3656–00 2-Wire Dial Pulse Terminating (2W DPT) and 3656–01 2-Wire Dial Pulse Terminating with Wink (2W DPT/WINK) Channel Units

®UL Complies with UL Standard 1459 Second Edition*

CONTENTS PAGE

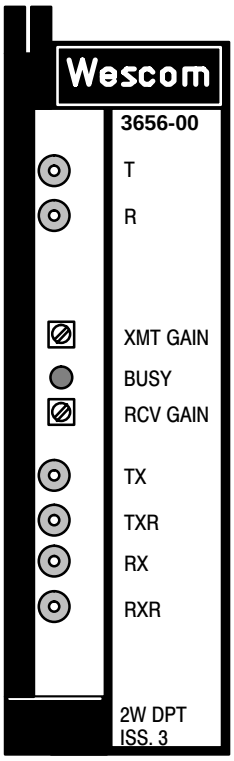

Figure 1. 3656–00 (Iss. 3) 2W DPT Channel Unit

1. GENERAL

1.1 Document Purpose

This document provides a general description and installation instructions for the Charles Industries 3656–00 2W DPT and 3656–01 2W DPT/WINK (Issue 3) Channel Units.

CAUTION

Field repairs/modifications may void compliance with UL 1459 – Second Edition. Compliance with UL 1459 – Second Edition is restricted to inside plant wiring.

1.2 Document Status

This document is reprinted to provide a general editorial update.

1.3 Equipment Function

The Charles Industries 3656–00 2W DPT and 3656–01 2W DPT/WINK (Issue 3) Channel Units are designed for operation in a Charles Industries 360/363 D4 Digital Carrier Terminal to provide the interface between a dial one-way trunk in a terminating office and the channel bank. The 3656–00 and 3656–01 are similar except that the 3656–01 is equipped with a wink-start generator circuit. The wink-start is used for send generators or integrity checks. The 3656–00 is shown in Figure 1.

1.4 Equipment Location/Mounting

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

1.5 Equipment Features

The 3656–00/01 (Issue 3) Channel Units include the following features:

- Front-panel potentiometer adjustment for transmit and receive levels
- Strap-selectable impedance of 600 or 900 ohms at the 2-wire interface ports
- Front-panel BUSY LED that indicates busy/idle status
- Front-panel BUSY switch to place the unit out of service
- Front-panel-accessible pin-jacks for accessing the transmit and receive ports
- Front-panel-accessible pin-jack test points (TX, TXR, RX, and RXR) for monitoring transmit and receive levels
- Optionable compromise network and build-out capacitors
- Screw optionable WINK circuit provides a nominal 140-millisecond reverse battery wink to the office (3656–01 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 module is shipped in static-protective packaging to prevent electrostatic charges from damaging static-sensitive devices. Use approved static-preventive measures, such as wrist straps, 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.

CAUTION

Do not ship or store modules near strong electrostatic, electromagnetic, or magnetic fields. Also, make sure to use the original static-protective packaging for shipping or storage.

3. APPLICATION GUIDELINES

The Charles Industries 3656–00/01 Channel Units provide a NORM/BUSY switch, an option for loop lengths greater than 400 ohms, a 600/900-ohm terminating impedance option, an optionable hybrid balance network, a wink circuit option (3656–01 only), and potentiometers for transmit and receive gain control.

The typical application for these channel units is at the terminating office end of a one-way trunk circuit employing loop and reverse battery supervision. The trunk circuit may employ either dial pulse or multifrequency (MF) signaling. These DPT channel units function equally well for step-by-step, X-Bar, ESS or other applications requiring loop and reverse battery supervision. The 3656–01 also provides a momentary WINK pulse for trunks requiring a wink start for generators or integrity checks.

A typical application configuration is shown in Figure 2.

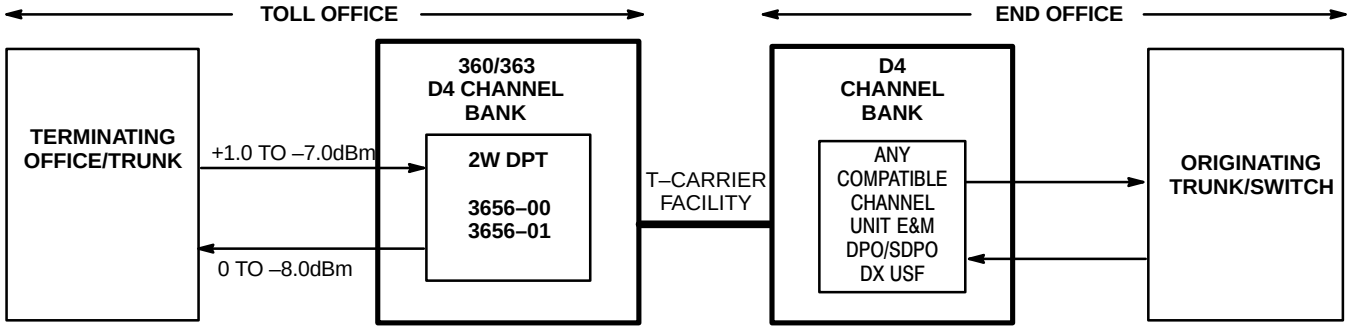

Figure 2. 3656–00/01 2W DPT Typical Application

4. CIRCUIT DESCRIPTION

Refer to the 3656–00/01 (Issue 3) block diagram, Figure 3, as needed while reading the following circuit description. Notes for these figures are explained in Table 1.

4.1 Transmit VF Path

Voice Frequency (VF) signals applied to T (pin 50) and R (pin 48) are routed through the NORM/BUSY switch S1, the front-panel test jacks marked T and R, and to transformer T1, which provides a strap-selectable 600/900-ohm balanced input impedance and DC isolation from the line.

The VF signals are routed through the 2-wire to 4-wire electronic hybrid circuit to the XMT GAIN circuit. The front-panel accessible XMT GAIN CONTROL compensates for office transmission loss and provides an adjustment range of +1.0 to –7.0dBm.

From the transmit gain circuit, signals are fed to the XMT FILTER where 60Hz signals are attenuated 20dB minimum (relative to 1kHz) and frequencies above 4kHz are attenuated. The XMT FILTER output enters the XMT GAIN, which applies a fixed 4.2dB of gain to set the TLP level at TX and TXR to 5.2dBm. The signals then pass to the ENCODER. The TX and TXR front-panel-accessible test jacks are used to monitor the VF signals just before they enter the ENCODER. The nominal level at this point is +5.2dBm, measured with a 600-ohm bridged meter (TTS-35B).

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.

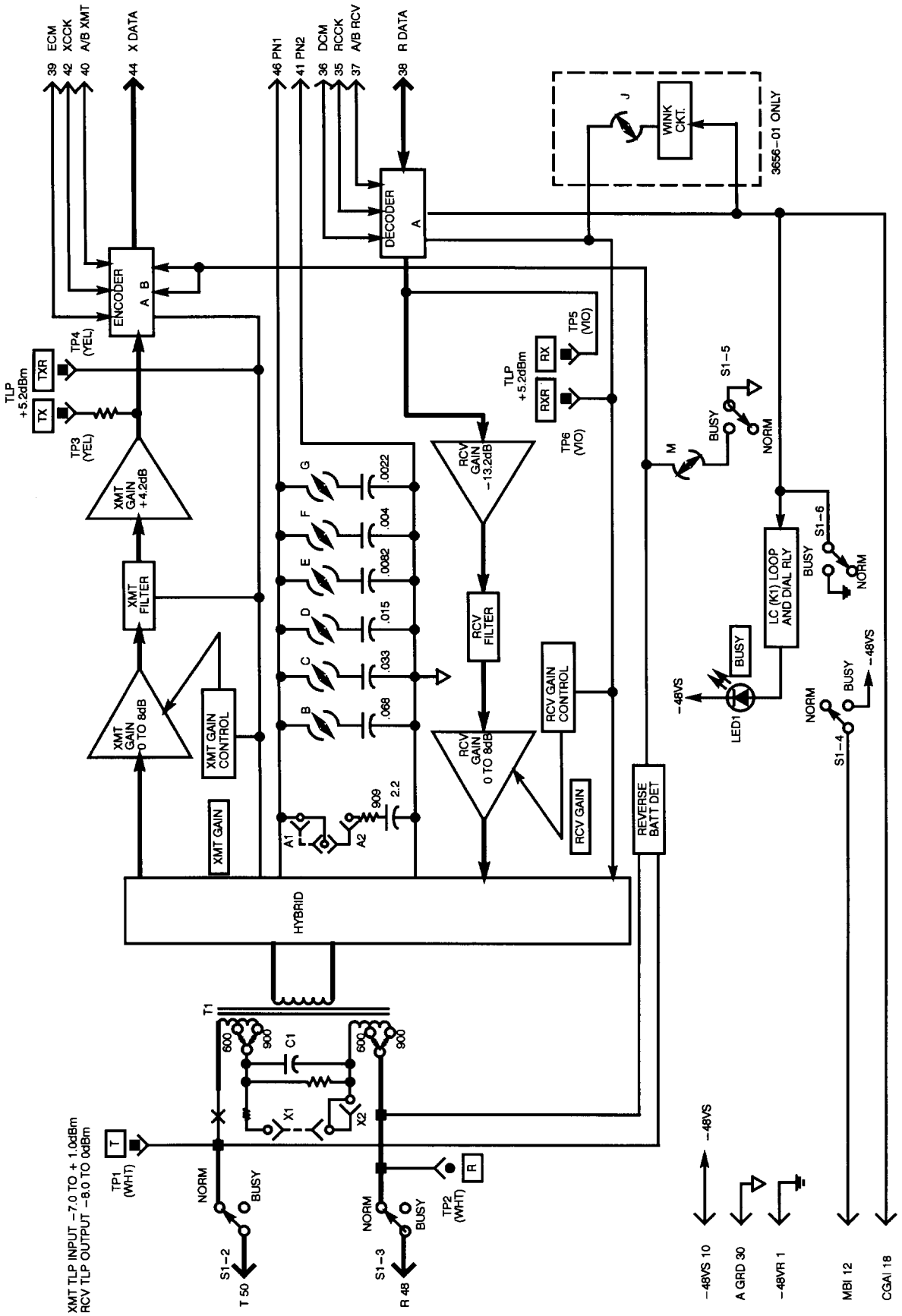

Figure 3. 3656–00 And 3656–01 Block Diagram

Table 1. Notes for Figure 3

<table>
<tr><th>#</th><th>Note</th><th>#</th><th>Note</th></tr>
<tr><td>1.</td><td>← PC board connector pin</td><td>11.</td><td>Potentiometer XMT GAIN is used to compensate for up to +1dB. –7dB level variation received from the VF pair, nominal level is 0dBm.</td></tr>
<tr><td>2.</td><td>●〉— PC mount test point</td><td>12.</td><td>Nominal level at 4 wire XMT unbalanced monitor point TX and TXR. Measured with bridged meter, should be +5.2dBm ±1dB.</td></tr>
<tr><td>3.</td><td>[XXXX] Front panel marking</td><td>13.</td><td>Potentiometer RCV GAIN varies the receive level applied to VF path by 0dB, –8dB, nominal level is –3dBm.</td></tr>
<tr><td>4.</td><td>○〉—〈○ Receptacle-type optional strap, factory-installed
○〉--〈○ Alternate position</td><td>14.</td><td>The level at 4 wire RCV unbalanced monitor point RX and RXR, measured with bridged meter, should be +5.2dBm +/–1dB.</td></tr>
<tr><td>5.</td><td>←→ Factory-installed optional strap
←--→ Optional strap</td><td>15.</td><td>For 900-ohm strapping, use balance capacitance equal to the line capacitance.
For 600-ohm strapping, use balance capacitance equal to the 2/3 line capacitance.</td></tr>
<tr><td>6.</td><td>–×– –|– N.O., N.C. relay contact.</td><td>16.</td><td>Connect option A to A2 to provide a 900-ohm +2.15uF compromise balance network. Options B through G provide additional balance capacitance for balancing of cable capacitance. Connect option A to A1 if a precision external balance network (attached to pins 46 and 41) is required. Use only 900-ohm strapping with external PBN.</td></tr>
<tr><td>7.</td><td>Open, closed screw option</td><td>17.</td><td>For loop lengths from 0 to 400 Ohms, place option X to X2. For loop lengths longer than 400 Ohms, place option X to X1.</td></tr>
<tr><td>8.</td><td>— Primary transmission path</td><td>18.</td><td>a. For 3656-00: Loop closure is inhibited immediately upon occurrence of Carrier Group Alarm.
b. For 3656-01: When option J is closed, a wink circuit is added which provides REV battery wink signal of approximately 140 milliseconds duration, occurring 75 milliseconds after loop closure.</td></tr>
<tr><td>9.</td><td>← Signal flow direction</td><td>19.</td><td>Busy switch:
Switch handle down is normal NORM position.
Switch handle up is busy BUSY position.
Use to perform the following functions:
Disconnect Tip and Ring from channel unit.
Turn on BUSY busy lamp on channel and busy lamp on ALU.
Sends busy condition to the remote end. This function can be disabled by screw option M. Channel unit signaling may be tested when option M is opened.</td></tr>
<tr><td>10.</td><td>PC mount test jacks
<table><tr><th>Function</th><th>Marking</th><th>Color</th></tr><tr><td>Tip and ring (EQIP) monitor</td><td>T</td><td>white</td></tr><tr><td></td><td>R</td><td>white</td></tr><tr><td>4-wire XMT monitor</td><td>TX</td><td>yellow</td></tr><tr><td></td><td>TXR</td><td>yellow</td></tr><tr><td>4-wire RCV monitor</td><td>RX</td><td>violet</td></tr><tr><td></td><td>RXR</td><td>violet</td></tr></table></td><td>20.</td><td>Close screw down option M when using busy switch to send busy conditions (REVERSE BATT) to remote end. This function is disabled by opening option M. The open condition is selected when performing signaling tests on a looped channel bank or when performing single channel maintenance routines on an operating system. In this position, the REV BATT circuit may be tested.</td></tr>
</table>

4.2 Receive Path

The PCM digital signal transmitted from the far-end is received by the DECODER. The DECODER performs a Digital-to-Analog (D/A) conversion of the signal. In addition, receive signaling is converted from digital to analog by the DECODER and is fed to the signaling output lead.

The output of the DECODER is applied to the RCV GAIN circuit which adds –13.2dB of gain and adjusts the nominal output at T&R to 0dBm. The signals are then applied to the RCV FILTER and RCV GAIN circuits. The RCV FILTER attenuates frequencies above 4kHz. The RCV GAIN and RCV GAIN CONTROL (front-panel accessible) provide an adjustment range of zero to –8.0dBm.

The RX and RXR test jacks are used to monitor the receive signals immediately after they leave the RCV FILTER. The nominal level at these test jacks is +5.2dBm, measured with a 600-ohm bridged meter (TTS-35B). This level is not affected by the setting of the RCV GAIN potentiometer.

The output from the RCV GAIN circuit is applied through the HYBRID circuit to transformer T1. The output of the transformer is fed through the NORM/BUSY switch S1.

The HYBRID circuit has an internal compromise balancing network and a series of build-out capacitors (BOCs) for balancing the hybrid relative to the capacitance of the cable connected to the 2-wire port. For balancing plant cabling longer than 6000 feet, an optional Precision Balance Network (PBN) can be connected across pins 46 and 41.

4.3 Signaling Circuit

In the transmit direction, the 3656–00/01 converts normal battery and reverse battery conditions on the 2-wire line into signaling levels which are multiplexed with the outgoing Pulse Code Modulation (PCM) XMT data. In the receive direction, signaling information is demultiplexed from the incoming PCM RCV data, and is converted into open loop and closed loop conditions on the 2-wire line to the trunk circuit.

4.4 Transmit Signaling

When the trunk circuit is idle, normal battery is present across the tip and ring leads, causing the REVERSE BATTERY DETECTOR circuit to apply a signal to the ENCODER. A logic 0 is then transmitted in the signaling bit stream, indicating that the trunk circuit is idle.

When the trunk circuit is busy, the battery across the tip and ring leads is reversed, causing the REVERSE BATTERY DETECTOR to apply a signal to the ENCODER. A logic 1 is then transmitted, indicating that the trunk circuit is busy.

4.5 Receive Signaling

The receive signaling is demultiplexed by the DECODER. When the level at the A signaling output is a logic 0, the LC LOOP AND DIAL RELAY (K1) operates. This closes the loop across the 2-wire tip and ring leads and illuminates the BUSY LED.

4.6 Carrier Group Alarm (CGA)

During an alarm condition, the CGAI bus goes to ground, causing the LC LOOP AND DIAL RELAY to be de-energized and the BUSY LED to be extinguished.

5. MOUNTING

The 3656–00/01 mount in one channel unit slot of a 360/363 D4 terminal. The 3656–00/01 are equipped with an insert/eject lever mechanism in the form of a hinged front panel. The mechanism ensures positive connection between the channel unit's card-edge connector and the backplane connector when the unit is installed. This insert/eject lever also facilitates removal of the unit.

To install a channel unit into a terminal, first lift the bottom edge of the front panel until it is parallel with the top edge of the card. Insert the unit into the appropriate card guide slots and slide it in until the top part of the front panel is under the front lip of the terminal. Then push down on the front panel until it is in the vertical position. Press in the bottom edge of the front panel until it snaps and locks into place.

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 guides and connector to verify proper alignment and the absence of foreign material.

6. INSTALLER CONNECTIONS

Installer connections are made to the channel unit by wire-wrapping leads onto the associated 50-pin connectors located on the back-plane assembly of the 360/363 D4 terminal. When installing a 3656–00/01 into a non-connectorized 360/363 D4 terminal (00-suffixed), make the required connections to T (pin 50) and R (pin 48) on the appropriate connector. Also, when using an external (optional) Precision Balance Network (PBN), connect it to PN1 (pin 46) and PN2 (pin 41). On connectorized 360/363 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 terminal being utilized. Electrical connections are made when the unit is installed.

7. OPTIONS

The following paragraphs describe the options used to condition the 3656–00/01 for their intended application and operation. Also refer to Figure 4 and Table 2 for an illustration of the option locations and a table summarizing the option conditioning requirements.

7.1 Switch S1 (NORM/BUSY)

Switch S1 is a 2-position slide switch which selects either the NORM (down) position for in-service operation, or the BUSY (up) position for looped or single channel tests. When in the BUSY position, it performs the following functions:

- Disconnects the transmit tip and ring leads from the local office.
- Causes the loop closure relay to energize.
- Either normal or reverse battery will be sent to the far end, depending on the position of screw option M.
- Illuminates the BUSY LED on the front panel and the BUSY LED on the front panel of the local ALU.
- Connects MBI lead (pin 12) to –48VS.

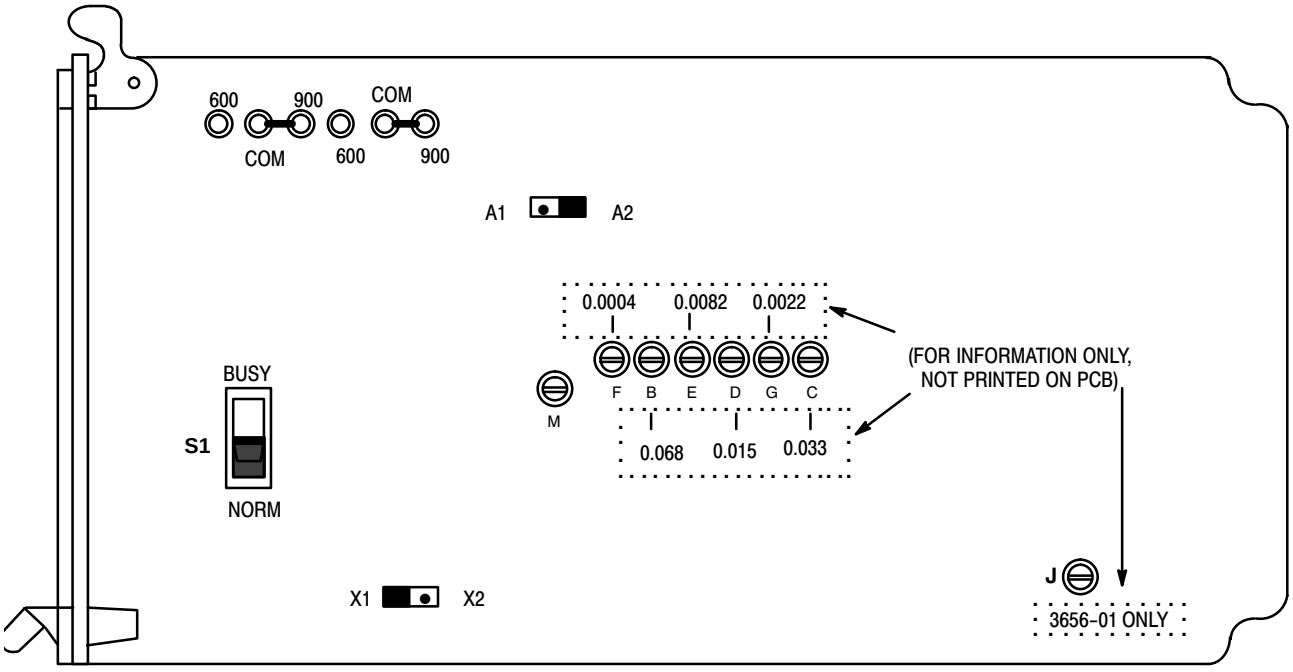

Figure 4. 3656–00/01(Issue 3) Option Locations and Optioning Summary

Table 2. Description of Figure 4

Option	Function	Position
S1	For in-service operation.	NORM
	For out-of-service testing.	BUSY
M Screw Option	To transmit a busy condition to far–end with S1 in BUSY.	CLOSED
	No busy condition to far-end with S1 in BUSY.	OPEN
600/900 Impedance Strap	Straps soldered between 900 and COM posts (factory wired).	900-ohm IMPEDANCE
	Straps soldered between 600 and COM posts.	600-ohm IMPEDANCE
A1/A2 Jumper	When using an external PBN.	Jumper = A1
	To provide 900 ohm +2.15uF compromise network.	Jumper = A2
B Thru G Screw Options	To add capacitance of 0 to 0.13uF in approximately 0.002uF increments.	CLOSED
	To remove balance capacitance.	OPEN
X1/X2 Jumper	For loop lengths longer than 400 ohms.	Jumper = X1
	For loop lengths from 0 to 400 ohms.	Jumper = X2
J Screw Option (3656-01 Only)	To enable WINK circuit.	CLOSED
	To disable WINK circuit.	OPEN

7.2 Strapping for 600/900-ohm Impedance

The 3656–00/01 are factory-conditioned for 900-ohm impedance by means of straps connected between the two pairs of 900 and COM posts. To condition these units for 600-ohm impedance, remove the two factory-installed straps and solder a strap between each pair of 600-ohm and COM posts.

7.3 Loop Length Push-On Jumper (X1/X2)

With the push-on jumper in the X1 position, the channel unit is conditioned for loop lengths longer than 400 ohms. For loop lengths from 0 to 400 ohms, place the jumper in the X2 position.

7.4 Hybrid Balance Network (Push-On Jumper A1/A2 and Screw Options B through G)

Screw options B through G and a push-on jumper in the A1 or A2 position are used for hybrid balancing. Placing the push-on jumper in the A2 position provides a 900-ohm +2.15uF compromise network. When using an external PBN (connected across pins 46 and 41), place the jumper in the A1 position, and strap the unit for 900-ohm impedance.

Screw options B through G, when closed, add hybrid balance capacitance as follows: option B, 0.068uF; option C, 0.033uF; option D, 0.015uF; option E, 0.0082uF; option F, 0.004uF; and option G, 0.0022uF. These capacitance values are additive and provide a range of zero to 0.13uF in approximately 0.002uF increments. For 900-ohm line impedance, use balance capacitance equal to the line capacitance. For 600-ohm line impedance, use balance capacitance equal to two-thirds of the line capacitance.

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.

7.5 Battery Reversal Control (Screw Option M)

When closed, screw option M allows a busy indication to be sent to the far end with the NORM/BUSY switch in BUSY. Open screw option M when a busy indication is not to be sent to the far end.

7.6 Wink Circuit (Screw Option J – 3656–01 Only)

The wink circuit (3656–01 only) provides a nominal 140-millisecond reverse battery wink to the office upon receiving an initial off-hook indication. This feature is enabled by closing screw option J and is disabled by opening screw option J.

8. ALIGNMENT

The input and output levels of the 3656–00/01 channel units are adjusted to compensate for transmission losses (0 to 8dB) by the XMT GAIN CONTROL and the RCV GAIN CONTROL.

8.1 Transmit Alignment

The XMT GAIN is a potentiometer control that provides gain from zero to 8dB to accommodate an input TLP range of –7 to 1.0dBm. To adjust the transmit path to the proper operating level, insert nominal input signal at T and R and adjust the XMT GAIN until a +5.2 TLP is measured at test jacks TX and TXR with a bridged meter.

8.2 Receive Alignment

The RCV GAIN is a potentiometer control that provides gain from zero to 8dB to accommodate an output TLP range of –8 to 0dBm. Using either the 1kHz signal from the 3619–00 Channel Unit Extender or an internal 1kHz from the channel bank, adjust the RCV GAIN until the desired output level is measured at T and R.

9. TESTING

After completing Parts 5. through 8., place a call end-to-end through the facility to verify proper operation. If trouble is encountered, recheck all installer connections, optioning, and gain settings. Also, verify that the channel unit is making positive contact with the backplane connector. If the difficulty persists, replace the unit with one known to be good, and retest. 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 re-

placement 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 3656–00/01 (Issue 2) are as follows:

12.1.1. Transmission

(a) PERMISSIBLE MODES: 2L-4T, 2N-4T, 2T6-4T, 2T9-4T, 4T-2L, 4T–2N, 4T-2T6, 4T–2T9.

(b) 2-WIRE IMPEDANCE: 600/900 ohms.

(c) LINE-SIDE LEVELS (XMT and RCV): +5.2dBm TLP (fixed).

(d) DROP-SIDE LEVELS: Transmit Input, –7.0dBm (minimum), +1.0dBm (maximum); Receive Output, –8.0dBm (minimum), 0.0dBm (maximum).

(e) INTERNAL FIXED 1000Hz GAIN: Transmit, +4.2dB; Receive: –13.2dB.

(f) ADJUSTABLE GAIN (XMT and RCV): 0.0dBm to +8.0dBm continuous adjustment.

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

FREQUENCY (Hz)	XMT (dB)	RCV (dB)
60 200	–20 maximum	——
300	–3 to +0.15	–2 to +0.15
1000	–0.5 to +0.25	–0.5 to +0.25
3000	0 (Reference)	0 (Reference)
3400	–0.5 to +0.25	–0.5 to +0.25
4000	–1.2 to 0	–1.2 to 0
	–14.0 maximum	–14.0 maximum

(h) LONGITUDINAL BALANCE: –68dB maximum at 200Hz, –62dB maximum at 1kHz; –60dB maximum at 3kHz (Referenced to –16dBm TLP – AT&T Method).

(i) SIGNAL TO DISTORTION RATIO: 35dB minimum at 0 to –30dBm0; 29dB minimum at –40dBm0; 24dB minimum at –45dBm0.

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

(k) RETURN LOSS: Echo 33dB minimum; singing 20dB minimum.

(l) TRANSMIT AND RECEIVE IDLE CHANNEL NOISE (SINGLE-ENDED): 20dBrnC0 maximum.

(m) LEVEL TRACKING (MEASURED SINGLE-ENDED AT 1010Hz): ±0.25dB from +3 to –37dBm0; ±0.5dB from –37 to –50dBm0.

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

12.1.2. Signaling

(o) MINIMUM OPERATING CURRENT: 20mA at –48 volt.

12.2 Physical

The physical characteristics of the 3656–00/01 (Issue 2) are shown in Table 3:

Table 3. Physical Specifications

Feature	U.S.	Metric
Height	4.27 inches	10.8 centimeters
Width	1.39 inches	3.5 centimeters
Depth	10.3 inches	26.1 centimeters
Weight	16 ounces	453.6 grams