

3652-35 4-Wire E&M with Extended Range (4W E&M/ER) Channel Unit

Complies with UL Standard 1459 Second Edition*

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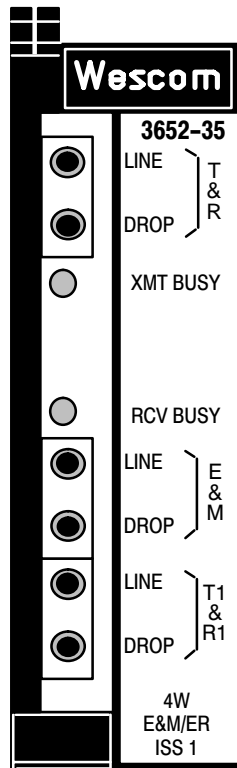


Figure 1. 3652-35 4W E&M/ER Channel Unit

1. GENERAL

1.1 Document Purpose

This document provides general and installation information about the Charles Industries 3652-35 4-Wire E&M with Extended Range (4W E&M/ER) Channel Unit, shown in Figure 1

***CAUTION**

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

1.2 Document Status

This document is reprinted to include a general editorial update.

1.3 Equipment Function

The Charles Industries 3652-35 4-Wire E&M with Extended Range (4W E&M/ER) Channel Unit is designed for operation in a Charles Industries 360/363 D4 Digital Carrier Terminal. The 3652-35 provides a direct interface between 600 ohm 4W E&M circuits and the 360/363 D4 Digital Carrier Terminal.

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 3652-35 4W E&M/ER includes the following features:

- Complies with AT&T Publication 43801 Specifications
- Complies with UL Standard 1459 Second Edition
- Accommodates transmit and receive TLP levels from –19.0 to +13dBm
- Provides 600 ohm impedance at the 4W port interface
- Front-panel-mounted bantam jacks for accessing the transmit and receive ports and the E&M leads
- Optional sealing current configuration with automatic ZAP
- Compatible with E&M signaling Types I, II, & III
- Front-panel LEDs to indicate E&M signal status

The breaking jacks provided on the T & R, T1 & R1, and E&M leads of the 3652-35 provide access by breaking the line toward the DROP (trunk facility) and LINE (carrier facility).

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 3652-35 provides an interface between 600-ohm 4-wire E&M trunk circuits and the 360/363 D4 Digital Carrier Terminal. The receive and transmit paths of the 3652-35 provide 0 to 32.5dB prescription adjustable attenuators to accommodate transmit and receive TLP levels from -19.0 to $+13$ dBm. See Figure 2 for a typical E&M application.

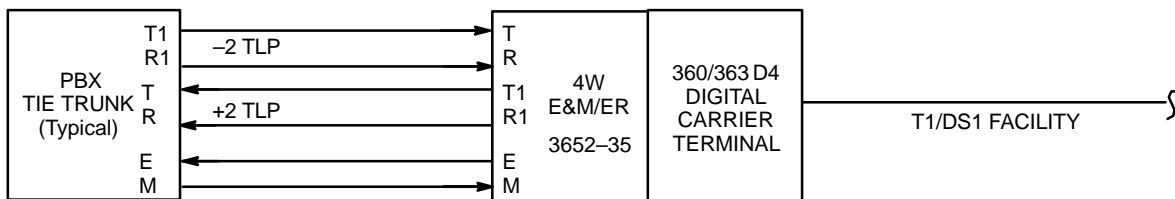


Figure 2. Typical 3652–35 4W E&M Application

4. CIRCUIT DESCRIPTION

Refer to Figure 3, the 3652-35 block diagram, as needed while reading the following circuit description.

4.1 Transmit VF Path

VF signals applied to the input T & R (pins 50 and 48) are routed through the DROP and LINE lifting jacks to transformer T1. Transformer T1 provides a balanced input and dc isolation from the line.

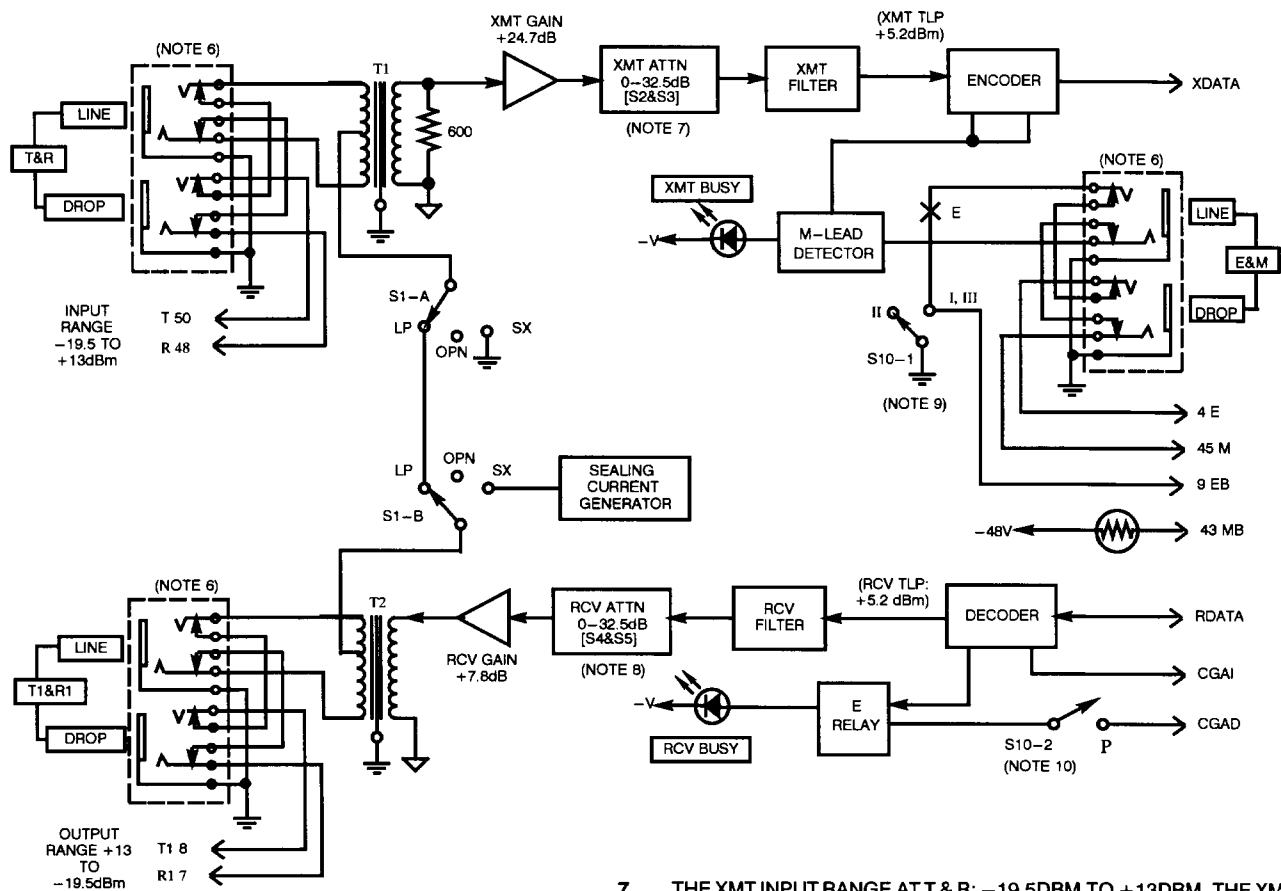
Voice energy from transformer T1 is routed to the XMT GAIN which provides a fixed 24.7dB of gain.

The output of the XMT GAIN circuit is applied to the XMT ATTN which provides 0.0 to 32.5dB of attenuation in 0.1dB steps. The XMT ATTN allows the input at T & R to range from -19.5 to $+13.0$ dBm.

The adjusted VF signal is then applied to the XMT FILTER circuit. The filter suppresses frequencies that are outside of the standard voice frequency and prevents them from entering the ENCODER. The ENCODER performs an analog-to-digital (A/D) conversion and sends the resulting PCM signal to the 360/363 common equipment via the XDATA lead. A level of $+5.2$ dBm 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 from the far end is received by the 360/363 D4 Digital Carrier Terminal, is routed to the 3652-35 via the RDATA lead, and is applied to the DECODER circuit. The DECODER then performs a digital-to-analog (D/A) conversion of the signal. The analog signal from the DECODER circuit is applied to the RCV FILTER. The RCV FILTER suppresses frequencies that are outside of the bandwidth of the standard voice band. A level of $+5.2$ dBm at the output of the DECODER is equivalent to a 0dB level on the digital line.



NOTES:

1. ← PC BOARD CONNECTOR PIN
2. → SIGNAL FLOW DIRECTION
3. [XXXX] FRONT PANEL MARKING
4. ✕ + N. O., N. C. RELAY CONTACT
5. GANGED SWITCHES ARE INDICATED BY ALPHABETICALLY SUFFIXED REFERENCE. NUMERICAL SUFFIX DENOTES DISCRETE SWITCH WITHIN A PACKAGE.
6. PC MOUNT TEST JACKS:

MARKING	FUNCTION
T & R LINE	ACCESS TOWARD CHANNEL UNIT
T & R DROP	ACCESS TOWARD OFFICE EQUIPMENT
E&M LINE	ACCESS TOWARD CHANNEL UNIT
E&M DROP	ACCESS TOWARD OFFICE EQUIPMENT
T1 & R1 LINE	ACCESS TOWARD CHANNEL UNIT
T1 & R1 DROP	ACCESS TOWARD OFFICE EQUIPMENT

7. THE XMT INPUT RANGE AT T & R: -19.5DBM TO +13DBM. THE XMT ATTN PROVIDES FROM 0 TO 32.5DB OF ATTENUATION IN 0.1DB INCREMENTS TO ACCOMMODATE VARIOUS INPUT TLPs. SEE EXAMPLE BELOW.

INPUT (dBm)	XMT ATTN SETTING
0.0	19.5
-2.0	21.5
-6.0	25.5

8. THE RCV OUTPUT RANGE AT T1 & R1 IS +13.0 TO -19.5DBM. THE RCV ATTN PROVIDES FROM 0 TO 32.5DB OF ATTENUATION IN 0.1DB INCREMENTS TO ACCOMMODATE VARIOUS OUTPUT TLPs. SEE EXAMPLE BELOW.

OUTPUT (dBm)	RCV ATTN SETTING
0.0	13.0
+2.0	11.0
-2.0	15.0

9. M-LEAD SIGNALING: BUSY = -BATT; IDLE = GND/OPEN E-LEAD SIGNALING: BUSY = E LEAD SHORTED TO EB LEAD; IDLE = OPEN E-LEAD
10. CARRIER GROUP ALARM OPTION S10-2 (P).
 - (A) FOR A CONTINUOUS IDLE DURING CGA, PLACE S10-2 IN THE OFF POSITION.
 - (B) FOR A 2-SECOND IDLE FOLLOWED BY CONTINUOUS BUSY, FOR THE DURATION OF CGA, PLACE S10-2 IN THE ON (P) POSITION.

Figure 3. 3652-35 4W E&M/ER Channel Unit Block Diagram

The output of the RCV FILTER is applied to the RCV ATTN circuit which provides 0.0 to 32.5dB of attenuation in 0.1dB steps. The RCV ATTN and the fixed gain of the RCV GAIN circuit allows the output level at T1 & R1 to be adjusted from +13.0 to –19.5dBm.

The adjusted VF signal is then buffered via the RCV GAIN circuit and routed through transformer T2 which provides dc isolation from the line and a balanced output level. The signal is then fed to the T1 & R1 leads (pins 8 and 7) via the LINE and DROP jacks.

4.3 Sealing Current

Three different configurations of Sealing Current are provided and are selected by option Switch S1.

The SX (Simplex) position supplies ground to leads T and R and –48Vdc, through a 750 ohm thermistor, to leads T1 and R1. When the module is first plugged in, the current surges to approximately 100mA and decreases quickly to a steady simplex current of approximately 30mA. This low value of dc current being applied to the 4W cable pairs, on a simplex basis, will break down any resistance film which may build up at nonsoldered splices. Continued application of this dc sealing current sustains the normal resistance of the cable pairs and prevents degradation of transmission performance.

In the LP (Loop) position, the simplex leads of T1 and T2 are shorted together. Sealing current from the other end of the analog facility will be looped by the channel unit.

The OPN (Open) position is used when no sealing current is required.

4.4 Signaling

The 3652-35 signaling path interfaces with the trunk circuit via the E&M leads. In the transmit direction, signaling is applied to the M-LEAD DETECTOR. When an off-hook condition (–48V) is applied to the M-lead, a logic 1 is transmitted by the ENCODER circuit on both A & B signaling highways, indicating a busy condition and illuminating the XMT BUSY LED. A ground/open condition on the M-lead will result in a logic 0 to be transmitted on the A & B highways, extinguishing the XMT BUSY LED.

In the receive direction, a logic 1 (off-hook) on the RCV A signaling highway, will activate the E RELAY, shorting the E lead to the EB lead and illuminating the RCV BUSY LED. An on-hook condition from the far end, a logic 0 on the RCV A signaling highway, will deactivate the E RELAY extinguishing the RCV BUSY LED. Option switch S10 provides a ground on the EB lead for Type I and III signaling compatibility.

When a carrier failure occurs, the CGAI bus will idle the E RELAY immediately. If option S10-2 is in the ON (P) position, the E RELAY will go from idle to busy approximately 2.5 seconds later, preventing the 3652-35 from being seized.

5. MOUNTING

The 3652-35 mounts in one channel-unit slot of a 360/363 D4 Digital Carrier Terminal. The 3652-35 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 guides and connector to verify proper alignment and the absence of foreign material.

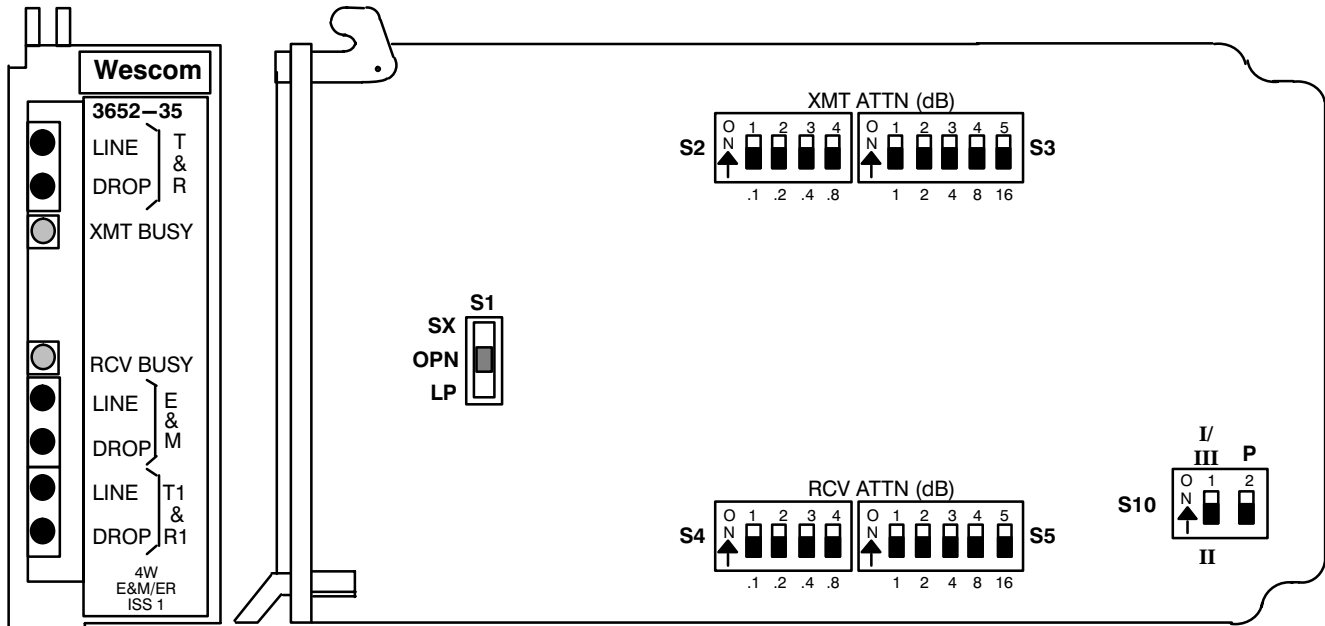
Align the channel unit with the appropriate card-guided slot of the terminal. Slide the unit into the slot with the front panel in a horizontal (up) position. When the top portion of the hinged front panel is under the front lip of the terminal, push down on the front panel until it is in the vertical 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

Installer connections are made to the channel unit via connectorized cable connectors that are part of the channel bank assembly. Refer to the appropriate channel bank installer Practice for pin assignments.

7. OPTIONS

The 3652-35 is equipped with DIP and slide switch options that are used to condition the module for proper application and operation. Refer to Figure 4 for the location of these options while reading the following instructions.



Option	Function	Position
S1	Sealing current is generated by the channel unit with automatic ZAP when the module is first plugged in.	SX (Simplex)
	No sealing current is required.	OPN (Open)
	Sealing current supplied from the other end of the analog facility is looped by the channel unit via the simplex leads of transformers T1 and T2.	LP (Loop)
S2, S3 XMT ATTN	Switches S2 and S3 form a 9-section DIP switch that provides up to 32.5dB of attenuation, in 0.1dB steps, for adjusting the transmit path to the proper operating level at the ENCODER input.	ON/OFF as required. Refer to Transmit Alignment in Part 8.
S4, S5 RCV ATTN	Switches S4 and S5 form a 9-section DIP switch that provides up to 32.5dB of attenuation, in 0.1dB steps, for adjusting the receive path to the proper operating level output at leads T1 & R1.	ON/OFF as required. Refer to Receive Alignment in Part 8.
S6 – S9	Designations S6 through S9 not used on this module.	————
S10–1 I III/II	Provides Type I or Type III signaling interface (See Figure 5).	I/III
	Provides Type II signaling interface (See Figure 5).	II
S10–2 P	Provides continuous idle condition during CGA.	OFF
	Provides busy condition, after 2-second idle, during CGA.	ON (P)

Figure 4. 3652-35 4W E&M/ER/LB Channel Unit Option Locations

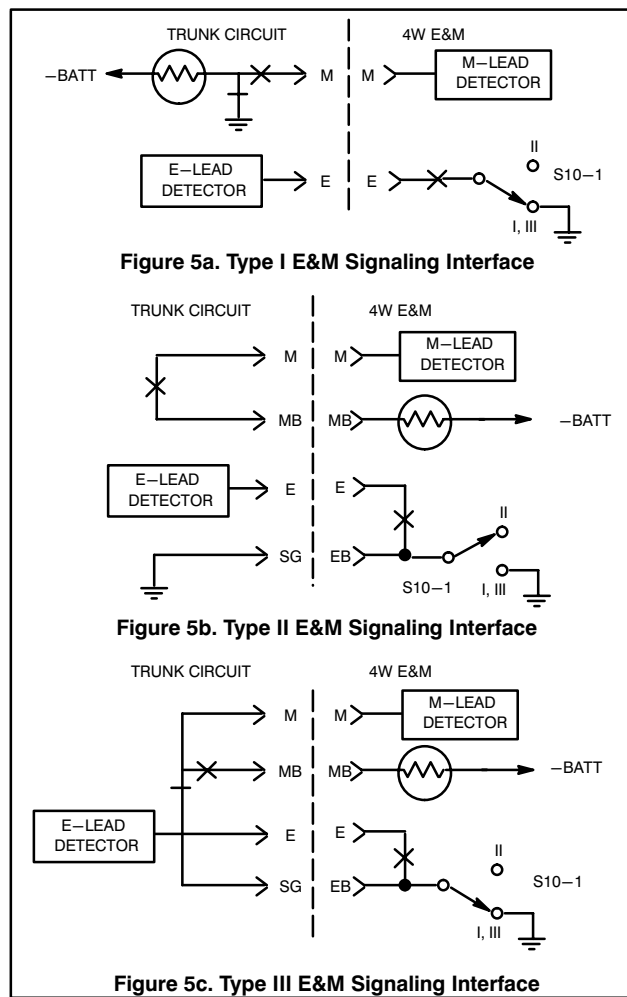


Figure 5. 3652-35 E&M Type I, II, and III Signaling Interface

7.1 Slide-Switch S1 - Sealing Current Control

When S1 is placed in the SX (Simplex) position the 3652–35 provides sealing current to leads T and R (ground) and leads T1 and R1 (–48Vdc). In the SX position the module also provides an automatic ZAP when it is first plugged in. When switch S1 is placed in the LP (Loop) position, the simplex leads of T1 and T2 are shorted together, which allows the channel unit to loop sealing current applied from the other end of the analog facility. The OPN (Open) position is used when no sealing current is required.

7.2 Switches S2 and S3 – XMT ATTN (Transmit Prescription Attenuation)

Switches S2 and S3 form a 9-section DIP switch that provides up to 32.5dB of attenuation, in 0.1dB steps, to accommodate various input TLPs. Refer to Transmit Alignment in Part 8.

7.3 Switches S4 and S5 – RCV ATTN (Receive Prescription Attenuation)

Switches S4 and S5 form a 9-section DIP switch that provides up to 32.5dB of attenuation, in 0.1dB steps, to accommodate various output TLPs. Refer to Receive Alignment in Part 8.

7.4 Switch S10-1 – Type I/III or Type II Signaling

Switch S10-1 is used to condition the 3652–35 for E&M signaling Types I, II or III. Refer to Figure 5 for appropriate optioning of S10-1 for E&M Type I, II or III compatibility.

7.5 Switch S10-2 (P) – Carrier Failure (CGA)

With S10-2 in the OFF position, the 3652-35 will respond immediately to a carrier failure by forcing the E RELAY idle. With S10-2 in the ON (P) position, the E RELAY will go to an idle condition and then to a busy condition approximately 2.5 seconds later. This will prevent the 3652-35 from being seized during a CGA condition.

8. ALIGNMENT

8.1 Transmit Alignment

The XMT ATTN switches S2 and S3 are prescription controls that provide attenuation from 0.0 to 32.5dB in increments of 0.1dB to accommodate an input TLP range from –19.5 to 13.0dBm. To adjust the transmit path to the proper operating level, the difference between –19.5 and the transmit TLP at T & R must be obtained:

$$\text{XMT ATTN} = \text{TLP} - (-19.5)$$

For an input TLP of –2.0dBm, the XMT ATTN = $-2 - (-19.5) = 21.5\text{dB}$. Set the sum of switches S2 and S3 settings to 21.5.

8.2 Receive Alignment

The RCV ATTN switches S4 and S5 are prescription controls that provide attenuation from 0.0 to 32.5dB in increments of 0.1dB to accommodate an output TLP range from +13.0 to –19.5dBm. To adjust the receive path to the proper operating level, the difference between +13.0 and the receive TLP at T1 & R1 must be obtained:

$$\text{RCV ATTN} = 13.0 - \text{TLP}$$

For an output TLP of +2.0dBm, the RCV ATTN = $+13.0 - (+2.0) = 11.0\text{dB}$. Set the sum of switches S4 and S5 settings to 11.

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 connections 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
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

The electrical characteristics of the 3652-35 are as follows:

(a) POWER REQUIREMENTS

Power is supplied via the 3609–XX PSU which is part of the 360/363 Channel Bank common equipment.

Power consumption: Idle, 1.2 watts; Busy, 1.5 watts (plus sealing current if provided).

12.1 Transmission

- (a) XMT INPUT TLP RANGE: +13.0 to –19.5dB.
- (b) RCV OUTPUT TLP RANGE: +13.0 to –19.5dB.
- (c) TRANSMIT AND RECEIVE PRESCRIPTION ATTENUATION: 0.0 to 32.5dB in 0.1dB steps.
- (d) LONGITUDINAL BALANCE (REFERENCED TO –16dBm TLP): 74dB minimum at 200Hz to 1KHz; 69dB minimum at 3KHz.

- (e) SIGNAL TO DISTORTION RATIO: 35dB minimum at zero to –30dBm0; 29dB minimum at –40dBm0; 25dB minimum at –45dBm0.
- (f) RETURN LOSS: 23dB minimum at 300Hz to 3KHz; 28dB minimum at 1kHz.
- (g) TRANSMIT/RECEIVE IDLE CHANNEL NOISE: 20dBm0 maximum.
- (h) TRANSMIT AND RECEIVE PATH FREQUENCY RESPONSE: (Referenced at 1kHz)

FREQ (Hz)	XMT (dB)	RCV (dB)
60	Less than –14.0	_____
200	+0.15 to –2.0	+0.15 to –1.0
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	Less than –14.0	Less than –14.0

- (i) CROSSTALK: 61dBm0 minimum at 400Hz; 71dBm0 minimum at 700Hz to 1KHz; 70dBm0 minimum at 3kHz
- (j) LEVEL TRACKING SINGLE-ENDED AT 1020Hz: ±0.25dB from +3 to –37dBm0, ±0.5dB from –38 to –50dBm0.
- (k) OPERATING ENVIRONMENT: Temperature, 32 to 122°F (0 to 50°C).

12.2 Signaling

- (a) DIAL PULSE DISTORTION: ±2% single ended; ±4% end-to-end.

12.3 Physical Specifications

See Table 1 for the physical characteristics of the 3652-35 .

Table 1. Physical Specifications

Feature	U.S.	Metric
Weight	9.25 ounces	263 grams
Height	4.25 inches	10.8 centimeters
Width	1.31 inches	3.3 centimeters
Depth	10.31 inches	26.2 centimeters

