13 — Paging Amplifier Connections for Three Areas and One Amplifier. (PA Contacts Rating: 1A Max.)

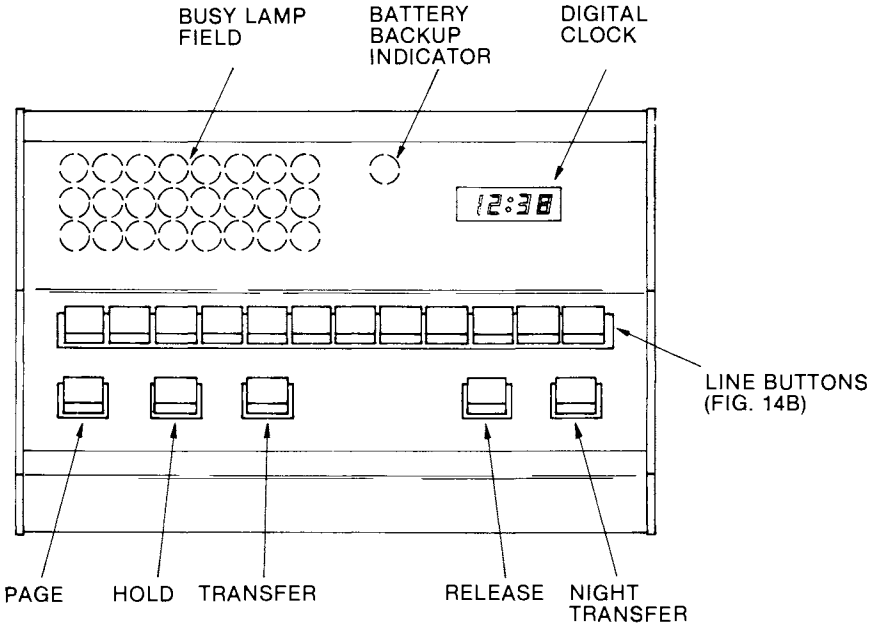



Fig. 14A — Front of Attendant's Console.

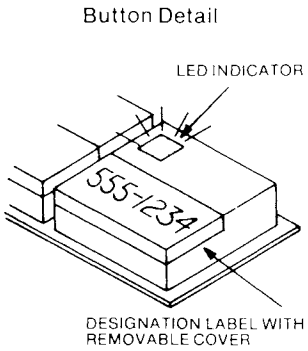
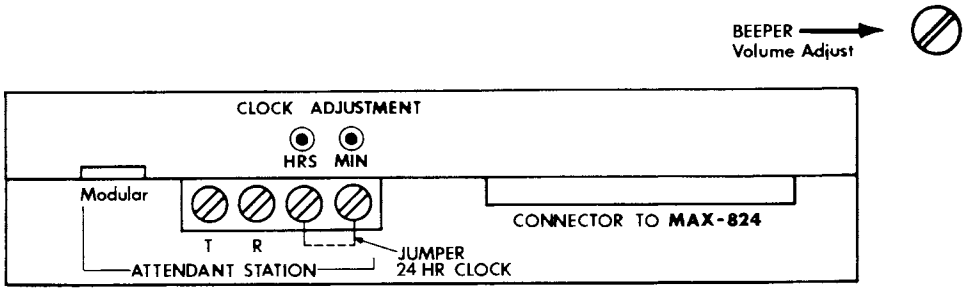



Fig. 14B — Line Button Detail.




NOTES:
1. CONNECT HANDSET THROUGH MODULAR JACK OF SCREW TERMINALS T AND R.
2. CHANGE BEEPER VOLUME BY TURNING THE SCREW SHOWN.
3. CHANGE CLOCK BY PRESSING HRS AND MIN BUTTONS.
4. FOR 24 HR CLOCK DISPLAY, ADD JUMPER INDICATED.

FIG. 14C — Underside of Attendant's Console.

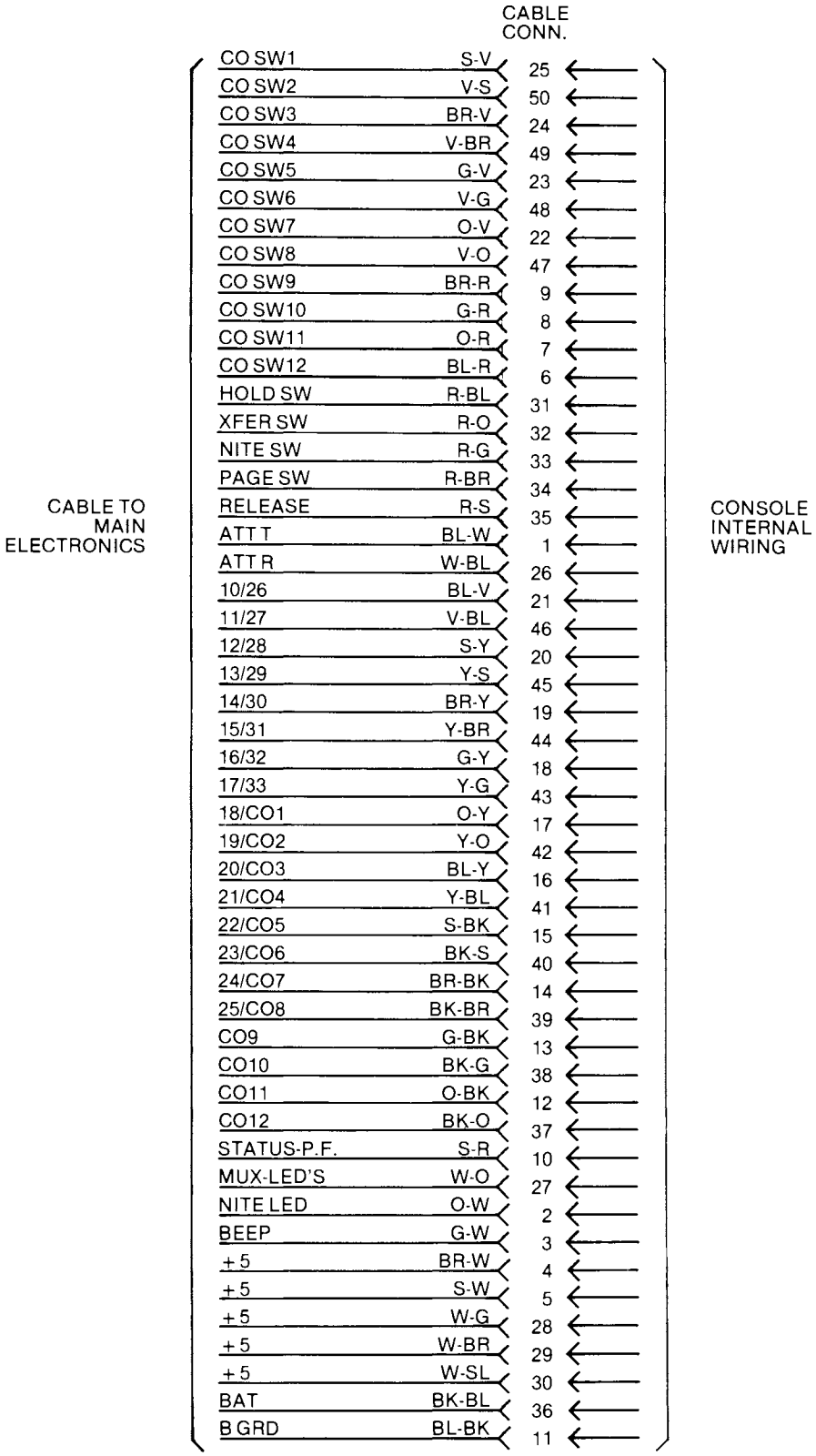
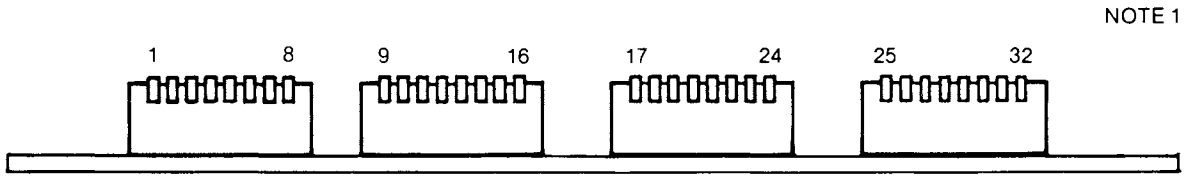



Fig. 15 — Console Cable.




NOTES:
1. SWITCH 32 MUST BE IN THE OFF POSITION.

Fig. 16A — Option Switches Located on Side of Control Circuit Pack.

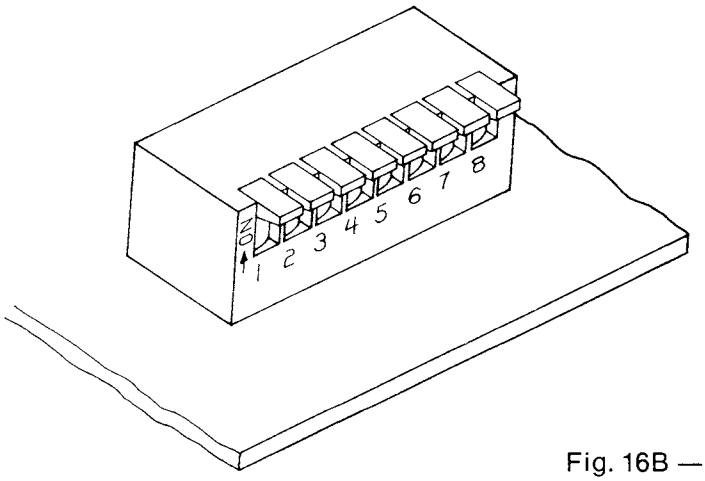



Fig. 16B — Switch Detail.

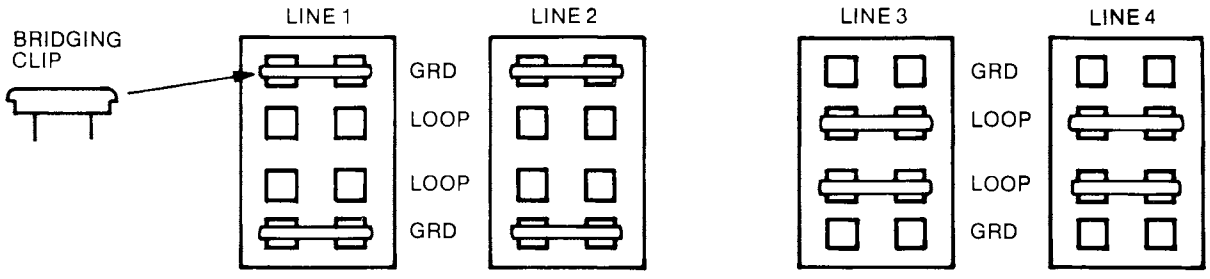



Fig. 17 — Method of Selecting Ground or Loop Start of Network Lines on CO Pack.
(Selection Shown for Lines 1 and 2 Ground Start, Lines 3 and 4 Loop Start.)

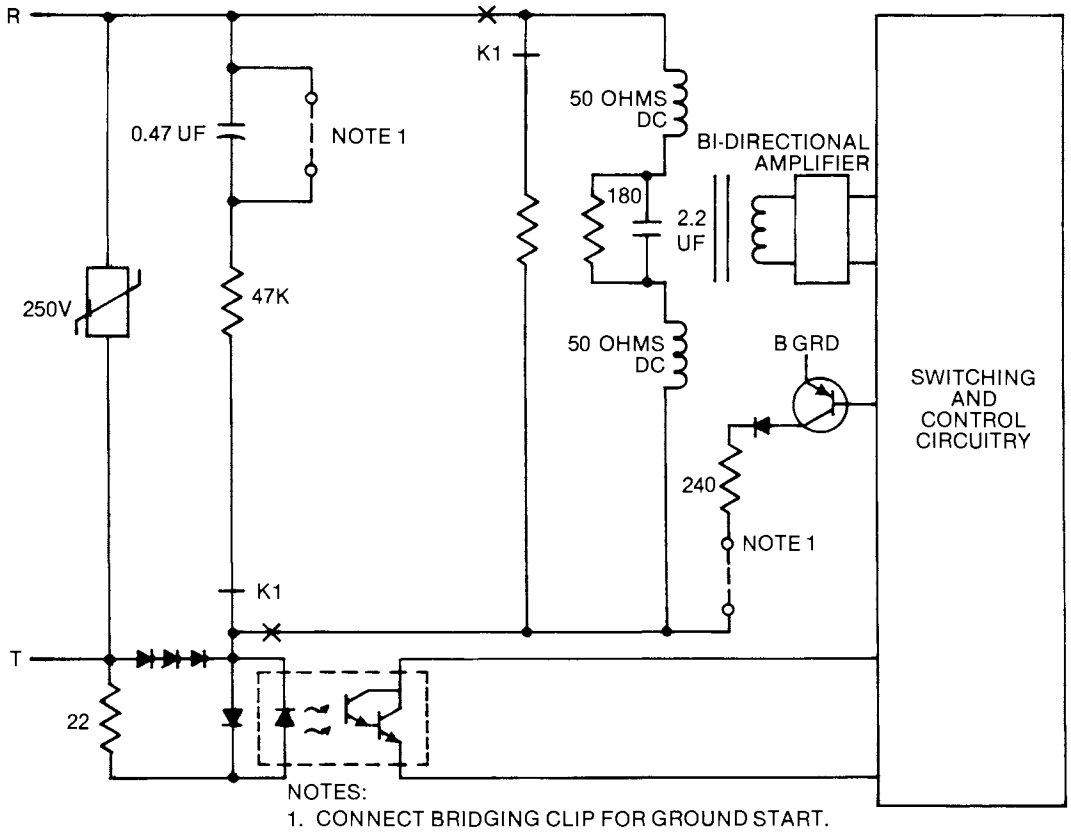
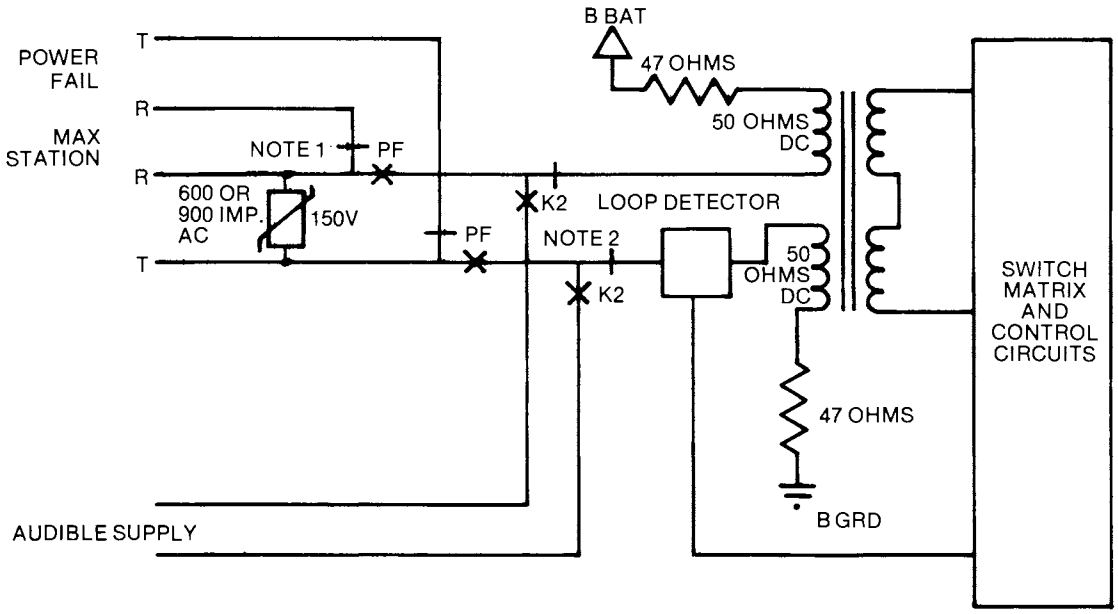



Fig. 18 — Interface to Network Lines.




NOTES:
1. POWER FAILURE RELAY NORMALLY OPERATED (FIRST STATION PER PACK).
2. K2: RINGING RELAY.

Fig. 19 — Station Interface.

## MAX-824
## TROUBLESHOOTING GUIDE

| PROBLEM | PROBABLE CAUSE | SOLUTION |
|---|---|---|
| **DEAD PHONE** | | |
| All stations dead | | |
| no talk battery | No B-Battery or polarity reversal | *Check Power Supply & Polarity* |
| | Blown fuse (B-Battery) | *Replace fuse* |
| Talk battery, but not dial tone | | |
| when off-hook | Defective Volt. Reg. Pack (Check power supply test points) | *Replace Volt. Reg. Pack* |
| •if system does not operate | Defective Control Pack | *Replace Control Pack* |
| •if system operates | Defective Link Pack | *Replace Link Pack* |
| Some station(s) dead | Defective Station Pack(s) | *Replace Station Pack(s)* |
| | Miswiring to stations | *Check wiring* |
| | Defective station phone | *Replace phone* |
| Some station(s) not | | |
| functioning correctly | Defective Station Pack | *Replace Pack* |
| **SYSTEM OPERATES, BUT NO RINGING** | | |
| All stations | Blown audible supply fuse | *Replace fuse* |
| | No audible supply | *Check wiring & supply* |
| | Defective Volt. Reg. Pack | *Replace Pack* |
| Some stations | Defective Station Pack(s) | *Replace Pack(s)* |
| | Defective Control Pack | *Replace Pack(s)* |
| One station | Defective ringer | *Replace ringer* |
| | Defective Station Pack | *Replace Pack(s)* |
| Console | Console in night mode (night lamp on) | *Operate "night" button to extinguish lamp* |
| | Defective Volt. Reg. Pack | *Replace Pack* |
| | Defective console or cable | *Replace console or cable* |
| **CONSTANT RINGING** | | |
| All stations, no | | |
| system operation | Defective Control Pack | *Replace Pack* |
| Some stations, | | |
| system operates | Defective Station Pack(s) | *Replace Pack(s)* |
| Console or night stations | Improper line mode selected for loop-start line | *Move jumper plugs to "loop" position on the CO circuit Pack* |
| Console | Defective Volt. Reg. Pack | *Replace Pack* |

| PROBLEM | PROBABLE CAUSE | SOLUTION |
|---|---|---|
| **NO CALL PROGRESS TONES— DIAL, BUSY, RINGBACK** | | |
| All stations: | | |
| •system operates | Defective Link/Sig. Gen. Pack | *Replace Pack* |
| •no system operation | Defective Control Pack | *Replace Pack* |
| Some stations: | | |
| •system operates | Defective Station Pack | *Replace Pack* |
| | Defective or miswired phone | *Check phone & wiring* |
| Multiple Call Progress Tones . . . . . | Defective Matrix Pack | *Replace Pack* |
| **CANNOT BREAK DIAL TONE** | | |
| All stations . . . . . | Defective Link/Sig. Gen. Pack | *Replace Pack* |
| Some stations . . . . . | Defective Station Pack | *Replace Pack* |
| **CO PROBLEMS** | | |
| System operates but cannot sieze CO line (cannot call out): | | |
| • no LED or relay operation | Defective CO Pack | *Replace Pack* |
| • relay and LED operate | Miswiring of trunks to block | *Correct wiring* |
| | Ground start network line | *Connect B GRD to earth. Install bridging clips on CO card.* |
| No CO dial tone . . . . . | Network line with tip/ring reversal | *Reverse tip and ring on network line* |
| Loud tone when CO line is accessed . . . . . | Defective CO Pack | *Replace Pack* |
| | Unused Line | *Connect "CO T" to "CO R" for all unused lines* |
| **ATTENDANT CONSOLE PROBLEMS** | | |
| System operates but Station(s) LED(s) does not light when station comes off-hook or console switch(es) do not respond correctly . . . . . | Defective Volt. Reg. Pack | *Replace Pack* |
| | Defective console or cable | *Replace console or cable* |
| Attendant's phone does not function . . . . . | Wiring problem | *Check wiring to terminal or jack* |
| | Defective Volt. Reg. Pack | *Replace Pack* |
| No incoming call audible signal . . . . | Defective console or cable | *Replace console or cable* |
| | Defective Volt. Reg. Pack | *Replace Pack* |
| | Console in Night Mode (Lamp On) | *Operate night button to extinguish lamp* |

# MAX-824
# SIMPLIFIED FAULT ISOLATION PROCEDURE

Perform the following procedures in order. If a problem is found, do not proceed with next step until it is corrected. (Correction occasionally is made by replacing the most recently added card.) Be sure to turn the power off each time a card is added and to restore power before testing.

1. Verify that the power supply in use is an EAK-41, EAK-6, MPS-360 or Melco approved substitute with a 3 amp or greater output rating.
2. Turn the power off and remove all circuit cards.
3. Verify that all power and ground connections are clean, tight and correct. Verify that all grounds are connected in common and that the system has an approved earth ground.
4. Turn the power on and verify -20 to -28 V DC between the B BAT and B GRD terminals on the chassis.
5. Turn the power off and install the voltage regulator card. Restore the power and check all testpoint voltages (Para. 8.03).
6. Turn the power off and install the control card. If convenient, connect the console near the main unit using the cord assembly furnished. Be certain the cable assembly is in serviceable condition.
7. Restore the power. Verify that there are no console lamps lighted except the night lamp. Lift the attendant's handset off-hook and verify that when each console line button is pressed, a beep is heard and a line lamp lights.
8. Turn the power off and install the matrix card. Repeat Step 7.
9. Turn the power off and install the link/signal card. Repeat Step 7. Dial tone should now be heard on the attendant's telephone.
10. Turn the power off. Install one station card and repeat Step 7.
11. Turn the power off. Add the remaining station and central office cards one at a time. Repeat Step 7 each time. BE SURE TO REMOVE THE POWER EACH TIME A CARD IS ADDED OR REMOVED.

# MAX-824 Switch Option Features Worksheet

| Switch No. ↓ | On | Off | Feature Option: Class of Service | 1 Fully Restricted | 2 Toll Restricted | 3 Partially Restricted | 4 Unrestricted |
|---|---|---|---|---|---|---|---|
| 1 | | | Station 12 | Off | On | Off | On |
| 2 | | | | Off | Off | On | On |
| 3 | | | Station 13 | Off | On | Off | On |
| 4 | | | | Off | Off | On | On |
| | | | Restricted Group (Station 11 Included if Switch 15 is On) | **None** | **14-15** | **14-21** | **14-33** |
| 5 | | | | Off | Off | On | On |
| 6 | | | | Off | On | Off | On |
| | | | | **1 Fully Restricted** | **2 Toll Restricted** | **3 Partially Restricted** | **4 Unrestricted** |
| 7 | | | Class of Service for Restricted Group | Off | On | Off | On |
| 8 | | | | Off | Off | On | On |
| 9 | | | On - Enables Music On Hold | Off - Disables Music On Hold | | | |
| 10 | | | On - Enables Background Music | Off - Disables Background Music | | | |
| 11 | | | Digits Restricted After Dialing 9 (Classes 2 & 3) | Off-00 Allowed | | On-00 Restricted (0 Allowed) | |
| 12 | | | | Off-9 Allowed | | On-9 Restricted | |
| 13 | | | | Off-1 Allowed | | On-1 Restricted | |
| 14 | | | | Off-0 Allowed | | On-0 Restricted | |
| 15 | | | Night Station(s) | Off-Station 10 & 11 | | On-10 Only | |
| 16 | | | Mode | Off-Hotel/Motel | | On-Business | |

**Network Line Grouping**
**Number of Dial 9 Lines (0-12)**

| | | | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | | | Off | On | Off | On | Off | On | Off | On | Off | On | Off | On | Off |
| 18 | | | Off | Off | On | On | Off | Off | On | On | Off | Off | On | On | Off |
| 19 | | | Off | Off | Off | Off | On | On | On | On | Off | Off | Off | Off | On |
| 20 | | | Off | Off | Off | Off | Off | Off | Off | Off | On | On | On | On | On |

**Number of Dial 8 Lines (0-12)**

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | | | Off | On | Off | On | Off | On | Off | On | Off | On | Off | On | Off |
| 22 | | | Off | Off | On | On | Off | Off | On | On | Off | Off | On | On | Off |
| 23 | | | Off | Off | Off | Off | On | On | On | On | Off | Off | Off | Off | On |
| 24 | | | Off | Off | Off | Off | Off | Off | Off | Off | On | On | On | On | On |
| 25 | | | System Configuration | | | | | | On - 8X24 | | | | Off - 12X18 | | |
| 26 | | | Off - USA | | | | | | On - International | | | | | | |
| 27 | | | Off - 5 Second Ringing Time Out | | | | | | On - 10 Second Ringing Time Out | | | | | | |
| 28 | | | Night Bell Activation | | | | | | Off - Night Mode Only | | | | On - Day & Night Mode | | |
| 29 | | | Message Registration | | | | | | On - Station Outputs Data to MRU | | | | Off - Station 10 Operates Message Lamp | | |

| | | | **Number of D.I.S.A. Lines** | **0** | **1** | **2** | **4** |
|---|---|---|---|---|---|---|---|
| 30 | | | **NOTE:** D.I.S.A. Group Starts at the High Network Lines Beginning with C.O. No. 8 or 12, Tone Dialing Only. Ground Start Trunks Only. | Off | On | Off | On |
| 31 | | | | Off | Off | On | On |
| 32 | | | Off - To Run | On - Momentarily to Reset | | | |

# MRU-24™ MESSAGE REGISTER UNIT FOR MELCO MAX-824 COMMUNICATIONS SYSTEM

## 1. GENERAL

1.01 The MRU-24 is a Message Registration Unit for the Melco MAX-824 Communications System. Primarily designed for systems in the Hotel/Motel Mode, it counts calls from individual motel rooms to local network lines for call billing.

1.02 A 12-button key pad is used to access a display of total outside calls by station (room) number. The pad is also used to set or verify the minimum call count time when elapsed time after line access is the basis for registering calls and to set or verify that the MRU-24 will register calls when reverse battery answer supervision is the basis for registering calls.

1.03 Registration of the MRU-24 under Part 68 of FCC Rules and Regulations is not required.

## 2. DESIGN FEATURES

2.01 The MRU-24:

- counts up to 99 completed calls from stations (rooms) to local network lines.
- indicates when 99 calls, the register capacity, has been exceeded.
- uses a standard 12-button key pad to access a display of total local calls by station room number.
- uses the key pad to set the mode of registration . . . elapsed time after line access or reverse battery answer signal from the MAX line circuit.
- allows rapid scanning of all rooms by station number to observe call count and nearness of count to the maximum of 99.
- provides for reset of room call count.
- retains the call count during a power failure without stand-by batteries.
- connects to the MAX-824 and the power supply with only four wires.

## 3. OPERATION

### PREPARING THE MRU-24 FOR OPERATION

**NOTE:** *Program Switch No. 29 on the MAX-824 Control Circuit Pack must be in the ON position. This disables the Message Waiting function for Station 10.*

3.01 There are two modes of operation for the Message Register Unit: Elapsed Time and Reverse Battery. When the MRU-24 is preset to operate in the first mode, it will register a call after a selected length of time after seizure of a local network line. When the second mode is set, a call will register after reverse battery answer supervision has been detected by the network line circuit. To prepare for one or the other of the operating modes, proceed as follows:

A. Press the digit 0 button on the key pad.

*Either a minimum call time in seconds will indicate that the present mode is Elapsed Time or --:00 will indicate that the mode is Reverse Battery.*


Fig. 1

B. To change the minimum call time, press a pad button: 2 for 20 seconds, 3 for 30 seconds, etc., up to 10 for 100 seconds.

*The display will show the new time.*

C. To change the Elapsed Time mode to Reverse Battery, dial digit 0.

*The MRU-24 timer turns off.*

D. After setting the mode as desired, press the pound (#) button.

*The display shows --:-- to indicate that*

*the chosen mode has been set and the register is ready to count calls.*

**NOTE:** *If M and MM Message Registration is provided by the central office, please contact Melco Labs for assistance.*

3.02 When it is necessary to display the station call count, proceed as follows:

A. Key the unit station number (10 to 33).

*Station number will show on the left side and the call count will show on the right side of the display. If the station call count exceeds 99, the display will read xx:9.9.*

*The station number and count will continue to be displayed until the pound key (#) is pressed to display the next consecutive station number, or until another station number is keyed.*

**NOTE:** *While a station number is on display, additional calls placed from a room will not show on the register but will be counted in the memory. Any calls that were completed after a station call count is displayed and before it is cleared will not be lost. When the station number is again keyed, the latest count will be displayed. For this reason it is good practice to display the station number a second time before billing.*

3.03 To review the call count:

A. Key the first station number of the review. To review all stations, start at station 10.

*The station number will be displayed, followed by the call count.*

B. Take note and reset totals approaching 99. Stations exceeding 99 calls will read 9.9. See Paragraph 3.04.

C. Operate the pound button once.

*The next station number will be displayed. Each time the pound button is pressed, the next station number and its call count will be displayed.*

D. The call count for any room may be displayed at any time by keying its station number.

3.04 When a call count is approaching 99 or for any other reason, it is desirable to begin a call count at zero, a station call count may be reset by the following method:

A. Key the station number.

*The station number and its call count will be displayed.*

B. Press the asterisk (*) button twice.

*The station number will show on the left side and 00 will show on the right side of the display. Calls completed while that station number was displayed will not be cleared, but will be counted and displayed with the next reading.*

C. Press the pound button to display the next station number or leave the message display as it is.

## 4. INSTALLATION

4.01 Make the following connections from the MRU-24 screw terminals or the modular jack to the MAX-824:

*A. Connect MRU terminals LAMP and LAMP GRD to the MAX-824 connecting block terminals L10 and LG10, terminals for the motel office number. These are required even if the system does not use message waiting lamps (Figure 4).*

*B. Make the two remaining power supply connections, GRD and -24V, to the screw terminals on the MAX-824. Lamp ground and B ground should be commoned at the power supply. See Figures 3 and 4 for connecting information and Tables A and B for conductor sizes and lengths.*

*C. Turn on switch No. 29 on the MAX-824 Control Circuit Pack.*

## 5. MAINTENANCE

5.01 If the MRU-24 does not function properly after installation is completed, verify all connections and fuses. If the voltage at the B battery terminal of the Message Register Unit is lower than 16 volts, verify that conductor gauge and length conform with specifications shown in Tables A or B. Test the system by replacing the unit with another of known serviceability.

5.02 The MRU-24 is warranted against defects in material and workmanship for five years.

If if fails within that time, it will be repaired or replaced without charge. See the Melco Warranty Service Policy for repair and return details.

## 6. SPECIFICATIONS

External power supply requirements:

Operating voltage
B BAT .....-20 to -28V DC
-24V DC nom

Operating current .....350 ma max

MAX-824 lamp battery .....-10V to -130V DC
or 10V to 130V AC
25 to 60 Hz

Max length from power supply .....see Table A

Data retention period (unpowered) .....48 hours minimum

Count max .....99 calls and overflow indication

Operating temperature .....0° to 50° C
32° to 122° F

Operating humidity .....0 to 95% noncondensing

Storage temperature .....-30° to +70° C
-22° to 158° F

Placement .....flat surface

Connections .....screw terminals and modular jack

Minimum reverse battery detection time .....1.9 sec

Dimensions:
max height .....4.5″
width .....7.33″
depth .....7.12″

Housing .....aluminum

Weight .....1 lb, 14 oz

## 7. ORDERING

7.01 If the MAX-824 and the MRU-24 are ordered together for a new installation, they will be compatible. However, if the MAX-824 is in place and the MRU-24 is to be added, it will be important to note the color of the extractors on the Control Circuit Pack, the Links/Signal and the CO Circuit Pack. Red extractors indicate that the circuit packs in place have enhanced circuitry and are compatible with the MRU-24. If the extractors are white, an enhancement package will be required. Please order one of the following for each MAX-824 system for which Message Registration is required:

120287 ENHANCEMENT PACKAGE FOR 600 OHM CO APPLICATION

120288 ENHANCEMENT PACKAGE FOR 900 OHM CO APPLICATION

and add one:

120265 MESSAGE REGISTRATION UNIT FOR MAX-824

7.02 More detailed ordering information is included in the MAX-824 Ordering Guide.

7.03 Disconnect the power from the MAX-824, remove the cover and change the in-place Control Circuit Pack, the Links/Signal Circuit Pack and the Central Office Circuit Pack(s) with those furnished in the package. After the circuit packs have been exchanged, replace the MAX-824 cover and reconnect the power input.

7.04 For further information on the MRU-24, for the MAX-824 or any other Melco product, call or write:

MELCO LABS, INC.
14408 N.E. 20th Street
Bellevue, WA 98007
(206) 643-3400
TWX: 910-443-3040

## TABLE A

CONDUCTOR SIZE AND LENGTH
MRU-24 TO MAX-824

| Minimum Power Supply Voltage | Wire Gauge (AWG.) | Maximum Distance from MAX-824 to MRU-24 (feet) |
|---|---|---|
| -20V to -28V DC | 22 | 250 |
| -20V to -28V DC | 24 NOTE 1 | 180 |
| -20V to -28V DC | 26 NOTE 1 | 115 |

**NOTES:**

1. MAXIMUM DISTANCE FROM MRU-24 TO MAX-824 IS 250 FEET WITH ANY WIRE GAUGE.

## TABLE B

CONDUCTOR SIZE AND LENGTH
COMBINATION MODULAR CORD AND INSIDE WIRE

| Power Supply Voltage | Wire Gauge (AWG.) | Modular Cord Length (feet) | Max. Wire Length (feet) |
|---|---|---|---|
| -20V to -28V DC | 22 | 5<br>10<br>14 | 180<br>120<br>60 |
| -20Vto -28V DC | 24 | 5<br>10<br>14 | 135<br>90<br>40 |
| -20V to -28V DC | | 18 max. | no wire |

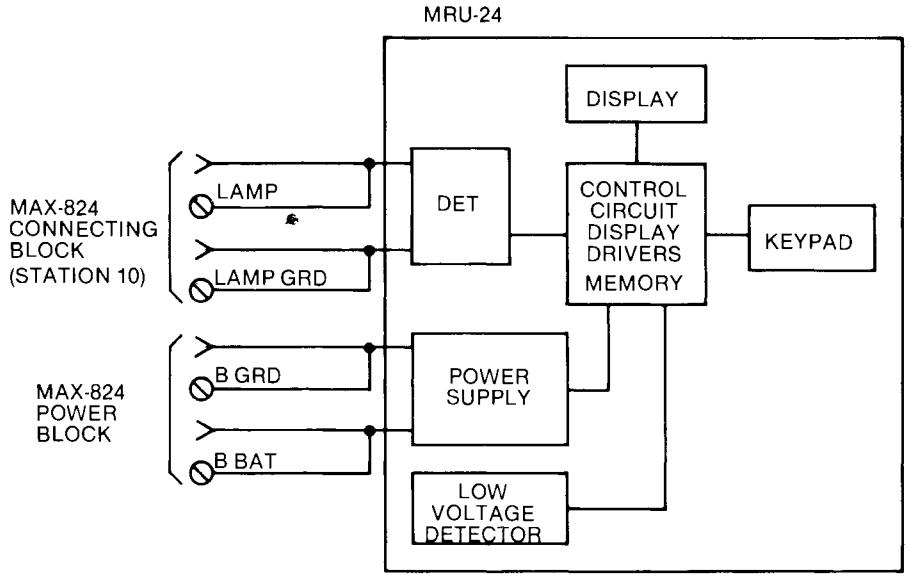



Fig. 2 — MRU-24 Block Diagram.

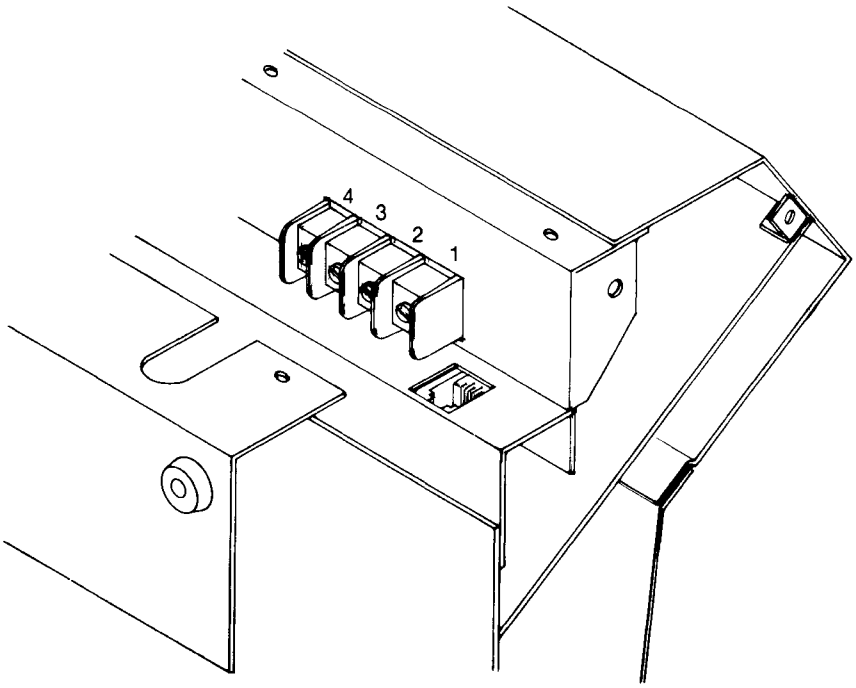
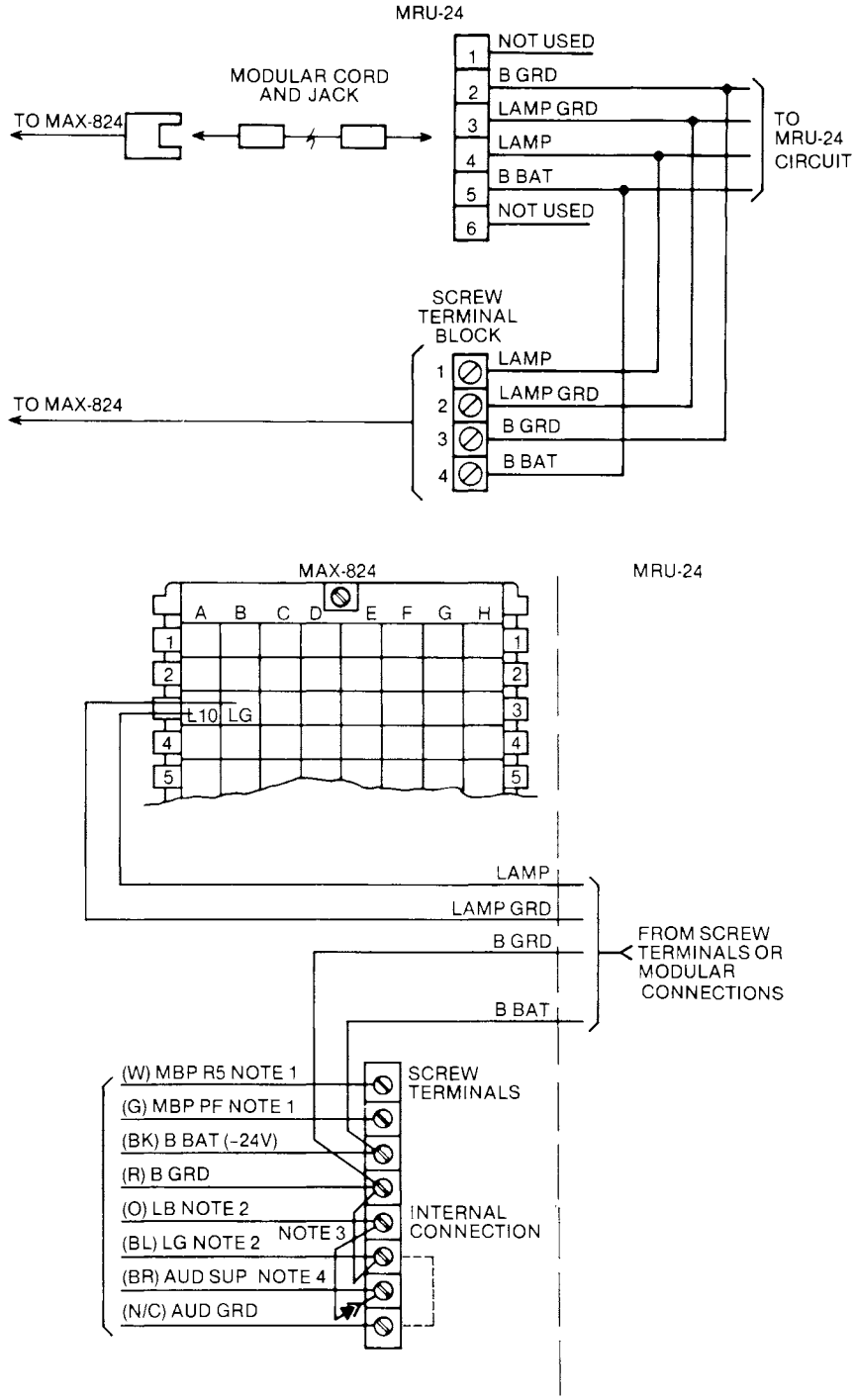



Fig. 3 — Back Underside of MRU-24 Showing Screw Terminal and Modular Jack Connections.




NOTES:
1. USED WITH MELCO MPS SERIES POWER SUPPLIES ONLY.
2. TERMINALS LB AND LG ARE USED WITH MESSAGE WAITING LAMPS OR WHEN MRU-24 IS USED. SEE PARAGRAPH 4.01A.
3. CONNECT B GRD TO LAMP GROUND AT SCREW TERMINALS.
4. WHEN MESSAGE WAITING IS NOT USED AND LAMP BATTERY IS NOT PRESENT AT THE MAX-824, CONNECT LAMP BATTERY AND AUD SUP AT MAX-824 SCREW TERMINALS.

Fig. 4 — MAX-824 Connections to MRU-24 Input Board.

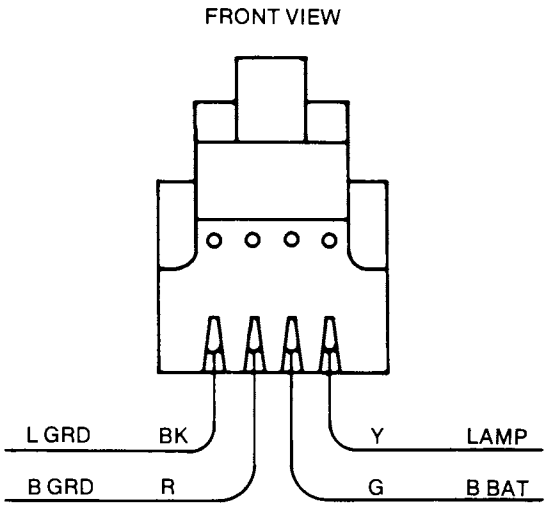



Fig. 5a — Modular Plug, Multipled with Screw Terminals.

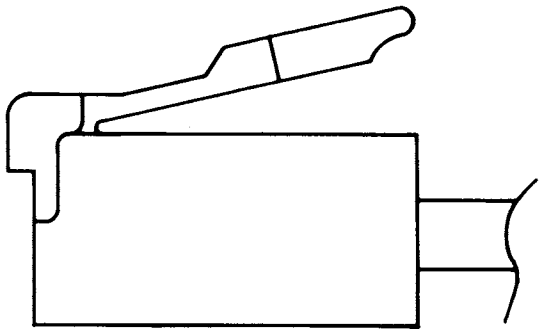


Fig. 5b — Side View of Modular Plug.

| | |
|---|---|
| 455030-1<br>REL 2.0.0 | 455030-2<br>REL 2.0.0 |
| 455030-3<br>REL 2.0.0 | 455030-4<br>REL 2.0.0 |
| | 455030-5<br>REL 2.0.0 |
| | |

Fig. 6 — New EPROMS of Control Circuit Pack 120220-1, Suitable for use with MRU-24 Message Registration Unit. Enhanced Circuitry will read 2.0.0 or Higher.

# PLC-400™ PBX LINE CARD

## 1. GENERAL

1.01 The PLC-400 is a 1A2 type key system line card which allows up to 4 C.O. lines to be added to a Melco MAX Communication System or a similar PABX system. It is especially designed to enable key system telephones to be used with a PABX installation. The PLC-400 provides the key telephones with lamp control, bell or buzzer ringing and line hold. In addition, input ports are provided to allow the PABX stations controlled access to the same C.O. lines as the key telephone stations.

1.02 The PLC-400 can be used as a stand-alone key system.

1.03 This device is pending FCC registration under Part 68 of the FCC Rules and Regulations.

## 2. DESIGN FEATURES

2.01 Incoming calls on a C.O. line will activate the PLC-400 R-lead output and operate associated key telephone lamps and bells. If the PLC-400 is connected to the PABX, a strap option allows incoming calls to ring at the PABX as well.

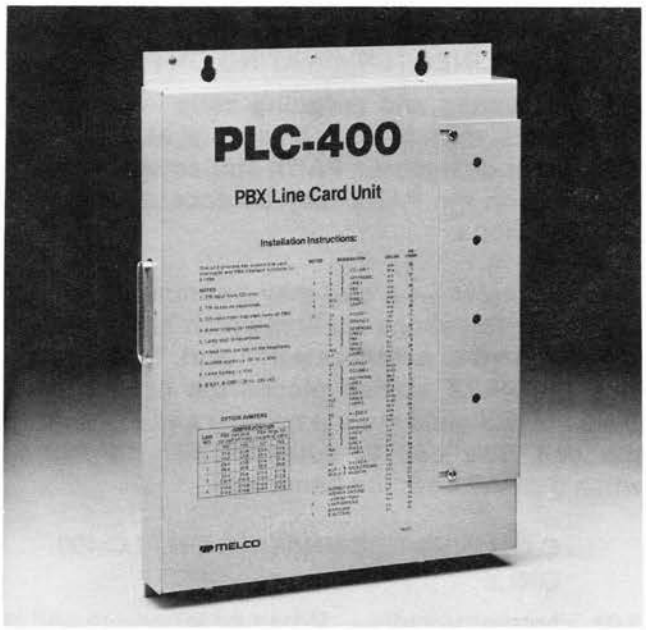
2.02 When a C.O. line can be accessed by both key telephones and PABX stations, the key telephone stations have unrestricted access to the line. If a PABX station attempts to access a line in use by a key telephone station, the PLC-400 will exclude the PABX station and issue busy tone.

2.03 If the PLC-400 is connected to the PABX, a strap option allows a PABX station to retrieve a call placed on hold by a key telephone station.

2.04 A key telephone station may access all stations, lines and features available through the PABX system, by assigning the key telephone station a PABX station port number and dedicating a pickup key to that port.

2.05 The PLC-400:

- can be used with standard loop start PABX C.O. ports.
- operates with standard 1A1 or 1A2 type key telephones.
- provides circuits for up to 4 C.O. lines. Additional PLC-400 units may be used for more than 4 lines.
- is equipped with LED's to indicate the status of each line.
- detects incoming bridged ringing and generates R-lead ringing for the keysets.
- is equipped with an internal interrupter which provides lamp and R-lead control for the key telephones.
- provides lamp control to the key telephones when a PABX station seizes the C.O. line.
- provides the hold function for the keysets.




- provides an input for music-on-hold.
- connects key telephones and PABX inputs directly to the C.O. line inputs when in the power failure mode.
- mounts in an apparatus cabinet, a relay rack, on a backboard or on a wall.

- connects through a single A25B type 25-pair connector cable.
- operates from an standard key system power supply.

## 3. OPERATION

3.01 With the PLC-400, it is possible to have a PABX installation with the C.O. lines terminated in three different manners:

A. C.O. lines terminated only on the PABX.

B. C.O. lines terminated only on the PLC-400 (accessible only by key telephone stations).

C. C.O. lines terminated on the PLC-400 and connected through to the PABX (accessible by both PABX and key telephone stations).

This section describes the various procedures for placing, receiving and handling calls from key telephone and PABX stations, as applicable for each of these conditions.

### C.O. LINES TERMINATING ON PABX ONLY

3.02 **Incoming and outgoing calls** — Incoming calls may be received only at the PABX console or designated PABX station(s). Lines terminating on the PABX may be accessed only by PABX stations.

3.03 **Transfer** — A call may be transferred to a key telephone station which has a pickup key assigned to a PABX station port. To transfer a call, the PABX station places the call on hold, dials the assigned station number and announces the call. The call is automatically transferred when the PABX station hangs up.

### C.O. LINES TERMINATING ON PLC-400 ONLY

3.04 **Incoming calls** — When an incoming call is received, the associated key telephone lamp(s) will flash at 60 IPM and the PLC-400 R-lead output will switch audible supply at a rate of 1 second on/3 seconds off. The R-lead output may be connected to bells or buzzers on the associated key telephone(s) or to a common audible source.

To answer the incoming call, depress the flashing pickup key and come off-hook. Only key telephone stations may answer incoming calls on these lines.

3.05 **Outgoing calls** — To place an outgoing call, select an idle line (designated by an unlit pickup key), depress the pickup key, and come off-hook. The lamp will light steady and the C.O. will issue dial tone. Proceed to place call. Outgoing calls on these lines may be placed only by key telephone stations.

3.06 **Hold** — To place a line on hold, depress and release the hold button. This disconnects the station from the line and places the line on hold through the PLC-400. To indicate that the line is on hold, the line lamp(s) will flash at 120 IPM. If a music source is connected to the PLC-400, the holding party will hear music.

To retrieve a call on hold, depress the line pickup key and come off-hook from any key telephone station. A PABX station cannot retrieve a held call on a C.O. line terminating on the PLC-400 only.

3.07 **Transfer** — To transfer a call to another key telephone station, first place the call on hold as described in the preceeding paragraph. Announce the call to the desired key telephone station, identifying the line on which the call is on hold. (If both the transferring station and the station to which the call is to be transferred are equipped with a pickup key assigned to a station port, the call can be announced by depressing that pickup key and dialing the desired station number. If the key telephones are connected to an intercom, the call may be announced through the intercom system. The call can also be announced through the PABX paging system if the transferring station has a pickup key assigned to a station port. In addition, the call can be announced through the key telephone paging system if a pickup key is dedicated to a direct paging system such as Melco's KA-390 Direct Paging Access Unit. See paragraph 4.06.) The station may pick up the call by depressing the appropriate pickup key and coming off-hook. A call cannot be transferred to a PABX station.

3.08 **Disconnect** — To disconnect a call, simply go on-hook. When the line becomes idle, the lamp of the associated pickup key will become dark.

C.O. LINES TERMINATING ON PLC-400 AND CONNECTED TO PABX

3.09 **Incoming calls** — An incoming call will always activate the PLC-400, and operate the lamps and the bells and buzzers of the key telephone(s). An option may be enabled to allow incoming calls to bridge ring into the PABX as well. Calls may then be received at the PABX console or night station in the same manner as other incoming calls.

3.10 **Outgoing calls** — The PABX trunk ports connected to the PLC-400 should be assigned specific line access codes rather than group access codes such as dial 8 or dial 9. To place an outgoing call from a PABX station, come off-hook and dial the desired individual line access code. If the line is not in use, the PABX station will seize it and the associated line lamp(s) will light steady at the key telephone(s). If the line is in use, the PLC-400 will issue busy tone. If the line is on hold, the PLC-400 will issue busy tone or the PABX will seize the line, depending on how the strap option is configured. (Refer to Paragraph 4.01 and Table A.)

Place an outgoing call from a key telephone station as described in Paragraph 3.05. A key telephone station has unrestricted access to the line(s). If a key telephone station accesses a line already in use by a PABX station, a conference situation will be established.

3.11 **Hold** — A key telephone station may place a line on hold as described in Paragraph 3.06. The held call may be retrieved by any key telephone station, and may also be retrieved by a PABX station if the strap option is configured to allow a PABX to pick up a call on hold. See Table A.

A PABX station may place the line on hold as usual if the PABX provides a hold feature. The PABX station does not have access to the PLC-400 hold function.

3.12 **Transfer-PABX to key telephone station** — A call may be transferred from a PABX station to a key telephone station using one of the following two methods:

A. If the key telephone is equipped with a pickup key assigned to a station port, the PABX station user can transfer the call as described in Paragraph 3.03.

B. The PABX station may also transfer the call by first placing the call on hold and announcing the call through the PABX paging system if equipped. The PABX station then retrieves the held call, stays on the C.O. line until the key telephone station picks it up, and then hangs up. If the PABX station does not hang up, a conference call is established.

3.13 **Transfer-key telephone to PABX station** — A key telephone station may transfer a call to a PABX station if the PLC-400 is strapped to allow a PABX station to retrieve a call placed on hold by a key telephone station. To transfer a call, the key telephone station first places the line on hold, then announces the call through the pickup key assigned to a PABX station port, if equipped, or through the paging system. The key system station user should make sure to identify on which line the call is holding. The PABX station may then pick up the call and release the hold by dialing the designated individual line access code. A conference call can be established if the key telephone station then re-accesses the line.

## 4. INSTALLATION

4.01 Select the options desired for each C.O. line:

A. A PABX station may or may not be allowed to retrieve a call placed on hold by a key telephone station. (The line must be connected to the PABX in order for this feature to be enabled.)

B. An incoming call on the line may or may not signal the PABX console or designated PABX station(s) in addition to signaling the associated key telephone(s). (The line must be connected to the PABX in order for this feature to be enabled.)

To access the strap option pins on the PLC-400 printed circuit board, remove the panel on the front of the PLC-400 housing. Place jumpers over the pins as applicable for the options selected. See Table A and Figure 2.

4.02 Mount the PLC-400 in an apparatus cabinet, in a relay rack or on a wall or backboard.

4.03 Connect an A25B or equivalent 25-pair connector cable to the PLC-400 plug and secure it with the clamp provided.

4.04 Terminate the cable on a 66-type connecting block.

4.05 Make key telephone connections as shown in Figures 3, 4 and 5. If intercom capability between PABX and key telephone stations is desired, assign a PABX station port to each key telephone station. Dedicate a pickup key to the station port and place a bridged ringer across the tip and ring of that pickup key. If intercom capability is desired only between the key telephone stations, a Melco or equivalent standard KTU intercom may be connected to the stations.

4.06 To provide the key telephone stations with access to a paging system other than the PABX paging system, if equipped, dedicate a pickup key for paging access and connect the stations to a Melco KA-390 Direct Paging Access Unit. If the key telephones are equipped with an intercom, they may also be connected to a paging system that operates from the intercom key such as a Melco KA-380 Paging Access Unit or KT-363 Paging Amplifier. See the applicable paging unit technical practice.

4.07 Connect LAMP BATTERY, AUDIBLE SUPPLY, B-GROUND AND B BATTERY leads to the power supply. Common all power supply grounds.

4.08 Connect the PLC-400 R( ) lead for each C.O. line used to a bell or buzzer in the common audible source or in the key telephone(s) desired to ring for incoming calls.

4.09 Cross connect T and R for each C.O. line used.

4.10 Connect a music source to terminals 21 and 46 if the music on hold feature is desired when a key telephone station places a call on hold.

4.11 Apply power and test each key telephone station as follows:

A. Come off-hook and access C.O. line 1. Confirm that the lamp in the associated pickup key lights and you receive dial tone when the line is accessed. Confirm that you can place the line on hold and that the lamp in the appropriate pickup key flashes at 120 IPM. If the PLC-400 is connected to a music source, ensure that music can be heard when the line is placed on hold.

B. Repeat the above procedure for C.O. lines 2-4 as applicable.

C. Place an incoming call to each C.O. line. Verify that the common audible source rings, or that the appropriate key telephone station(s) ring and that the line lamp(s) flash at 60 IPM.

4.12 If the PABX stations are to be allowed access to the C.O. line(s), connect the selected loop start ports from the PABX to the PABX line inputs on the PLC-400.

4.13 If the C.O. lines are connected to the PABX system, test the total system operation as follows:

A. Access each C.O. line through the PABX and confirm that dial tone is received and that the line lamps of the key telephones light.

B. Access each C.O. line from a key telephone station and confirm that busy tone is heard from a PABX station which attempts to access the line.

C. Confirm proper operation of the two strapped options:

1. Place each line on hold from a key telephone station and attempt to access the line through the PABX. If the line is strapped to allow the PABX to retrieve a call on hold, confirm that the line is seized. If the line is strapped to disallow the PABX to retrieve a call on hold, confirm that busy tone is heard.

2. Place an incoming call to each C.O. line. If the line is strapped to allow the PABX system to receive incoming calls, confirm that the PABX console or designated PABX station(s) ring.

## 5. MAINTENANCE

5.01 Test the system for proper operation as described in Paragraphs 4.11 and 4.13. Ensure that the strapped options are in the appropriate positions for the desired features.

5.02 No provision is made for field adjustment or repair. If no output is detected, verify power connections and fuses. Check the cable plug and connector for dirt, corrosion and contact tension.

5.03 Check to determine if the PLC-400 is defective by removing the cable and connecting it to a substitute PLC-400 unit.

5.04 The PLC-400 is warranted against defects in material and workmanship. If it becomes defective within the warranty period, it will be repaired or replaced without charge. See the Melco Warranty Service Policy for repair and return details.

## 6. SPECIFICATIONS

External power supply requirements:
- operating voltage, B BAT . . . . . -24V DC -20 to -28V DC
- operating current . . . . . 1.3 amps max
- lamp battery . . . . . ± 10V nom
- audible signal supply . . . . . 10V, 60 Hz or ± 105V, 20-30 Hz

Signaling:
- lamp period:
  - incoming call . . . . . 60 IPM nom
  - hold . . . . . 120 IPM nom
  - in use . . . . . steady
- ringing . . . . . 1 sec on/3 sec off begins when any line rings in and ends 8 seconds after the last ring-in
- busy signal . . . . . 250 Hz and 500 Hz 50% DC, 60 IPM

Output ratings (per line):
- lamp (triac) . . . . . 3 amps max
- audible (triac) . . . . . 3 amps max

Music source . . . . . 8 ohm output impedance

Temperature range:
- operating . . . . . 0° to 50° C 32° to 122° F
- storage . . . . . -30° to 70° C -22° to 158° F

Humidity . . . . . 0 to 90% noncondensing

Loop current (from C.O. through PLC-400 to keyphone or PABX) . . . . . 15 ma min

Connections . . . . . A25B or equivalent connector cable

Dimensions . . . . . 10.20″ x 14.00″ x 1.88″

Housing . . . . . Epoxy coated aluminum

Weight . . . . . 3.5 lbs.

## 7. ORDERING GUIDE

7.01 Order as follows:

(QTY) 120315 PLC-400 PBX LINE CARD

from your local supplier or distributor.

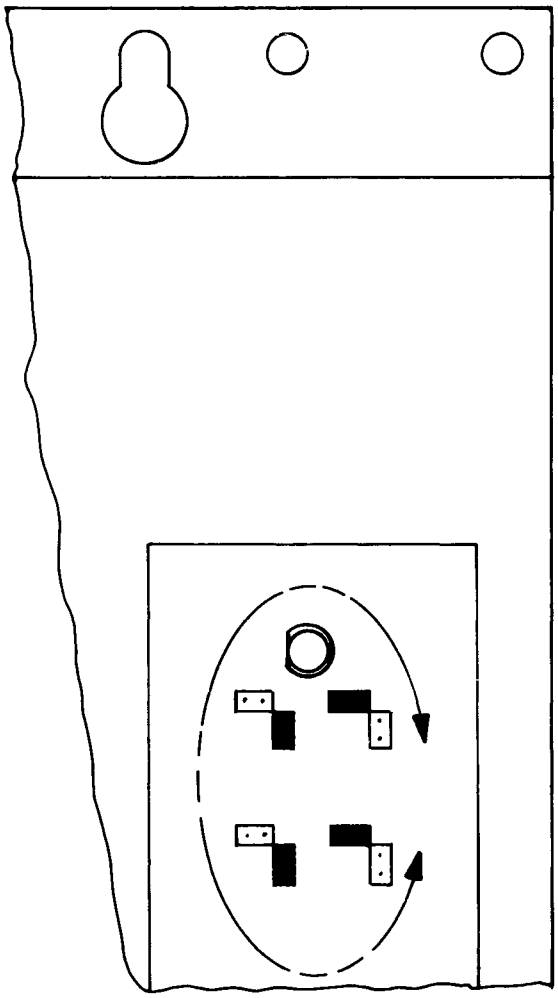
7.02 Technical assistance on the PLC-400 or any Melco product is available from:

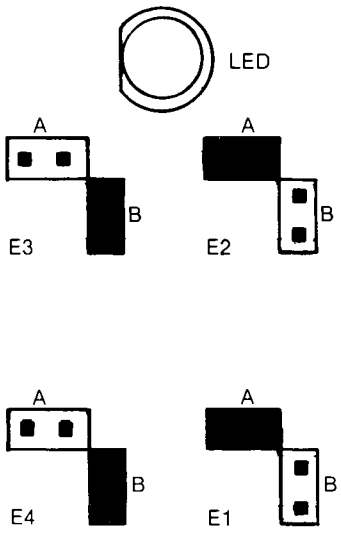
MELCO LABS, INC.
14408 N.E. 20th Street
Bellevue, WA 98007
(206) 643-3400
TWX: 910-443-3040

Table A — Strap Options

| LINE NO. | JUMPER POSITION | | | |
|---|---|---|---|---|
| | PBX can pick up call off-hold | | PBX rings for incoming calls | |
| | NO | YES | NO | YES |
| 1 | E1-A E2-A | E1-B E2-B | E3-A E4-A | E3-B E4-B |
| 2 | E5-A E6-A | E5-B E6-B | E7-A E8-A | E7-B E8-B |
| 3 | E9-A E10-A | E9-B E10-B | E11-A E12-A | E11-B E12-B |
| 4 | E13-A E14-A | E13-B E14-B | E15-A E16-A | E15-B E16-B |

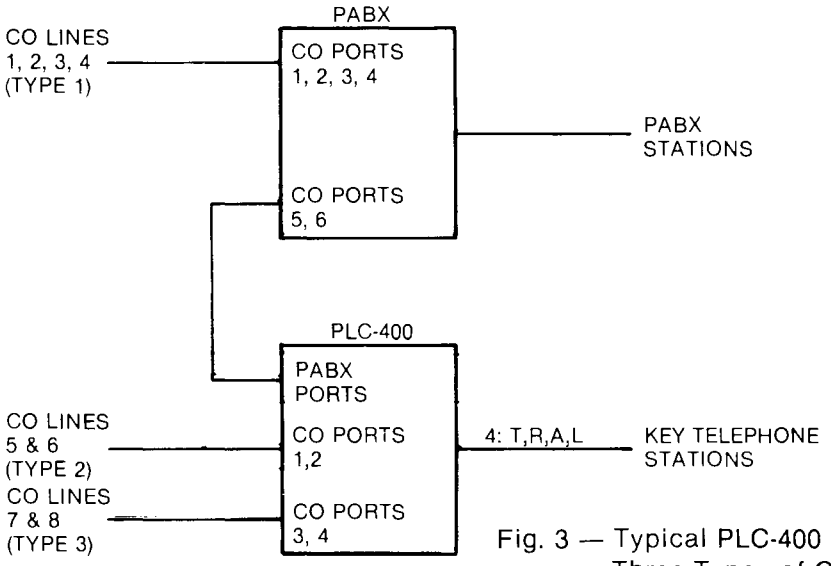
NOTE:
1. THE JUMPERS OPERATE IN PAIRS AS FOLLOWS: E1-E2, E3-E4, E5-E6, E7-E8, E9-E10, E11-E12, E13-E14, E15-E16. EACH MEMBER OF A PAIR MUST HAVE ITS JUMPER IN THE SAME POSITION (I.E. E1 AND E2 MUST BOTH BE IN POSITION A OR BOTH IN POSITION B).






NOTE:
1. JUMPERS ARE SHOWN IN POSITIONS E1-A, E2-A, E3-B, E4-B

Fig. 2 — Strap Options - Typical For Each Line.




TYPE 1: CO LINES 1-4 — TERMINATE ONLY ON THE PABX. ACCESSIBLE TO PABX STATIONS ONLY.

TYPE 2: CO LINES 7 AND 8 — TERMINATE ONLY ON THE PLC-400. ACCESSIBLE ONLY TO KEY TELEPHONE STATIONS.

TYPE 3: CO LINES 5 AND 6 — TERMINATE ONLY ON THE PLC-400 AND CONNECT TO THE PABX PORTS. ACCESSIBLE TO BOTH PABX AND KEY TELEPHONE STATIONS.

Fig. 3 — Typical PLC-400 Installation Showing Three Types of CO Lines.

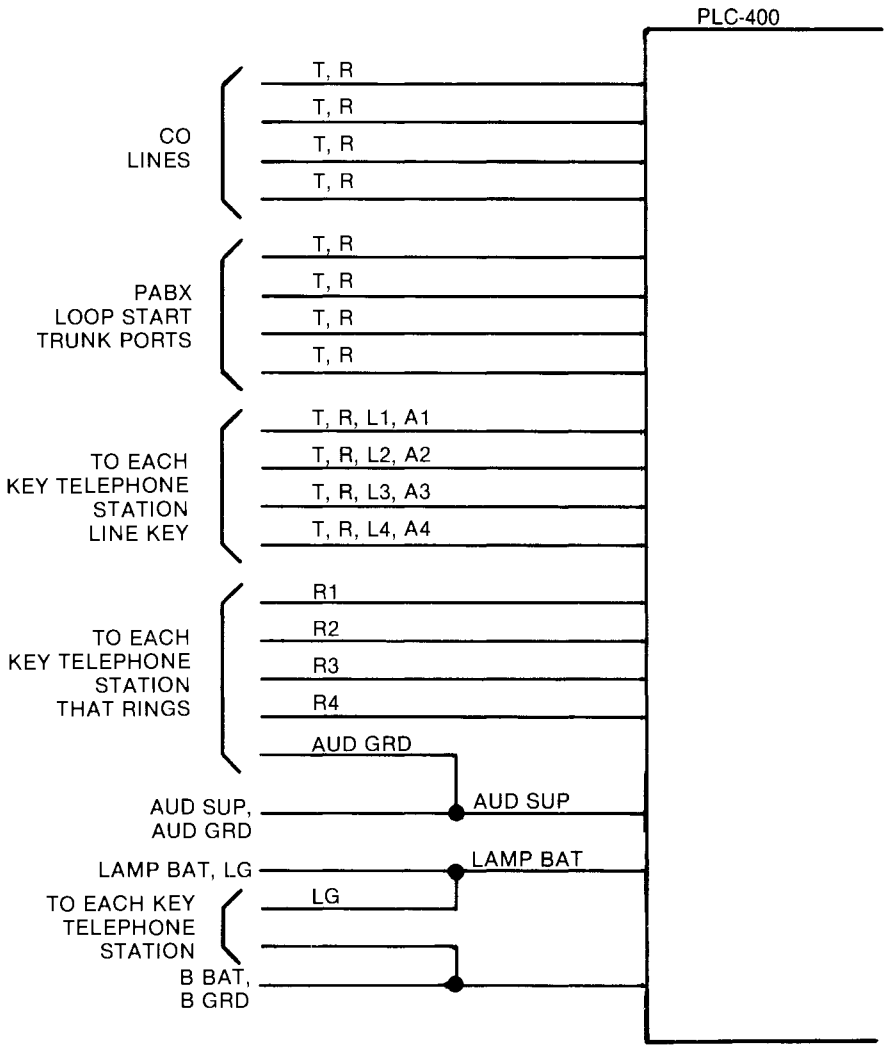



Fig. 4 — Application Schematic

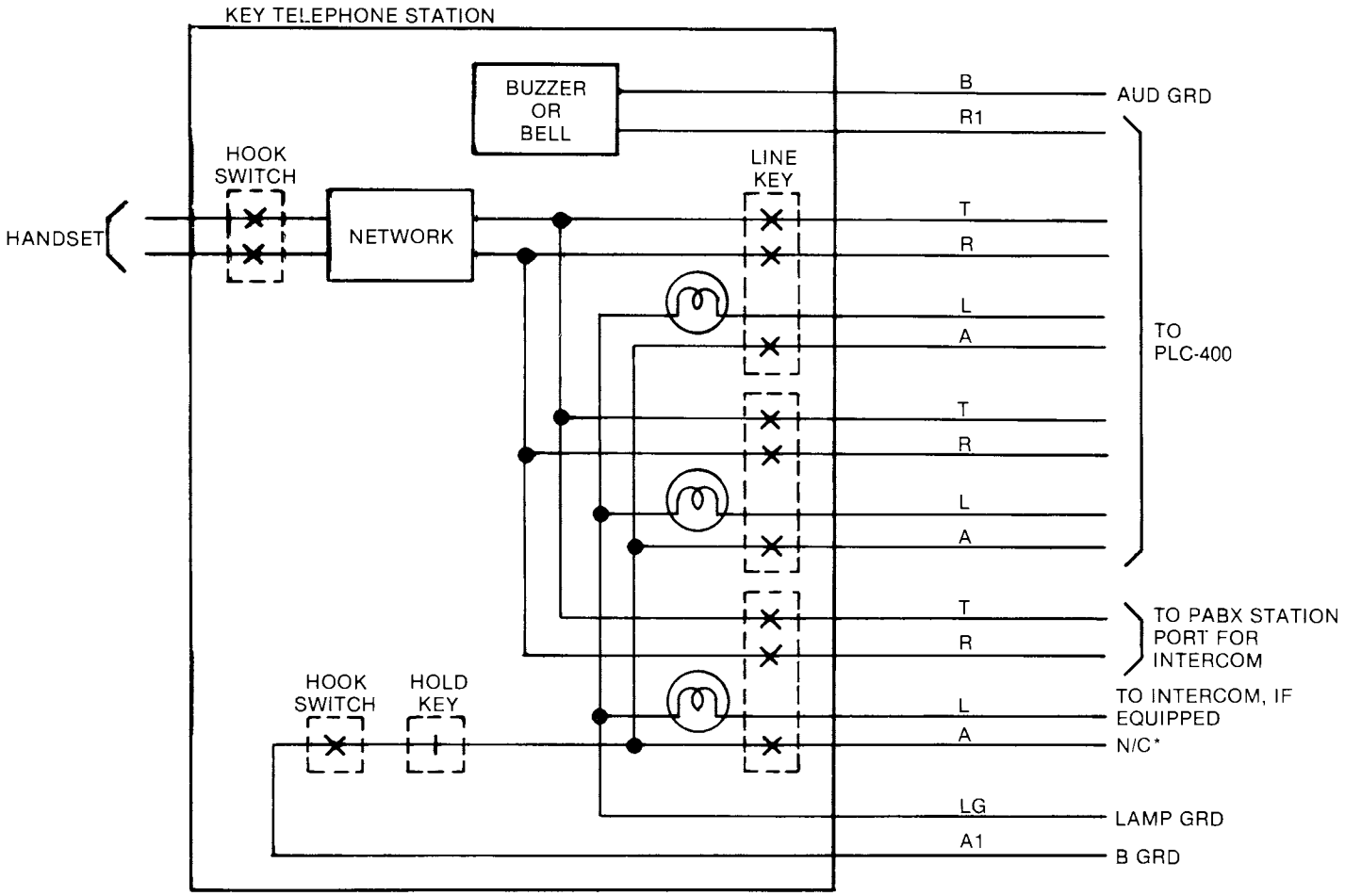



Fig. 5 — Typical Key Telephone Station Connections.

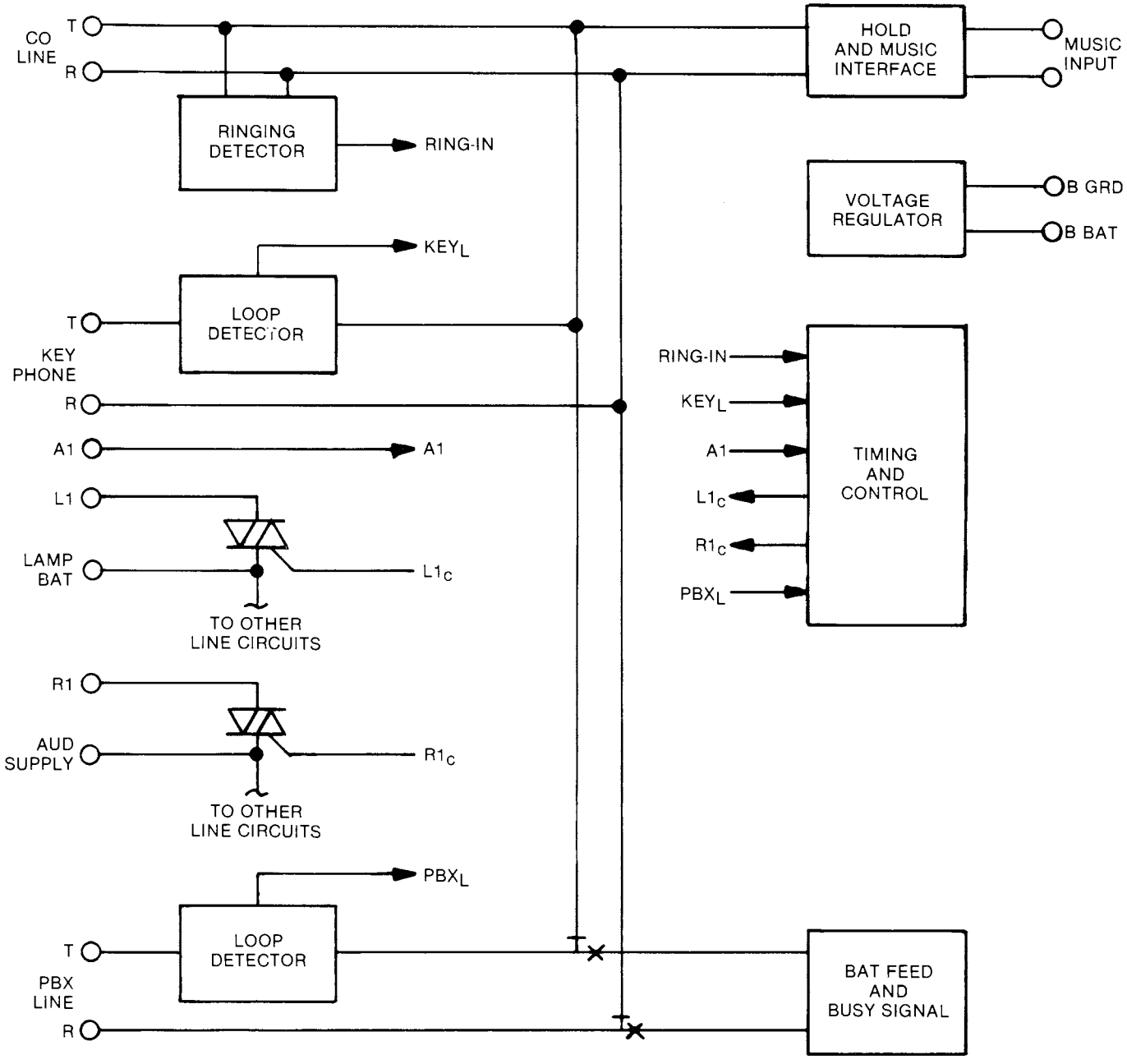



Fig. 6 — Functional Schematic of PLC-400 - Typical for 4 Lines.