3658–06 2–Wire Foreign Exchange Office with Loop to E&M Conversion (2W FXO LP/E&M) Channel Unit

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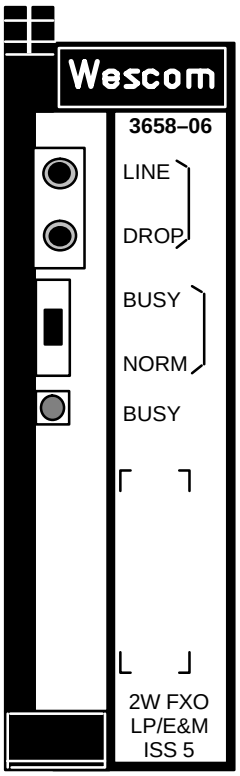


Figure 1. 3658–06 2W FXO LP/E&M (Issue 5) Channel Unit

1. GENERAL

1.1 Document Purpose

This document provides information on the Charles 3658–06 (Issue 5) 2-Wire Foreign Exchange Office with Loop to E&M Conversion (2W FXO LP/E&M) Channel Unit.

1.2 Document Status

This document is reprinted to include a general editorial update.

1.3 Equipment Function

The 3658–06, shown in Figure 1, is used in the Charles 360/363 D4 Digital Carrier Terminal to provide an interface to special service circuits.

1.4 Equipment Location/Mounting

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

1.5 Equipment Features

The 3658–06 2W FXO LP/E&M includes the following features:

- Compliance with AT&T Publication 43801
- 900 ohm + 2.2μF Compromise Network and Line Build-Out Capacitors (LBOC)
- Front-panel-mounted bantam breaking jacks for accessing the 2-wire port
- Prescription attenuation for the transmit and receive levels
- Front-panel accessible NORM/BUSY switch
- Front-panel BUSY LED indicator
- On-board loop supervision to E&M conversion
- Automatic trunk processing and lead conditioning during carrier failure
- Compatible with 100-millisecond ringing intervals
- Build-out resistance of 400 ohms for loops less than 1.1k ohms

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 module 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 modules outside of their protective packaging. A module 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 3658–06 provides a 900-ohm balanced interface between a 2-wire PBX/CO line (ground start with loop supervision) and the common equipment units of the 360/363 D4 terminal. Refer to Figure 2 for a typical application.

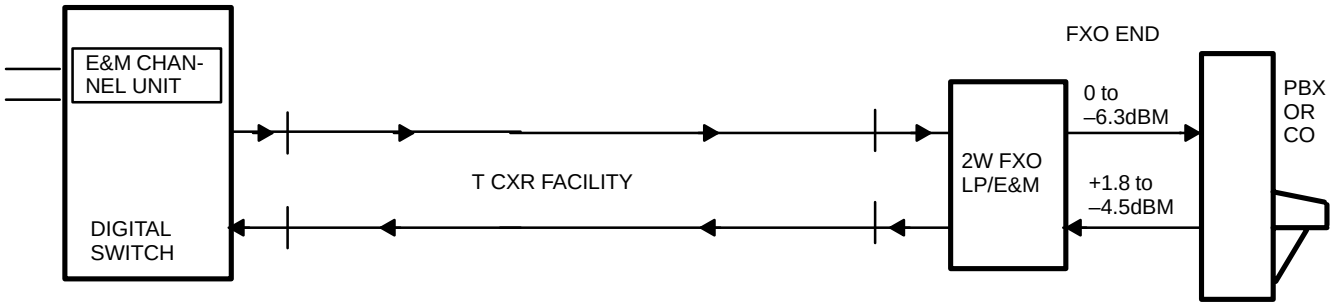


Figure 2. 3658–06 2W FXO/LP E&M Application

4. CIRCUIT DESCRIPTION

Refer to Figure 3, the 3658–06 (Issue 5) Block Diagram, as needed while reading the following circuit description.

4.1 Transmit VF Path

VF(Voice Frequency) 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 hybrid circuit converts the 2-wire input/output to a 4-wire interface.

The output of the 2W/4W HYBRID is applied to the XMT PRESCRIPTION ATTEN and XMT GAIN circuits. The XMT PRESCRIPTION ATTEN provides 0 to 6.3dB of attenuation, in 0.1dB increments, to accommodate input signals from –4.5 to +1.8dBm. The XMT GAIN circuit provides a fixed gain of 9.7dB.

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. A level of +5.2dBm at the input of the ENCODER is equivalent to a 0dB level on the digital line.

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 is routed to the 3658–06 via the RDATA lead. The DECODER and RCV FILTER then performs a Digital-to-Analog (D/A) conversion of the signal and suppression of frequencies that are outside the standard voice frequency bandwidth. A level of +5.2dBm at the output of the DECODER is equivalent to a 0dB level on the digital line.

The filtered analog output of the RCV FILTER is then applied to the RCV PRESCRIPTION ATTEN and RCV GAIN circuits. The RCV PRESCRIPTION ATTEN provides 0 to 6.3dB of attenuation, in 0.1dB increments, to accommodate output signals from –6.3 to +0.0dBm at T&R. The RCV GAIN circuit provides a fixed gain of –5.2dB.

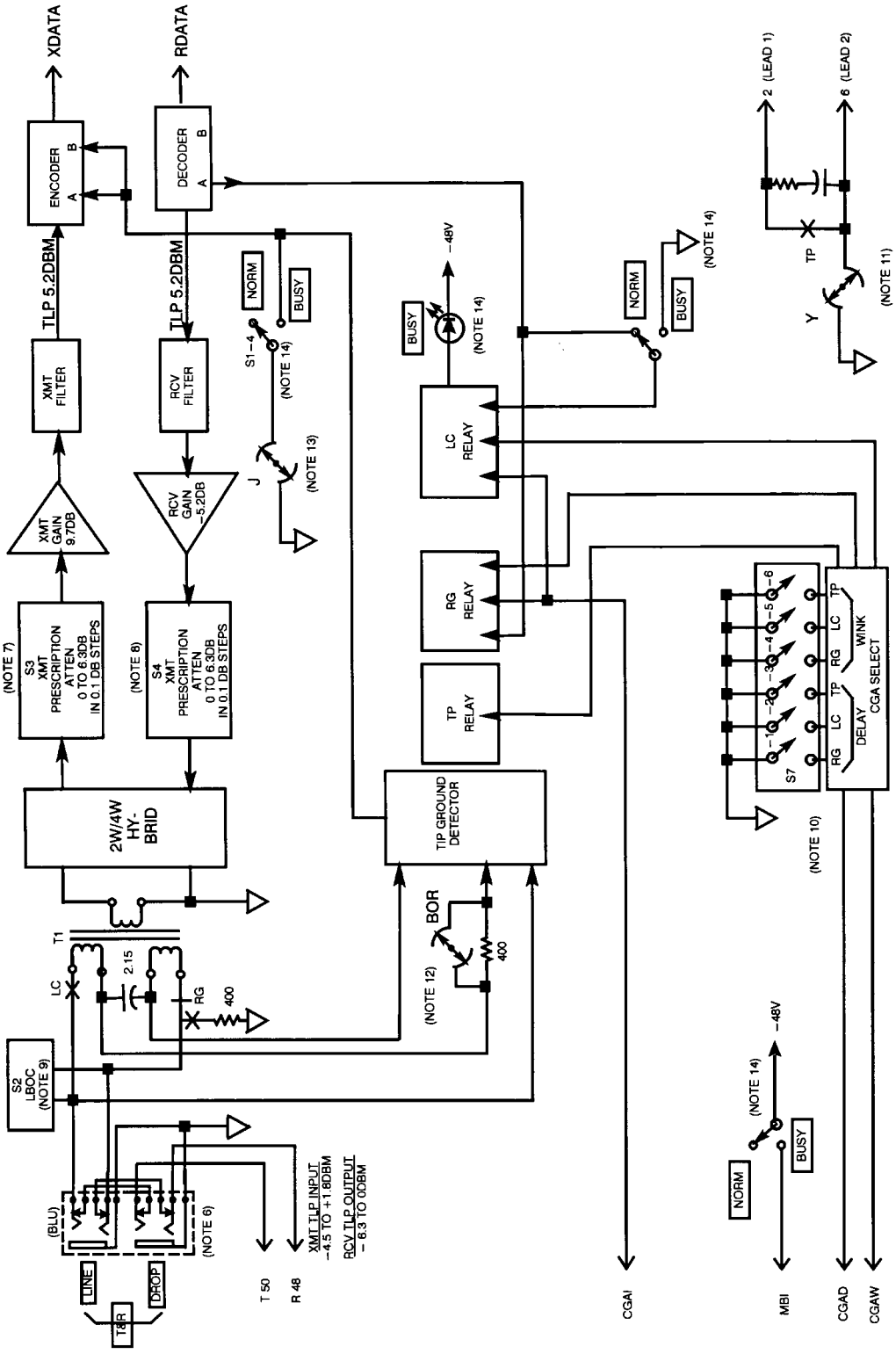
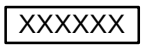
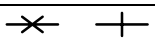


Figure 3. 3658–06 2W FXO LP/E&M (Issue 5) Block Diagram

Table 1. Notes for the Block Diagram

#	Note	
1.		PCB connector pin
2.		Front panel marking
3.		Signal flow direction
4.		N.O., N.C. relay contact
5.	Ganged switches are indicated by alphabetically suffixed reference designations. The numerical suffix denotes a discrete switch within a package.	
6.	Front panel test jacks:	
	Marking	**Function**
	T&R LINE	Access towards channel unit
	T&R DROP	Access towards office equipment
7.	The XMT input range at T & R is –4.5 to 1.8 dBm. The XMT ATTEN (S3) is adjustable from 0 to 6.3 dB in 0.1 dB increments. For a 0.0 dBm input at T&R, the XMT ATTEN should be set for 4.5 dB of attenuation.	
8.	The RCV OUTPUT range at T & R is –6.3 to 0.0 dBm. The RCV ATTEN (S4) is adjustable from 0 to 6.3 dB in 0.1 dB increments. For a –2.0 dBm output at T&R, the RCV ATTEN should be set for 2.0 dB of attenuation.	
9.	Close switch ‘A’ to provide a 900-ohm +2.2μF balanced network. Switches B through G provide additional capacitance for hybrid balancing.	
10.	During a carrier group alarm, the unit shall force no RG and no LC. Approximately 2 seconds later: With only RG DLY (S7–1) closed, RG relay closes. With only LC DLY (S7–2) closed, LC relay closes. With only TP DLY (S7–3) closed, TP relay closes. With only RG WNK (S7–4) closed, RG relay winks. With only LC WNK (S7–5) closed, LC relay winks. With only TP WNK (S7–6) closed, TP relay winks.	
11.	Open screw option ‘Y’ to provide a balanced (floating) contact closure between lead 1 (pin 2) and lead 2 (pin 6). Close screw option ‘y’ to provide switched ground output on lead 1 (pin 2) and ground on lead 2 (pin 6).	
12.	When screw option ‘BOR’ is open, an additional 400 ohms is provided for short loops. If the total resistance is greater than 1100 ohms, remove the 400 ohms by closing screw option ‘BOR’.	
13.	When screw option ‘J’ is closed, and the NORM/BUSY switch is in the BUSY position, a tip ground signal is sent to the far-end.	
14.	When the front panel NORM/BUSY switch is in the BUSY position, the BUSY LED is illuminated, a tip ground signal is sent to the far-end (with screw option ”J” closed), the make busy (pin 12) is connected to –48V, and the LC (loop closure) relay is closed.	

4.3 Signaling

In the transmit direction, detection of tip ground signal on T&R will cause the ENCODER circuit to transmit a logic ‘1’ on both the A & B signaling highways. During an idle condition, a logic ‘0’ is encoded on both A & B signaling highways.

In the receive direction, a logic ‘1’ on the RCV A signaling highway will activate the RG RELAY or LC RELAY, depending on the TIP GROUND DETECTOR status. If a tip ground has been detected, a logic ‘1’ on the RCV A signaling highway will activate the LC RELAY and illuminate the BUSY LED. If a tip ground has not been detected, the RG RELAY will be activated. A logic ‘0’ on the RCV highway will deactivate both the RG RELAY and the LC RELAY.

4.4 Trunk Processing

When a carrier failure occurs, the CGA bus goes to ground, causing the LC RELAY to open and the RG RELAY to be disconnected. Approximately 2.5 seconds after the carrier failure, the TP, RG, or LC RELAYs can momentarily activate and return to idle, activate and remain activated, or just remain idle, depending on how the CGA options (S7–1 to –6) are set.

5. MOUNTING

The 3658–06 mounts in one channel unit slot of a Charles 360/363 D4 Digital Carrier Terminal. The 3658–06 is equipped with an insert/eject lever, in the form of a top-hinged front panel, which ensures 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 channel unit removal.

CAUTION

Installation and removal of channel units should be done with care. Use static-preventive measures when handling. Do not force a unit into place. If excessive resistance is encountered during installation, remove the unit and check the card guides 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. The channel unit's card-edge connector will begin to make contact with the inner portion of the backplane connector.
4.	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 on the backplane assembly of the 360/363 D4 Digital Carrier Terminal. On connectorized 360/363 D4 Digital Carrier Terminal (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 Digital Carrier Terminal. Refer to Section 360–000–200 for the wiring diagrams of the female connectors with respect to the 360/363 D4 Digital Carrier Terminal being used.

7. OPTIONS

The following paragraphs describe the screw and switch options that are used to condition the 3658-06 for proper application and operation. Refer to Figure 4 for option locations and 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.

7.1 Switch S1 – NORM/BUSY

Place Switch S1 to the NORM (down) position to condition the 3658–06 for normal (in-service) operation. Place switch S1 in the BUSY (up) position to busy the 3658–06 for looped or single channel tests. S1 in the BUSY position performs the following functions:

- LC (Loop Closure) RELAY operates and closes the loop to the local office.
- Sends a busy condition to the far end if screw option J is CLOSED.
- Lights the BUSY LEDs on the front panel of the 3658–06 and on the front panel of the local Alarm Logic Unit (ALU) via lead MBI.

7.2 Screw Option J – OPEN/CLOSE

CLOSE Screw Option J to send a tip-ground signal to the far-end when S1 is in the BUSY position. When Screw Option J is OPEN, the signal is not transmitted.

7.3 DIP Switch S2 – Hybrid Balance Impedance

DIP Switch S2 is used for selecting the appropriate amount of capacitance required for balancing the 2W/4W hybrid circuit.

7.3.1. Switch S2–1 (A) Compromise Balance Network

Switch S2–1 (A) is used to select a compromise balance network of 900-ohms in series with a 2.2μF capacitor. To select this option, place S2–1 (A) to ON.

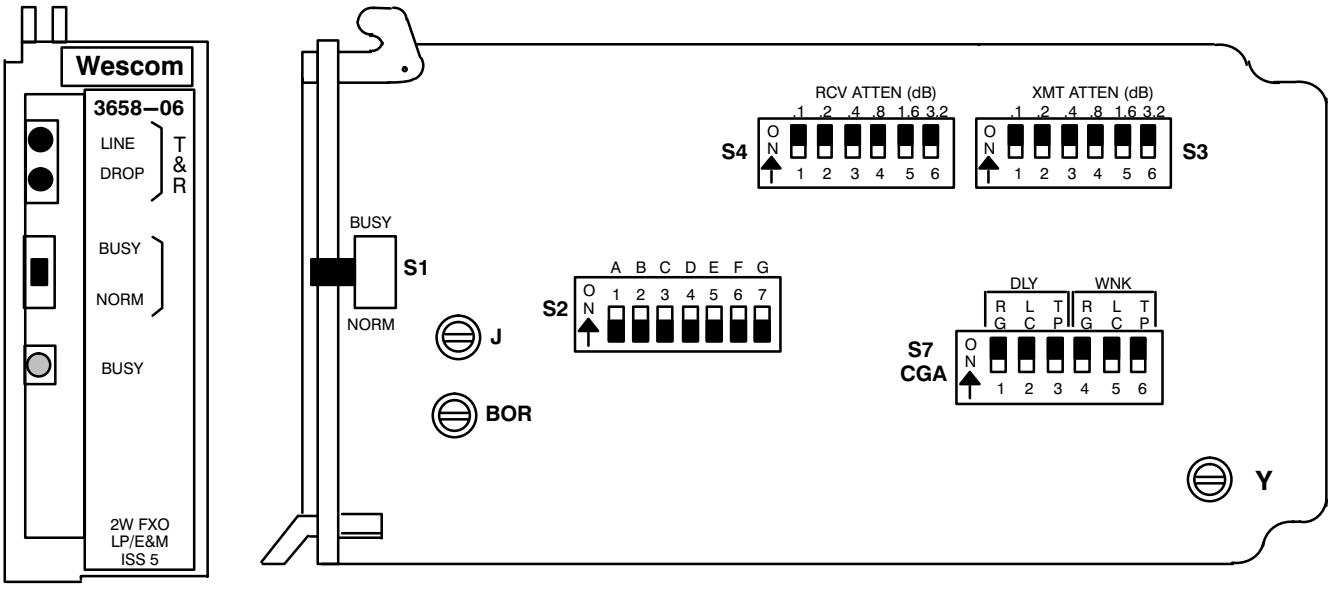


Figure 4. 3658—06 2W FXO LP/E&M (Issue 5) Option Locations

Option	Position	Function
S1	NORM	For in-service operation.
	BUSY	For testing or alignment.
J (screw option)	OPEN	With S1 is in the BUSY position, tip ground information is not sent.
	CLOSED	With S1 is in the BUSY position, tip ground information is sent normally to the far end.
S2–1 (A)	ON	To select on-board Compromise Network of 900 ohms +2.15μF.
	OFF	When an external PBN is to be used.
S2–2 (B) S2–3 (C) S2–4 (D) S2–5 (E) S2–6 (F) S2–7 (G)	S2–2(B) ON Adds 0.064μF S2–3(C) ON Adds 0.032μF S2–4(D) ON Adds 0.016μF S2–5(E) ON Adds 0.008μF S2–6(F) ON Adds 0.004μF S2–7(G) ON Adds 0.002μF	Provides hybrid balancing of up to to 0.126μF in 0.002μF increments relative to the office cabling connected to the 2-wire port.
S3 (XMT ATTEN)	See paragraph 8.1	Provides up to 6.3dB of attenuation (additive in 0.1dB steps) for setting the transmit level at the input to the ENCODER.
S4 (RCV ATTEN)	See paragraph 8.2	Provides up to 6.3dB of attenuation (additive in 0.1dB steps) for setting the receive level at the output of the DECODER.

Option	Position	Function
S7–1 thru S7–6	S7–1 RG DLY=ON	Closes RG RELAY during carrier failure.
	S7–2 LC DLY=ON	Closes LC RELAY during carrier failure.
	S7–3 TP DLY=ON	Closes TP RELAY during carrier failure.
	S7–4 TP WNK=ON	Causes RG RELAY to wink during carrier failure.
	S7–5 LC WNK=ON	Causes LC RELAY to wink during carrier failure.
	S7–6 TP WNK=ON	Causes TP RELAY to wink during carrier failure.
Y (screw option)	OPEN	Provides isolated contact closure between Lead 1 (pin 2) and Lead 2 (pin 6) during carrier failure (TP RELAY closed).
	CLOSED	Provides switched ground output on Lead 1 (pin 2) and ground on Lead 2 (pin 6) during carrier failure (TP RELAY closed).
BOR (screw option)	OPEN	Provides an additional 400 ohms for loop circuits less than 1100 ohms.
	CLOSED	For loop circuits1100 ohms or more.

7.3.2. Switches S2–2 (B) Thru S2–7 (G) Line Build-Out Capacitors (LBOC)

Switches S2–2 (B) through S2–7 (G) provide up to 0.126μF build-out capacitance for balancing the hybrid circuitry relative to the line connected to the 2W port of the 3658–06. By placing the individual switches to the ON position, the required amount of capacitance can be added in approximately 0.002μF increments. For example, Switches S2–2 (B) and S2–6 (F) in the ON position will provide approximately 0.068μF of capacitance.

7.4 DIP Switch S4 – RCV ATTEN

DIP Switch S4 is used for selecting the required amount of attenuation, between 0.0 and 6.3dB (in 0.1dB steps), for adjusting the receive path to the proper operating level. By placing the appropriate switches of S4 to the ON position, the level at the output of the DECODER can be adjusted to obtain the desired output (between –6.3 and 0.0dB) at leads T (pin 50) & R (pin 48).

7.5 DIP Switch S3 – XMT ATTEN

DIP Switch S3 is used for selecting the required amount of attenuation, between 0.0 and 6.3dB (in 0.1dB steps), to accommodate an input range from –4.5 to +1.8dBm at T&R.

7.6 DIP Switch S7 – CGA

Upon carrier failure, an immediate alarm (CGAI) opens the LC RELAY and disconnects the RG RELAY. Approximately 2.5 seconds later, when a Carrier Group Alarm Delay (CGAD) or Carrier Group Alarm Wink (CGAW) arrives, depending on how the switches on S7 are set, the following will occur:

- With only S7–1 set to ON, RG RELAY closes
- With only S7–2 set to ON, LC RELAY closes
- With only S7–3 set to ON, TP RELAY closes
- With only S7–4 set to ON, RG RELAY winks
- With only S7–5 set to ON, LC RELAY winks
- With only S7–6 set to ON, TP RELAY winks

Note: Switches S7–4, –5, and –6 will override switches S7–1, –2, and –3, respectively.

7.7 Screw Option Y–Trunk Processing Control

Screw Option Y is used to condition the auxiliary set of contacts between pins 2 and 6 (lead 1 and lead 2, respectively) during trunk processing. To provide a balanced (floating) contact closure between Lead 1 (pin 2) and Lead 2 (pin 6), OPEN Screw Option Y. To provide switched ground output on Lead 1 (pin 2) and ground on Lead 2 (pin 6), CLOSE Screw Option Y.

7.8 Screw Option BOR (Build-Out-Resistance)

To provide an additional 400 ohms for loop circuits with resistance less than 1100 ohms, OPEN Screw Option BOR. For loop circuits with resistance of 1100 ohms or more, CLOSE Screw Option BOR.

8. ALIGNMENT

8.1 Transmit Alignment

The XMT ATTEN switch S3 is a prescription control that provides attenuation from 0 to 6.5dB, in increments of 0.1dB, to accommodate an input TLP range from –4.5 to +1.8dBm. To adjust the transmit path to the proper operating level, the difference between –4.5dBm and the transmit TLP at T&R must be obtained.

XMT ATTEN = TLP – (–4.5)

For an input TLP of –2.0dBm, the XMT ATTEN = (–2.0) – (–4.5) = 2.5dB. Set the sum of the S3 switches to 2.5.

8.2 Receive Alignment

The RCV ATTEN switch S4 is a prescription control that provides attenuation from 0 to 6.5dB in increments of 0.1dB to accommodate an output TLP range from –6.3 to 0.0dBm. To adjust the receive path for the proper operating level, the difference between 0.0dBm and the receive TLP at T&R must be obtained.

RCV ATTEN = 0.0 – TLP

For an output TLP of –6.0dBm, the RCV ATTEN = (0.0) – (–6.0) = 6.0dB. Set the sum of the S4 switches to 6.0

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 connection, 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 3658–06 (Issue 5) are as follows:

12.1.1. Transmission

(a) PERMISSIBLE MODES: 2L–4T, 2N–4T, 2T9–4T, 4T–2L, 4T–2N, and 4T–2T9.

(b) 2-WIRE IMPEDANCE: 900 ohms.

(c) LINE-SIDE LEVELS: Transmit (fixed), +5.2. TLP: Received (fixed), +5.2.

(d) DROP-SIDE LEVELS: Transmit minimum –4.5dB, maximum +1.8dB; received minimum –6.3dB, maximum +0.0dB.

(e) 1000Hz GAIN: Transmit (fixed), +9.7dB; received (fixed), –5.2dB.

(f) TRANSMIT AND RECEIVE PRESCRIPTION ATTENUATION: 0.0 to –6.3dB in 0.1dB increments.

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

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

(i) TRANSMIT AND RECEIVE PATH FREQUENCY RESPONSE (Referenced at 1kHz):

FREQ (Hz)	XMT (dBm0)	RCV (dBm0)
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

(j) TRANS-HYBRID LOSS: Echo, 34dB minimum; singing, 20dB minimum.

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

(l) TRANSMIT/RECEIVE IDLE CHANNEL NOISE: 20dBrnC0 maximum.

(m) LEVEL TRACKING: ±0.25dB from +3 to –37dBmO, ±0.5dB from –38 to –50dBmO.

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

12.1.2. Signaling

(a) OPERATION: Ground start, loop supervision.

(b) MINIMUM OPERATE CURRENT: 20mA.

(c) BUILD-OUT RESISTANCE: BOR CLOSED (IN), 800 ohms; BOR OPEN (OUT), 360 ohms.

(d) RING LEAD RESISTANCE TO GROUND: 410 ohms nominal.

(e) TIP GROUND DETECTOR SENSITIVITY: 850 ohms must be detected; 10,000 ohms must not be detected.

12.2 Physical

See Table 2 for the physical characteristics of the unit:

Table 2. Physical Specifications

Feature	U.S.	Metric
Height	4.25 inches	10.8 centimeters
Width	1.31 inches	3.3 centimeters
Depth	10.31 inches	26.2 centimeters
Weight	16 ounces	454 grams