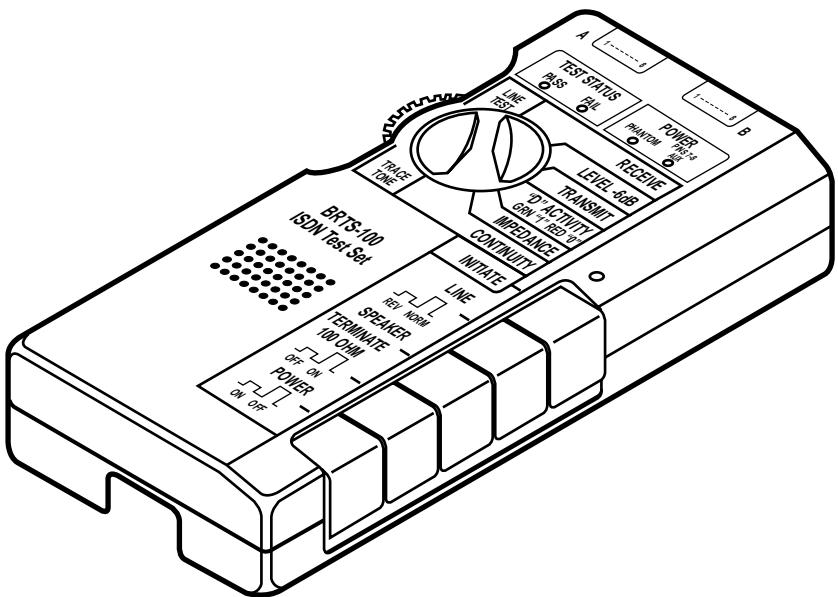




# BRTS-100 ISDN Test Set



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AND  
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RADIO FREQUENCY INTERFERENCE STATEMENTS

This equipment generates, uses, and can radiate radio-frequency energy, and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

*This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.*

*Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.*

**NORMAS OFICIALES MEXICANAS (NOM)  
ELECTRICAL SAFETY STATEMENT**

**INSTRUCCIONES DE SEGURIDAD**

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
  - A: El cable de poder o el contacto ha sido dañado; u
  - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
  - C: El aparato ha sido expuesto a la lluvia; o
  - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
  - E: El aparato ha sido tirado o su cubierta ha sido dañada.

**TRADEMARKS USED IN THIS MANUAL**

*Any trademarks mentioned in this manual are acknowledged to be the property of the trademark owners.*

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# 1. Specifications

**Input/Output** — (2) modular 8-pin jacks (included)

**ISDN Interface** — S/T

**Line Type** — ISDN BRI

**Nominal Data Rate** — 192 kbps

**Power** — 9-VDC battery

**Size** — 7.3"H x 3.3"W x 1.1"D (18.5 x 8.3 x 2.8 cm)

**Weight** — 11 oz. (311.8 g)

## 2. Introduction

### 2.1 Overview

The BRTS-100 ISDN Test Set is a portable, hand-held, communication-line tester that helps you troubleshoot and verify ISDN S/T interface lines (see Figure 2-1). The Test Set supports a variety of comprehensive tests designed to help telephone and ISDN craft technicians isolate line problems.

### 2.2 How to Use This Manual

This manual is written for the user who wants a quick guide for troubleshooting—and for the more technical user who wants to understand how the unit operates.

The novice user should read chapters one through three inclusively. The more advanced user can skip chapter three and read chapter four instead. Refer to the appendix at the end of this user's guide for maintenance information, including how to change the 9-volt battery.

The manual is divided into the following sections:

#### 1. Specifications

**2. Introduction** — Contains an overview of this manual and provides a brief description of the Test Set's features.

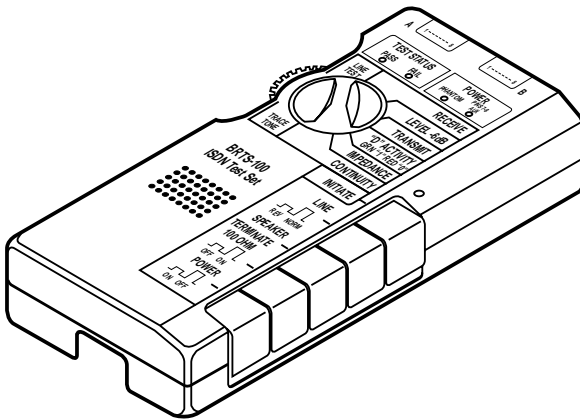
**3. Operation** — Describes how the unit operates, including the controls and indicators. This chapter also contains suggested test configurations.

**4. Test Procedures** — Explains various product applications and some suggested step-by-step troubleshooting guides.

**5. Technical Reference** — Provides an in-depth discussion of Test Set components and how the Test Set performs a variety of tests.

**Appendix — Maintenance** — Includes how to replace the 9- VDC battery and the 8-pin jack.





**Figure 2-1. The BRTS-100 ISDN Test Set.**

## 2.3 Features

This compact, rugged ISDN S/T interface line test set provides many essential diagnostic functions. It's easy to use, too, requiring very little knowledge about complex ISDN protocols. The Test Set:

- Verifies physical layer (Layer 1) parameters.
- Checks for D Channel Access.
- Is lightweight and hand-held.
- Derives power from a 9-volt battery.
- Includes easy-to-use, Pass/Fail LEDs that give instantaneous test results.
- Can monitor a D Channel.
- Samples every frame on the line (one every 250 microseconds).
- Supports various modes of operation for fault isolation.
- Can be used in either passive bus or point-to-point configurations.
- Verifies DC Continuity.
- Features Power Indication lamps that indicate battery presence and polarity.
- Generates a 4-KHz test tone.
- Includes a speaker that allows audio monitoring of line activity.

## 3. Operation

### 3.1 Overview

You can operate the BRTS-100 ISDN Test Set in a variety of modes. Select them by turning the selector dial on the left of the unit (see Figure 3-1). The indicator lights (LEDs) on top of the unit indicate test results. The various test modes and indicator lights are explained in more detail below.

### 3.2 Connecting the Unit

In the shipping box, you'll find:

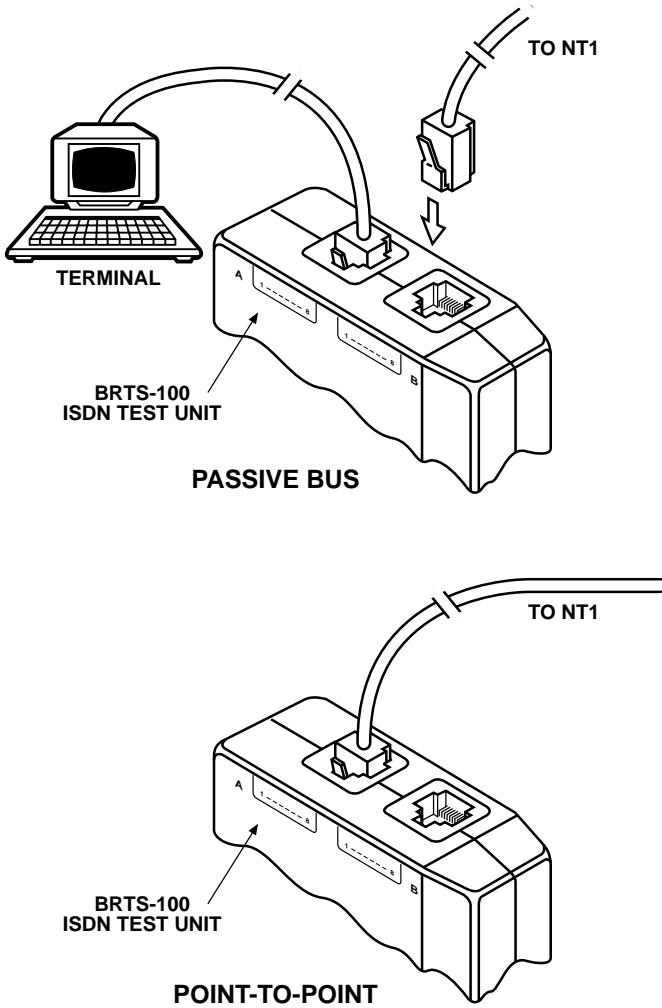
- The BRTS-100 ISDN Test Set.
- (1) 9-volt battery.
- An RJ-45-to-RJ-45 cable.
- (4) RJ-45-to-alligator-clips cable.

Attach one end of the RJ-45-to-RJ-45 cable to either port A or port B at the top of the Test Set. Attach the other end to a standard 8-pin phone jack. Attach one end of the second cable (the RJ-45-to-alligator-clips) to the A or B port on the Test Set and the other end to a telephone block. The alligator clips are color coded as follows:

COLOR	SIGNAL	PIN NUMBER
Black	TX	3
Red	RX	4
Green	RX	5
Yellow	TX	6

You can use the Test Set in either a point-to-point or a passive-bus mode (see Figure 3-2).





**Figure 3-2. Connecting the Test Set for point-to-point or passive-bus configurations.**

To connect the Test Set in a point-to-point configuration, simply connect the 8-pin plug to either the A or B port located on top of the unit. To connect the Test Set in a passive bus configuration, connect the line from the NT1 to either the A or B port, and connect the terminal to the other port. The ports are parallel, so they can be used interchangeably (see Figure 3-2).

### 3.3 Powering Up the Unit

Power up the Test Set up by depressing the POWER feature button (Figure 3-1). During operation, the unit automatically performs a battery check. If the battery is low, the unit will beep for approximately 30 minutes.

**AUTOMATIC POWER DOWN.** If the Test Set does not sense any activity on the line for approximately 10 minutes, it will automatically power down. In a 4-KHz Tone Trace, the Automatic Power Down circuit is disabled.

### 3.4 Controls and Indicators

#### Feature Buttons

Feature buttons (Figure 3-1) operate in two modes—in or out. Pushing the button will toggle it to the other mode.

**INITIATE** — Certain test modes require that you press the INITIATE key. Whenever this is necessary, the INITIATE lamp (yellow LED) will light.

**LINE** — Lets the user put the loop in NORMAL or REVERSE modes. In REVERSE mode, the Test Set transposes the transmit and receive pairs. When the LINE button is out, the unit is in NORMAL mode.

**SPEAKER** — Turns on the speaker. The speaker lets you hear all the transmissions on the line. Voice transmissions are digitized over the ISDN line and therefore will not be decipherable over the speaker.

**TERMINATE** — The Test Set normally provides a 100-ohm termination to the line. When pressed (in), the Test Set removes the 100-ohm termination from the line.

**POWER** — Turns the Test Set on and off.

#### Indicators

**PHANTOM LIGHT** — Indicates the presence and polarity of battery power.

Green light — Battery present, normal polarity.

Red light — Battery present, polarity reversed.

No light — No battery present.

**NOTE:** In reverse mode, the light indicators are opposite.

**AUXILIARY POWER LIGHT** — Indicates the presence and polarity of auxiliary power.

Green light — Auxiliary power present, normal polarity.

Red light — Auxiliary power present, reverse polarity.

No light — No auxiliary power present.

**TEST STATUS (PASS/FAIL) LIGHTS** — Reflects test status.

**INITIATE LIGHT (yellow LED)** — The INITIATE button and light are used in testing modes. When performing certain test functions, this LED indicates that the INITIATE button must be pushed.

### 3.5 Modes of Operation

You can select a mode of operation by turning the selector dial (see Figure 3-1).

**LINE TEST** — Verifies that a terminal will be able to access the D channel.

**NOTE:** After selecting this function with the selector, depress the INITIATE button and the test will begin.

Pass — Good line.

Fail — Bad line.

**RECEIVE** — Monitors activity on the terminal's receive pair.

Pass — Test Set is in SYNCH with the NT1.

Fail — Test Set is not in SYNCH with the NT1.

## 4. Test Procedures

### 4.1 Overview

This chapter gives you several suggested test procedures. However, it is by no means the only way to use the Test Set to isolate trouble or to verify lines.

**NOTE:** The following procedures assume certain conditions exist (that procedures are followed in the correct order.) These conditions are described at the beginning of each procedure.

#### TEST CONFIGURATIONS

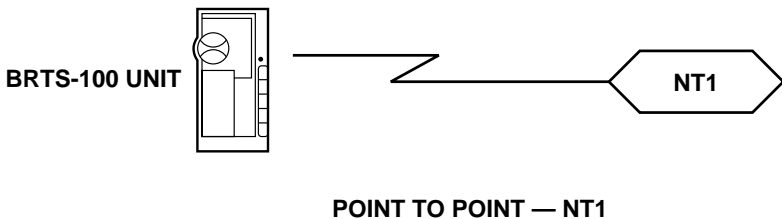
##### **Test Configuration 1 — Point-to-Point — NT1** (Figure 4-1)

To put the circuit in the point-to-point test configuration:

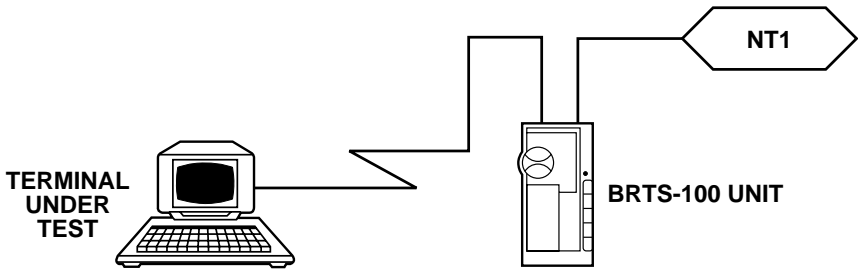
1. Disconnect the terminal.

**NOTE:** With a passive bus, testing the S/T interface may disrupt the operation of other devices on the bus.

2. Connect the jack to either Port A or Port B of the Test Set.
3. The Test Set should be terminated; the TERMINATE button should be out.



**Figure 4-1. Test Configuration 1.**



**Figure 4-2. Test Configuration 2.**

### Test Configuration 2 — Passive Bus (Figure 4-2)

To put the terminal in the Passive Bus Test Configuration:

1. Disconnect the terminal.

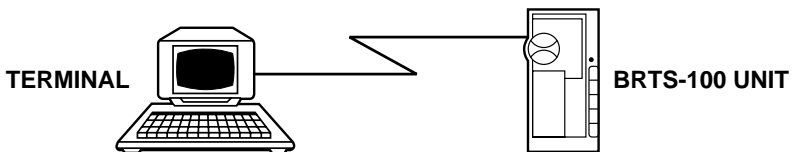
**NOTE:** With a passive bus, the S/T interface may disrupt the operation of the other devices on the bus.

2. Connect the S/T jack to Port B of the Test Set.
3. Connect the terminal to Port A of the Test Set.
4. The Test Set should be unterminated; the TERMINATE button should be in.

### Test Configuration 3 — Point-to-Point — Terminal (Figure 4-3)

To put the circuit in the Point-to-Point — Terminal configuration:

1. Disconnect the terminal.
2. Connect the terminal to the Test Set's A or B port.
3. Put the Test Set in REverse mode, LINE button in.
4. The Test Set should be terminated; the TERMINATE button should be out.



**POINT TO POINT — TERMINAL**

**Figure 4-3. Test Configuration 3.**



## 4.2 Comprehensive Troubleshooting Procedure

This troubleshooting guide is for the user who is either installing a new line and wants to verify the S/T interface, or has a problem with an in-service ISDN terminal. It is a comprehensive procedure which uses virtually all of the Test Set's testing capabilities and features.

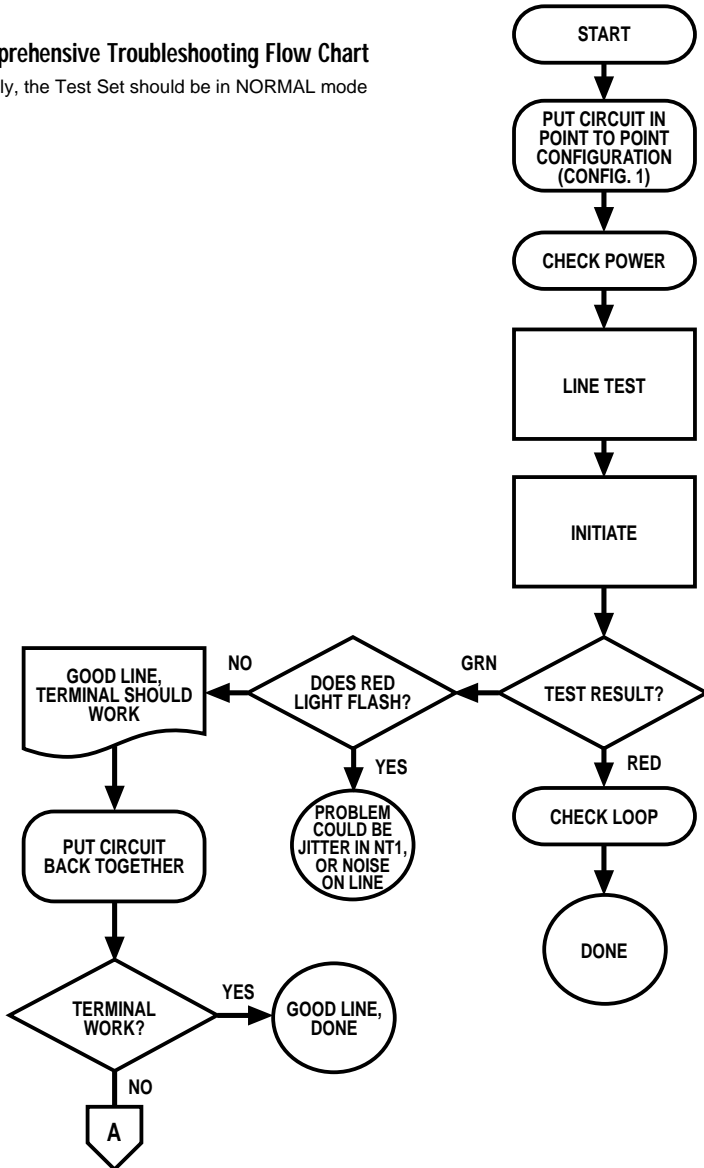
This Procedure uses other test procedures outlined in this section. If you identify a problem at any point in this procedure, stop the test and fix the problem. Then repeat the procedure from the beginning. See the comprehensive flow chart, Figure 4-4, for an outline of the operations performed in this test.

1. Put the circuit in the Point-to-Point Test Configuration (Configuration 1). If you're installing a passive bus, start at the port closest to the NT1.
2. Power up the Test Set.
3. Perform the CHECK POWER test procedure (see page 14).
4. Make sure that the Test Set is in NORMAl mode; the LINE button should be out.
5. Put the Test Set in the LINE TEST test mode.
6. Press the INITIATE button.
7.
  - a. If the Red Test Status Light lights up, perform the CHECK LOOP test procedure (*see page 15*).
  - b. If the Red Test Status Light flashes, the problem could be jitter in the NT1 or noise on the line. Check the NT1. There's no need for any further testing.
  - c. If the Green Test Status Lamp lights up, continue on to step eight.
8. Put the circuit into its normal operating configuration. (Connect all terminals to the S/T interface.)
9.
  - a. If the terminal works, there is no need to proceed any further.
  - b. If the terminal does not work, proceed to step 10.
10.
  - a. If the circuit is point-to-point, skip steps 11 through 16, and go to step 17.
  - b. If the circuit is a passive bus, proceed to step 11.
11. The problem may be that all devices on the passive bus are not properly terminated. Verify this by performing the CHECK TERMINATIONS test procedure (see page 19).

- Put the circuit into its normal operating configuration. (Connect all terminals to the S/T interface.)

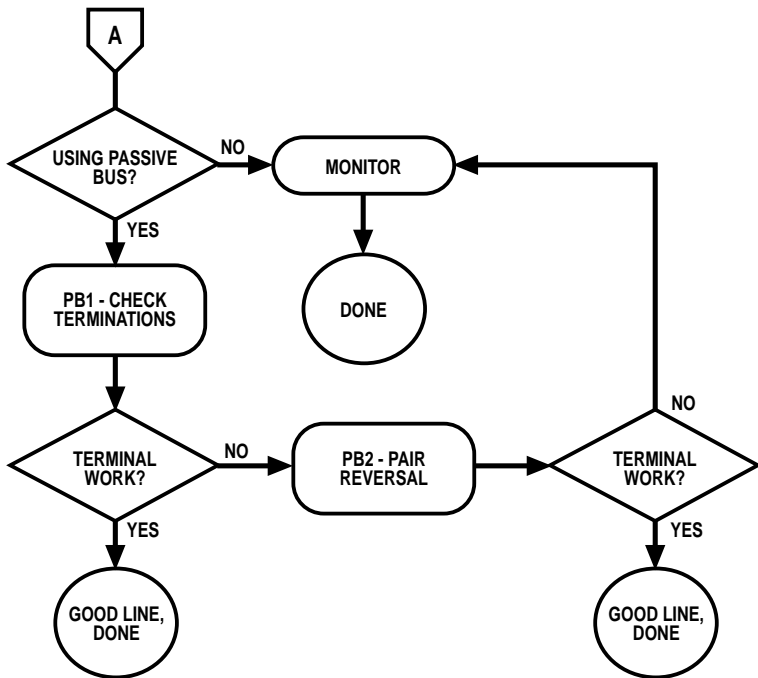
**Comprehensive Troubleshooting Flow Chart**

Initially, the Test Set should be in NORMAL mode



**Figure 4-4. Comprehensive troubleshooting flow chart (1 of 2).**

13. a. If the terminal works, there's no need to proceed any further.  
b. If the terminal does not work, proceed to step 14.
14. Perform the PAIR REVERSAL test procedure (see page 22).
15. Put the circuit into its normal operating configuration. (Connect all terminals to the S/T interface.)
16. a. If the terminal works, there's no need to proceed any further.  
b. If the terminal does not work, proceed to step 17.
17. At this point, you've determined that there's nothing wrong physically with the S/T interface. The problem is either within the terminal or NT1—or possibly the ISDN network. Perform the MONITOR test procedure (see page 26).



**Figure 4-4. Comprehensive troubleshooting flow chart (2 of 2).**

### 4.3 Check Power

Some (not all) ISDN terminals require power from the S/T interface. This procedure verifies that power is received properly at the S/T interface. See Figure 4-5 for an outline of the functions performed in this test.

1. Put the circuit in Test Configuration 1.
2. Make sure the Test Set is in NORMal mode; LINE button should be out.
3. If the terminal requires Phantom Power (see terminal user guide) use the following table:

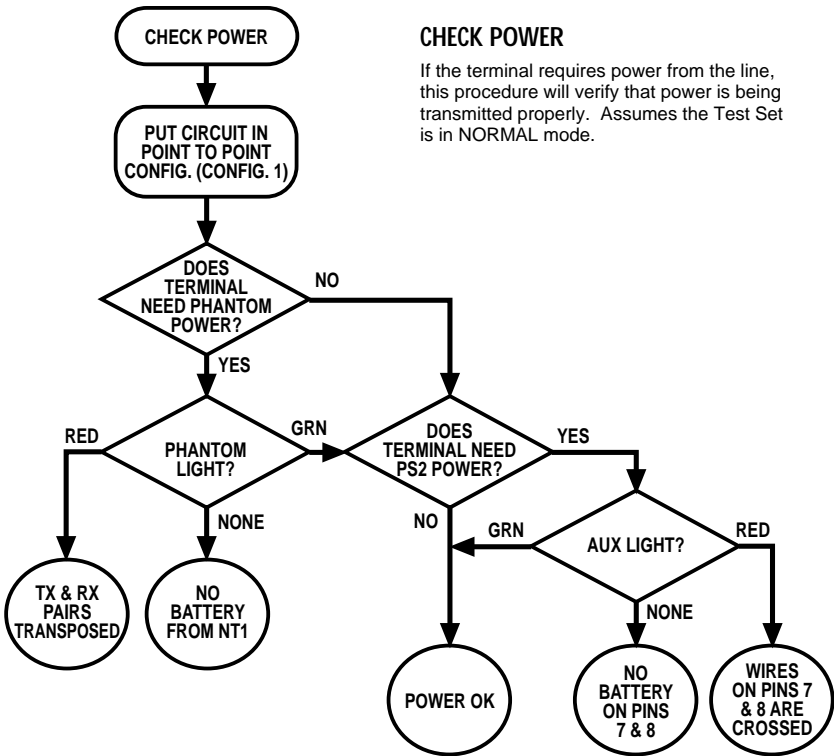
<b>Phantom Light</b>	<b>Conclusion</b>
Green	Power OK
Red	TX & RX pairs reversed
None	No power being received

4. Certain terminals use what is known as PS2 power, which is delivered on pins 7 and 8. If your terminal uses PS2 power check the AUX light and use the following table:

<b>AUX Light</b>	<b>Conclusion</b>
Green	AUX power OK
Red	Pins 7 & 8 reversed
None	No PS2 power being received

**CHECK POWER**

If the terminal requires power from the line, this procedure will verify that power is being transmitted properly. Assumes the Test Set is in NORMAL mode.



**Figure 4-5. Check power flow chart.**

**4.4 Check Loop**

This procedure checks for physical impairments in the S/T interface. See Figure 4-6 for an outline of the functions performed during this test. Before implementing this procedure, you must meet the following prerequisites:

- The terminal should be receiving proper power (see CHECK POWER, page 14).
- LINE TEST should fail.

With the Check Loop procedure, first check to see if the transmit pairs (pins 3 and 6) and the receive pairs (pins 4 and 5) are reversed.

1. Put the Test Set in REVerse mode; LINE button should be in.
2. Put circuit in the Point-to-Point NT1 Test Configuration (Test Configuration 1).
3. Put the Test Set in the LINE TEST test mode.
4. Press the INITIATE button.
5.
  - a. If the Green Test Status light goes on, the Loop is reversed.
  - b. If the Red Test Status light goes on, the Loop is wired properly.

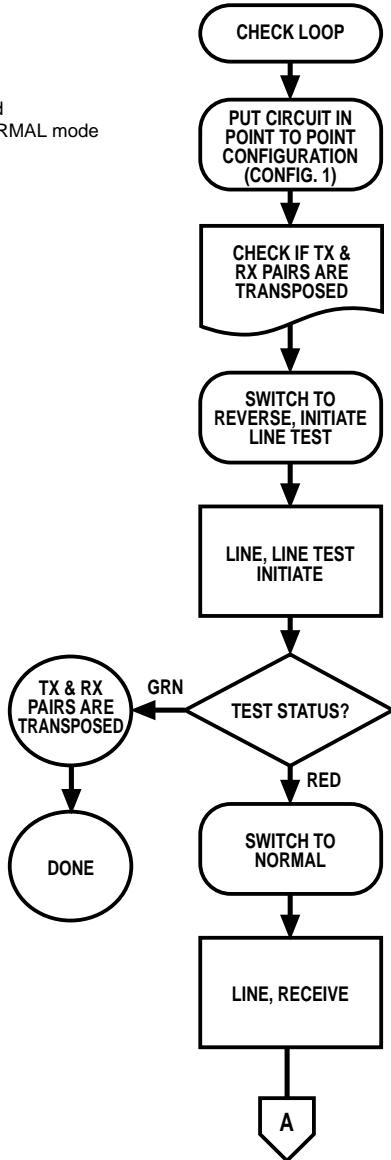
Now, try to isolate the problem between the Transmit Pair and the Receive Pairs.

1. Put the Test Set back in NORMAl mode by pressing the LINE button.
2. Put the Test Set in the RECEIVE test mode.
3.
  - a. If the Red Test Status light goes on, there is a problem with the receive pair. Skip steps four and five and go to step nine.
  - b. If the Green Test Status light goes on, the receive pair is good and there's a problem with the transmit pair.
4. Put the Test Set in the CONTINUITY test mode.
5.
  - a. If the Red Test Status light goes on, there is an open in the TX pair. There's no need to do any further testing.
  - b. If the Green Test Status light goes on, got to step six.
6. The problem could be that there is a short on the transmit pair. Put the Test Set back in the NORMAl mode by pushing the LINE button (LINE should be out).
7. Put the Test Set in the IMPEDANCE test mode.
8.
  - a. If the Red Test Status light goes on, either the NT1 is not terminated or there's a short in the TX pair. There's no need to do any further testing.
  - b. If the Green Test Status light goes on, there's no problem with the NT1 and no further testing is required.
9. Perhaps the problem is that there's no continuity on the RX pair between the terminal and the NT1. Put the Test Set in REVerse mode by pressing the LINE button (LINE button should be in).

**CHECK LOOP**

Assume

- 1. Power good
- 2. LINE TEST failed
- 3 Test Set is in NORMAL mode



**Figure 4-6. Check loop flow chart (1 of 3)**

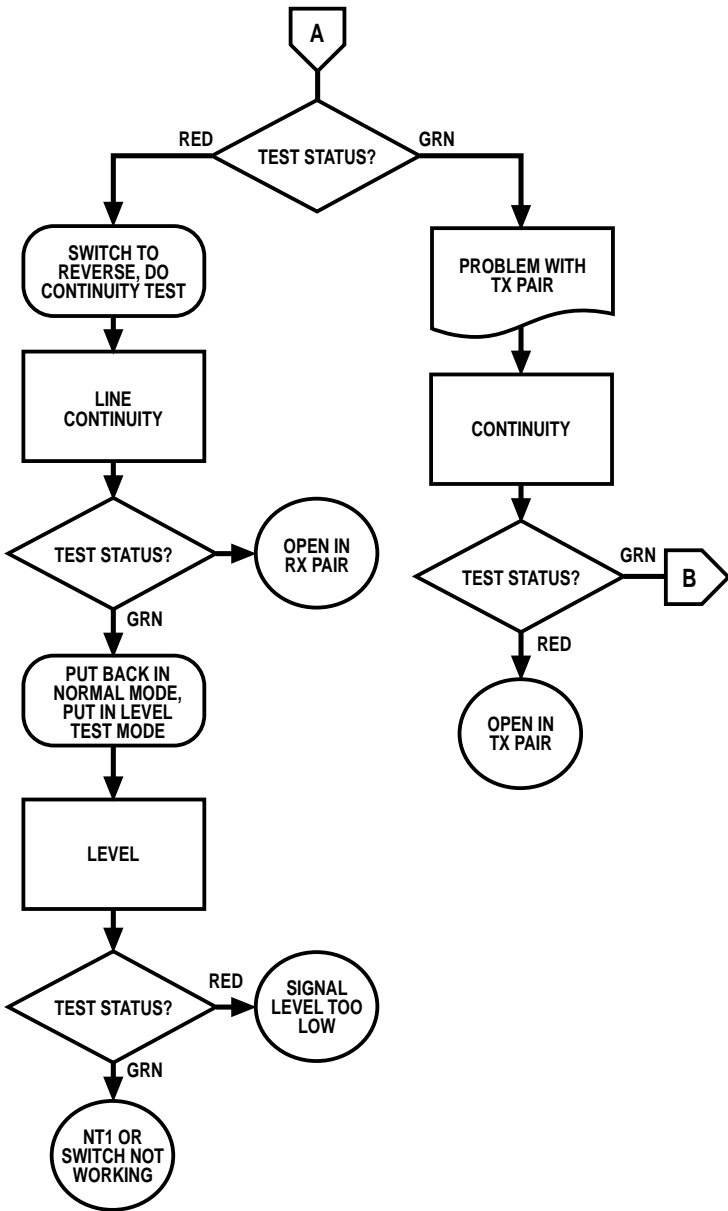


Figure 4-6. Check loop flow chart (2 of 3).



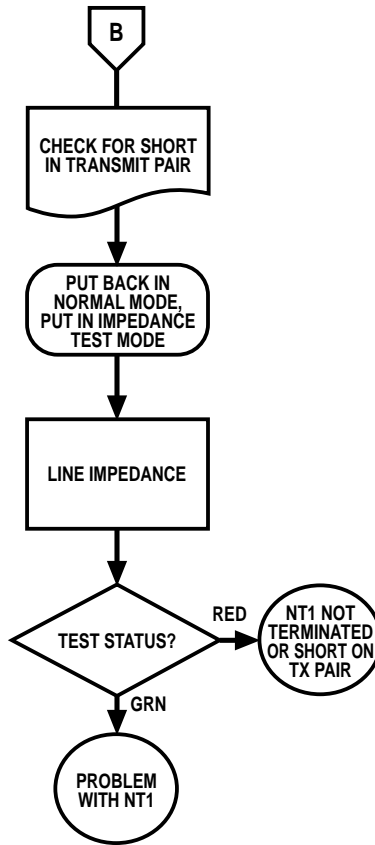


Figure 4-6. Check loop flow chart (3 of 3).

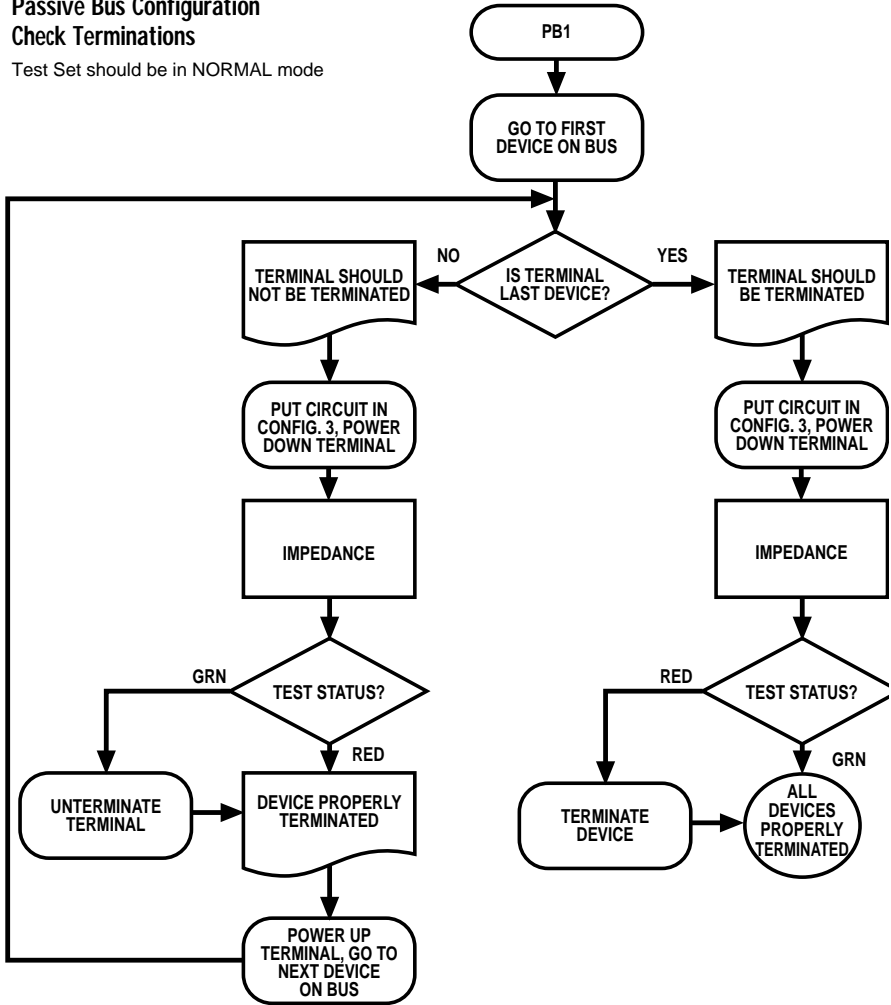
10. Put the Test Set in the CONTINUITY Test Mode.
11.
  - a. If the Green Test Status light goes on, there is a physical connection between the terminal and the NT1.
  - b. If the Red Test Status light goes on, there is no continuity on the receive pair between the terminal and the NT1. You should check the loop for opens. There's no need for any further testing.
12. The problem may be that the signal received at the NT1 is too low. To check this, put the Test Set back in the NORMAL mode by pushing the LINE button.
13. Put the Test Set in the LEVEL test mode.
14.
  - a. If the Green Test Status light goes on, the terminal is receiving the proper level. The problem may be that either the switch or the NT1 isn't working.
  - b. If the Red Test Status light goes on, the signal level at the terminal is too low. Check the loop length.

**4.5 Passive Bus—Check Terminations**

When you're using a passive-bus configuration, it's imperative that the last device on the bus be terminated at 100 ohms. The other devices on the bus must be left unterminated. Termination should be an option on each ISDN terminal. Refer to your terminal's user manual to determine how to configure the terminal in terminated/unterminated mode. See Figure 4-7 for an outline of the functions performed in this test.

**Passive Bus Configuration  
Check Terminations**

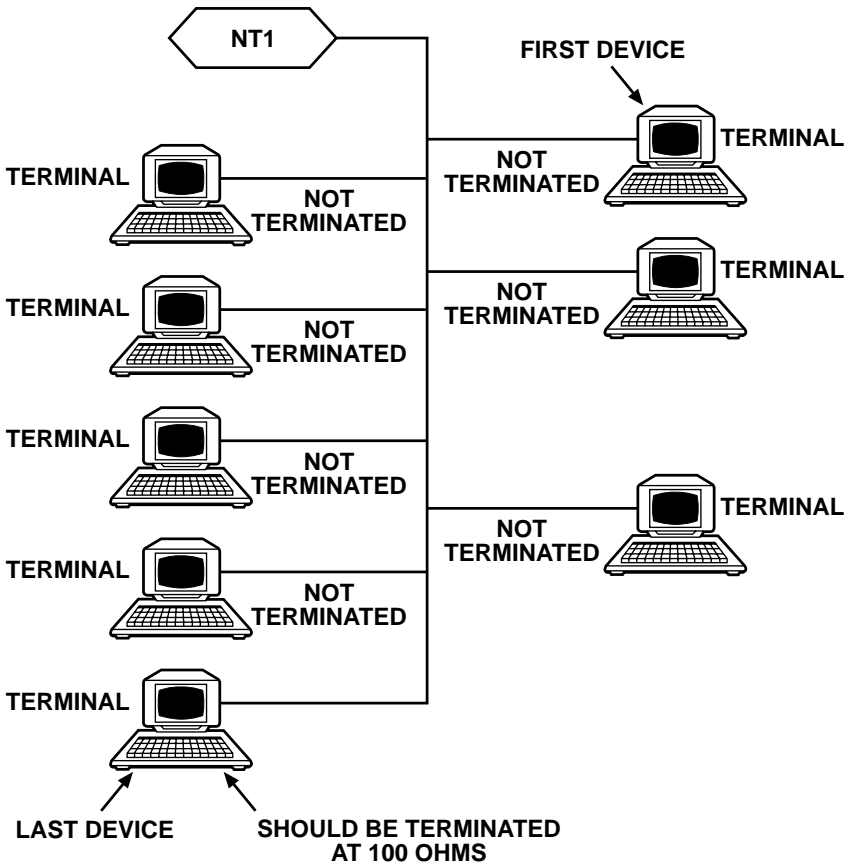
Test Set should be in NORMAL mode



**Figure 4-7. Passive bus flow chart.**

1. Determine which devices are the first and last devices on the bus. The first device is the one closest to the NT1. The last device is the one furthest from the NT1. *See Figure 4-8* for an example of proper device termination.
2. Go to the first device on the bus.
3. Put the Test Set in TERMINATED and NORMAL mode.
4. Put circuit in Test Configuration 3.
5. Make sure the Test Set is in REVERSE mode; LINE button should be in.
6. Power down the terminal.
7. Put the Test Set in the IMPEDANCE test mode.
8.
  - a. If the Green Test Status light goes on, the terminal is terminated. Underminate the terminal by following the instructions in the terminal's user manual.
  - b. If the Rest Test Status light goes on, no change in the termination is necessary.
9. Go to the next device on the bus. If the terminal is NOT the last device on the bus, go to step four. Otherwise, continue on to step 10.
10. You should be at the last device on the bus. Repeat steps four through seven.
11.
  - a. If the Green Test Status light goes on, the terminal is properly terminated.
  - b. If the Red Test Status light goes on, the terminal is not terminated. Terminate the terminal by following the instructions in the terminal's user guide.

All devices on the bus should now be properly terminated.



**Figure 4-8. Proper device terminations diagram.**

## 4.6 Pair Reversal

When you use the passive-bus configuration, it's imperative that all the transmit pairs (from terminal) be wired the same. That is to say, pins 3 and 6 from each terminal on the bus must be wired to pins 3 and 6 of the NT1 respectively. On a point-to-point configuration, the circuit will operate properly even if the pair is reversed (pin 3 [terminal] to pin 6 [NT1], pin 6 [terminal] to pin 3 [NT1]). However, on a passive-bus configuration, if two terminals are wired differently, their signals, (having opposite polarity) will cancel each other.

This problem, known as pair reversal, usually occurs when the installer accidentally transposes the pairs in the S/T interface cable. A common symptom of pair reversal is that a device works when it is by itself on the bus, but doesn't work when other devices are present on the bus.

To identify this condition, an additional Test Set or any terminal that initializes itself automatically is required (check with terminal manufacturer). Refer to the Pair Reversal Flow Chart in Figure 4-9 and the diagram in Figure 4-10 for an outline of the functions performed during this test.

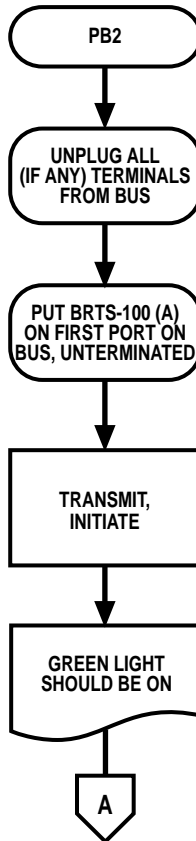
This procedure assumes that LINE TEST passes on each individual port on the bus.

1. Remove all terminals from the passive bus.
2. Place the first Test Set or ISDN terminal on the last port of the passive bus. This will be referred to as terminal A.
3. Terminate terminal A at 100 ohms. If you're using the Test Set as terminal A, the TERMINATE button should be out.
4. If terminal A is:
  - a. The Test Set, put it in the LINE TEST test mode.
  - b. An ISDN terminal, power it on.
5. Take the second Test Set, which will be known as terminal B, and connect it to another port on the bus.
6. Unterminate terminal B by pressing the TERMINATE button.
7. Put terminal B in the LINE TEST Test Mode.
8. Press the INITIATE button.
9.
  - a. If the Green Test Status light goes on, terminals A and B are using the same polarity.

b. If the Red Test Status light goes on, the terminals' wires are crossed—pin 3 of terminal is electrically connected to pin 6 of the other terminal. At this point, you should check the wiring of both terminal A and terminal B.

10. Repeat steps five through eight until all ports on the bus have been checked.

Assume LINE TEST passes independently on every port. Test Set should be in NORMAL mode



**Figure 4-9. Pair reversal flow chart (1 of 2).**

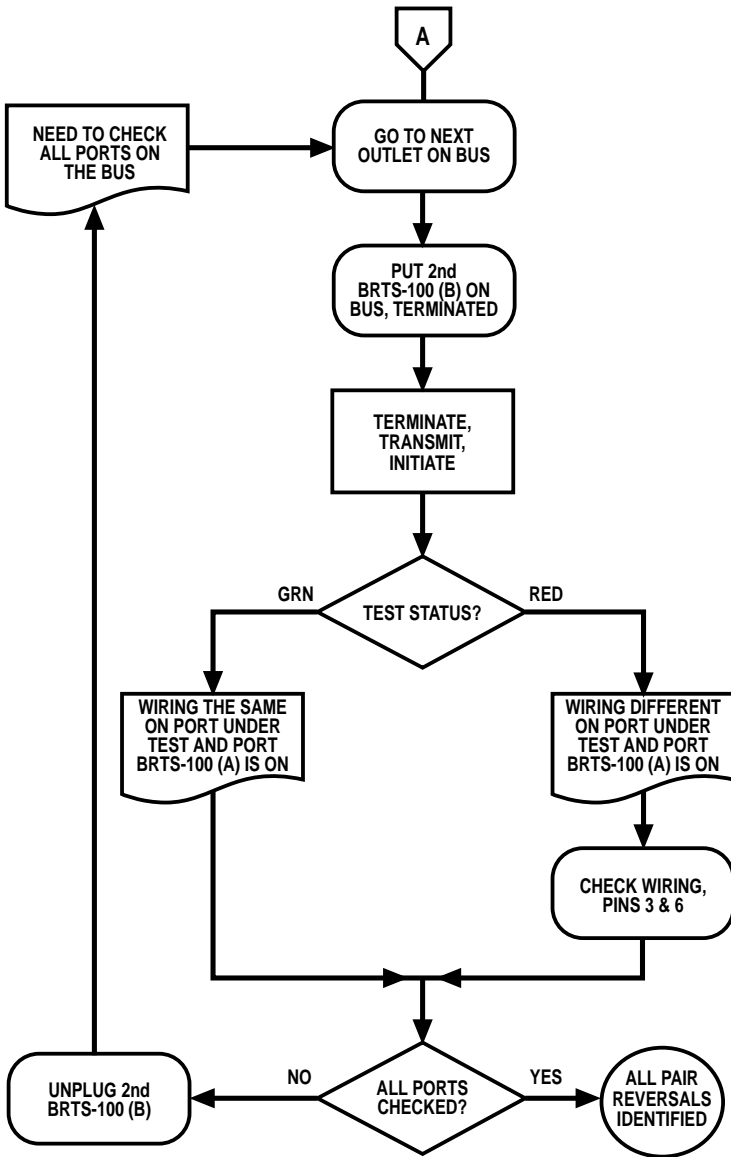
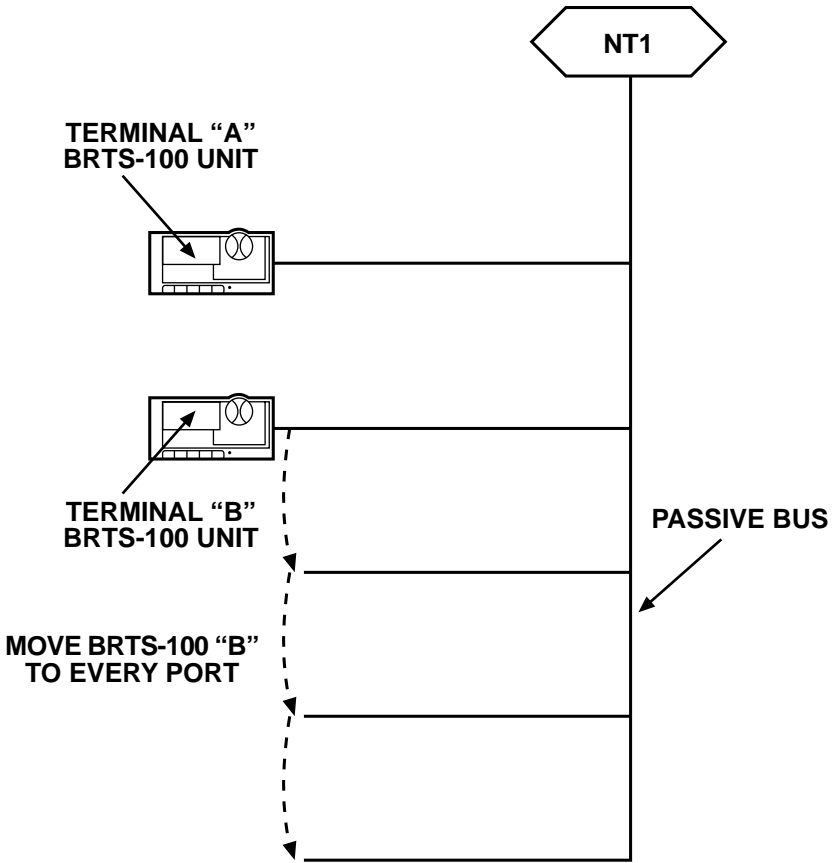


Figure 4-9. Pair reversal flow chart (2 of 2).





**Figure 4-10. Pair reversal diagram.**

## 4.7 Monitor

Use this test when you've determined there's nothing physically wrong with the circuit. The MONITOR procedure checks for any D channel activity. See the Monitor Flow Chart in Figure 4-11 for an outline of the functions performed during this test.

Before using this procedure, the following prerequisites must be met:

1. All terminals are properly terminated (CHECK TERMINATIONS).
2. No pair reversals exist on a passive bus (PAIR REVERSAL).
3. LINE TEST passes.
4. Terminal does not work properly.
5. Terminal receiving proper power (CHECK POWER).

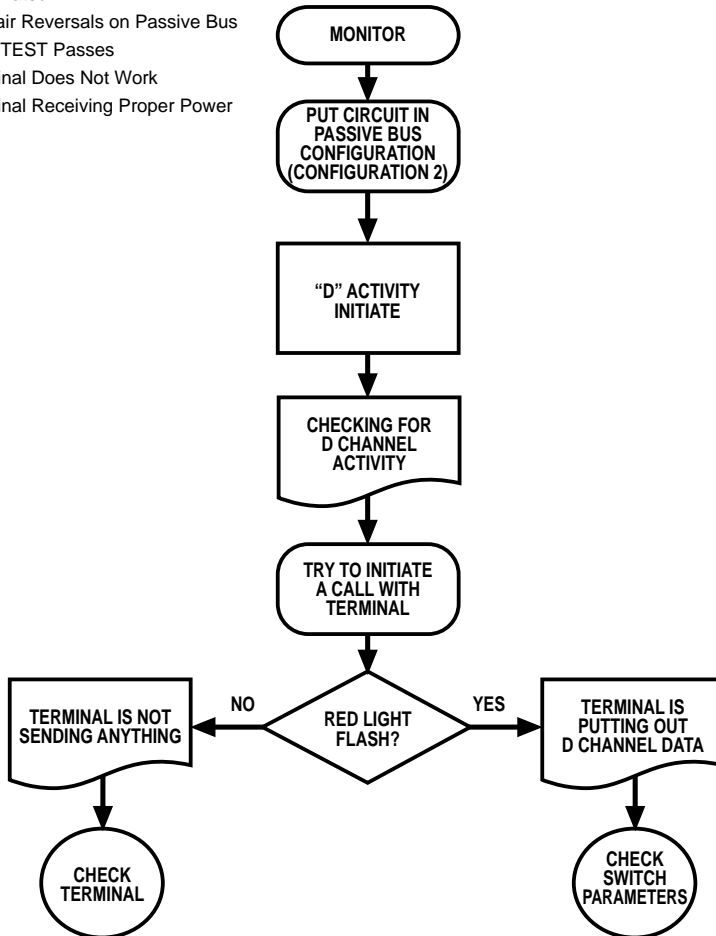
If all prerequisites exist, proceed with the MONITOR test procedure.

1. Put the Test Set in UNTERMINATED and NORMAL modes.
2. Put circuit in Test Configuration 2.
3. Put the Test Set in the D Activity test mode.
4. Press the INITIATE button.
5. Try to initiate a call with the terminal.
6.
  - a. If the Red Test Status light flashes, the terminal is putting D channel data on the bus. There's a problem with the switch. Possibly the switch parameters are set wrong.
  - b. If the Red Test Status light does not flash, the terminal is not outputting any D channel data. Check your terminal.

This section gives you the Test Set's circuit-level information.

**Monitor Assumes**

1. Test Set is in Normal Mode
2. All Terminals are Properly Terminated
3. No Pair Reversals on Passive Bus
4. LINE TEST Passes
5. Terminal Does Not Work
6. Terminal Receiving Proper Power

**Figure 4-11. Monitor flow chart.**

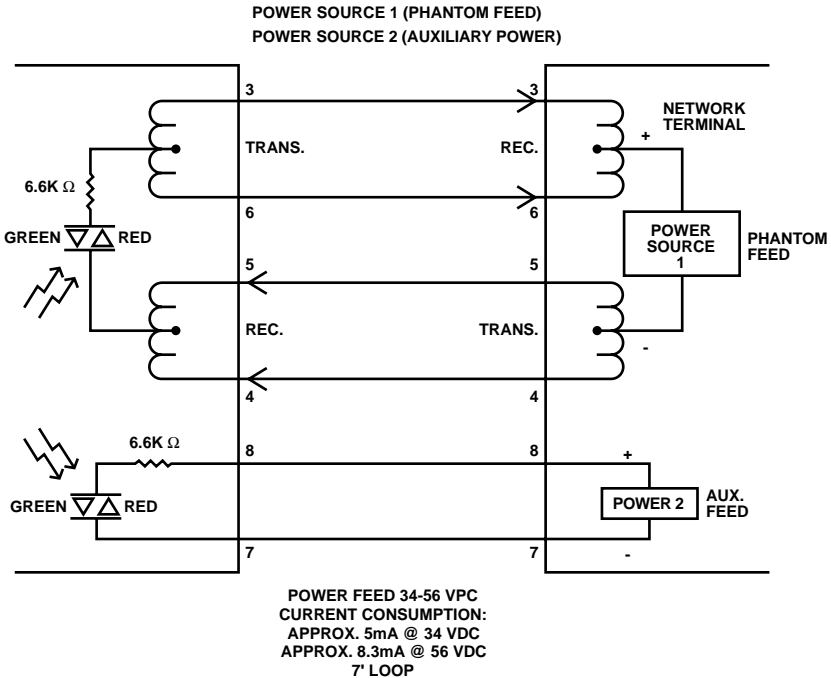
## 5. Technical Reference

### 5.1 Power-Source Indicators

The Phantom Feed light indicates the presence and polarity of battery power. In NORMAL mode, the Test Set verifies that the terminal's transmit pairs are positive and its receive pairs are negative. In REVERSE mode, the Test Set verifies that the opposite (transmit negative and receive positive) is true. See Figure 5-1.

The presence and polarity of Power Source 2 (Auxiliary Power), using pins 7 and 8, can be determined by the AUX LED. Normally, Pin 7 should be negative and pin 8 should be positive.

The maximum current consumption in Phantom Power (PS1) and Auxiliary Power (PS2) is approximately 5 mA at 34 VDC and 8.3 mA at 56 VDC.

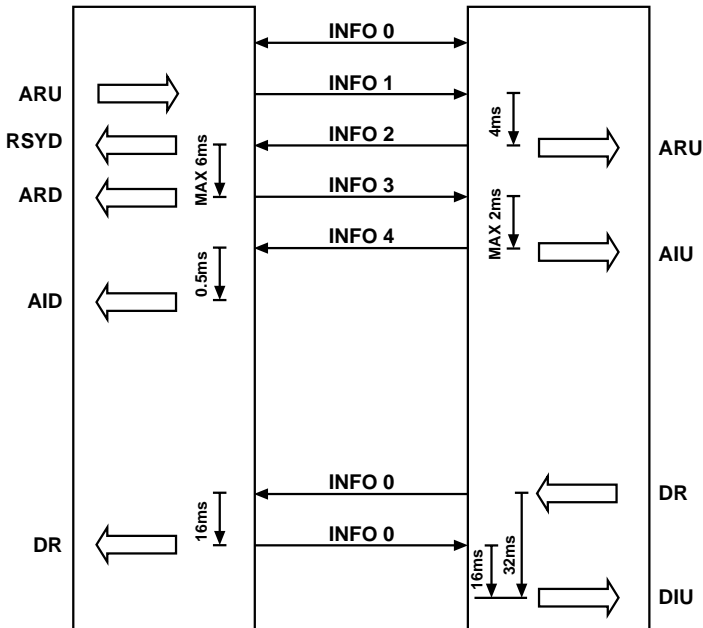


**Figure 5-1. Power source indicators.**

**5.2 Activation/Deactivation Modes**

The following information provides the steps that lead to an Active Link state and subsequent Activation/Deactivation modes (Figure 5-2) between the Test Set (TE) and an NT device. The Test Set uses this Activation/Deactivation procedure in Line Test, Transmit, and D Activity modes. See Figure 5-3 for a diagram of Info 0–Info 4.

- DIU—Deactivate Indication (Timer [32 ms] expired or Info 0 received [during 16 ms] after deactivation request).
- AIU—Activate Indication (Synchronous Receiver).
- ARU—Activate Request (Info 1 Received).
- RSYD—Resynchronization of U-Interface (Transmission of pseudo ternary pulses at 96-KHz frequency after loss of synchronization of U-Interface; Info 2).
- ARD—Activate Request (Transmission of Info 3).
- AID—Activate Indication (Transmission of Info 4, Active Link).
- DR—Deactivate Request.



**Figure 5-2. Activation/deactivation procedure.**

CCITT I.430 Info 0: No Signal

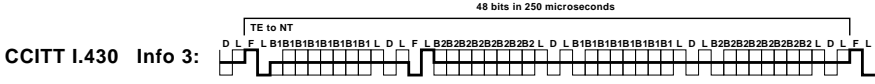
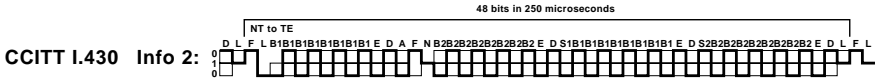
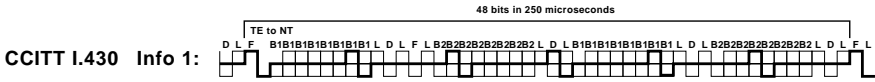


Figure 5-3. Info frames.

Line Test/Transmit (See Figure 5-4)

Line Test and Transmit are exactly the same test. The test is conducted as follows.

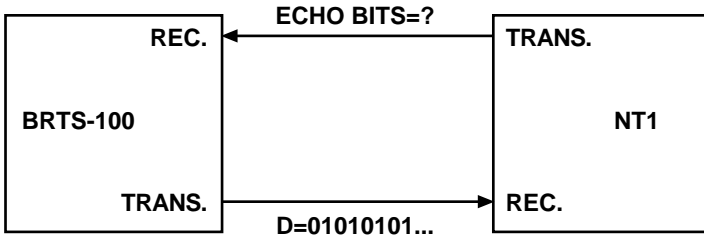
1. Upon pressing the INITIATE button, the Test Set tries to establish an ACTIVE link with the NT1.
2. If the ACTIVE state is reached, the Test Set sends an alternating “101010” pattern over the D channel.
3. The Test Set compares the incoming Echo bits with the outgoing D bits. If they’re not the same, the Test Set flashes the red LED.

Receive Test

The RECEIVE test checks the Test Set’s receive pair to ensure that the Test Set’s internal clock can synchronize itself to the master clock that’s provided by the NT1.

Level Test

In the LEVEL test mode, the Test Set measures the transmit level generated by the NT1 and verifies that the pulse level is above 375mVp or -6 dB, 0 to peak, ±10%, (per CCITT 1.430 specifications). Note that the LEVEL test is not included in the LINE TEST. Because many manufacturers of S/T interface chips exceed the CCITT requirements, terminals using these chips will accept a lower pulse level.



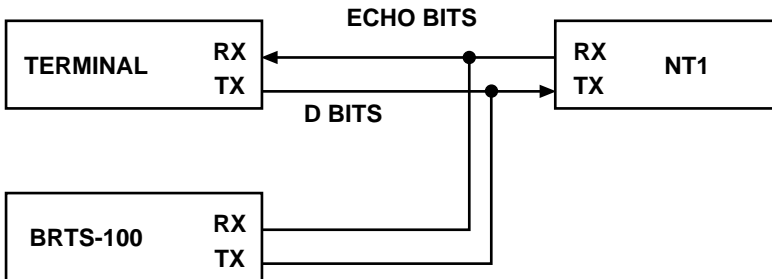
D=E, LINE IS GOOD, PASS  
 D≠E, LINE IS BAD, FAIL

**Figure 5-4. Transmit and line test.**

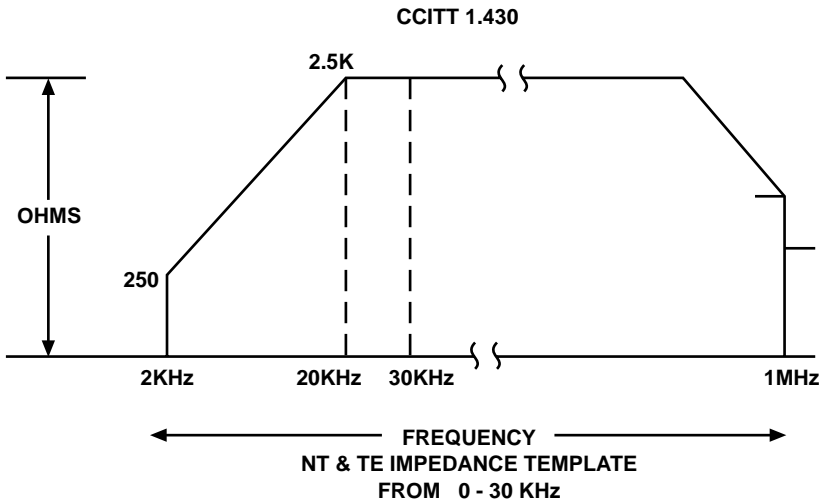
**D Activity** (See Figure 5-5)

The D Activity test is designed to run when the Test Set is bridged onto the S/T interface with an ISDN terminal. D Activity will monitor the Echo bits for any D channel data transmitted by the terminal. The D Activity test is conducted as follows:

1. Upon pressing the INITIATE button, the Test Set tries to establish an ACTIVE link with the NT1.
2. If the ACTIVE state is established, the Test Set monitors the D bits and the red LED lights up whenever terminal activity is detected on the D channel (D = 0).



**Figure 5-5. D Activity.**



**Figure 5-6. CCITT 1.430.**

### 5.3 AC Impedance

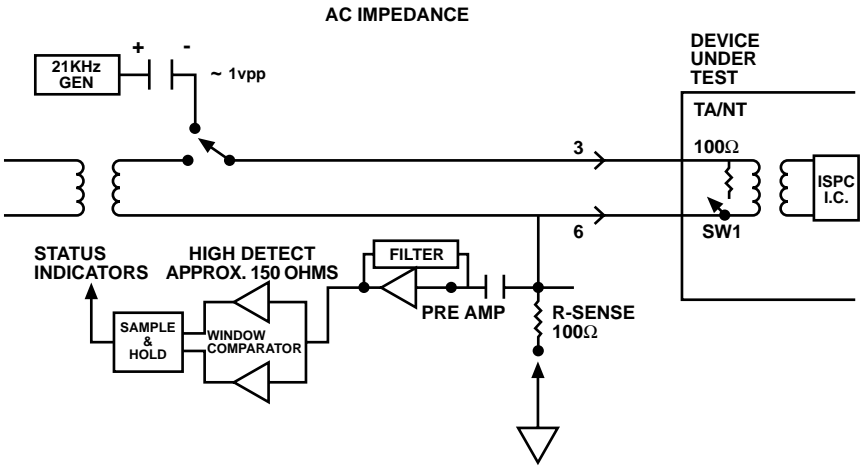
As shown in Figure 5-6, CCITT recommends that the AC impedance at 20 to 30 KHz should be greater than 2.5K ohms. To detect this, the Test Set puts an R-sense resistor in series with the device under test (Figure 5-7). A 21-KHz sinusoidal voltage, approximately 1V peak-to-peak, is generated. If the device is properly terminated, the AC voltage will be equally divided between the R-sense resistor and the terminating resistor. The AC impedance at 21 KHz is negligible compared to 100 ohms in parallel. The voltage drop across the R-sense resistor is fed through a pre-amp and then through a window comparator circuit. The window is set to detect impedance of between 40 and 140 ohms. The low detect is 40 ohms. The high detect is 140 (min.) and 300 (max) ohms.

If there is no termination provided, the majority of the voltage will drop across the device under test, and the resultant impedance will fall outside the comparator window.

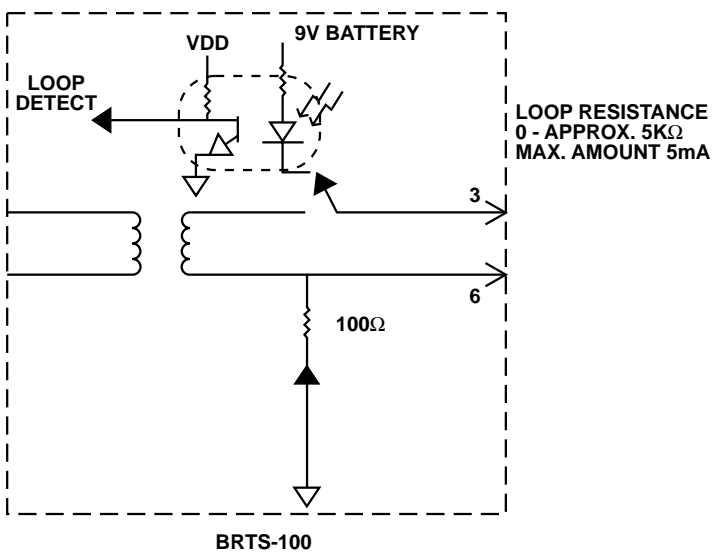
### 5.4 DC Continuity

The DC Continuity test assumes that the loop resistance will be within 0 to 5 K ohms (see Figure 5-8). A maximum of 5 mA of loop current is generated.





**Figure 5-7. AC impedance.**

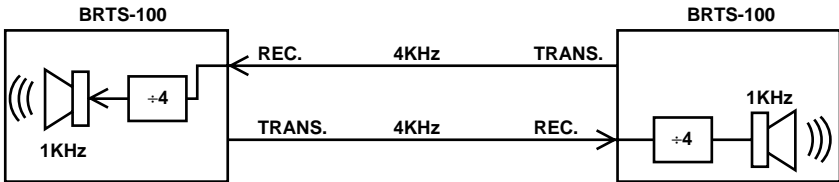


**Figure 5-8. DC continuity.**

## 5.5 Speaker

The incoming frequency to the speaker is divided by eight. Since ISDN signals are transmitted at 96 KHz, it has to be reduced in order to be heard over the speaker.

When the Test Set is in TRACE TONE mode, the incoming frequency to the speaker is divided by four. So a TRACE tone received by the Test Set will be heard at 1 KHz. See Figure 5-9.



**Figure 5-9. Two Test Set units used for tracing.**

## Appendix: Maintenance

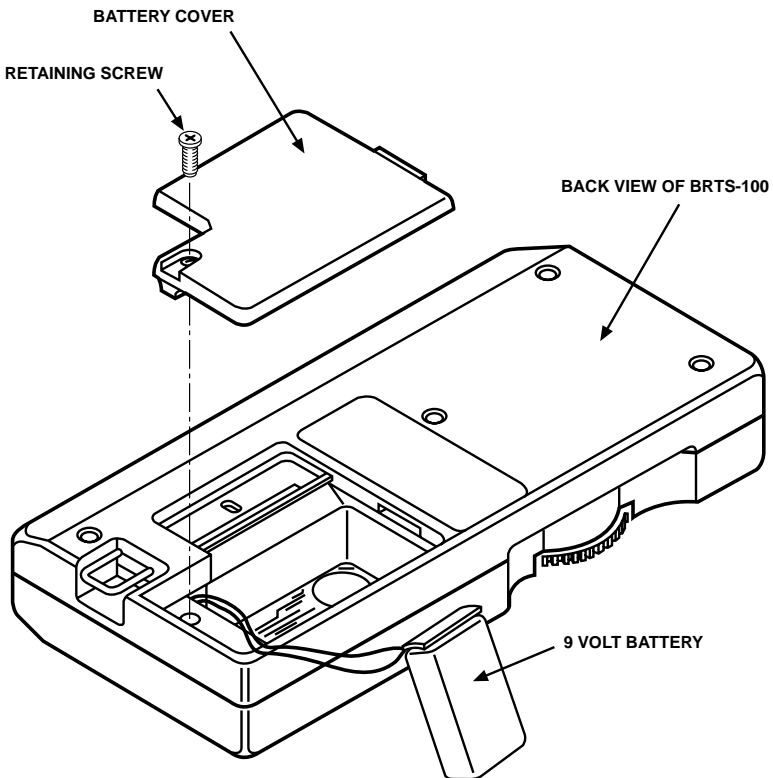
The Test Set requires very little maintenance other than replacing the 9-VDC battery periodically and possibly replacing one or both of the two 8-pin RJ-45-type jack connectors.

**NOTE:** Average battery life is approximately 15 hours of continuous use.

### Battery Replacement

To replace the 9-VDC battery follow these steps and refer to Figure A-1.

1. Using a #2 Phillips screwdriver, remove the battery cover retaining screw.
2. Lift up on the battery cover and expose the 9-VDC battery.
3. Replace the battery. Replace the battery cover and retaining screw.

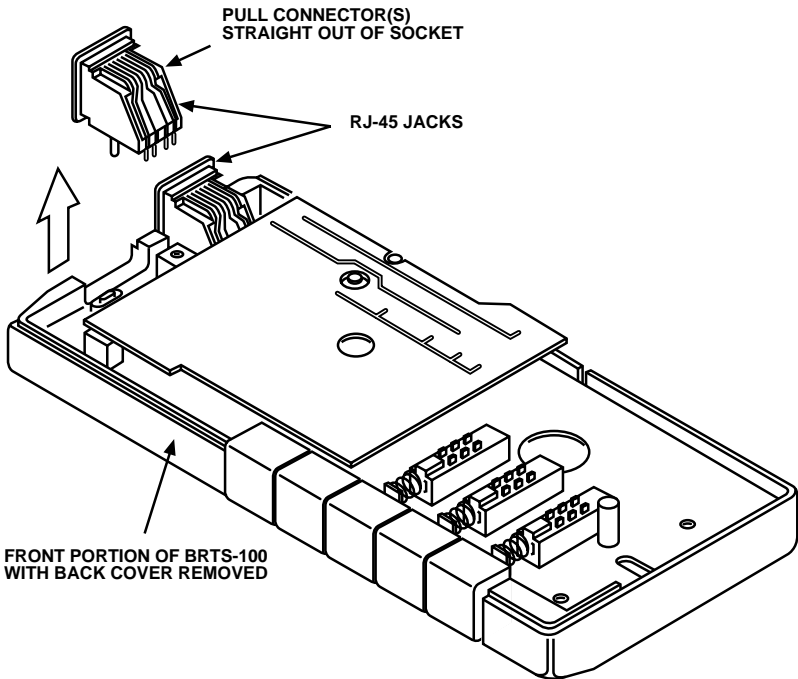


**Figure A-1. Battery replacement diagram.**

## 8-Pin Jack Replacement

These connectors need to be replaced only when connections no longer permit a secure-tight connection or when connectors are damaged. In standard use, however, these connectors shouldn't ever need to be replaced. Follow these steps and see Figure A-2.

1. Remove the five screws from the Test Set back cover.
2. Gently lift off the back cover to expose the inside of the unit. Remove the damaged connector(s) as indicated in Figure A-2.
3. Secure the new jack connector to the Test Set as indicated in Figure A-2.
4. Replace the back cover and retaining screws.



**Figure A-2. Replacing the 8-Pin Jack Connector(s).**



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