

360-22 D4 Digital Carrier Terminal Troubleshooting Procedures

CONTENTS	PAGE
Part 1. GENERAL	2
Part 2. TEST EQUIPMENT	2
Part 3. INDICATOR DESCRIPTIONS	3
Part 4. ALARM TROUBLESHOOTING PROCEDURES	4
Part 5. CHANNEL UNIT TROUBLESHOOTING PROCEDURES	8
Part 6. TECHNICAL ASSISTANCE	13
Part 7. WARRANTY & CUSTOMER SERVICE	13

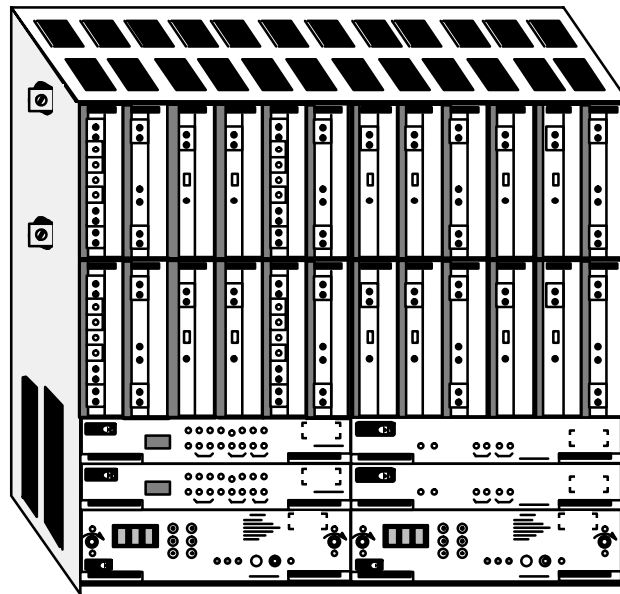


Figure 1. Charles Industries 360-22 D4 Digital Carrier Terminal

1. GENERAL

1.1 Document Purpose

This document provides troubleshooting procedures for the Charles Industries 360–22 D4 Digital Carrier Terminal (DCT). These procedures are aimed at clearing both alarm and nonalarm problems. Alarm problems are generally caused by a common equipment unit failure, and are displayed by alarm indicators on the unit front panels. Non-alarm problems are generally caused by a channel unit failure, and are detected by performing tests outlined in this and related documents (refer to Section 360–000–000 Numerical Index to Digital Carrier practices 360 and 363 D4 Digital Carrier Terminals).

The troubleshooting procedures in this document are in the form of flowcharts and tables. When using the flowcharts to clear alarms, always start with Figure 1 (the Power Alarm Troubleshooting Flowchart). The tables are used primarily for troubleshooting channel unit (nonalarm) problems.

The flowcharts and tables in this document refer to the near-end and far-end terminal. The near-end terminal is at the reader's location.

1.2 Document Status

This document is reprinted to provide a general editorial update.

1.3 Unit Replacement

When replacing a suspected faulty unit, use the faulty unit as a guide for optioning the replacement unit. If the replacement unit is not optioned exactly as is the faulty unit, the troubleshooting procedure may not be conclusive.

When a suspected faulty unit is replaced but does not clear the problem, it should be reinstalled in its original position.

1.4 Safety Precautions

All due caution should be exercised to avoid coming in contact with any of the voltages present on the rear panel of the 360–22 D4 DCT.

2. TEST EQUIPMENT

Test equipment required to perform the troubleshooting procedures in this document is as follows:

- Hewlett Packard 3551A Transmission Test Set (which includes a noise measuring test set) or equivalent, with patch cords.
- 3619–00 Channel Unit Extender (CUX) with patch cords.
- Impulse noise counter, Northeast Electronics TTS 58-A, or equivalent.
- Dial pulse test set, Northeast Electronics TTS 26-B, or equivalent.
- Volt/Ohm Meter (VOM), Simpson 260, or equivalent.
- Test lead assemblies, necessary to perform troubleshooting procedures.
- Mini-to-310-plug conversion patch cord, ADC PJ946 (or equivalent).
- 900-ohm resistor in series with a 2.15uF capacitor termination network.
- 600-ohm resistor in series with a 2.15uF capacitor termination network.

Verify that all test equipment used in the troubleshooting procedures is accurately calibrated.

3. INDICATOR DESCRIPTIONS

The operating status of a 360–22 D4 DCT is indicated by LEDs mounted on the front panel of the common equipment units and the display of the DIU–R. These indicators are divided into three categories: major alarm, alarm status, and maintenance indicators. The major alarm indicators illuminate when a failure is detected in the 360–22 D4 common equipment. The alarm status indicators are used to determine the cause of an alarm, and as troubleshooting aids in clearing the alarm. The maintenance indicators display the type and status of various functions that are activated during alarm conditions and troubleshooting procedures. Table 1 shows the location and function of each indicator.

Table 1. 360–22 Indicator Locations and Functions

Indicator Type	Indicator	Located On	Function (When On)
Major Alarm	AR	3608–04	Local alarm. Indicates common equipment failure, power failure, or framing loss at near-end terminal.
	AY	3608–04	Remote alarm. Indicates presence of an AR alarm at far-end terminal.
Alarm Status	PCMF	3603–02	Indicates loss of incoming bipolar signal.
	PWR ALM	3609–04	Indicates power failure at near-end terminal.
Maintenance	TP	3608–04	Indicates that the trunks have been processed at the near-end.
	LT	3608–04	Indicates looped terminal or group.
	ACO	3609–04	Indicates alarm cut-off circuitry activated.
	DISPLAY	3608–04	Activity, alarm type, TP count, mode of operation.

The AR (alarm red) and AY (alarm yellow) LEDs are major alarm indicators. The PCMF (PCM fail) and PWR ALM (power alarm) LEDs are alarm status indicators. The TP (trunk processing) LED, LT (looped terminal) LED, ACO (alarm cut-off) LED and the DIU–R display are maintenance indicators. The PWR ON (power on) LED displays the status of the 3609–04 Power Supply Unit (PSU–R). During normal operation, the PWR ON indicator is ON and all other indicators are OFF.

3.1 Major Alarm Indicators

The 360–22 D4 DCT is in a major alarm condition when the AR, the AY, or both the AR and AY indicators are ON. During a major alarm condition, the 360–22 D4 DCT processes the trunk circuits out of service.

The AR indicator on a 360–22 D4 DCT is a locally–detected alarm and indicates, when ON, that the 360–22 D4 DCT is either unable to frame (synchronize) on the incoming bit stream, or has detected a common equipment or power failure in the near-end terminal. An AR alarm can be caused by a failure in one (or more) of the following: the receive circuitry of the near end, the transmit circuitry of the far end, or the intervening DS1 facility. The AR indicator will always be ON in conjunction with one or more of the alarm status indicators. By observing which alarm status indicator(s) is ON, the cause of the AR alarm can be determined, and steps can be taken to clear the alarm. The AR LED indicator is located on the 3608–04.

Note: Timing of the AR and TP LEDs is dependent on DIU–R S7–5 optioning.

The AY alarm indicator on a 360–22 D4 DCT is a remote alarm and indicates, when ON, the presence of an AR alarm at the far–end terminal. An AY alarm can be caused by a failure in one (or more) of the following: the transmit circuitry of the near end, the receive circuitry of the far end, or the intervening DS1 facility. The AY alarm is activated when the near end receives a remote alarm code from the far end. For diagnostic purposes, the AY alarm indicates that the far end is transmitting properly, the near end is receiving properly, and the intervening facility is operating properly.

Note: AY activity is dependent on DIU–R S7–5 optioning.

3.2 AR and AY Indicators Illuminated

When an AR alarm and AY alarm are present on the DIU–R simultaneously, it is an indication that the far end had an AR alarm and then was looped for troubleshooting.

3.3 Alarm Status Indicators

The alarm status indicators on a 360–22 D4 DCT illuminate during an AR alarm condition, and are used as troubleshooting aids to locate the cause of the AR alarm.

3.4 PCMF Indicator (LIU–3E)

The PCMF indicator illuminates when the LIU–3E is not receiving data from the far end, or when excessive zeros are in the bit stream. This condition can result from a failure at the far end, a failure in the DS1 facility, or a failure in the near–end receive circuitry.

3.5 PWR ALM Indicator (PSU–R)

The PWR ALM indicator illuminates when a power failure is detected within the 360–22 D4 DCT. A PWR ALM indication may result from one (or more) of the following: a blown fuse in the PSU–R, a failed PSU–R, an excessive load on one of the voltage buses from the PSU–R, or a failure of the reference voltages supplied to the channel units by the 3608–04 Digroup Interface /Redundant Unit (DIU–R). A PWR ALM indication always takes precedence over all other alarm indications because a loss of power may result in misleading alarm indications.

3.6 Maintenance Indicators

The maintenance indicators on a 360–22 D4 DCT display the status of the trunk processing, alarm cut-off, and looping functions of the 360–22 D4 DCT. These functions are activated during alarm conditions and troubleshooting procedures.

3.7 TP Indicator (DIU–R)

The trunk processing function is activated automatically during an alarm condition. The TP indicator illuminates when all trunks have been processed out of service. The DIU–R also provides a count of CGA (carrier group alarm) occurrences. The GCA counter or TP is incremented each time trunk processing is initiated by the 360–22 D4 DCT.

3.8 ACO Indicator (PSU–R)

Alarm conditions in a 360–22 D4 DCT activate audible and/or visual alarms in the local office via the PSU–R. Depressing the ACO switch on the PSU–R disengages the relays, thereby cutting off the office alarms. The ACO indicator illuminates when the alarm cut-off circuitry is activated.

3.9 Loop Terminal

The looping function, for the terminal, is activated by the LT switch located on the DIU–R. The looping status is displayed by the LT indicator, which is also located on the DIU–R.

Pressing the LT switch loops the bipolar output of the terminal to the bipolar input, disconnects the bipolar input from the DS1 facility, and transmits an all-ones quiet code to all channel units of the far-end terminal.

3.10 DIU–R Display

The front-panel display is responsible for indicating activity, error messages, TP count and operating mode. Refer to document Section 360–804–201 (DIU–R) for a complete list of messages.

4. ALARM TROUBLESHOOTING PROCEDURES

The procedure for clearing alarms in a 360–22 D4 DCT consists of using the Power Alarm Troubleshooting Flowchart (Figure 1) to ensure that any power alarms are clear and then referring to the appropriate flowchart to clear any other alarms in the terminal. If it is determined that a problem is present in the facility, refer to the line loop-back test.

After all alarms have been cleared and before the terminal is returned to service, all units that were replaced during troubleshooting should be reinstalled in the terminal to determine which replaced units are bad and which are good. Reinstall each unit that was replaced. If no alarms appear when a unit is reinstalled, the unit is good and should be left in the terminal. If an alarm does appear when a unit is reinstalled, the unit is faulty and should be replaced.

4.1 Power Alarm Troubleshooting Procedure

Figure 1 gives the procedure for clearing a PWR ALM indication (power failure). Since a power failure may cause misleading indications on the other alarm indicators, the flowcharts are arranged such that all alarm troubleshoot-

ing procedures begin with Figure 1. If further troubleshooting is required after performing the routine outlined in Figure 1, refer to the appropriate flowchart for clearing alarms in a particular mode.

4.2 Redundancy Troubleshooting Procedure

Figure 2 gives the procedure for clearing AR and AY alarms in a 360-22 D4 DCT equipped with redundant common equipment. The LIU-3E, PSU-R, and DIU-R, are independent and can be replaced without affecting the operation of the other group.

In the event that both groups are alarmed, troubleshoot group A first and then group B.

4.3 Line Loopback Test Procedure

The line loopback test should be performed when the operation of both end terminals has been verified and the facility is suspected of causing the problem. Use the following steps to perform the line loopback test. (Also see Figure 3.)

Note: When troubleshooting a redundant mode, perform Step 1 on the DIU-R in the affected group only.

Step	Action
1.	Using a test pin-plug, enable the FTP test point on the DIU-R. The AR LED should light in approximately 2.5 seconds (DIU-R S7-5 option). <i>Note: This action causes an AY alarm code to be inserted into the group transmit bit stream (DIU-R S7-5 option).</i>
2.	Verify that the terminal (set) is not looped. The LT indicator on the DIU-R is OFF.
3.	Have the facility looped back at the terminal end.
4.	Observe the AR and AY alarm indicators on the DIU-R at the near-end terminal. If both indicators are ON, the looped section of the facility is good. If the AR indicator is ON and the AY indicator is OFF (DIU S7-5 option), the looped section of the facility is defective.
5.	When the defective facility has been isolated, unloop the line, remove the pin-plug in the FTP test point on the DIU-R, and troubleshoot the facility in accordance with local practice.

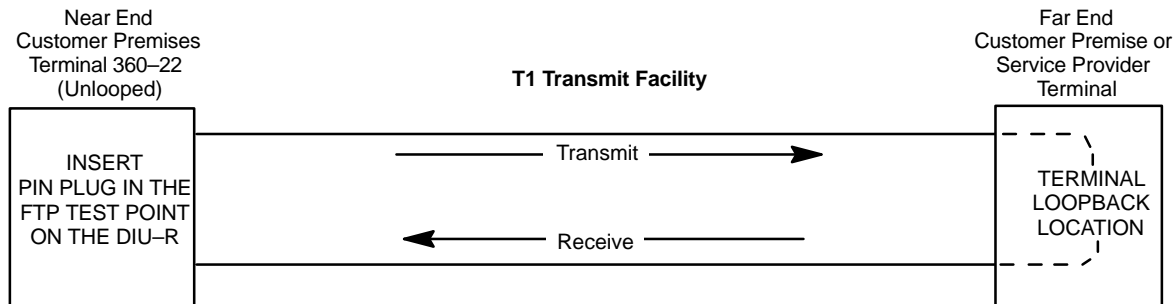


Figure 3. Line Loopback Test Example

NOTE: THE ACO LED ON THE RESPECTIVE PSU-R SHOULD BE ILLUMINATED. IF NOT, PRESS THE ACO SWITCH ON THE PSU-R.
 AFTER REPLACING A UNIT OR UNLOOPING THE TERMINAL, ALLOW 20 SECONDS FOR ALARMS TO CLEAR.

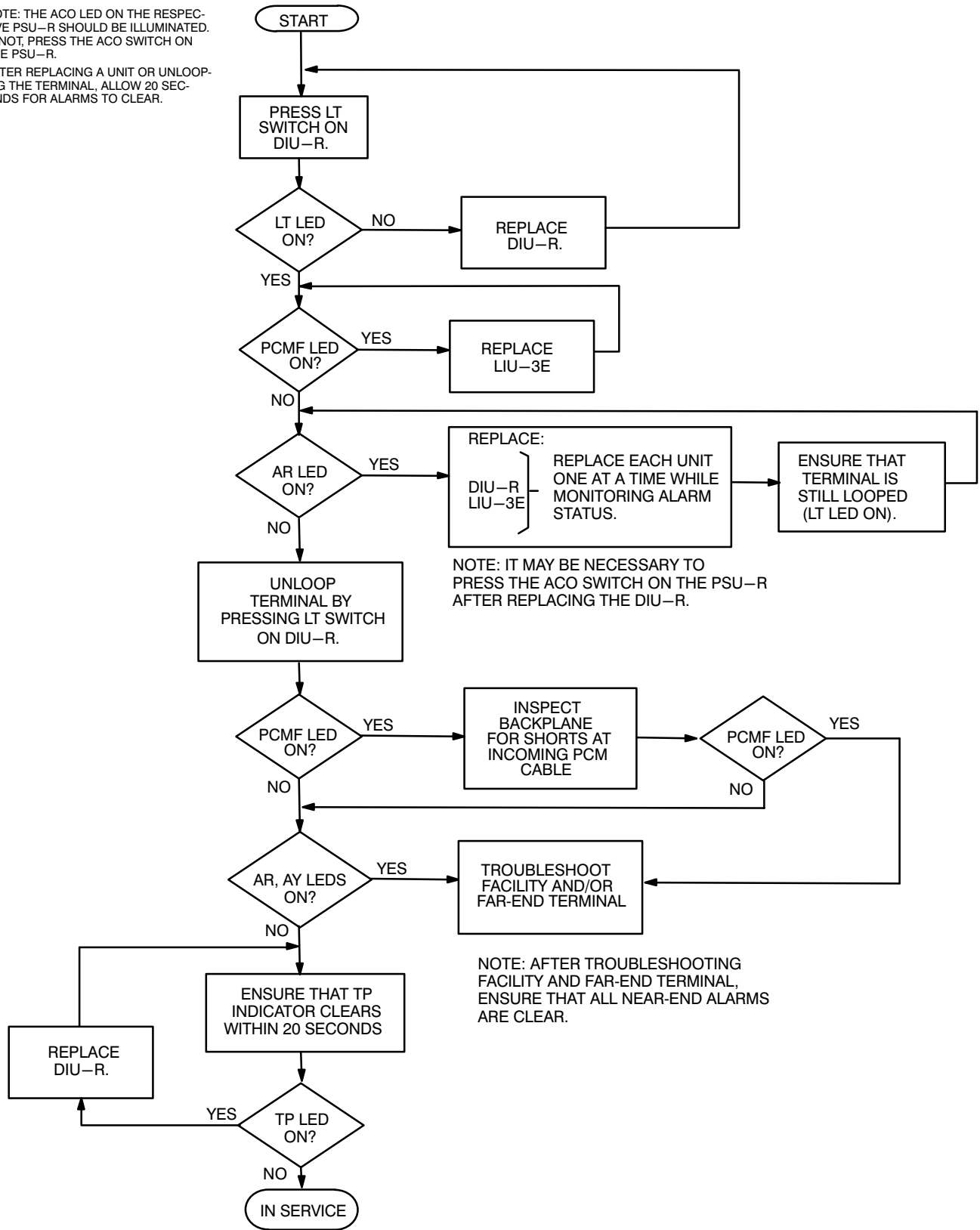


Figure 5. Troubleshooting Flowchart

5. CHANNEL UNIT TROUBLESHOOTING PROCEDURES

Channel unit troubleshooting procedures in this part should be used in conjunction with the VF transmission test procedures and signaling test procedures. Refer to Section 360–000–000 (Numerical Index to Digital Carrier practices) for the appropriate practice section that covers each particular channel unit.

Channel unit problems covered in this part are as follows:

- VF transmit and receive level problems.
- VF level tracking problems.
- High idle noise.
- High quantizing noise.
- High crosstalk.
- High impulse noise.

Because of the 360–22 D4 DCT's single channel coding/decoding scheme, crosstalk problems are virtually eliminated but any problems can usually be traced to a single channel unit. When one of these problems is reported in a single channel, follow the procedure outlined in 5.1. If these problems are reported in several channels, follow the procedure outlined in 5.2. For crosstalk troubleshooting procedures, refer to 5.3. For impulse noise troubleshooting procedures, refer to 5.4.

The channel unit troubleshooting procedure consists of isolating the problem to a particular channel unit or units by using the transmission test set and 3619–00 CUX to perform the single channel test outlined in Section 360–001–205. When the problem has been isolated, the suspected faulty unit is replaced and a single-ended alignment procedure is performed on the replacement unit. If the suspected faulty unit meets the requirements of the single channel tests, the problem exists in the far end or common equipment.

5.1 Single Channel Troubleshooting Procedure

Step	Action
1.	Remove the suspected faulty unit from the 360–22 D4 DCT. Insert the 3619–00 CUX unit into that empty slot of the removed unit. Place the suspected faulty unit in the 3619–00 CUX.
2.	Perform the single channel tests in accordance with Section 360–022–600 and the appropriate Section covering signaling tests.
3.	If the suspected faulty unit fails any of the single channel tests, replace the faulty unit and perform the single channel test on the replacement unit. <i>Note: When replacing channel units, use the faulty unit as a guide for optioning the replacement unit. If replacing a unit does not clear the problem, reinstall the old unit in its original slot.</i>
4.	If the suspected faulty unit passes all of the single channel tests, the problem probably exists in the far-end terminal. This should be verified before continuing troubleshooting procedures.
5.	If the problem is known to exist in the 360–22 D4 DCT and the operation of the channel unit has been verified by the single channel tests, inspect the wiring associated with the faulty channel's plug-in slot.
6.	If no problem is found in the wiring, replace the alarmed DIU–R.

5.2 Multiple Channel Troubleshooting Procedure

Step	Action
1.	If the faulty channels are not physically adjacent, treat them as single channels and perform the procedure outlined in 5.1 for each channel.
2.	If the faulty channels are physically adjacent or if the channel units all pass the single channel tests, inspect the backplane wiring associated with the faulty channels.
3.	If no problem is found in the backplane wiring and the problem is known to exist in the 360–22 D4 DCT, replace the following units one at a time in the order listed. After replacing each unit, perform the single channel test to see if the problem has cleared. <ol style="list-style-type: none"> 1. 3608–04 DIU–R (in the affected group). 2. 3603–02 LIU–3E (in the affected group for Redundancy Mode only). 3. 3609–04 PSU–R

5.3 Crosstalk Troubleshooting Procedure

Crosstalk problems can best be diagnosed by performing end-to-end tests on an operating system in accordance with Section 360–022–600.

The crosstalk path in the 360–22 D4 DCT generally exists in the transmit circuitry of the near-end terminal and the effect is measured at the far end. The two most likely interfering channels are selected for measuring crosstalk levels. The most likely interfering channels in a 360–22 D4 DCT are the physically adjacent ones. When a far-end terminal other than a 360–22 is used, the most likely interfering channels are the time-adjacent ones. Use the following procedure to troubleshoot crosstalk in a 360–22 D4 DCT.

Step	Action
1.	Perform the end-to-end system tests on the unit under test in accordance with Section 360–022–600.
2.	If the unit under test is picking up crosstalk from one or both of the adjacent channels, replace the unit under test. Perform the single channel adjustments on the replacement unit in accordance with Section 360–022–600, and repeat the end-to-end tests. If crosstalk level is still unacceptable proceed to Step 3. <i>Note: When replacing channel units, use the faulty unit as a guide for optioning the replacement unit. If replacing a unit does not clear the problem, reinstall the old unit in its original slot.</i>
3.	Replace the most likely interfering channel units one at a time. Perform the single channel adjustments on the replacement units, and repeat the end-to-end tests. If crosstalk level is still unacceptable after replacing one or both of the most likely interfering channel units, proceed to Step 4.
4.	Inspect the backplane wiring associated with the plug-in slots of the channel under test and both most likely interfering channels. If no problem is found in the backplane wiring, replace the 3608–04 DIU–R in the affected group. If crosstalk level is still unacceptable, troubleshoot the far end.

5.4 Impulse Noise Troubleshooting Procedure

Impulse noise levels can be affected by the performance of the near-end or far-end terminals, digital multiplexer equipment, DS1 facility, or the facility connecting the terminals.

The troubleshooting procedure consists of measuring the impulse noise level on the suspected faulty unit. The test set-up for impulse noise measurement is shown in Figure 6. In cases of intermittent impulse noise, time can be saved by creating an artificial source of impulse noise which will be detectable on the suspected faulty unit if it is susceptible to impulse noise. This test set-up is shown in Figure 7.

Use the following steps to perform impulse noise troubleshooting. To provide a reasonable time duration for impulse noise tests, the requirements are given for five-minute intervals.

Step	Action												
1.	<p>Take the channel unit out of service that is to be measured and terminate the far-end channel unit.</p> <p><i>Note: When a channel unit is replaced, use the old unit as a guide for optioning the replacement unit. If replacing a unit does not eliminate the problem, reinstall the old unit in its original slot.</i></p>												
2.	<p>Set up the test equipment as shown in Figure 6 for severe impulse noise problems. For intermittent impulse noise problems, set up the equipment as shown in Figure 7.</p>												
3.	<p>Configure the impulse noise counter as follows:</p> <ol style="list-style-type: none"> 1. Set the WGT switch to VOICE. 2. Set the INPUT switch to 600 ohms for 4W units and to 900 ohms for 2W units. 3. Set the BRDG/TERM switch to TERM. 4. Set the HOLD switch to ON for loop-start channel units (DPO, FXS, SDPO, PLAR, RD) and to OFF for all other channel units. <p>Set the REF LVL DBRN switches as follows:</p> <p>For 4W units with the receive level set to +7dBm;</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">HIGH level</td> <td>Maximum setting</td> </tr> <tr> <td>MID level</td> <td>70dBmC</td> </tr> <tr> <td>LO level</td> <td>65dBmC</td> </tr> </table> <p>For 2W units with the receive level set to –3dBm;</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">HIGH level</td> <td>Maximum setting</td> </tr> <tr> <td>MID level</td> <td>60dBmC</td> </tr> <tr> <td>LO level</td> <td>55dBmC</td> </tr> </table>	HIGH level	Maximum setting	MID level	70dBmC	LO level	65dBmC	HIGH level	Maximum setting	MID level	60dBmC	LO level	55dBmC
HIGH level	Maximum setting												
MID level	70dBmC												
LO level	65dBmC												
HIGH level	Maximum setting												
MID level	60dBmC												
LO level	55dBmC												
4.	<p>Set the TIMER control on the impulse counter for a five-minute interval. The requirements are:</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">HIGH level</td> <td>0 counts maximum</td> </tr> <tr> <td>MID level</td> <td>1 count maximum</td> </tr> <tr> <td>LO level</td> <td>5 counts maximum</td> </tr> </table>	HIGH level	0 counts maximum	MID level	1 count maximum	LO level	5 counts maximum						
HIGH level	0 counts maximum												
MID level	1 count maximum												
LO level	5 counts maximum												
5.	<p>If the requirements are not met, replace the near-end and/or far-end channel units one at a time, perform the single channel adjustments on the replacement units, and repeat the impulse noise test after replacing each unit.</p>												
6.	<p>If the requirements are not met, check the far-end terminal for errors per local practices. If the far-end terminal has excessive errors, remove it from service. If the far end is equipped with a 360–22 D4 DCT, remove it from service by inserting a pin plug into the FTP test point on the DIU–R. Repeat impulse noise test. If the requirements are not met, proceed to Step 7.</p> <p><i>Note: In the Redundancy Mode, remove only the defective DIU–R from service.</i></p>												
7.	<p>Replace the appropriate LIU–3E (in Redundancy Mode, replace only the LIU–3E in the defective group) and repeat the impulse noise test. If the requirements are met, return the terminal to service. If the requirements are not met, proceed to Step 8.</p>												
8.	<p>Check the facility for errors per local practices. If the facility has an acceptable error rate, the problem is probably at the near end.</p>												
9.	<p>Remove the near end from service (see Step 6 and NOTE).</p>												
10.	<p>Replace the following units one at a time in the order listed. After replacing each unit, repeat the impulse noise test.</p> <ol style="list-style-type: none"> 1. LIU–3E* 2. DIU–R* 3. PSU–R <p>*Replace only the units in the defective group.</p>												

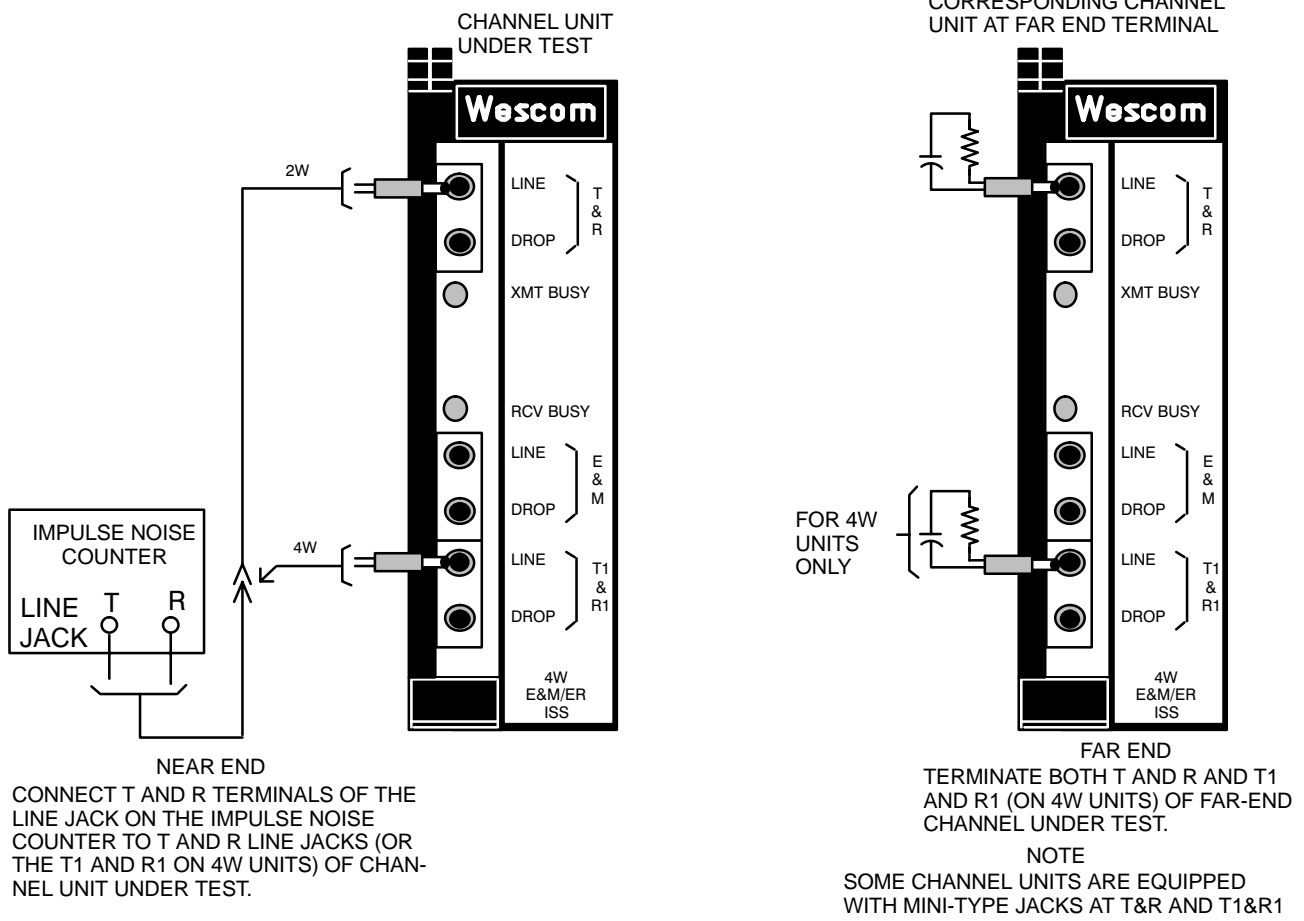
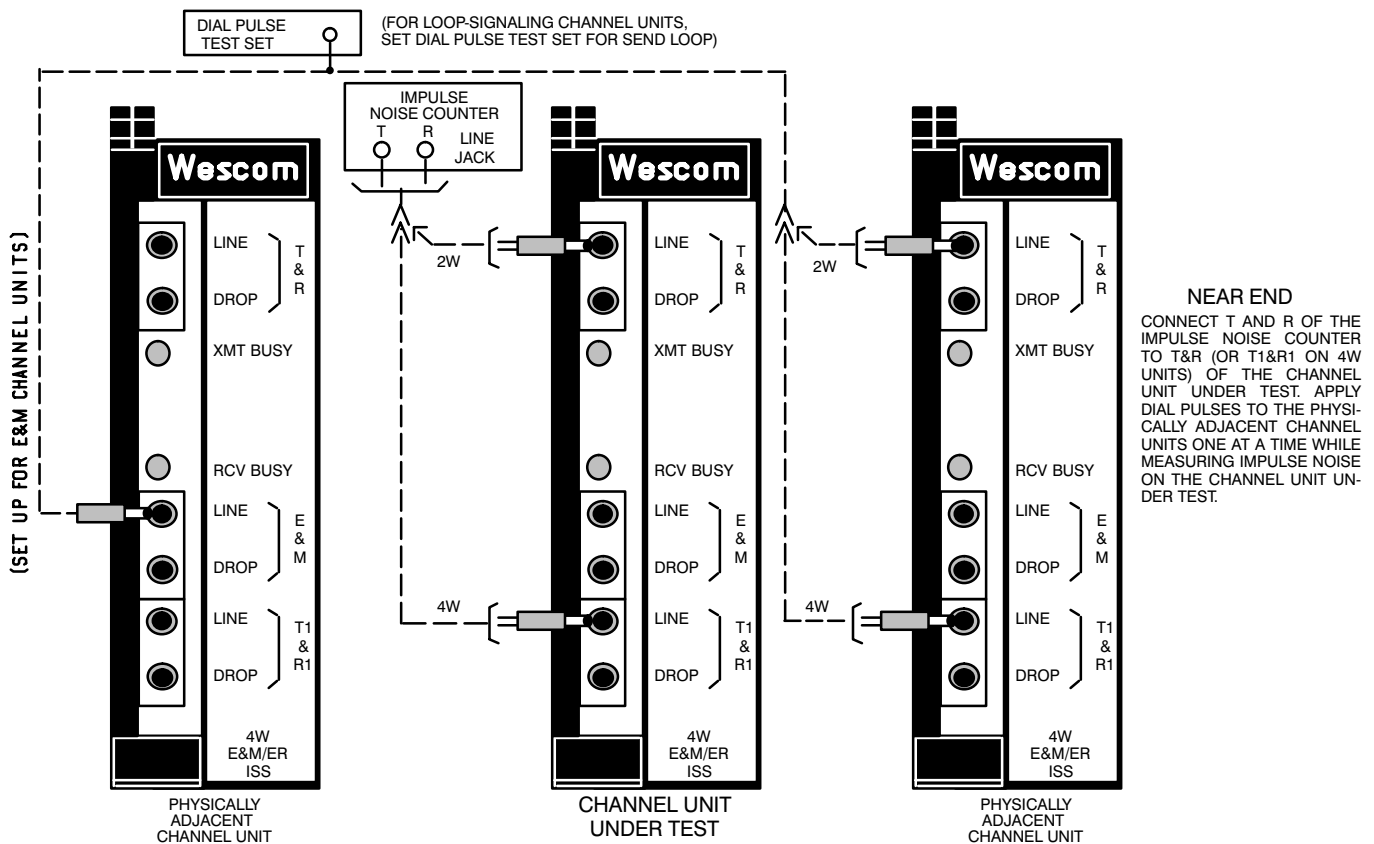
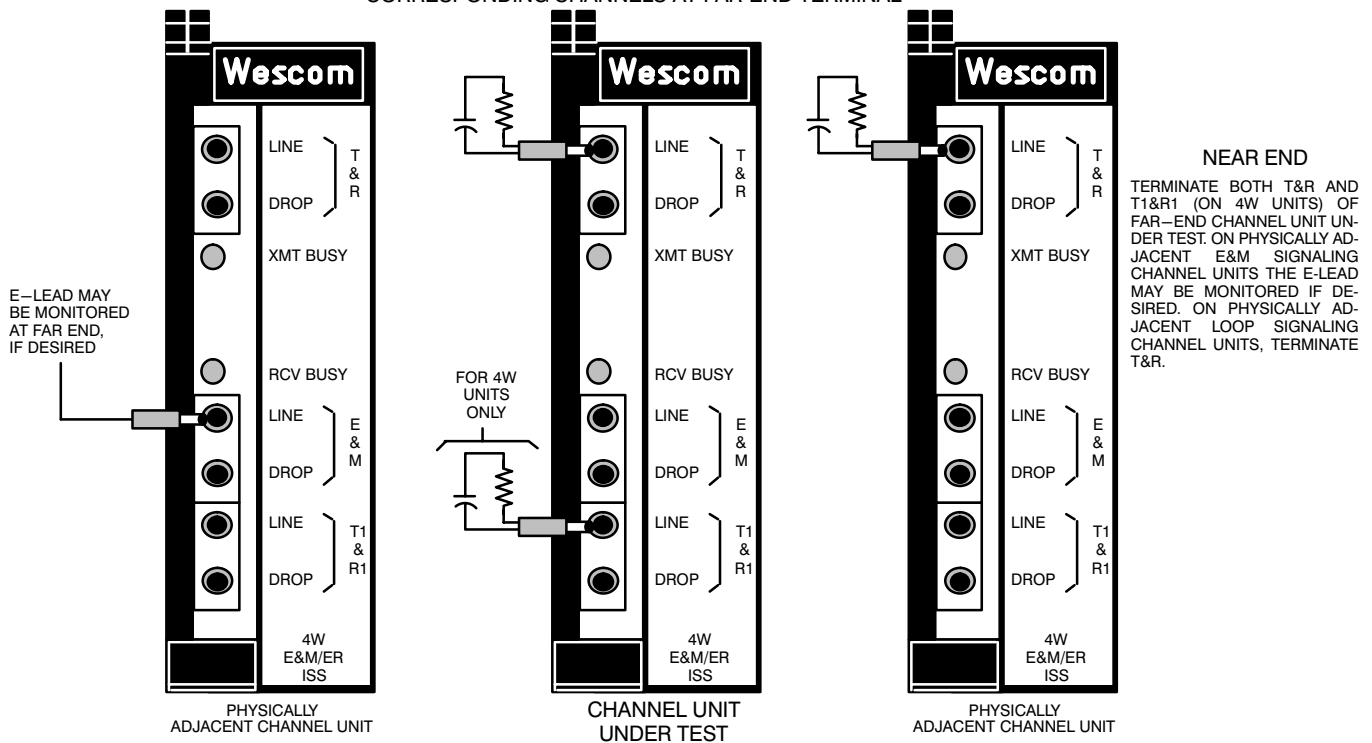


Figure 6. Impulse Noise Test Set-Up



CORRESPONDING CHANNELS AT FAR-END TERMINAL



Note: This test set-up will test the transmit path for susceptibility to impulse noise. To test the receive path, apply dial pulses to the physically adjacent channel units at the far end while measuring impulse noise at the near-end channel unit under test. Some channel units are equipped with mini-type jacks at T&R and T1&R1.

Figure 7. Intermittent Impulse Noise Test Set-Up

6. TECHNICAL ASSISTANCE

6.1 Technical Assistance — U.S.

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)

6.2 Technical Assistance — Canada

Canadian customers contact:

905–821–7673 (Main Office)
 905–821–3280 (FAX)

7. WARRANTY & CUSTOMER SERVICE

7.1 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)

7.2 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.

7.3 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.

7.4 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.

