Telecommunications Group

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# 3652–62 4-Wire E&M with PLR and ER Channel Unit
# 3652–68 4-Wire E&M with PLR and ER Channel Unit

® Complies with UL Standard 1459 Second Edition (3652–68 Only)*

CONTENTS PAGE



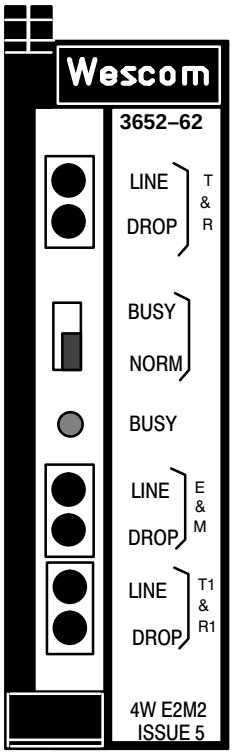


**Figure 1. 3652–62 4W E&M with PLR and ER (Issue 5) Channel Unit**

# 1. GENERAL

## 1.1 Document Purpose

This document provides information on the Charles Industries 3652–62 (Equipment Issue 5) and 3652–68 (Equipment Issue 6) 4-Wire E&M with PLR and ER (4W E&M/PLR) Channel Units. These channel units are used in the Charles Industries 360/363 D4 Digital Carrier Terminal. The 3652–62 is shown in Figure 1. Table 1 lists the 4W E&M/PLR channel units and those of the former issue which they replace.

***CAUTION**

**Field repairs/modifications may void compliance with UL 1459 — Second Edition.**

**Table 1. 4W E&M/PLR Channel Unit Cross Reference**

| Model | Issue | Description | Replaces | |
|---|---|---|---|---|
| | | | Model | Issue |
| 3652–62 | 5 | 4W E2M2 w/jacks, PLR, and ER | 3652–02<br>3652–12<br>3652–62 | 2<br>1<br>3 |
| 3652–68 | 6 | 4W E&M w/jacks, PLR, and ER | 3652–13 | 1 |

## 1.2 Document Status

This document is reprinted to include a general editorial update.

## 1.3 Equipment Function

## 1.4 Equipment Location/Mounting

Occupies one channel unit slot of a Charles Industries 360/363 D4 Digital Carrier Terminal.

## 1.5 Equipment Features

The 4W E&M/PLR channel units include the following features:

- Compliance with the specifications in AT&T Publication 43801
- Compliance with UL Standard 1459 Second Edition (3652–68 only)
- Front-panel NORM/BUSY switch
- Front-panel BUSY LED indicator
- Selectable Type I, II or III E&M or PLR signaling interface
- Prescription transmit and receive gain controls in 0.1dB steps
- Extended Range (ER) capability (+10dBm to –22.5dBm)
- Front-panel lifting jacks
- E&M reversal capability to accommodate office wiring and test equipment interfacing
- Automatic trunk processing during a carrier failure
- Additional set of E&M leads on the 3652–62

The 4W E&M/PLR channel units contain lifting jacks which provide access by breaking the line toward the DROP (trunk facility) and LINE (carrier facility). Jacks are provided on T&R, E&M, and T1&R1 leads.

## 2. INSPECTION

### 2.1 Inspect for Damages

Inspect the equipment thoroughly upon delivery. If the equipment has been damaged in transit, immediately report the extent of damage to the transportation company.

### 2.2 Equipment Identification

Charles Industries' equipment is identified by a model and issue number imprinted on the front panel or located elsewhere on the equipment. Each time a major engineering design change is made on the equipment, the issue number is advanced by 1 and imprinted on subsequent units manufactured. Therefore, be sure to include both the model number and its issue number when making inquiries about the equipment.

### 2.3 Static Concerns

Each channel unit is shipped in a static-protective carton to prevent electrostatic charges from damaging CMOS devices. A unit intended for future use should be tested as soon as possible and returned to its protective carton for storage. A protective carton can be identified by a black coating on the inside. Previously, Charles Industries used an uncoated carton and enclosed the channel unit in a black or brown static-protective plastic bag.

***CAUTION***

**Channel units contain sensitive electronic devices. Do not ship or store them near strong electrostatic, electromagnetic, magnetic, or radioactive fields. Use either the coated cartons or the protective bags with uncoated cartons for shipping or storage of channel units.**

## 3. APPLICATION GUIDELINES

The 4W E&M/PLR channel units allow versatility for use in many applications. These units provide switch-selectable E&M or PLR signaling and an E&M reversal switch to accommodate office wiring and test equipment interfacing for testing.

The 3652–62 (E2M2) provides an additional pair of E&M leads which can be used for tandem Foreign Exchange (FX) applications, alarm monitoring, or toll-ticketing.

Both the 3652–62 and 3652–68 can be used as universal spares for all 4W E&M or PLR channel units to cover a wide range of applications with maximum flexibility. Refer to Figure 2 through Figure 4 for typical applications.

### 3.1 Type I, II, III or PLR Signaling Interfacing

The signaling port of the 4W E&M channel units can be optioned for a Type I, II, or III interface. Type I is used when no ground potential exists between the trunk circuit and the carrier terminal. Type II is used when a difference in ground potential exists. Type III uses 3-wire balanced signaling leads for the M-lead, however; it relies on a return from the channel unit through ground for operating the E RELAY in the trunk circuit. The PLR signaling utilizes a negative battery to interface between the CO trunk circuit and the 4W E&M circuit. Refer to Figure 5 for the various interface applications.

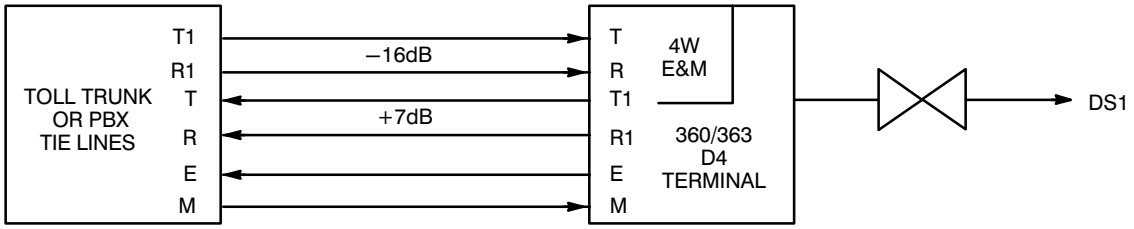


**Figure 2. Typical 4W E&M Application**

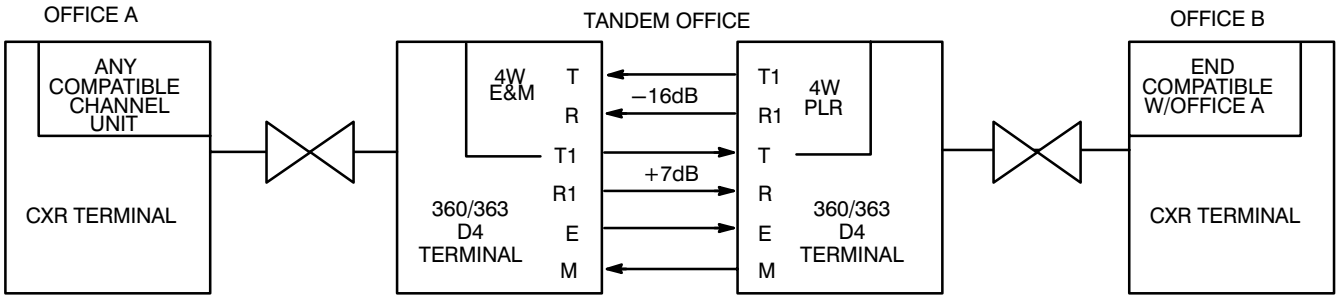


**Figure 3. Typical 4W PLR Application**

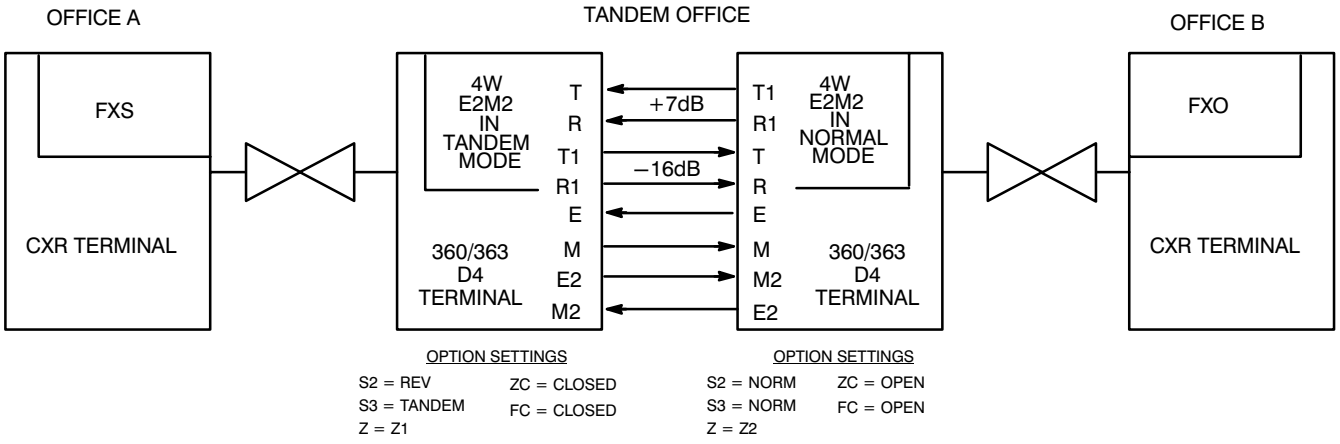


**Figure 4. Typical Tandem FX Application**

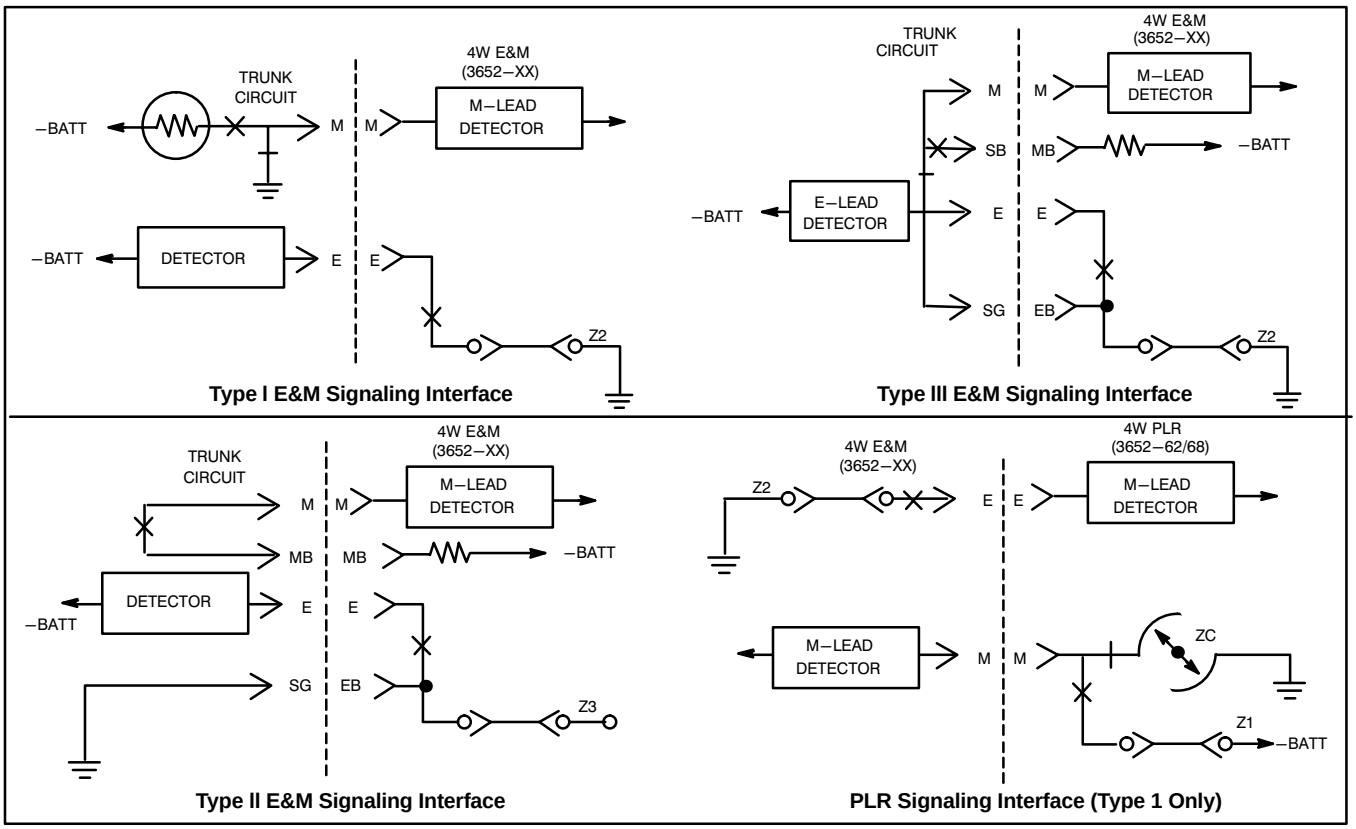


**Figure 5. Types I, II, III/PLR Signaling Interface**

# 4. CIRCUIT DESCRIPTION

Refer to Figure 6 and Figure 7 for the block diagrams, as needed, while reading the following circuit description. Notes are explained in Table 2.

## 4.1 Transmit Voice Path

Voice Frequency (VF) signals applied to the T&R leads (pins 50 and 48) are routed through transformer T1 to the XMT GAIN circuit.

The amplified VF signal is then applied to the XMT PRESCRIPTION GAIN circuit. This circuit provides up to 32.5dB of gain in increments of 0.1dB to accommodate input Transmission Level Points (TLPs) between –22.5dBm and +10dBm.

Following the XMT PRESCRIPTION GAIN circuit, the VF signal is passed to the XMT FILTER and the ENCODER circuits. The XMT FILTER attenuates frequencies outside the bandwidth of a standard voice channel and prevents it from passing into the ENCODER. The ENCODER converts the analog VF signal to a digital signal and applies it to the XDATA lead for transmission to the line.

## 4.2 Receive Voice Path

Digital signals received at the RDATA lead are applied to the DECODER and the RCV FILTER circuits for conversion to an analog signal and attenuation of frequencies outside the bandwidth of a standard voice channel. The output of the RCV FILTER circuit is routed to the RCV PRESCRIPTION GAIN.

The RCV PRESCRIPTION GAIN circuit provides up to 32.5dB of gain in increments of 0.1dB to accommodate output TLPs between –22.5dBm and +10dBm.

The RCV GAIN circuit amplifies the adjusted VF signal output from the RCV PRESCRIPTION GAIN circuit to the T1 and R1 leads (pins 8 and 7) via transformer T2.

## 4.3 Signaling

The channel unit's signaling path interfaces with the CO trunk circuit via the E- and M-leads (pins 4 and 45). The M-lead signal output by the CO trunk circuit passes through the NORM/BUSY switch and into the M-LEAD DETECTOR circuit.

### *4.3.1. E&M Signaling (Transmit)*

In E&M signaling, an off-hook condition (-battery) on the M-lead is applied to the M-LEAD DETECTOR circuit via the NORM/BUSY switch. This causes a logic 1 state to be transmitted by the ENCODER on both A and B signaling highways with the outgoing bit stream via the XDATA lead, indicating a busy condition on the channel circuit. An on-hook condition (ground/open) causes a logic 0 state to be transmitted with the outgoing bit stream and indicates a channel idle condition.

### *4.3.2. E&M Signaling (Receive)*

The information received via the carrier facility appears on the RDATA lead. An off-hook condition (logic 1 state on A signaling highway) detected by the DECODER circuit will cause the E RELAY to operate and the BUSY LED to illuminate, indicating a busy condition (ground or loop) on the E-lead. An on-hook condition (logic 0 state on A signaling highway) detected by the DECODER circuit will cause the E RELAY to release and the BUSY LED to extinguish, indicating an idle condition (open) on the E-lead.

### *4.3.3. E2M2 Signaling (3652–62 Only)*

The E&M signaling pair of the E2M2 channel unit operate in a similar manner as those described in Paragraphs 3.09 and 3.10, except the A and B signaling highways operate independently of each other. (M-lead signaling is applied to only the A highway; M2-lead signaling is applied to only the B highway). The E2 and M2 signaling pair can be used for tandem FX, alarm monitoring, or toll-ticketing applications, and utilizes –48V for the M2-lead busy status and ground or open for the M2-lead idle status.

### *4.3.4. M2-Lead Signaling (Transmit)*

A busy condition (-battery) applied to the M2-lead is routed to the M2-LEAD DETECTOR. The M2-LEAD DETECTOR circuit applies an input signal to the ENCODER, which causes a logic 1 state to be transmitted on the B highway with the outgoing bit stream via the XDATA lead. A ground or open applied to the M2-lead causes a logic 0 state to be transmitted with the outgoing bit stream.

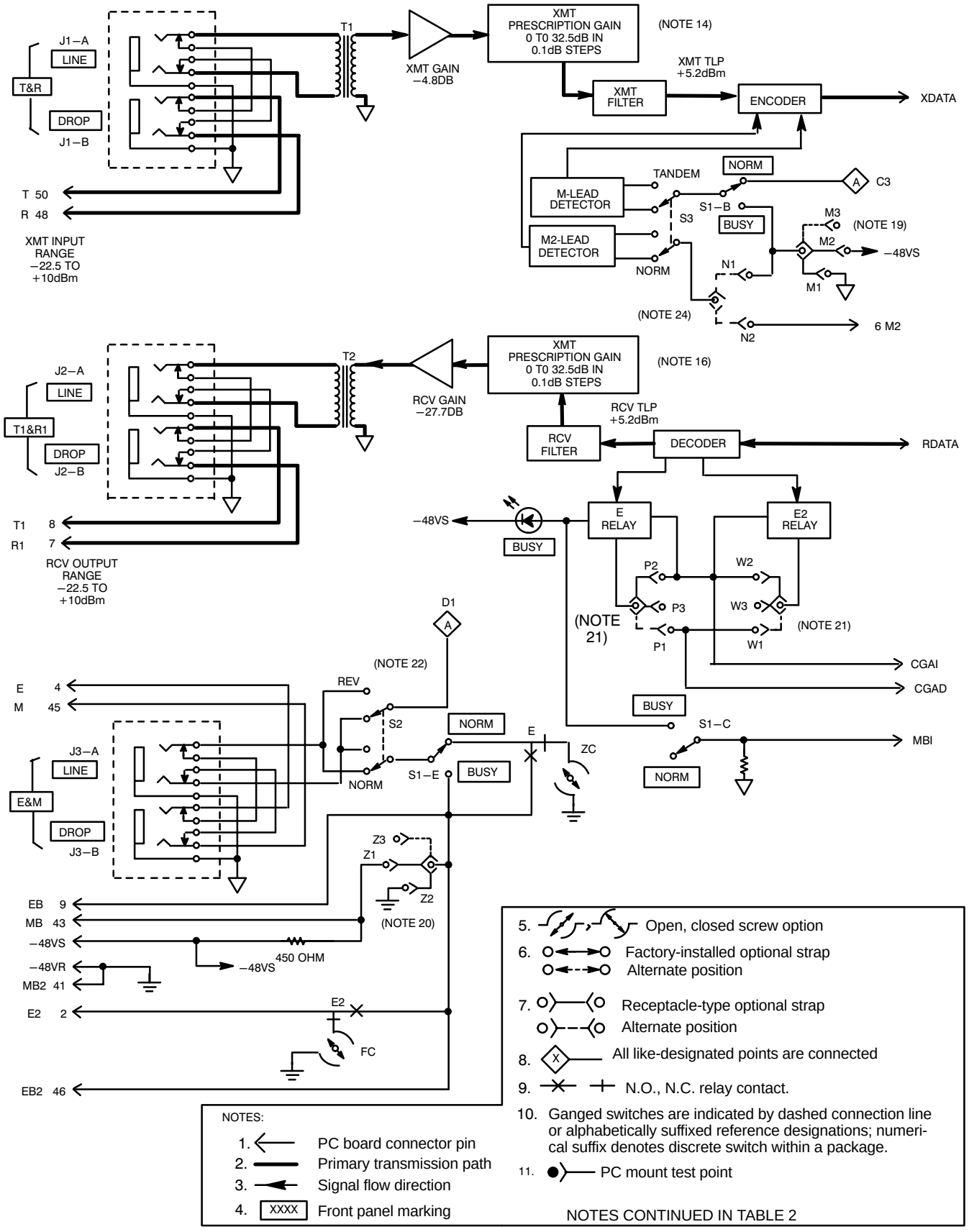


**Figure 6. 3652-62 4W E&M/PLR (Issue 5) Block Diagram**

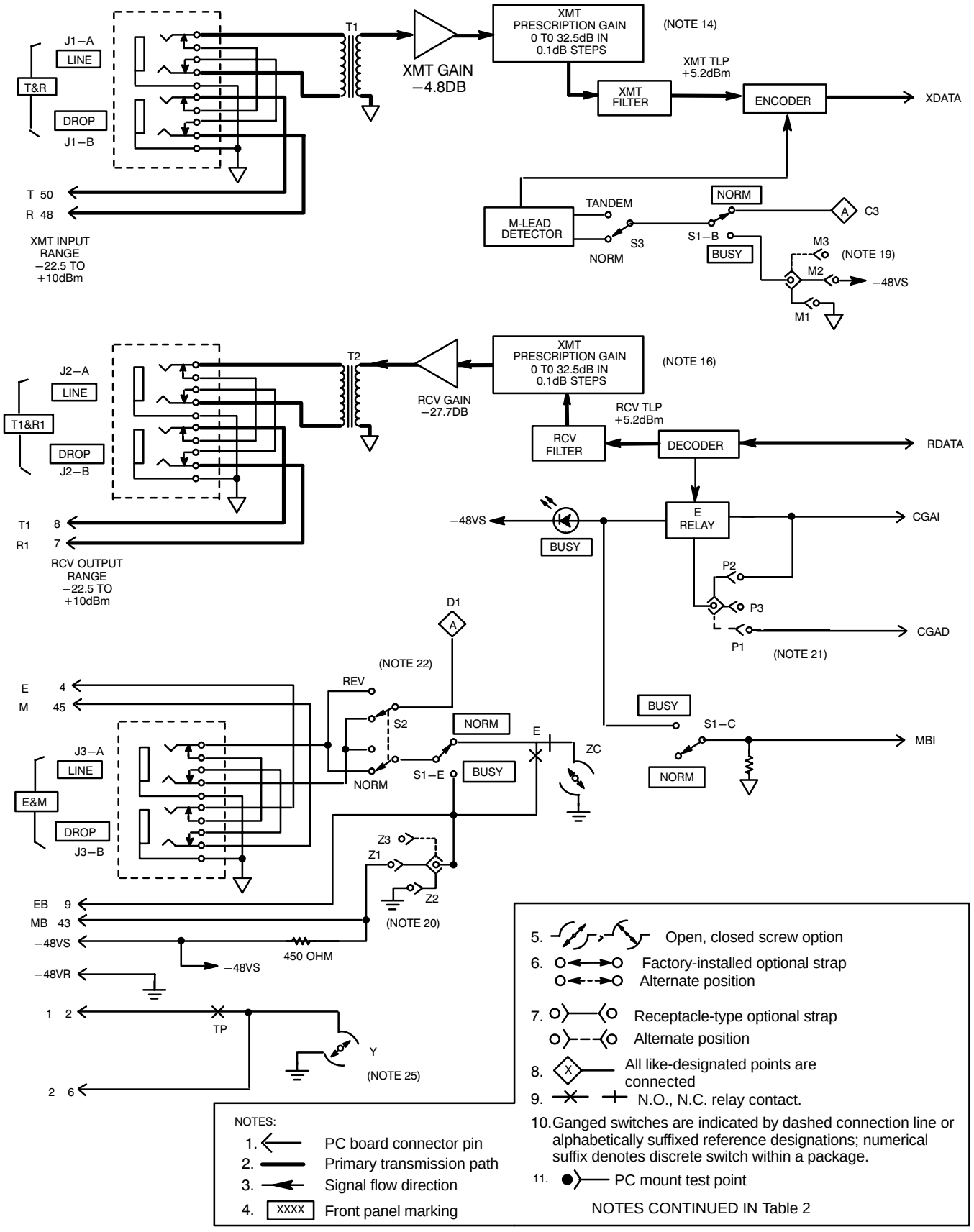


**Figure 7. 3652-68 4W E&M/PLR (Issue 6) Block Diagram**

## Table 2. Continuation of Notes for Figure 4 and Figure 5

<table>
<tr><th>#</th><th colspan="6">Note</th></tr>
<tr><td rowspan="8">12.</td><td colspan="6">PC mount test jacks</td></tr>
<tr><td colspan="4">Marking</td><td colspan="2">Access</td></tr>
<tr><td colspan="4">T&R Line, J1–A</td><td colspan="2">Towards channel unit</td></tr>
<tr><td colspan="4">T&R DROP, J1–B</td><td colspan="2">Towards office equipment</td></tr>
<tr><td colspan="4">T1&R1 Line, J2–A</td><td colspan="2">Towards channel unit</td></tr>
<tr><td colspan="4">T1&R1 Drop, J2–B</td><td colspan="2">Towards office equipment</td></tr>
<tr><td colspan="4">E&M Line, J3–A</td><td colspan="2">Towards channel unit</td></tr>
<tr><td colspan="4">E&M Drop, J3–B</td><td colspan="2">Towards office equipment</td></tr>
<tr><td>13.</td><td colspan="6">The XMT INPUT range at T&R: –22.5dBm to +10dBm. The unit is factory adjusted for –16dBm input with the XMT GAIN set to 26dB.</td></tr>
<tr><td rowspan="4">14.</td><td colspan="6">The XMT PRESCRIPTION circuit provides 32.5dB gain in 0.1dB steps to compensate for input level variations. Refer to the following:</td></tr>
<tr><td>INPUT (DBM)</td><td>+10</td><td>+7</td><td>0</td><td>–16</td><td>–22.5</td></tr>
<tr><td>XMT GAIN (DB)</td><td>0</td><td>3</td><td>10</td><td>26</td><td>32.5</td></tr>
<tr><td colspan="6">For normal mode (E&M) the XMT level is –16dBm nominal.<br>For tandem mode (PLR) the XMT level is +7dBm nominal.</td></tr>
<tr><td>15.</td><td colspan="6">The RCV OUTPUT range at T1&R1: –22.5dBm to +10dBm. The unit is factory adjusted for +7dBm output with the RCV GAIN set to 29.5dB.</td></tr>
<tr><td rowspan="4">16.</td><td colspan="6">The RCV PRESCRIPTION circuit provides 32.5dB gain in 0.1dB steps to compensate for output level variations. Refer to the following:</td></tr>
<tr><td>OUTPUT (DBM)</td><td>+10</td><td>+7</td><td>0</td><td>–16</td><td>–22.5</td></tr>
<tr><td>XMT GAIN (DB)</td><td>32.5</td><td>29.5</td><td>22.5</td><td>6.5</td><td>0</td></tr>
<tr><td colspan="6">For normal mode (E&M) the RCV level is +7dBm nominal.<br>For tandem mode (PLR) the RCV level is –16dBm nominal.</td></tr>
<tr><td>17.</td><td colspan="6">Busy switch:<br>Switch handle down is NORM (normal) position.<br>Switch handle up is BUSY (busy) position.<br>Busy switch performs the following functions:<br>Disconnect M-lead (E-lead in tandem mode) from the office equipment.<br>Turn on BUSY LED on front edge of units.<br>Applies a busy condition on the E-lead (M-lead for tandem mode) to the office equipment.<br>Send a busy condition to the far end. This function can be disabled by connecting option M to M3.<br>Provide a manual busy indication to the alarm and logic units.</td></tr>
<tr><td rowspan="4">18a.</td><td colspan="6">For 3652–62: M-lead conditions:</td></tr>
<tr><td colspan="2">Mode</td><td colspan="2">M-Lead Conditions</td><td colspan="2">Switch Setting</td></tr>
<tr><td colspan="2">Normal</td><td colspan="2">Busy: Battery<br>Idle: Open or Ground</td><td colspan="2">S2 NORM<br>S3 NORM</td></tr>
<tr><td colspan="2">Tandem (PLR)</td><td colspan="2">Busy: Battery<br>Idle: Open (ZC&FC open)<br>Ground (ZC&FC closed)</td><td colspan="2">S2 Rev<br>S3 Tandem<br>Connect Z to Z1 (EB resistance battery)</td></tr>
<tr><td></td><td colspan="6">The MB-lead (Pin 43) provides resistance battery which may be returned to the M-lead through an office contact for a Type II interface.</td></tr>
<tr><td rowspan="4">18b.</td><td colspan="6">For 3652–68: M-lead conditions:</td></tr>
<tr><td colspan="2">Mode</td><td colspan="2">M-Lead Conditions</td><td colspan="2">Switch Setting</td></tr>
<tr><td colspan="2">Normal</td><td colspan="2">Busy: Battery<br>Idle: Open or Ground</td><td colspan="2">S2 NORM<br>S3 NORM</td></tr>
<tr><td colspan="2">Tandem (PLR)</td><td colspan="2">Busy: Battery<br>Idle: Open (ZC open)<br>Ground (ZC closed)</td><td colspan="2">S2 Rev<br>S3 Tandem<br>Connect Z to Z1 (EB resistance battery)</td></tr>
<tr><td colspan="6">The MB-lead (Pin 43) provides resistance battery which may be returned to the M-lead through an office contact for a Type II interface.</td></tr>
<tr><td>19.</td><td colspan="6">Connect option M to M2 when using the busy switch to send a busy condition to the far end in the norm mode. Connect option M to M1 when sending a busy condition in the tandem mode. This function is disabled by putting M to M3. M3 is selected when performing signaling tests on a looped channel bank or when performing single channel maintenance routines on an operating system.</td></tr>
</table>

<table>
<tr><th>#</th><th>Note</th></tr>
<tr><td>20a.</td><td>For 3652–62: E-lead conditions: (Both E, E2)<br><br>BUSY: Leads E & EB, E2 & EB2 shorted<br>IDLE: Leads E & EB, E2 & EB2 open<br>For Types I & III trunk, connect Z to Z2 (EB & EB2 grounded)<br>For Type II trunk, connect Z to Z3 (E/E2 & EB/EB2 dry contact)<br>Tandem Mode: Busy, Ground; Idle, open</td></tr>
<tr><td>20b.</td><td>For 3652–68: E-lead conditions:<br><br>BUSY: Leads E & EB shorted<br>IDLE: Leads E & EB open<br>For Types I & III trunk, connect Z to Z2 (EB grounded)<br>For Type II trunk, connect Z to Z3 (E & EB dry contact)<br>Tandem Mode: Busy, Ground; Idle, open</td></tr>
<tr><td>21a.</td><td>For 3652–62: Options P and W are used to select the proper idle out/busy out sequence of the E-leads (M-leads for tandem mode) when Carrier Group Alarm (CGA) is activated due to an alarm condition in the channel bank.
<table>
<tr><th>E-Lead Sequence</th><th>Option Condition</th></tr>
<tr><td>E-lead idled out immediately upon CGA.</td><td>Connect P TO P3</td></tr>
<tr><td>E-lead busied out immediately upon CGA.</td><td>Connect P TO P2</td></tr>
<tr><td>E-lead idled out immediately upon CGA and busied out after 2.5 sec.</td><td>Connect P TO P1</td></tr>
<tr><td>E2-lead idled out immediately upon CGA.</td><td>Connect W TO W3</td></tr>
<tr><td>E2-lead busied out immediately upon CGA.</td><td>Connect W TO W2</td></tr>
<tr><td>E2-lead idled out immediately upon CGA. Busy 2.5 seconds later.</td><td>Connect W TO W1</td></tr>
</table></td></tr>
<tr><td>21b.</td><td>For 3652–68: Option P is used to select the proper idle out/busy out sequence of the E-lead (M-lead for tandem mode) when Carrier Group Alarm (CGA) is activated due to an alarm condition in the channel bank.
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<tr><th>E-Lead Sequence</th><th>Option Condition</th></tr>
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<tr><td>E-lead idled out immediately upon CGA and busied out after 2.5 sec.</td><td>Connect P TO P1</td></tr>
</table></td></tr>
<tr><td>22.</td><td>Switch S2 provides E-and M-lead reversal.
<table>
<tr><td>M-LEAD TO PIN 45 (J3 RING)</td><td rowspan="2">S2 NORM</td><td rowspan="2"></td></tr>
<tr><td>E-LEAD TO PIN 4 (J3 TIP)</td></tr>
</table></td></tr>
<tr><td>23a.</td><td>For 3652–62: When the channel unit is removed from its mounting slot, the E-lead (Pin 4) and the E2-lead (Pin 2) are grounded through a shorting contact in the backplane connector. A busy condition is transmitted to both far-end E-leads.</td></tr>
<tr><td>23b.</td><td>For 3652–68: When the channel unit is removed from its mounting slot, the E-lead (Pin 4) is grounded through a shorting contact in the backplane connector. A busy condition is transmitted to the far-end E-lead.</td></tr>
<tr><td>24.</td><td>For 3652–62: A busy condition may be sent to the far-end E2- lead for test purposes by connecting option N to N1. This disconnects the office M2-lead and busies the far-end E2-lead. Connect option N to N2 for normal operation.</td></tr>
<tr><td>25.</td><td>For 3652–68: Trunk process relay is activated immediately due to an alarm condition in the channel bank. Two seconds later it is deactivated for 70 milliseconds and again activated. During the activated mode, leads designated as 1 and 2 are shorted:<br><br>Lead 2 Ground: Close Y<br><br>Lead 2 Open: Open Y</td></tr>
<tr><td>26.</td><td>For 3652–68: When the channel unit is removed from its mounting slot, the lead designated as 1 (Pin 2) is grounded through a shorting contact in the card connector.</td></tr>
</table>

### *4.3.5. E2-Lead Signaling (Receive)*

The information received via the carrier facility appears on the RDATA lead. A logic 1 detected by the DECODER circuit on the B highway will cause the E2 RELAY to operate, looping the E2-lead to the EB-lead. A logic 0 on the B highway will cause the E2 RELAY to release, applying an open condition on the E2-lead.

### *4.3.6. PLR Signaling (Transmit)*

In PLR signaling, an E&M channel unit and a PLR channel unit are operated back-to-back to link two carrier facilities. When in tandem mode, an off-hook condition (ground or loop) on the E-lead of the PLR is applied to the m-lead DETECTOR circuit via the NORM/BUSY switch. This causes a logic 1 state to be transmitted on both A and B highways for the 3652–68 (only the A highway on the 3652–62) by the ENCODER circuit with the outgoing bit

stream via the XDATA lead, indicating a busy condition on the channel circuit. An on-hook condition (open) causes a logic 0 state to be transmitted with the outgoing bit stream and indicates a channel idle condition. On the 3652–62, the M2-LEAD DETECTOR will cause a logic 1 to be transmitted on the B highway for a ground condition on the M2-lead, and a logic 0 to be transmitted for an open on the M2-lead.

#### *4.3.7. PLR Signaling (Receive)*

The information received from the carrier facility appears on the RDATA lead of the PLR channel unit. A busy condition (logic 1 state on A signaling highway) detected by the DECODER circuit will cause the E RELAY to operate, the BUSY LED to illuminate, and the off-hook (-battery) signal to be applied to the M-lead of the PLR channel unit. An idle condition (logic 0 state on A signaling highway) detected by the DECODER circuit will cause the E RELAY to release, the BUSY LED to extinguish, and the on-hook (ground or open) signal to be applied to the M-lead of the PLR channel unit. On the 3652–62, when a logic 1 is detected on the B signaling highway, the DECODER will cause the E2 RELAY to operate, applying a -battery condition on the E2-lead. When a logic 0 is detected, the E2-RELAY does not operate, applying a ground or open on the E2-lead.

### 4.4 NORM/BUSY Switch

In the NORM position, the NORM/BUSY switch provides continuity between the E&M leads and the signaling interface circuitry within the 4W E&M/PLR. In the BUSY position, this switch disconnects the M-lead from the signaling circuitry, sends an off–hook signal to the opposite end of the carrier facility, illuminates the BUSY LED, and provides an output signal on the Make Busy Indicator (MBI) lead to light the BUSY LED on the Alarm Logic Unit (ALU) as a reminder that a channel unit within the digroup has been manually busied.

### 4.5 Trunk Processing During a Carrier Failure

When an alarm condition is detected, the ALU sends an output signal to the Carrier Group Alarm Immediate (CGAI) lead on the 4W E&M/PLR. After 2.5 seconds, the ALU sends a signal on the Carrier Group Alarm Delayed (CGAD) lead. These signals control the state of the E-lead sent toward the trunk circuit during a carrier failure. One of three trunk processing modes can be selected: E-lead to transmit an idle state then change to a busy state 2.5 seconds later; E-lead to transmit a busy state; or the E-lead to transmit an idle state. On the 3652–62, one of the three trunk processing modes also occurs on the E2-lead.

*Note: When the channel unit is optioned for tandem mode, the E-lead and M-lead are reversed.*

The Trunk Processing (TP) relay (3652–68 only) provides a set of dry contacts between pins 2 and 6 (1-lead and 2-lead) of the module connector. During a carrier failure, the TP relay is activated by a signal on the Carrier Group Alarm Wink (CGAW) lead that causes the contacts to close, wink open for 70 milliseconds after 2.5 seconds, then close again. The 2-lead can be grounded (optionable) to provide a switched ground output on the 1-lead.

When the channel unit is removed from its mounting position, the 1-lead/E2-lead (Pin 2) and the E-lead (Pin 4) are grounded through a shorting contact in the card connector, and an all-ones quiet busy code is transmitted to the far-end terminal.

## 5. MOUNTING

The 3652–62/68 mounts in one channel unit slot of a 360/363 D4 terminal. The 3652/68 is equipped with an insert/eject lever in the form of a hinged front panel which ensures a positive connection of the channel unit's card-edge connector to the backplane connector when the unit is installed. The insert/eject lever also facilitates removal of the unit.

***CAUTION***

**Installation and removal of modules should be done with care. Do not force a module into place. If excessive resistance is encountered while installing a module, remove the module and check the card guide and connector to verify proper alignment and the absence of foreign material.**

Align the channel unit with the appropriate card-guided slot of the terminal. Slide the unit into the slot with the front panel in a horizontal (up) position. When the top portion of the hinged front panel is under the front lip of the terminal, push down on the front panel until it is in the vertical (down) position. The channel unit's card-edge connector will begin to make contact with the inner portion of the backplane connector. Continue applying light pressure onto the bottom edge of the front panel until the unit snaps into place.

## 6. INSTALLER CONNECTIONS

Electrical connections for the channel unit are made by wire-wrapping leads onto the associated 50-pin connectors located on the backplane of the 360/363 D4 terminal. When installing a 3652–62/68 channel unit into a non-connectorized 360/363 D4 terminal (00-suffixed), make the required connections as shown in Table 3. On connectorized 360/363 D4 terminals (360–10, –11, etc.), connections are made via 25-pair female connectors (CINCH 222–22–50–023 or equivalent) to the appropriate 25-pair male connectors of the 360/363 D4 terminal. Refer to Section 360–000–200 for the wiring diagrams of the female connectors with respect to the 360/363 D4 terminal being utilized.

## 7. OPTIONS

The 3652–62 and 3652–68 channel units are equipped with push-on jumpers, DIP switches, and screw options that are used to condition the module for proper application and operation. Refer to Figure 8 and Table 4 for option locations and a brief summary of the option conditioning requirements.

*Note: When opening a screw option, rotate the screw counterclockwise two full turns to ensure that the connection is open. When closing a screw option, rotate the screw clockwise until it seats. When selecting the push-on jumper options, push the jumper over the appropriate pins within that option grouping to obtain the desired operation.*

### 7.1 Switch S1 – NORM/BUSY

Place the NORM/BUSY switch to the NORM position to condition the channel unit for normal operations. Place the NORM/BUSY switch to the BUSY position when testing or aligning the channel unit.

### 7.2 Switch S2 – NORM/REV and Switch S3 – NORM/TANDEM

For E&M signaling, place switches S2 and S3 to NORM. For PLR signaling, place switch S2 to REV and switch S3 to TANDEM. Switch S2 reverses the E&M leads to E on pin 45 (ring of the E&M jacks) and M to pin 4 (tip of the E&M jacks) to accommodate central office wiring in the tandem mode of operation. S2 also interfaces the use of standard test sets when in the tandem mode. Note that S2 does not affect the E2 and M2 leads, and that S3 does not affect the VF levels. With the ER feature, nominal PLR levels are within the adjustment range capability of S4 and S5 (Prescription Gain Controls.)

**Table 3. 3652–62/68 Installer Connections**

| Lead Designations | | Pin |
|---|---|---|
| Tip-transmit | T | 50 |
| Ring-transmit | R | 48 |
| Tip 1-receive | T1 | 8 |
| Ring 1-receive | R1 | 7 |
| E-lead signaling | E | 4 |
| E Battery-Type II signaling | EB | 9 |
| M-lead signaling | M | 45 |
| M Battery-Type II signaling | MB | 43 |
| Second E-lead as required | E2* | 2 |
| Second M-lead as required | M2* | 6 |
| Make Busy Lead 1 | 1 | 2 |
| Make Busy Lead 2 | 2 | 6 |
| Second E Battery lead-as required | EB2* | 46 |
| Second M Battery lead-as required | MB2* | 41 |
| Make these connections as required when installing the 3652–62 (E2M2) channel unit. | | |

### 7.3 Switch S4 – Prescription Gain

S4 provides up to 1.5dB of gain in increments of 0.1dB to accommodate various input and output TLPs. To obtain the correct operating levels, select switches S4–1 through S4–4 (0.1, 0.2, 0.4, and 0.8dB) in proper combination to adjust the RCV path and switches S4–5 through S4–8 (0.1, 0.2, 0.4, and 0.8dB) in proper combination to adjust the XMT path.

### 7.4 Switch S5 – Prescription Gain

S5 provides up to 31dB of gain in increments of 1dB to accommodate various input and output office TLPs. To obtain the correct operating levels, select switches S5–1 through S5–5 (1, 2, 4, 8, and 16dB) in proper combination with switches S4–1 through S4–4 to adjust the RCV path and switches S5–6 through S5–10 (1, 2, 4, 8, and 16dB) in proper combination with switches S4–5 through S4–8 to adjust the XMT path. A total of 32.5dB of gain is provided to each path when all the switches of S4 and S5 are ON.

### 7.5 Push-On Jumper Option M1/M2/M3 (M-Lead Conditioning)

To arrange a busy condition to the far-end terminal when the NORM/BUSY switch is in the BUSY position, place option M in the M2 position for E&M and in the M1 position for PLR. Connecting M to the M3 position disables the busy function to the far-end by operation of the NORM/BUSY switch and accommodates testing functions.

### 7.6 Push-On Jumper Option N1/N2 (M2-Lead Conditioning) – 3652–62 Only

To condition the M2-lead for normal E2M2 operation, place option N in the N2 position. To perform tests on the M2-lead, place option N in the N1 position. This will disconnect the office M2-lead and send a busy condition to the far-end.

### 7.7 Push-On Jumper Option P1/P2/P3 (E-Lead Conditioning) and W1/W2/W3 (E2-Lead Conditioning 3652-62 Only) Trunk Processing During a Carrier Failure

To condition the E-lead (M-lead for tandem mode) to go idle then busy 2.5 seconds later during an alarm condition, place option P in the P1 position. To condition the E-lead to go busy during an alarm condition, place option P in the P2 position. To condition the E-lead to go idle during an alarm condition, place option P in the P3 position. Push-on jumper option W (3652–62 only) conditions the E2-lead and is optioned similar to option P.

### 7.8 Screw Option Y (3652–68 Only) Auxiliary Trunk Processing

Screw option Y determines the state of an auxiliary set of contacts between pins 2 and 6 (1-lead and 2-lead, respectively) during trunk processing. To provide a balanced (floating) contact closure between the 1-lead and 2-lead, open option Y. To provide a switched ground output on the 1-lead and a ground on the 2-lead, close option Y.

### 7.9 Push-On Jumper Option Z1/Z2/Z3 (Types I, II, III or PLR Signaling Interface)

To condition the channel unit for an E&M Type I or Type III signaling interface, place option Z to Z2. To condition the channel unit for an E&M Type II signaling interface, place option Z to Z3. To condition the channel unit for PLR signaling in tandem mode, place option Z to Z1.

### 7.10 Screw Option ZC and FC (E-Lead/E2-Lead Conditioning)

Option ZC determines the idle condition of the M-lead in tandem mode. For an open on the M-lead (Type II), open ZC. For a ground on the M-lead (Types 1 and III), close ZC. Option FC (3652–62 only) determines the idle condition of the E2-lead and is optioned similar to option ZC. For normal mode operation, open options ZC and FC.

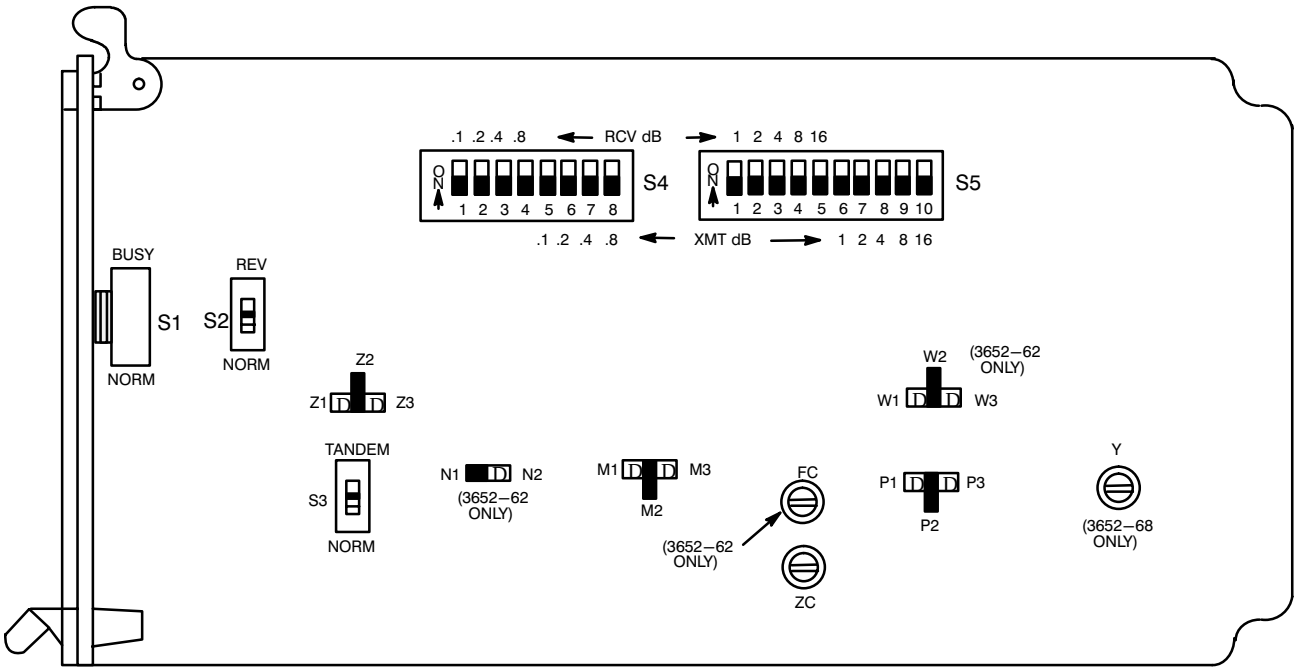


**Figure 8. 3652-62 and 3652-68 Option Locations**

**Table 4. Description of Figure 8**

| Option | Position | Function/Remarks |
|---|---|---|
| S1 | NORM | Normal channel unit operation |
| | BUSY | Busy out channel unit for out-of-service testing |
| S2 | NORM | Normal mode (E&M signaling) |
| | REV | Tandem mode (PLR signaling) — Reverses the E and M leads to accommodate office wiring and test equipment |
| S3 | NORM | Normal mode (E&M signaling) S2 must be in the NORM position |
| | TANDEM | Tandem mode (PLR signaling) S2 must be in the REV position |
| S4 | ON or OFF | Provide up to 1.5dB of gain to the transmit and receive path when all the switches of S4 are ON. |
| S5 | ON or OFF | Provide up to 32.5dB of gain to the transmit and receive path when all the switches of S4 and S5 are ON. |
| M (3–way push on jumper) | M1 | Tandem mode - Conditions the far end to receive a busy when NORM/BUSY switch is in BUSY |
| | M2 | E&M mode - Conditions the far end to receive a busy when NORM/BUSY switch is in BUSY |
| | M3 | Disables busy function to far end when NORM/BUSY switch is in BUSY |
| N | N1 | Condition the far end E2-lead to receive a busy and disconnect office M2 for testing |
| | N2 | Normal E2M2 channel unit operation |
| P (3–way push on jumper) | P1 | Condition the E-lead (M-lead for tandem mode) to go idle then busy after 2.5 seconds during a carrier failure |
| | P2 | Condition the E-lead (M-lead for tandem mode) to go busy during a carrier failure |
| | P3 | Condition the E-lead (M-lead for tandem mode) to go idle during a carrier failure |

| Option | Position | Function/Remarks |
|---|---|---|
| W (3652–62 only) | W1 | Condition the E2-lead to go idle then busy after 2.5 seconds during a carrier failure |
| | W2 | Condition the E2-lead to go busy during a carrier failure |
| | W3 | Condition the E2-lead to go idle during a carrier failure |
| Y (3652–68 only) | OPEN | Balanced contact closure between the 1-lead and 2-lead |
| | CLOSED | Switched ground output on the 1-lead and a ground on the 2-lead |
| Z (3–way push on jumper) | Z1 | Tandem mode — M-lead conditioning<br>Busy M-lead: Battery<br>Idle M-lead: Open (screw option ZC open)<br>Ground (screw option ZC closed) |
| | Z2 | E&M mode — E-lead conditioning<br>Type I/III E&M Signaling Interface (EB grounded) |
| | Z3 | E&M mode - E-lead conditioning<br>Type II Signaling Interface (E and EB dry contact)<br>Busy E-lead: E and EB shorted<br>Idle E-lead: E and EB open |
| ZC | OPEN | Normal mode E-lead signaling (open for idle) |
| | CLOSED | Tandem mode M-lead signaling (ground for idle) |
| FC (3652–62 only) | OPEN | E2-lead signaling (open for idle) |
| | CLOSED | E2-lead signaling (ground for idle) |

## 8. ALIGNMENT

### 8.1 Transmit Alignment

The XMT PRESCRIPTION GAIN switches (half of S4 and half of S5) are used together to provide up to 32.5dB of prescription gain in increments of 0.1dB to accommodate an input TLP range from +10.0 to –22.5dBm. To adjust the transmit path to the proper operating level, the difference between +10.0 and the transmit TLP at T&R must be obtained.

[XMT GAIN = (+10.0) –TLP]

For an input TLP of –22.5dBm, the XMT GAIN = (+10.0) - (–22.5) = 32.5dB. Set the sum of the switch settings on S4–5 through S4–8 and S5–6 through S5–10 to 32.5.

### 8.2 Receive Alignment

The RCV PRESCRIPTION GAIN switches (half of S4 and half of S5) are used together to provide up to 32.5dB of prescription gain in increments of 0.1dB to accommodate an output TLP range from +10.0 to –22.5dBm. To adjust the receive path to the proper operating level, the difference between the receive TLP at T1&R1 and –22.5 must be obtained.

[RCV GAIN = TLP – (–22.5)]

For an output of TLP of –16.0dBm, the RCV GAIN = (–16.0) - (–22.5) = 6.5dB. Set the sum of the switch settings on S4–1 through S4–4 and S5–1 through S5–5 to 6.5.

## 9. TESTING

After completing Parts 4 through 8, place a call end-to-end through the facility to verify proper operation. If trouble is encountered, recheck all installer connections, options and alignment settings, and verify that the channel unit is making positive connection to the backplane connector. If trouble persists, replace the unit with a similar unit known to be in proper operating order and retest the facility. Channel unit testing for fault diagnosis or verification of circuit operation is provided in Section 360–001–205.

## 10. TECHNICAL ASSISTANCE

If technical assistance is required, contact Charles Industries' Technical Services Center at:

847–806–8500
847–806–8556 (FAX)
800–607–8500
techserv@charlesindustries.com (e-mail)

## 11. WARRANTY & CUSTOMER SERVICE

### 11.1 Warranty

Charles Industries, Ltd. offers an industry-leading, 5-year warranty on products manufactured by Charles Industries. Contact your local Sales Representative at the address or telephone numbers below for warranty details. The warranty provisions are subject to change without notice. The terms and conditions applicable to any specific sale of product shall be defined in the resulting sales contract.

Charles Industries, Ltd.
5600 Apollo Drive
Rolling Meadows, Illinois 60008–4049
847–806–6300 (Main Office)
847–806–6231 (FAX)

### 11.2 Field Repairs (In-Warranty Units)

Field repairs involving the replacement of components within a unit are not recommended and may void the warranty and compatibility with any applicable regulatory or agency requirements. If a unit needs repair, contact Charles Industries, Ltd. for replacement or repair instructions, or follow the *Repair Service Procedure* below.

### 11.3 Advanced Replacement Service (In-Warranty Units)

Charles Industries, Ltd. offers an "advanced replacement" service if a replacement unit is required as soon as possible. With this service, the unit will be shipped in the fastest manner consistent with the urgency of the situation. In most cases, there are no charges for in-warranty repairs, except for the transportation charges of the unit and for a testing and handling charge for units returned with no trouble found. Upon receipt of the advanced replacement unit, return the out-of-service unit in the carton in which the replacement was shipped, using the pre-addressed shipping label provided. Call your customer service representative at the telephone number above for more details.

### 11.4 Standard Repair and Replacement Service (Both In-Warranty and Out-Of-Warranty Units)

Charles Industries, Ltd. offers a standard repair or exchange service for units either in- or out-of-warranty. With this service, units may be shipped to Charles Industries for either repair and quality testing or exchanged for a replacement unit, as determined by Charles Industries. Follow the *Repair Service Procedure* below to return units and to secure a repair or replacement. A handling charge applies for equipment returned with no trouble found. To obtain more details of this service and a schedule of prices, contact the CI Service Center at 217–932–5288 (FAX 217–932–2943).

*Repair Service Procedure*

1. Prepare, complete, and enclose a purchase order in the box with the equipment to be returned.

2. Include the following information:

   – Company name and address
   – Contact name and phone number
   – Inventory of equipment being shipped
   – Particulars as to the nature of the failure
   – Return shipping address

3. Ship the equipment, purchase order, and above-listed information, transportation prepaid, to the service center address shown below.

   CI Service Center
   Route 40 East
   Casey, IL 62420–2054

4. Most repaired or replaced units will be returned within 30 or 45 days, depending on the product type and availability of repair parts. Repaired units are warranted for either 90 days from the date of repair or for the remaining unexpired portion of the original warranty, whichever is longer.

## 12. SPECIFICATIONS

### 12.1 Electrical

The electrical characteristics of the 3652-62 and 3652-68 are as follows:

#### *12.1.1. Transmission (Single-Ended)*

(a) PERMISSIBLE MODE: 4T-4T.

(b) 4-WIRE IMPEDANCE: 600 ohms.

(c) LINE SIDE LEVELS: Transmit (fixed), +5.2dBm TLP; receive (fixed), +5.2dBm TLP.

(d) DROP SIDE LEVELS: Transmit input, –22.5dBm minimum, +10.0dBm maximum; receive output, –22.5dBm minimum, +10.0dBm maximum.

(e) 1000Hz GAIN: Transmit (fixed), –4.8dB; receive (fixed), –27.7dB.

(f) ADJUSTABLE GAIN: Transmit, 0.0dB minimum, 32.5dB maximum in 0.1dB steps; receive, 0.0dB minimum, 32.5dB maximum in 0.1dB steps.

(g) TRANSMIT AND RECEIVE PATH FREQUENCY RESPONSE (REFERENCED AT 1kHZ):

| Frequency (Hz) | XMT (dB) | RCV (dB) |
|---|---|---|
| 60 | –14 maximum | — |
| 200 | +0.15 to –2 | 0 to –1 |
| 300 | +0.15 to –0.15 | +0.15 to –0.15 |
| 1000 | 0 (REF) | 0 (REF) |
| 3000 | +0.15 to –0.15 | +0.15 to –0.15 |
| 3400 | 0 to –1.5 | 0 to –1.5 |
| 4000 | –14 maximum | –14 maximum |
| 4600 | –32 maximum | –28 maximum |

(h) TRANSMIT/RECEIVE IDLE NOISE: 20dBrnC0.

(i) LEVEL TRACKING: –37 to +3dBm0, ±0.25dB; –50 to –37dBm0, ±0.5dB.

(j) M-LEAD RESISTANCE: 1000 ohms maximum.

(k) LOSS STABILITY: ±0.5dB.

(l) RETURN LOSS AT NOMINAL IMPEDANCE: 28dB minimum at 1kHz; 23dB minimum at 300Hz to 3kHz.

(m) ENVELOPE DELAY DISTORTION:

| Frequency (Hz) | Delay Distortion |
|---|---|
| 1150 to 2300 | 60usec |
| 1000 to 2500 | 90usec |
| 800 to 2700 | 120usec |

(n) DIAL PULSE DISTORTION: 12pps at 60 percent break, ±2 percent.

(o) LONGITUDINAL BALANCE (REFERENCED TO –16dBm TLP):

| Frequency (Hz) | dB |
|---|---|
| 200 | 86 minimum |
| 1000 | 80 minimum |
| 3000 | 78 minimum |

(p) SINGLE FREQUENCY DISTORTION: –28dBm0 at 0 to 12kHz; –40dBm0 at1020Hz.

(q) SIGNAL-TO-DISTORTION RATIO AT 1020Hz:

| Signal | Signal-To-Distortion Ratio (dB) |
|---|---|
| 0 to –30dBm0 | 35 minimum |
| –40dBm0 | 29 minimum |
| –45dBm0 | 25 minimum |

(r) TLP RANGES: Transmit, –22.5 to +10dBm; receive, –22.5 to +10dBm.

(s) OPERATING ENVIRONMENT: Temperature, 32° to 122°F (0° to 50°C).

### *12.1.2. Electrical (Single-Ended)*

(t) TYPICAL CURRENT DRAIN FROM –48Vdc:

| Model | Idle | Busy |
|---|---|---|
| 3652-62 | 25mA | 40mA |
| 3652-68 | 20mA | 25mA |

### *12.1.3. Signaling*

(u) OPERATION: E&M or PLR.

## 12.2 Physical

See Table 5 for the physical characteristics of the 3652–62 and 3652–68.

**Table 5. Physical Specifications**

| Feature | U.S. | Metric |
|---|---|---|
| Height | 4.3 inches | 10.9 centimeters |
| Width | 1.36 inches | 3.5 centimeters |
| Depth | 10.4 inches | 26.4 centimeters |
| Weight | 9 ounces | 255 grams |