Telecommunications Group

Third Printing, March 2001

3657–00/04/14 2-Wire Foreign Exchange Subscriber (2W FXS) and 3657–02 2W FXS with Gain Transfer (2W FXS/GT) Channel Units

Complies with UL Standard 1459 Second Edition*

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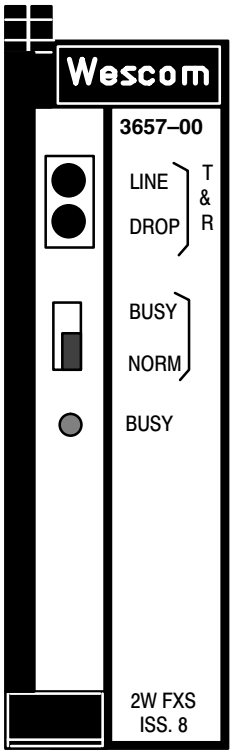

Figure 1. 3657—00 (Issue 8) 2W FXS Channel Unit

1. GENERAL

1.1 Document Purpose

This document provides information on the Issue 8 versions of the Charles Industries 3657–00/04 2–Wire Foreign Exchange Subscriber (2W FXS), the Issue 2 version of the 3657–14 2W FXS, and the Issue 8 version of the 3657–02 2W FXS with Gain Transfer (2W FXS/GT) Channel Units. The 3657–00 is shown in Figure 1.

1.2 Document Status

This document is reprinted to include a general editorial update.

1.3 Equipment Function

These channel units are used in the Charles Industries 360/363 D4 Digital Carrier Terminal to provide an interface to special service circuits.

Note: Field repairs or modifications may void compliance with UL 1459 – Second Edition. 3657–00/02/04/14 compliance with UL 1459 – Second Edition is restricted to inside plant wiring.

1.4 Equipment Location/Mounting

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

1.5 Equipment Features

The 3657–00/02/04/14 channel units include the following features:

- Complies with AT&T Publication 43801 Specifications
- Complies with UL Standard 1459 Second Edition
- 900–(3657–00/02)/600–(3657–04/14) ohms plus 2.15uF compromise network and line build-out capacitors (3657–00/04/14)
- Provision for external precision balance network
- Built-in jack (on 3657–02 only) to mount an optional 3690–00/10 Compromise Network Subassembly or an optional 3690–01/11, –02/12, or –03/13 Precision Balance Network Subassembly
- Prescription attenuation for the transmit and receive levels
- Front-panel-accessible bantam breaking- jacks for accessing the 2W port
- Built-in jacks (on 3657–02 only) to mount optional 3691–00 Nonloaded Cable Equalizer and/or 3691–01 Loaded Cable Equalizer Subassemblies for pre- and/or post-equalization
- DIP switch-selective ground-start or loop-start operation
- Compatible with 100-millisecond ringing intervals
- Ring tripping during the ringing or silent intervals
- Switch-selective talk-battery input of either –48Vdc or –72Vdc (3657–02 only) (requires external –72Vdc power)
- End-to-end signaling compatibility with D4, D3, D2, or D1D Foreign Exchange Office (FXO) channel units (3657–00/04/14 only)
- Front-panel-accessible NORM/BUSY switch (3657–00/04/14 only)
- Front-panel BUSY LED indicator
- DIP switch-selective operation for carrier failure (immediate or delayed) trunk processing
- DIP switch-selective GTD–3 EAX compatibility (3657–00/04/14 only)

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 unit is shipped in static-protective packaging to prevent electrostatic charges from damaging static-sensitive devices. Use approved static-preventive measures, such as static-conductive wrist straps and a static-dissipative mat, when handling units outside of their protective packaging. A unit intended for future use should be tested as soon as possible and returned to its original protective packaging for storage.

STATIC-SENSITIVE

This equipment contains static-sensitive electronic devices. To prevent electrostatic charges from damaging static-sensitive units:

- **Use approved static preventive measures (such as a static-conductive wrist strap and a static-dissipative mat) at all times whenever touching units outside of their original, shipped static-protective packaging.**
- **Do not ship or store units near strong electrostatic, electromagnetic, or magnetic fields.**
- **Use static-protective packaging for shipping or storage.**

3. APPLICATION GUIDELINES

The 3657–00/02/04/14 provides the interface between the 2-wire VF extensions of the foreign exchange line, off-premise extensions, PBX/CO trunks (loop start/ground start), and the common equipment units of the 360/363 D4 terminal. Refer to Figure 2 and Figure 3 for typical applications.

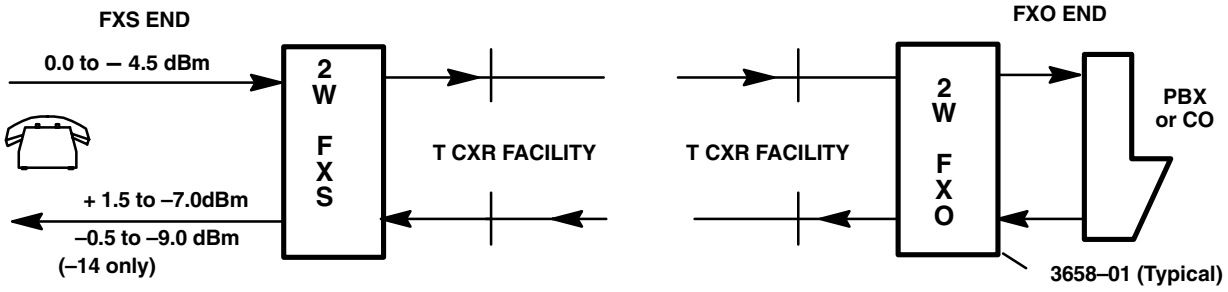

Figure 2. 3657—00/04/14 2W FXS Typical Application

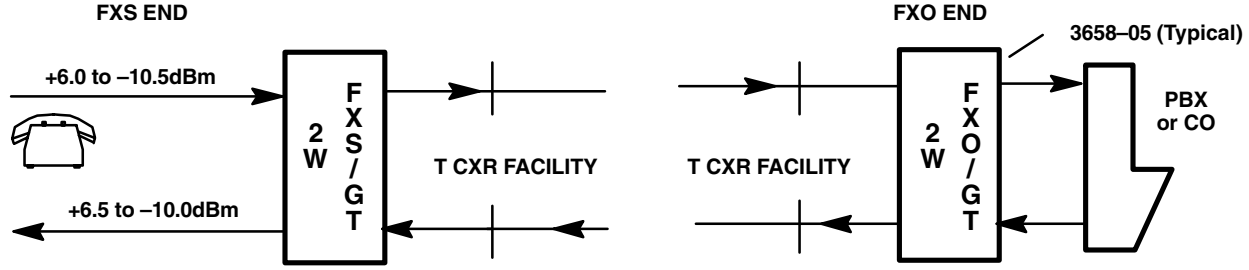

Figure 3. 3657—02 2W FXS/GT Typical Application

4. CIRCUIT DESCRIPTION

Refer to Figure 4, the 3657–00/04 (Issue 8) and 3657–14 (Issue 2) block diagram; or Figure 5, the 3657–02 (Issue 8) block diagram, as needed while reading the following circuit description. Differences between the channel units are indicated as required.

4.1 Transmit VF Path

Voice Frequency (VF) signals applied to the input T&R (pins 50 and 48) are routed through the DROP and LINE breaking-jacks to the 2W/4W HYBRID circuit. The 2W/4W HYBRID extracts the transmit signal from the combined signal at the 2-wire input.

The transmit signal from the 2W/4W HYBRID is adjusted via the XMT PRESCRIPTION ATTN circuit which provides 0 to 4.5dB (3657–00/04/14) or 0 to 16.5dB (3657–02) of attenuation in 0.1dB increments. The XMT PRESCRIPTION ATTN combines with the XMT GAIN circuit which adds a fixed amount of gain (3657–00/04/14: 9.7dB; 3657–02: 15.7dB) to achieve a + 5.2dBm level at the input to the ENCODER. The XMT PRESCRIPTION ATTN allows the input T&R leads to accept a TLP range from 0 to –4.5dBm (3657–00/04/14) or +6.0 to –10.5dBm (3657–02).

The adjusted VF signal is then applied to the XMT FILTER for suppression of frequencies that are outside the bandwidth of the standard voice frequency and prevents them from entering the ENCODER.

The filtered VF signal is then applied to the ENCODER. The ENCODER performs an Analog-To-Digital (A/D) conversion of the VF signal and sends the resulting Pulse Code Modulation (PCM) signal to the 360/363 D4 terminal common equipment via the XDATA lead.

4.2 Receive VF Path

The PCM digital signal transmitted from the far-end is received by the 360/363 D4 terminal common equipment and routed to the 3657–00/02/04/14 via the RDATA lead. The DECODER and RCV FILTER then, in turn, perform a Digital-To-Analog (D/A) conversion of the signal and suppression of frequencies that are outside the bandwidth of the standard voice frequency.

The filtered analog VF output of the RCV FILTER is then applied to the RCV PRESCRIPTION ATTN circuit which provides 0 to 8.5dB (3657–00/04/14) or 0.0 to 16.5dB (3657–02) of attenuation in 0.1dB increments. This circuit together with the RCV GAIN circuit, which provides a fixed gain of –3.7dB (3657–00/04) or –5.7dB (3657–14) or +1.3dB (3657–02), allows the output level at T&R to be adjusted from +1.5 to –7.0dBm (3657–00/04) or –0.5 to –9.0dBm (3657–14) or +6.5 to –10.0dBm (3657–02).

4.3 Transmit Signaling

Loop Closure (LC) and Ring Ground (RG) information is multiplexed onto the T1 line by the ENCODER.

Signaling information is sent from the ENCODER in the sixth and 12th frame in bit 8 of the PCM word.

Loop closure or open loop and ring ground or lack of ring ground conditions of the T&R leads are detected by the BATTERY FEED AND CURRENT DETECTOR. The output of the BATTERY FEED AND CURRENT DETECTOR goes to the LC/RG LOGIC circuit which, in turn, outputs this information to the ENCODER. If current is detected and no tip ground is present, the ENCODER sends a signal out on the B signaling highway indicating a ring ground. If a tip-ground signal is present when current is detected, the LC/RG LOGIC circuit will then transmit a signal on the A signaling highway indicating loop closure. If the tip-ground signal is then removed, the LC/RG LOGIC circuit will hold the detected current as loop closure and not as ring ground. This prevents false ring-ground requests from being transmitted. Whenever loop closure is being transmitted, the R RELAY will be disabled.

4.4 Receive Signaling

In the receive direction, signaling information is converted to tip-ground and ringing information for controlling the TG and R RELAYS.

Signaling information is received via the RDATA lead of the DECODER in the sixth and 12th frame in bit 8 of the PCM word.

A tip-ground signal from the far-end is output by the DECODER on its A output causing the TG RELAY to activate. When the TG RELAY is activated, filtered battery-ground is applied to the tip lead (pin 50). When optioned for loop start, the TG RELAY is activated regardless of A signaling highway activity.

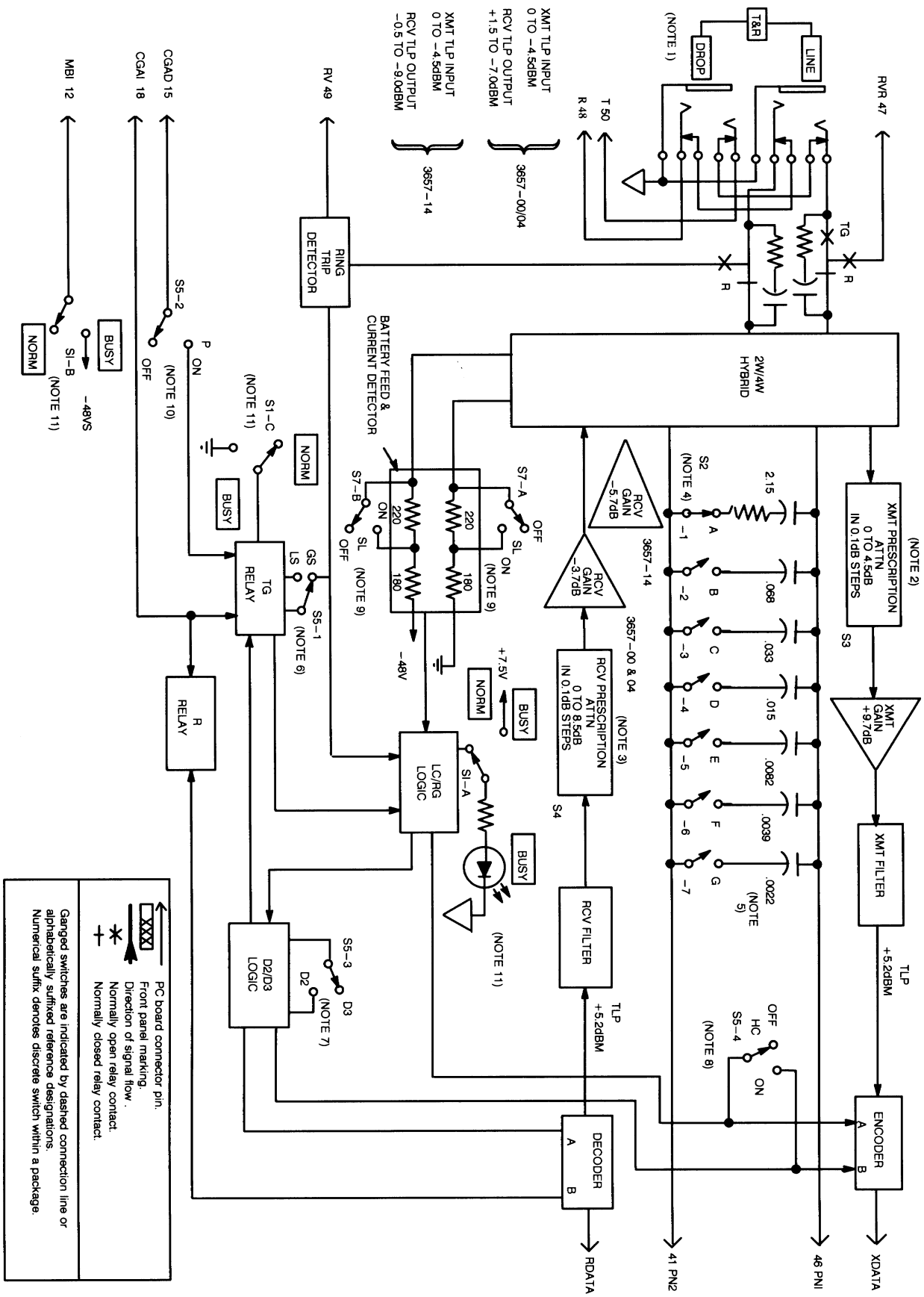

Figure 4. 3657–00/04 (Issue 8) and –14 (Issue 2) 2W FXS Channel Unit Block Diagram

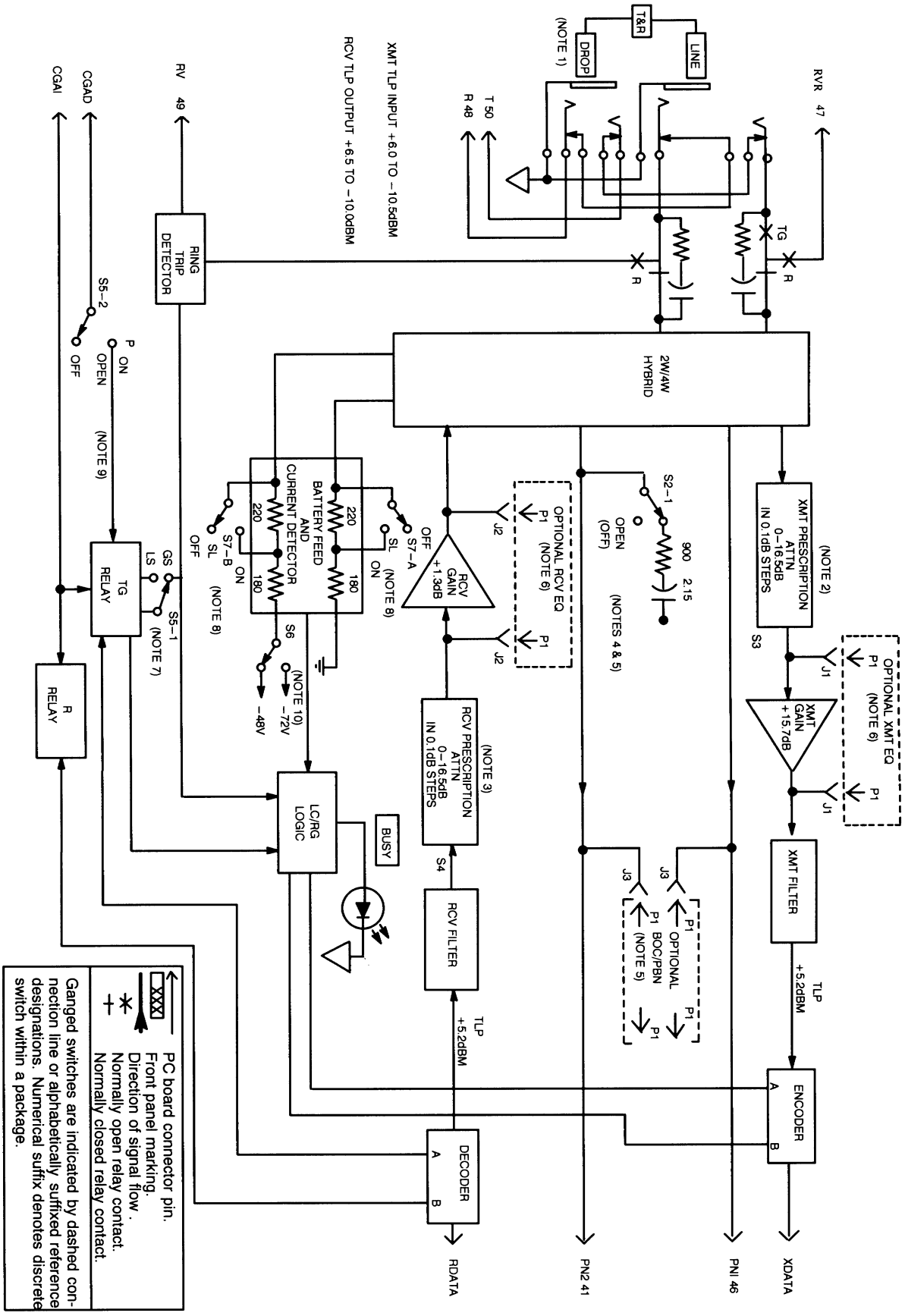

Figure 5. 3657–02 FXS/GT Channel Unit (Issue 8) Block Diagram

Table 1. Notes for Figure 4 (3657–00/04 (Issue 8) and –14 (Issue 2))

#	Note
1.	PC mount test jacks: T&R LINE: Access toward channel unit T&R DROP: Access toward office equipment
2.	The XMT INPUT range at T&R is –4.5 to 0.0dBm. The XMT ATTEN is adjustable for 0 to 4.5dB in 0.1 increments. For 0.0dBm input at T&R, the XMT ATTEN should be set for 4.5dB of attenuation.
3.	For 3657–00/04: The RCV output range at T&R is +1.5 to –7.0dBm. RCV ATTN is adjustable for 0.0 to 8.5 dB in 0.1dB increments. For 1.5dBm output at T&R, RCV ATTN should be set for 0.0dB of attenuation. For 3657–14: The RCV output range at T&R is –9.0 to –0.5dBm. RCV ATTN is adjustable for 0.0 to 8.5 dB in 0.1dB increments. For –0.5dBm output at T&R, RCV ATTN should be set for 0.0dB of attenuation.
4.	Option A (S2–1) is used to select a comp net resistance of 900 ohms for the 3657–00, 600 ohms for the 3657–04/14, in series with a 2.15uF capacitor. Leave S2–1 OFF for external comp net.
5.	Options B through G (S2–2–7) provide additional capacitance for balancing of cable capacitance.
6.	For loop start operation, place (S5–1) LS/GS in the LS position. For ground start operation, place (S5–1) in the GS position.
7.	For D2 signaling, place (S5–3) in the D2 position. For D3 signaling, place (S5–3) in the D3 position.
8.	For GTD–3 EAX compatibility, set (S5–4) option HC to ON.
9.	For loop lengths less than 300 ohms, set SL (S7) to OFF.
10.	During a carrier group alarm, S5–2 (option P) can be configured for a) continuous idle: Set S5–2 to OPEN or b) 2 sec. idle, followed by continuous busy for the duration of the carrier failure: Set S5–2 to P.
11.	To force a TG, light the BUSY LED on the front panel and send a busy signal to the 360 common equipment. The BUSY/NORM option (S1) should be placed in the BUSY position.

Table 2. Notes for Figure 5 (3657–02 FXS/GT Channel Unit, Issue 8)

#	Note
1.	PC mount test jacks: T&R LINE: Access toward channel unit T&R DROP: Access toward office equipment
2.	The XMT INPUT range at T&R is +6.0 to –10.5dBm. The XMT ATTN is adjustable for 0 to 16.5dB in 0.1dB increments. For +6.0dBm input at T&R, the XMT ATTN should be set for 16.5dB of attenuation.
3.	The RCV OUTPUT range at T&R is +6.5 to –10.0dBm. The RCV ATTN is adjustable for 0 to 16.5dB in 0.1dB increments. For +6.5dBm output at T&R, the RCV ATTN should be set for 0dB of attenuation.
4.	Option A (S2–1) is used to select a comp net resistance of 900 ohms in series with a 2.15uF capacitor. Leave option OFF for external comp net
5.	3690–XX PBN/BOC are ordered separately for 3657–02 and used when inserted into connector J3. Open Option A (S2–1) when PBN/BOC is used. For 3657–42, set (S2–1) to open because a 3690–10 comp net and BOC is included and factory installed.
6.	3691–00 non-loaded cable equalizer or 3691–01 loaded cable equalizer is ordered separately to provide post-equalization when inserted in connector J1 and pre-equalization when inserted in connector J2.
7.	For loop start operation, set S5–1 to LS. For ground start operation, set S5–1 to GS.
8.	For loop lengths from 300 to 2000 ohms, set (S7) SL to ON. For loop lengths less than 300 ohms or for –72 Volt operation (see Note 10), set SL to OFF.

#	Note
9.	During a carrier group alarm, S5–2 (option P) can be configured for continuous idle: Set (S5–2) to OPEN, or 2 sec. idle, followed by continuous busy for the duration of the carrier failure: Set (S5–2) to P.
10.	Option switch –48/–72 (S6) provides for either –48 V or –72 V operation. For loop lengths between 2000 and 3000 ohms, a –72 Volt supply must be provided. Also, set S7 (SL) to OFF. **Cable Length** **Position** 0 to 2000 ohms –48V 2000 to 3000 ohms –72V (See Note 7)

A ringing signal from the far-end is output by the DECODER on its B output causing the R RELAY to activate, which allows ringing to be applied to the ring lead (pin 48). The RING TRIP DETECTOR will be connected into the loop and the BATTERY FEED AND CURRENT DETECTOR will be disconnected from the circuit. The RING TRIP DETECTOR detects the DC bias on ring voltage during ringing cycles.

Loop current is detected by either the BATTERY FEED AND CURRENT DETECTOR during silent intervals or the RING TRIP DETECTOR during ringing intervals. Detection of loop current causes the R RELAY to be disabled allowing loop closure information to be transmitted onto the A signaling highway. Note that the TG RELAY must be activated for ringing to be sent to the subscriber equipment.

4.5 Trunk Processing During A Carrier Group Alarm (CGA)

When a carrier failure occurs, the CGAI bus (pin 18) goes to ground, causing the TG and R RELAYs to be disabled. If the DIP switch S5–P position is set to ON, a tip ground will be forced by the CGAD bus (pin 15) approximately 2.5 seconds after the carrier failure.

5. MOUNTING

The 3657–00/02/04/14 mounts in one channel unit slot of a 360/363 D4 terminal. The 3657–00/02/04/14 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.

Step	Action
1.	Align the channel unit with the appropriate card-guided slot of the terminal.
2.	Slide the unit into the slot with the front panel in a horizontal (up) position.
3.	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 position.
4.	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

Installer connections are made to the channel unit by wire-wrapping leads onto the associated 50-pin connectors located on the backplane assembly of the 360/363 D4 terminal. 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. Electrical connections are made when the unit is installed.

7. OPTIONS

The following paragraphs describe the options that are used to condition the 3657–00/02/ 04/14 for proper application and operation. Refer to Figure 6 (3657–00/04/14) or Figure 7 (3657–02) for a drawing showing the option locations and a summary of the option functions.

7.1 Switch S1 – NORM/BUSY – 3657–00/04/ 14 Only

Place switch S1 to the NORM (down) position to condition the 3657–00/04/14 for normal (in-service) operation. Place S1 to the BUSY (up) position to create an out-of-service condition for testing or alignment purposes (this will also light the BUSY LED and busy the channel unit on the far [FXO] end).

7.2 Switch S2–1 (A), Compromise Balance Network

Switch S2–A is used to select a compromise balance network of 900 (3657–00/02) / 600 (3657–04/14) ohms in series with a 2.15uF capacitor. To select this option, set switch S2–1 to ON (A). Hybrid balance can also be provided by an external compromise network or PBN via pins 46 and 41 (PN1 and PN2, respectively) or by equipping jack J3 on a 3657–02. In these cases, set S2–1 to the OFF position.

7.3 Switches S2–2 (B) Thru S2–7 (G), BOC 3657–00/04/14 Only

Switches S2–2 (B) through S2–7 (G) provide up to 0.1303uF Build-Out Capacitance (BOC) for balancing the hybrid circuitry relative to the line connected to the 2-wire port of the 3657–00/04/14. By placing the individual switches to the ON position, the required amount of capacitance can be added in approximately 0.002uF increments.

7.4 Switch S3, XMT Prescription Attenuation

7.4.1. For 3657–00/04/14

S3 is a six-section DIP switch that selects the appropriate amount of attenuation between zero and 4.5dB in 0.1dB increments for adjusting the transmit path to the proper operating level. By placing the individual switches of S3 (2, 1, 0.8, 0.4, 0.2, 0.1dB) to the ON position as required, the desired level of 5.2dBm at the input to the ENCODER can be achieved.

7.4.2. For 3657–02

S3 is an eight-section DIP switch that selects the appropriate amount of attenuation between zero and 16.5dB in 0.1dB increments for adjusting the transmit path to the proper operating level. By placing the individual switches of S3 (8, 4, 2, 1, 0.8, 0.4, 0.2, 0.1dB) to the ON position as required, the desired level of 5.2dBm at the input to the ENCODER can be achieved.

7.5 Switch S4, RCV Prescription Attenuation

7.5.1. For 3657–00/04/14

S4 is a seven-section DIP switch that selects the appropriate amount of attenuation between zero and 8.5dB in 0.1dB increments for adjusting the receive path to the proper operating level. By placing the individual switches of S4 (4, 2, 1, 0.8, 0.4, 0.2, 0.1dB) to the ON position as required, the 5.2dBm level at the output of the DECODER can be varied to obtain the desired output level (between +1.5 and –7dBm for –00/04 and between –0.5 and –9dBm for –14) at T&R.

7.5.2. For 3657–02

S4 is an eight-section DIP switch that selects the appropriate amount of attenuation between zero and 16.5dB in 0.1dB increments for adjusting the receive path to the proper operating level. By placing the individual switches of S4 (8, 4, 2, 1, 0.8, 0.4, 0.2, 0.1dB) to the ON position as required, the 5.2dBm level at the output of the DECODER can be varied to obtain the desired output level (between +6.5 and –10dBm) at T&R.

7.6 Switch S5–1, LS/GS (Loop Start/Ground Start)

The LS/GS option selects the proper mode of operation. To operate in the loop-start mode, place the switch in the LS position. To operate in the ground-start mode, place the switch in the GS position.

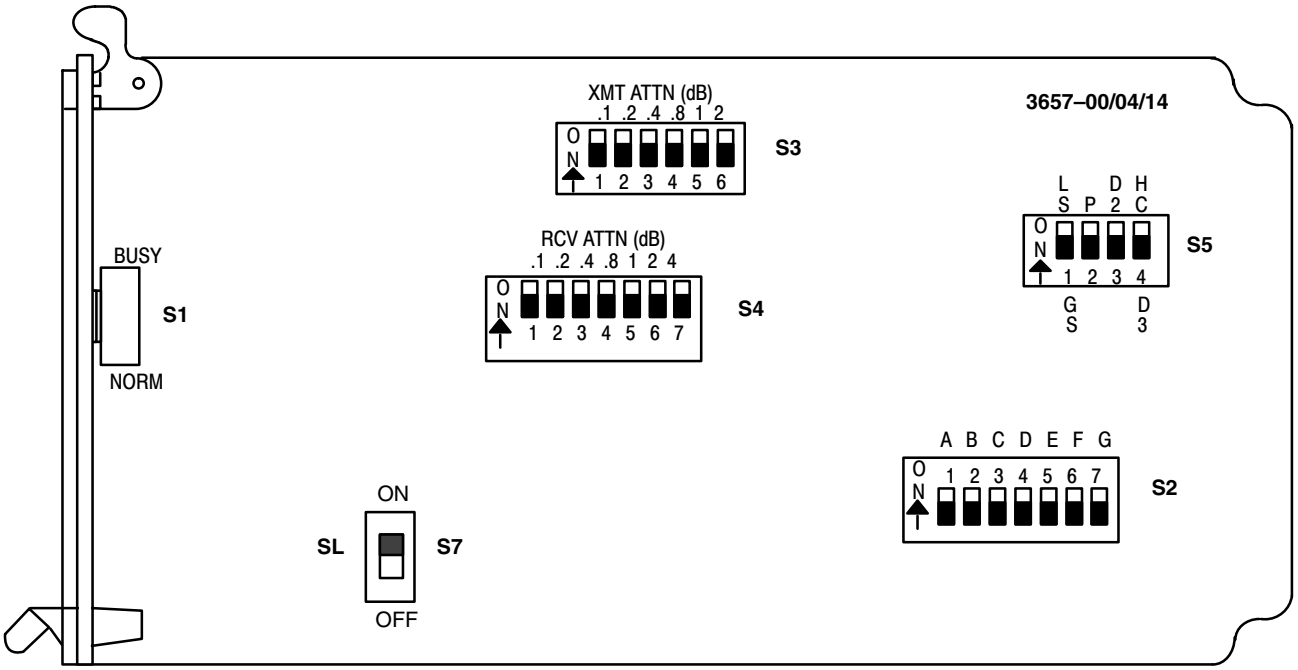

Figure 6. 3657—00/04 (Issue 8) —14 (Issue 2) 2W FXS Option Locations

Table 3. Description of Figure 6

Option	Function/Remarks	Position
S1	For in-service operation.	NORM
	For testing or alignment purposes.	BUSY
S2–1	To select a compromise net resistance of 900 (3657–00) /600 (3657–04/14) ohms +2.15uF	ON (A)
	If an external Comp Net/PBN is used.	OFF
S2–2 thru S2–7	Provides up to 0.1303uF additional capacitance for balancing of cable capacitance. Place in ON position to add: 0.068 S2–B, 0.033 S2–C, 0.015 S2–D, 0.0082 S2–E, 0.0039 S2–F, and 0.0022 S2–G.	ON/OFF as required
S3	Six-sections (0.1, 0.2, 0.4, 0.8, 1, 2) total 4.5dB of transmit attenuation when all sections are ON.	See page 9
S4	Seven-sections (0.1, 0.2, 0.4, 0.8, 1, 2, 4) total 8.5dB of receive attenuation when all sections are ON.	See page 9
S5–1	To select loop-start mode of operation.	LS
	To select ground-start mode of operation.	GS
S5–2	During CGA: Two seconds idle followed by continuous busy.	ON (P)
	Continuous idle.	OFF
S5–3	To select D2 signaling.	D2
	To select D3 signaling.	D3
S5–4	For GTD–3 EAX compatibility.	ON (HC)
	For other applications.	OFF
S7	Short loops: If loop is less than 300 ohms.	OFF
	If loop is 300 ohms or greater.	ON

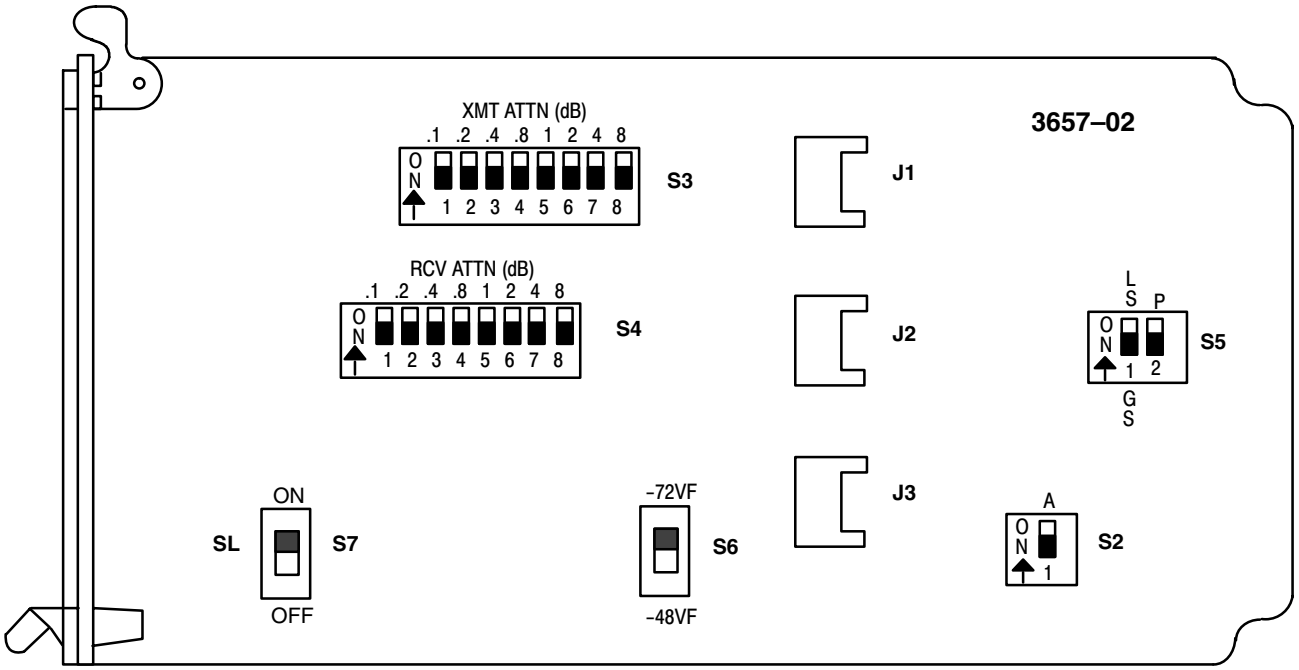

Figure 7. 3657–02 2W FXS/GT (Issue 8) Option Location

Table 4. Description of Figure 7

Option	Function/Remarks	Position
J1	Jack for mounting optional XMT post-equalizer 3691–00/01.	See page 12
J2	Jack for mounting optional RCV pre-equalizer 3691–00/01.	
J3	Jack for mounting optional Comp Net/PBN 3690–00/10,–02/12, or 03/13.	
S2–1	To select a compromise net resistance of 900 ohms + 2.15uF.	ON (A)
	If an external Comp Net/PBN is used or if jack J3 is equipped.	OFF
S3	Eight-sections (0.1,0.2,0.4,0.8, 1,2,4,8) total 16.5dB of transmit attenuation when all sections are ON.	See page 9
S4	Eight-sections (0.1,0.2,0.4,0.8,1,2,4,8) total 16.5dB of receive attenuation when all sections are ON.	See page 9
S5–1	To select loop-start mode of operation.	LS
	To select ground-start mode of operation.	GS
S5–2	During CGA: To select two seconds idle followed by continuous busy.	ON (P)
	To select continuous idle.	OFF
S5–6	To select talk-battery input of –48Vdc. To select talk-battery input of –72Vdc.	–48VF –72VF
S7	If loop is less than 300 ohms or for –72V operation.	OFF
	If loop is from 300 to 2000 ohms.	ON

7.7 Switch S5–2, P – Carrier Failure (CGA)

The P option provides the capability to respond to a carrier failure alarm by immediately releasing a call (P to OFF), or by activating the TG RELAY which simulates a busy condition (P to ON) during a carrier failure. When P is in the ON position, the tip lead will release immediately upon an alarm, then reapply a tip ground signal after two seconds which causes the TG RELAY to activate and forces the trunk busy. This prevents seizure from the far-end.

7.8 Switch S5–3, D2/D3 – 3657–00/04/14 Only

The D2/D3 option selects the signaling mode that the 3657–00/04/14 operates in. For D3 or D4 signaling, set the switch to D3. For D2 signaling, set the switch to D2.

7.9 Switch S5–4, HC (GTD–3 EAX) 3657–00/04/14 Only

For GTD–3 EAX compatibility, set the HC option to ON. For other applications, set the HC option to OFF.

7.10 Switch S6, –48VF/–72VF (3657–02 Only)

The –48VF/–72VF option selects either –48Vdc or –72Vdc talk -battery operation. For a loop length (resistance) below 2000 ohms, set S6 to the –48VF position. For a loop length from 2000 to 3000 ohms, a –72Vdc supply must be supplied to the backplane of the 360/363 D4 terminal and S6 to the –72VF position. If –72V operation is used, set the SL option OFF.

7.11 Switch S7, Short Loop (SL)

For a short-loop length (below 300 ohms), set S7 to the OFF position. If the loop length is 300 ohms or greater, set S7 to the ON position. If –72V operation is used, set the SL option OFF.

7.12 Jacks J1, J2, and J3 (3657–02 Only)

7.12.1. Jacks J1 and J2 – Post-/Pre-Equalization

A Charles Industries 3691–00 Nonloaded Cable Equalizer Subassembly or 3691–01 H88 Loaded Cable Equalizer Subassembly can be ordered separately to provide post-equalization (transmit path) when inserted into jack J1, or pre-equalization (receive path) when inserted into jack J2. Additional information on the 3691–00/01 is available in Section 369–100–201.

7.12.2. Jack J3 – Comp Net/PBN – Hybrid Balancing

For the 3657–02, a Charles Industries 3690–00/10, –01/11, –02/12, or –03/13 Subassembly can be ordered separately and inserted into jack J3 to provide hybrid balancing. Hybrid balance can also be provided by an external compromise network or PBN via pins 46 and 41 (PN1 and PN2, respectively). Additional information on the 3690–XX Subassemblies is available in Sections 369–0XX–201.

8. ALIGNMENT

8.1 Transmit Alignment – 3657–00/04/14

The XMT ATTN switch S3 is a prescription control that provides attenuation from 0 to 4.5dB, in increments of 0.1dB, to accommodate an input TLP range from 0 to –4.5dBm. To adjust the transmit path to the proper operating level, the difference between –4.5 and the transmit TLP at T&R must be obtained.

[XMT ATTN = TLP – (–4.5)]

For an input TLP of 0dBm, the XMT ATTN = 0 – (–4.5) = 4.5dB. Set the sum of the switch settings on S3 to 4.5.

8.2 Receive Alignment – 3657–00/04/14

The RCV ATTN switch S4 is a prescription control that provides attenuation from 0 to 8.5dB, in increments of 0.1dB, to accommodate an output TLP range from +1.5 to –7dBm for 3657–00/04 and –0.5 to –9dBm for 3657–14. To adjust the receive path to the proper operating level, the difference between +1.5 (for 3657–00/04) or –0.5 (for 3657–14) and the receive TLP at T&R must be obtained.

[RCV ATTN = (+1.5) or (–0.5) – TLP]

For an output TLP of –7dBm {or –9dBm for the 3657–14 only}, the RCV ATTN = +1.5 {or –0.5} – (– 7) {or – (–9)} = 8.5dB. Set the sum of the switch settings on S4 to 8.5.

8.3 Transmit Alignment – 3657–02

The XMT ATTN switch S3 is a prescription control that provides attenuation from 0 to 16.5dB in increments of 0.1dB to accommodate an input TLP range from + 6.0 to –10.5dBm. To adjust the transmit path to the proper operating level, the difference between –10.5 and the transmit TLP at T&R must be obtained.

[XMT ATTN = TLP – (–10.5)]

For an input TLP of +6.0dBm, the XMT ATTN = + 6.0 – (–10.5) = 16.5dB. Set the sum of the switch settings on S3 to 16.5.

8.4 Receive Alignment – 3657–02

The RCV ATTN switch S4 is a prescription control that provides attenuation from 0 to 16.5dB in increments of 0.1dB to accommodate an output TLP range from + 6.5 to –10.0dBm. To adjust the receive path to the proper operating level, the difference between +6.5 and the receive TLP at T&R must be obtained.

[RCV ATTN = (+6.5) – TLP]

For an output TLP of –6.0dBm, the RCV ATTN = +6.5 – (–6.0) = 12.5dB. Set the sum of the switch settings on S4 to 12.5.

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 preaddressed 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
   503 N.E. 15th St., P.O. Box 339
   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 3657–00/02/04 (Issue 8) and 3657–14 (Issue 2) are as follows:

12.1.1. Transmission

(a) PERMISSIBLE MODES: 3657–00/02/04/14, 2L–4T, 2N–4T, 2T9–4T, 4T–2L, 4T–2N, 4T–2T9; 3657–04, 2L–4T, 2N–4T, 2T6–4T, 4T–2L, 4T–2N, 4T–2T6.

(b) 2–WIRE IMPEDANCE: 3657–00/02, 900 ohms; 3657–04/14, 600 ohms plus 2.15uF.

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

(d) DROP SIDE LEVELS:

3657–00/04	Transmit input minimum –4.5dBm, maximum 0.0dBm; receive output minimum –7.0dBm, maximum +1.5dBm.
3657–14	Transmit input minimum –4.5dBm, maximum 0.0dBm; receive output minimum –9.0dBm, maximum –0.5dBm.
3657–02	Transmit input minimum –10.5dBm, maximum +6.0dBm; receive output minimum –10.0dBm, maximum +6.5dBm.

(e) FIXED 1000Hz GAIN:

3657–00/04	Transmit +9.7dB; receive –3.7dB.
3657–14	Transmit +9.7dB; receive –5.7dB.
3657–02	Transmit +15.7dB; receive +1.3dB.

(f) TRANSMIT AND RECEIVE PRESCRIPTION ATTENUATION:

3657–00/04/14	Transmit minimum 0.0dB, maximum –4.5dB, in 0.1dB step; receive minimum 0.0dB, maximum –8.5dB, in 0.1dB step.
3657–02	Transmit minimum 0.0dB, maximum –16.5dB, in 0.1dB step; receive minimum 0.0dB, maximum –16.5dB, in 0.1dB step.

(g) LONGITUDINAL BALANCE: 58dB minimum at 200Hz TO 1kHz; 53dB minimum at 3kHz.

(h) SIGNAL TO DISTORTION RATIO: 35dB minimum at zero to –30dBm0; 29dB minimum at –40dBm0; 25dB minimum at –45dBm0.

(i) TRANS–HYBRID LOSS: Echo, 34dB minimum; singing, 20dB minimum.

(j) RETURN LOSS: Echo, 28dB minimum; singing, 20dB minimum.

(k) TRANSMIT/RECEIVE IDLE CHANNEL NOISE: 20dBrnCO.

(l) TRANSMIT AND RECEIVE PATH FREQUENCY RESPONSE:

Frequency (Hz)	XMT(dB)	RCV (dB)
60	–20 maximum	—
200	0 to –3	0 to –2
300	+0.25 to –0.5	+0.25 to –0.5
1000	0 (Ref)	0 (Ref)
3000	+0.25 to –0.5	+0.25 to –0.5
3200	+0.25 to –0.75	+0.25 to –0.75
3400	0 to –1.5	0 to –1.5
4000	–14 maximum	–14 maximum
4600	–32 maximum	–28 maximum

(m) LEVEL TRACKING (Measured single-ended at 1020Hz): ±0.25dB from +3 to –37dBm0, ±0.5dB from –38 to –50dBm0.

(n) –48V CURRENT DRAW: Idle, 28mA; busy, 54mA.

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

12.1.2. Signaling

(a) OPERATION: Loop-start or ground-start.

(b) MINIMUM OPERATE CURRENT: 20mA.

(c) BATTERY FEED RESISTANCE: SL OFF, 800 ohms; SL ON, 360 ohms; can be used with external BBRE.

(d) SUPERVISION RANGE: 2000-ohm loop at –48Vdc; 3657–02 only, 3000-ohm loop at –72Vdc.

(e) RING TRIP RANGE: 2000–ohm loop.

(f) 20Hz RINGING RANGE: 2000-ohm loop.

(g) GROUND START SIGNALING: 1500 ohms.

12.2 Physical

The physical characteristics of the 3657–00/02/04 (Issue 8) and 3657–14 (Issue 2) are as follows:

Feature	U.S.	Metric
Weight	16 ounces	454 grams
Height	4.3 inches	10.9 centimeters
Width	1.36 inches	3.5 centimeters
Depth	10.4 inches	26.4 centimeters