TS®220 and TS®250
Basic Rate ISDN Test Set
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Introduction

General Information

This document provides the user with operating information for the TS220 and TS250 Basic Rate ISDN Test Set manufactured by Harris Corporation, Camarillo, California.

Basic Rate ISDN

The Basic Rate Test Set for Integrated Services Digital Network (ISDN) communication lines allows technicians and installers to verify functionality of an ISDN line without having to interpret complex ISDN protocols. The TS220 and TS250 Test Sets are a single solution for ISDN subscriber loop prequalification, installation, and maintenance.

The TS220 and TS250 Test Sets have three main modes of operation:

- NT1+Terminal Equipment (NT1-TE, U Interface).
- Line Termination (LT)/Dry Loop (U) (TS250 Model Only).
Description

The TS220 and TS250 Basic Rate ISDN Test Set (see Figure 1-1) is a compact, portable handset used by installers, repair technicians and other authorized personnel for testing of Basic Rate ISDN subscriber loops. The TS220 and TS250 Test Sets are battery or wall socket powered.

![Figure 1-1. TS220 and TS250 Basic Rate ISDN Test Set](image)

Design Features

Table 1-1 lists the TS220 and TS250 Test Set features.

<table>
<thead>
<tr>
<th>Features</th>
<th>TS220</th>
<th>TS250</th>
</tr>
</thead>
<tbody>
<tr>
<td>NT1-TE Mode for U Interface Testing</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>TE Mode for S/T Interface Testing</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>LT Mode/Dry Loop Mode Downstream Testing</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>1B or 2B Channel Bit Error Rate Testing (BERT)</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>FEBE/NEBE Testing</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Embedded Operations Channel Monitoring</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>64K and 56K Data, Voice, and LAPD (X.25) Calls</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Amplified Speaker</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Transmitter Mute Switch</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>
Table 1-1. TS220 and TS250 Features (Continued)

<table>
<thead>
<tr>
<th>Features</th>
<th>TS220</th>
<th>TS250</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 kHz Tone Generation (U interface)</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>96 kHz Tone Generation (S/T interface)</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>On-Line Assist Key Explaining Complex Messages in Plain English</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>20 Location, 19 Digit Repertory Dialer</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Last Number Redial</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Backlit Liquid Crystal Display (LCD)</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Backlit Keypad</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Software Upgradeable</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Impact Resistant and Water Resistant with No-Fog Display</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Low Battery Indication</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Operates on 4 AA Alkaline, rechargeable NiCad batteries, or 120 Vac (adaptor included)</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Field Replaceable Line Cord and Batteries</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Field Replaceable Spring-Loaded Belt Clip</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Automated Call Yourself BERT</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

Physical Characteristics

The TS220 and TS250 Test Sets’ (see Figure 1-2) housing is made of high-impact plastic. The Test Sets are designed to provide rugged service and withstand the rough handling and shocks normally associated with field use. The housing is designed to permit operation of the Test Sets in bad weather (e.g., in heavy rain and dust storms).

The belt clip is located on the receiver end of the housing and is equipped with a spring-loaded clip that assures a secure connection to belt loops and D-rings.

The line cord is attached to the TS220 and TS250 Test Sets through a rubber strain relief at the transmitter end of the unit.

The line cord has either:

- An angled bed-of-nails cord and a RJ-45 modular connector.
- A 346A plug.
Table 1-2 lists the specifications for the TS220 and TS250 Test Sets.

Table 1-2. Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Working Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ELECTRICAL</strong></td>
<td></td>
</tr>
<tr>
<td>Switch Compatibility</td>
<td>Lucent Technologies' 5ESS switches.</td>
</tr>
<tr>
<td></td>
<td>Northern Telcom DMS-100 switches.</td>
</tr>
<tr>
<td></td>
<td>National ISDN-1.</td>
</tr>
<tr>
<td>S/T Interface</td>
<td>ANSI T1.605 - 1991</td>
</tr>
<tr>
<td>U Interface</td>
<td>ANSI T1.601 - 1992 (supports Quiet Mode and Insertion Loss Mode per ANSI T1.601-1992)</td>
</tr>
<tr>
<td>Battery Life</td>
<td>NiCad 8 to 10 hours, fully charged.</td>
</tr>
<tr>
<td></td>
<td>Alkaline battery (AA) 10 to 12 hours.</td>
</tr>
<tr>
<td>Charge Time</td>
<td>Approximately 4 to 5 hours</td>
</tr>
<tr>
<td>40 kHz Transmit (U Interface)</td>
<td>40 kHz tone at nominal 0dBm ±2 dB output (open circuit).</td>
</tr>
<tr>
<td>96 kHz Transmit (S/T Interface)</td>
<td>96 kHz tone at nominal 750 mV peak (100 ohms termination).</td>
</tr>
<tr>
<td>S/T Termination</td>
<td>User selectable menu; bridge, or 100 ohms ±10%.</td>
</tr>
</tbody>
</table>
Table 1-2. Specifications (Continued)

<table>
<thead>
<tr>
<th><strong>RS-232 SPECIFICATIONS</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud Rate</td>
<td>9600, 19200</td>
</tr>
<tr>
<td>Data Bit</td>
<td>8 bits</td>
</tr>
<tr>
<td>Parity</td>
<td>None</td>
</tr>
<tr>
<td>Stop Bits</td>
<td>1</td>
</tr>
<tr>
<td>Active Pin Assignments (DB9)</td>
<td>2 - Receive</td>
</tr>
<tr>
<td></td>
<td>3 - Transmit</td>
</tr>
<tr>
<td></td>
<td>7 - Ground</td>
</tr>
</tbody>
</table>

**PHYSICAL**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>10 inches</td>
</tr>
<tr>
<td>Width</td>
<td>3-3/4 inches</td>
</tr>
<tr>
<td>Height</td>
<td>4-1/4 inches</td>
</tr>
<tr>
<td>Weight</td>
<td>2-1/2 pounds</td>
</tr>
</tbody>
</table>

**ENVIRONMENTAL**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Resistance</td>
<td>TS220 and TS250 Test Sets are designed to be rain and moisture resistant under conditions of inclement weather.</td>
</tr>
<tr>
<td>Temperature Operating</td>
<td>0° to +50°C</td>
</tr>
<tr>
<td>Storage</td>
<td>-20° to +70°C</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>Noncondensing.</td>
</tr>
<tr>
<td>Drop</td>
<td>Designed not to exceed 12 foot drop.</td>
</tr>
</tbody>
</table>

Note: Specifications subject to change without notice.
Keypad

Numeric Keypad

The numeric keypad (see Figure 2-1) is used to dial telephone numbers and make menu selections. The numeric keypad includes 12 standard dialing keys including the asterisk (*) and the pound (#) keys.

Primary Function Keys

The primary function keys are:

- **Power**

  Allows the user to apply power to, and remove power from the test set. The Power key is recessed to avoid accidental power down. To turn the Test Set off, press and hold the Power key. Unless Auto Power Down is disabled, or the test set is powered by the AC adapter, the TS220 and TS250 Test Sets automatically power down after 5 minutes, if no activity is detected.
Figure 2-1. Front View
■ **On/Off Hook**

Press once to initiate or answer a call. Press again to terminate a call.

■ **Light**

Press the Light key to backlight the menu display (LCD) and the keypad for easier viewing in dark areas. Press the Light key again to turn the backlight off. Unless the backlight timeout is changed, the backlight turns off automatically if the keypad isn't used for a period of 30 seconds, and test set is operating off of battery power.

■ **Assist**

During operation, pressing the Assist key will present relevant information on the LCD for explaining the selected menu item (e.g., SPIDs, Rate, Call, etc). Pressing the Assist key twice allows the user to enter a number and jump alphabetically to all relevant information on the topic in the Test Set (e.g., press the number 2 twice to go to all topics beginning with the letter B); or scroll alphabetically through the list of topics.

The Assist key will also allow the user to view the definition of cause messages.

■ **Menu**

Provides a menu of functions which are then selectable using the numeric keys. The Menu stays on the display until either a menu function is selected, or the Menu key is pressed again, thereby returning to the previous display.

■ **LNR**

Allows the user to redial the last number dialed.

■ **Recall**

Recalls a number stored in repertory dialer memory.

**Soft Function Keys**

The three soft function keys are located below the LCD and their function changes depending on the context on the display. The three soft keys are labeled F1, F2, and F3 (see Figure 2-1).
Speaker Key

Note: Transmitter is automatically muted when speaker is on.

Pressing the Speaker Key on the TS220 and TS250 Test Sets changes the amplified speaker volume to its next setting, and all signals heard through the receiver are routed to the speaker. The user may set the volume level of the amplified speaker to either off, low, or high. Settings change from off to low to high and back to off.

The Amplified Speaker icon (see Figure 2-2) is displayed on the LCD any time the speaker is active, regardless of the specific volume setting.

When low battery is detected, the speaker is automatically disabled.

![Figure 2-2. Amplified Speaker Icons](image)

Mute Key

The Mute key is used as a toggle to activate or deactivate the muting of the transmitter. The active mute condition is indicated to the user by displaying the Mute icon (see Figure 2-3).

![Figure 2-3. Mute Icon](image)
Indicators

Battery Indicator

A low battery condition is indicated to the user through the use of a low battery icon on the LCD (see Figure 2-4). A flashing icon indicates the test set has reached its first warning level. When the Low Battery icon appears on the LCD display, you have approximately 30 minutes of operating time left before the test set automatically powers off. The second level occurs when the icon is solid. At this level, the test set is not functional. Refer to Maintenance for more information on low battery condition.

LED Indicators

The LED indicators (see Figure 2-1) are located above the LCD Menu display window. See Table 2-1 for indication status.

Sync LED

**U Interface** - The U (basic rate) interface refers to the physical interface on the network side of a network termination 1 (NT1). When Layer 1 is in SYNC, the SYNC LED indicator blinks amber. When Layer 1 activation is complete and the U interface is activated, the SYNC LED indicator lights up a solid amber. When Layers 2 and 3 are ready, the SYNC LED indicator lights up green.

**S/T Interface** (TS250 only) - The S/T interface is a two-pair (four wire) interface between the terminal equipment (TE) and a NT1. When Layer 1 is in SYNC, the SYNC LED blinks amber. When Layer 1 activation is complete and S/T is synchronized, the SYNC LED indicator lights up amber. When Layers 2 and 3 are ready, the SYNC LED indicator lights up green.
Table 2-1. LED Status Indicators

<table>
<thead>
<tr>
<th>LED</th>
<th>LED Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOOK</td>
<td>OFF</td>
<td>On Hook</td>
</tr>
<tr>
<td></td>
<td>Green Blinking</td>
<td>Off hook, waiting for SYNC and activation.</td>
</tr>
<tr>
<td></td>
<td>Green Solid</td>
<td>Off hook.</td>
</tr>
<tr>
<td>SYNC</td>
<td>OFF</td>
<td>No Layer 1 communication.</td>
</tr>
<tr>
<td></td>
<td>Amber Blinking</td>
<td>Layer 1 SYNC.</td>
</tr>
<tr>
<td></td>
<td>Amber Solid</td>
<td>Activation complete.</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>Layer 1, 2 and 3 SYNC.</td>
</tr>
<tr>
<td>CHARGE</td>
<td>OFF</td>
<td>Running on battery.</td>
</tr>
<tr>
<td></td>
<td>Amber</td>
<td>Fast charge.</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>Trickle charge.</td>
</tr>
<tr>
<td>VOLTAGE U INTERFACE</td>
<td>OFF</td>
<td>Sealing current not present.</td>
</tr>
<tr>
<td></td>
<td>GREEN</td>
<td>Sealing current present.</td>
</tr>
<tr>
<td>VOLTAGE S/T INTERFACE*</td>
<td>OFF</td>
<td>No PS1, PS2, PS3 present.</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>Normal polarity (see Section 3, Layer 1 [TE Mode]).</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>Reverse polarity (see Section 3, Layer 1 [TE Mode]).</td>
</tr>
</tbody>
</table>

Note: *TS250 only.

Charge LED

The charging LED indicates the battery is currently in charge mode. An amber LED indicates the unit is in fast charge (approximately 4 to 5 hours, if battery is completely dead). After fast charge, the TS220 and TS250 Test Sets will remain in trickle charge indicated by a green LED. When the LED is off, the battery is not being charged.

Voltage LED

Voltage LED illuminates automatically to indicate the presence of sealing current. If there is no sealing current on the line or the TS220 or TS250 Test Set is not connected to the line, the voltage LED is not lit.

U Interface - The LED will light green if sealing current is present across tip or ring.

S/T Interface (TS250 only) - In S/T mode the Voltage LED can be programmed to indicate a single power source or a combination of power sources (see Section 3, Layer 1 (TE Mode) for more information).
Off Hook LED

When the unit is taken off hook and layer 3 communication is established, the off hook LED lights green and is on continuously. If no Layer 3 SYNC is established, the LED will blink green.

During times when activation and synchronization of network elements are in progress and the unit is off hook, the off hook LED blinks on and off until such time as dial tone can be provided to indicate to the user that dialing may now proceed.

When the unit is placed on hook, the LED is extinguished.

Package Contents

Provided in the shipping box is either the TS220 or TS250 Test Set and the following additional items:

<table>
<thead>
<tr>
<th>Items</th>
<th>TS220</th>
<th>TS250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply, 12VDC, 5%W</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Soft Case</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Battery, NiCad</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Banjo (RJ-45), 10 inches</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Linecord, RJ-45 to BDN</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Cable, RJ-11 to RJ-11, 6 feet</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Cable, RJ-11 to RJ-11, 6 inches</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Cable, RS-232, 9-Pin</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Manual, User's Guide</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>User Card</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>
Connections

Line Cord

The TS220 and TS250 Test Sets come equipped with an angled bed-of-nails/RJ-45 cord or a 346A plug for CO applications (see Figure 2-5).

![Angled Bed-of-Nails/RJ-45 and 346A Plug]

Figure 2-5. Line Cords

Banjo Clip

The TS250 Test Set comes equipped with a banjo clip. The banjo clip and the short line cord together, with the RJ-45 line cord, allows testing through an RJ-11 jack (transmit/receive).

Power Supply/Charging

The TS220 and TS250 Test Sets are designed to operate with one of the following power sources:

- AC adapter (12 VDC ±10% 600 mA).
- Four NiCad batteries or 4 AA alkaline batteries.
When an AC adapter is used, the batteries are automatically disconnected; if NiCad batteries are installed the charging process will begin. The TS220 and TS250 Test Sets, when using an AC adapter and power is turned on, receives power from the AC adapter and does not affect the battery charging process.

The charge (Chg) indicator will display amber during fast charge (4 to 5 hours to charge when batteries are completely dead). When fast charge is complete, the test set switches to trickle charge (green indicator) and is ready for use (fully charged). The Test Set will remain in trickle charge until the charger (DC power) is removed.

The NiCad batteries should be charged for 4 to 5 hours before first use of the TS220 or TS250 Test Set. When fully charged, the NiCad battery pack can power the Test Set for 8 to 10 hours of continuous operation.

Default Mode

The Test Set will default to the last mode selected by the user (e.g., NT, LT, or TE mode).

Table 2-2 shows the default settings for the Test Set when powered on for the first time.

Table 2-2. Factory Default Settings

<table>
<thead>
<tr>
<th>Setting</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>BERT Rate</td>
<td>56K</td>
</tr>
<tr>
<td>BERT Time</td>
<td>3:00 minutes</td>
</tr>
<tr>
<td>Call Appearance</td>
<td>1</td>
</tr>
<tr>
<td>ISDN Mode</td>
<td>NT1+TE</td>
</tr>
<tr>
<td>Receiver Volume</td>
<td>Medium</td>
</tr>
<tr>
<td>Switch Type</td>
<td>National ISDN-1</td>
</tr>
<tr>
<td>Terminal Equipment Identifier (TEI)</td>
<td>Auto (127)</td>
</tr>
<tr>
<td>Contrast</td>
<td>Setting 4</td>
</tr>
<tr>
<td>Auto Off</td>
<td>Enable</td>
</tr>
<tr>
<td>Key Beep</td>
<td>Enable</td>
</tr>
<tr>
<td>Ringer</td>
<td>Low</td>
</tr>
</tbody>
</table>
Memory Dial

The automatic dialing modes, memory dial and last number redial, provide the ability to perform both enbloc and overlap dialing.

Enbloc dialing occurs when the entire number to be called is transmitted to the CO in a single message. This is the fastest dialing method, but there is no audible feedback to the user and enbloc dialing cannot be used to control remote equipment that responds to DTMF signaling.

Overlap dialing occurs when the number to be dialed is transmitted to the CO, one digit at a time. Each digit is accompanied by DTMF signaling which is audible to the user as well as any remote equipment on the other end of the line. Using overlap mode, the memory dial feature can be used to issue commands and passwords to remote equipment that respond to DTMF signaling.

For either memory dial or last number redial, enbloc dialing will be performed if the test set is on hook at the time the auto dial feature is invoked. Overlap dialing will be performed if the test set is off hook at the time the auto dial feature is invoked.

Overlap dialing may occur immediately after going off hook (when dial tone is heard) or after a connection has already been established (for DTMF signaling to remote equipment).
Last Number Redial

The last number dialed may be recalled by pressing the Last Number Redial (LNR) key. The last number dialed is displayed on the screen as it is dialed. The last number dialed may be recalled even after powering down the unit. The redial memory has a 20-digit capacity.

Speed Dial/Recall

Pressing the speed Recall key (see Figure 2-6) followed by the memory address (01 to 20) will automatically dial the contents of that particular address. Each memory address, up to 20 digits in length, can be stored.

Speed dial numbers may be used for phone numbers, DTMF commands for automated equipment passwords, etc.

Figure 2-6. Recall Screen
User Interface

Power On

Press the **Power** key to turn on the test set. Each time the test set is turned on, the user is presented with the screen shown in Figure 3-1.

![Initial Power On Screen](image1)

**Figure 3-1. Initial Power On Screen**

Power On Self Test (POST)

A power on self test is performed each time power is applied to the test set. The user may press the **F3** soft key to abort the self test. Upon completion of the self test, a **PASS** or **FAIL** result is displayed at the bottom of the screen (see Figure 3-2).

![Self Test Passed Screen](image2)

**Figure 3-2. Self Test Passed Screen**
If the self test fails, a message indicating the cause of the failure will appear at the bottom of the screen. The user then has the option to abort or continue with the self test.

### Home Screen

The Home Screen (see Figure 3-3) is used to set or change a call configuration description. The Home Screen is displayed after powering on the unit.

![Home Screen](image)

**Figure 3-3.** Home Screen

From the Home Screen, the user can:

- Make changes to the call, bearer capability, and selection of outgoing B Channel.
- Change the switch type.
- Assign a Service Profile Identifier (SPID) or a Directory Number (DN).

### Differentiating Between Voice/Data Calls

There are three types of calls supported (data, voice, and X.25 LAPD [see Section 4]). Two B Channels support voice and data calls. Call A and Call B can be reserved for either voice or data on either B channel.

1. At the Home Screen (see Figure 3-3), press **F1** to select Call. The Call Selection Screen (see Figure 3-4) is displayed. From this screen, changes and settings can be made to the call type, rate, and B Channel.
2. Press either:
   a. 1 to select Call A as the active call.
   b. 4 to select Call B as the active call.
   c. 7 to select x.25 D packet calls.

3. Press F3 to return to the previous screen.

Identifying the Rate

The Rate Selection Screen allows the user to tell the switch equipment the rate at which it is going to transmit (e.g., 56K, 64K, or voice). Some older lines are provisioned with connections that can only support 56K.

To identify the transmission rate:

1. At the Call Selection Screen (see Figure 3-4), press F1 to select Rate. The Rate Selection Screen is displayed (see Figure 3-5).

2. Press either 1, 4, or 7, and either 2, 5, or 8.

3. Press F3 to return to the previous screen.
Selecting the B Channel

There are two Bearer (B) Channels (B1 and B2) over which you can make or receive a call. You can either select the channel or you can let the switch equipment select the channel for you.

To select or change the B Channel used for outgoing calls:

1. At the Call Selection Screen (see Figure 3-4), press F2 to select B Chan. The B Channel Selection Screen is displayed (see Figure 3-6).

2. Press 1, 4, or 7 to select channel allocation for Call A and Call B.

3. Press F3 to return to the previous screen.

Selecting the Switch Type

To select or change the switch type:

1. At the Home Screen (see Figure 3-3), press F2 to select Switch. The Switch Selection Screen is displayed (see Figure 3-7). From this screen, the switch type can be changed.
2. Press 1, 2, 4, 5, or 7. A checkmark will be entered next to the desired switch type.

3. Press F3 to return to the previous screen.

4. When the Home Screen (see Figure 3-3) is displayed, verify that the correct switch information is displayed. If the information is incorrect, correct the information in accordance with the procedures in this manual.

Assigning Service Profile Identifiers/Directory Number

**Note:** A SPID is not used on a 5ESS Point-to-Point (PP) Switch and therefore SPID is not displayed on the Home Screen (see Figure 3-3).

The user may assign up to two SPIDs to the test set. One SPID can be assigned to Call A and one to Call B. In some cases, a line may only be provisioned for a single SPID. If the line is provisioned for a single SPID, the test set must be set up for a single SPID. If not set up properly, the user may be unable to initiate or receive a call.

The user may assign up to two Directory Numbers (DN) to the test set. Each DN will identify the telephone number associated with each call (Call A or Call B). The DN can only be entered or changed after the SPID has been assigned. The test will attempt to derive the DN from the SPID. The user can verify if the DN is correct through the DN menu.

**NAT’L, DMS100, and 5ESS Multi Point Switches**

To assign a SPID to a NAT’L, DMS100, or 5ESS Multi Point (MP) switch:

1. At the Home Screen (see Figure 3-3), press F3 to select **SPID**. The Two SPID/DN Setup Screen is displayed (see Figure 3-8).

   ![Figure 3-8. Two SPID/DN Setup Screen](image)

2. Pressing F1 (#SPIDs) toggles between the One SPID Setup Screen (see Figure 3-9) and the Two SPID Setup Screen.
3. If the Two SPID/DN Setup Screen is selected, press 1 or 4 to edit the SPID/DN. The Edit SPID screen is displayed (see Figure 3-10).

4. If the One SPID/DN Setup Screen is selected, press 1 to edit the SPID. The Edit SPID screen is displayed (see Figure 3-10).

5. Press F2 to select <BkSp to delete SPID shown on display. The cursor moves backward to delete the existing SPID. Press and hold <BkSp to delete multiple digits.

6. Enter the new SPID and press F1 to Send. One of the following messages will appear:
   a. Sending SPID.
   b. Resending SPID.
   c. SPID A registered.
   d. SPID A failed.
   e. SPID B registered.
   f. SPID B failed.
   g. SPIDs must be unique.

7. If the SPID has registered, the user can then press F3 to select Save and go to the DN Edit Screen (see Figure 3-11).

Note: In most cases, once a SPID is entered, you don’t have to enter DN number.
Figure 3-11. DN Edit Screen

8. Press F2 to select <BkSp> to delete a DN shown on the display. The cursor moves backward to delete the existing DN. Press and hold <BkSp> to delete multiple digits.

9. Enter the new DN (either 7 or 10 digits) and press F3 to Save and return to the SPID/DN Setup Screen (see Figure 3-8 and Figure 3-9).

10. To enter another SPID, press the key associated with that SPID and repeat steps 5 and 6.

Note: Version 3.02 used on the TS220 and TS250 Test Sets has improved support for 10 digit dialing networks by allowing the entry of a 10 digit DN for each call, even if the line under test only provides a 7 digit called party number. Use of a 10 digit DN will eliminate the need to use the Centrex prefix to perform AutoBERT on such networks.

5ESS Point-to-Point Switch

To assign a DN for a 5ESS Point-to-Point switch:

1. At the Home Screen (see Figure 3-3) for 5ESS Point-to-Point (PP), press F3 to select DN. The 5ESS PP DN Setup Screen is displayed (see Figure 3-12).

Figure 3-12. 5ESS PP DN Setup Screen

2. Press 1 to select DN. The DN Edit Screen (see Figure 3-11) is displayed.

3. Press F2 to select <BkSp> to delete a DN shown on the display. The cursor moves backward to delete the existing DN. Press and hold <BkSp> to delete multiple digits.

4. Enter the new DN and press F3 to Save.
Nat’L Auto SPID

The AutoSPID feature sends an inquiry to the switch and if the switch supports AutoSPID then the switch will return the SPID to the test set and the test set will register the SPID. AutoSPID works only on lines which originate in a CO that supports AutoSPID. To determine if you have an Auto SPID:

1. At the Home Screen (see Figure 3-3), press F2 to select Switch. The Switch Selection Screen is displayed (see Figure 3-7).

2. At the Switch Selection Screen, press 7 to select NAT’L AutoSPID. A checkmark is placed by the entry.

3. Press F3 to return to the previous screen.

4. Wait for Sync (solid amber light is displayed under Sync above LCD). The AutoSPID Processing Screen is displayed (see Figure 3-13).

Figure 3-13. AutoSPID Processing Screen

5. If the switch is set up for AutoSPID, the AutoSPID Screen is displayed (see Figure 3-14) showing the SPID, and the Sync light will turn green.

Figure 3-14. AutoSPID Screen

6. If the switch does not support AutoSPID, the AutoSPID Failed Screen is displayed (see Figure 3-15).
7. If the switch does not show an AutoSPID, it will be necessary to assign a SPID. Refer to Assigning Service Profile Identifiers/Director Number for instructions on how to assign a SPID.

8. While in AutoSPID, if you try to manually change the SPID, the test set will notify you that any SPID changes will deselect the AutoSPID feature and asks whether you want to accept the change or not. The SPID Changed Screen is displayed (see Figure 3-16).

9. If you press F1 for Yes, the Edit DN Screen is displayed (see Figure 3-11). Refer to Assigning Service Profile Identifiers/Director Number for instructions on how to change a DN.

10. If you press F2 for No, the Two SPID/DN Setup Screen (see Figure 3-8) or the One SPID/DN Setup Screen (see Figure 3-9) is displayed.

Assigning Call Appearance Number

For any voice call there is a call appearance number, which must be assigned. A call appearance value of 1 is usually accepted by most switches. Some lines are provisioned with a limited range of values that will be accepted. Setting call appearance allows the user to pick a value that is in the range that will be accepted by the switching equipment.
NAT’L, DMS100, and 5ESS Multi Point Switches

To assign the call appearance number for a NAT’L, DMS100, or a 5ESS MP switch:

1. At the Home Screen (see Figure 3-3), press F3 to select SPID. The SPID Setup Screen is displayed (see Figure 3-8 or Figure 3-9).

2. Press 2 or 5 to select CallAp. The Call Appearance Edit Screen is displayed (see Figure 3-17).

3. Press F2 to select <BkSp to delete the call appearance number shown on the display. The cursor moves backward to delete the existing number.

4. Enter number and press F3 to select Save.

5ESS Point-to-Point Switch

To assign the call appearance number for a 5ESS PP switch:

1. At the Home Screen (see Figure 3-3) for 5ESS PP, press F3 to select DN. The 5ESS PP DN Setup Screen is displayed (see Figure 3-12).

2. Press 2 to select CallAp. The Call Appearance Edit Screen is displayed (see Figure 3-17).

3. Press F2 to select <BkSp to delete the call appearance number shown on the display. The cursor moves backward to delete the existing number.

4. Enter number and press F3 to select Save.

Assigning a Terminal Equipment Identifier (TEI)

The TEI may automatically be assigned by the CO or the user could request a specific TEI. Two TEIs may be required, one for each SPID. Working on lines with fixed TEIs may require that a TEI be manually entered.
NAT’L, DMS100, and 5ESS Multi Point Switches

To enter a TEI for a NAT’L, DMS100, or a 5ESS MP switch:

1. At the SPID Setup Screen (see Figure 3-8 or Figure 3-9), press F2 to select TEI. Either the One Call TEI Setup Screen (see Figure 3-18) or the Two Call TEI Setup Screen (see Figure 3-19) is displayed.

   ![Figure 3-18. One Call TEI Setup Screen](image1)

   ![Figure 3-19. Two Call TEI Setup Screen](image2)

2. Press 1 to edit the TEI for Call A. The TEI Edit Screen is displayed (see Figure 3-20).

   ![Figure 3-20. TEI Edit Screen](image3)

3. Press F1 to select Auto. Auto will set the TEI to 127 (the numerical value for a broadcast TEI) and return you to the previous menu.

4. To delete a TEI, press F2 to select <BkSp. The cursor moves backward to delete the existing TEI.

5. Enter the TEI number and press F3 to select Save.

6. To enter the TEI for Call B, press 4 and repeat Steps 3 through 5.

Note: Only fixed TEI values between 0 and 63 are valid in this switch.
5ESS Point-to-Point Switch

To enter a TEI for a 5ESS PP switch:

1. At the Home Screen (see Figure 3-3) for 5ESS PP, press F3 to select DN. The 5ESS PP DN Setup Screen is displayed (see Figure 3-12).

2. Press F2 to select TEI. The One Call TEI Setup Screen (see Figure 3-18) is displayed.

3. Press 1 to edit the TEI. The TEI Edit Screen is displayed (see Figure 3-20).

4. Press F1 to select Auto. Auto will set the TEI to 127 (the numerical value for a broadcast TEI) and return you to the previous menu.

5. To delete a TEI, press F2 to select <BkSp. The cursor moves backward to delete the existing TEI.

6. Enter the TEI number and press F3 to select Save.

7. Press F3 to return to the previous menu.

Menu Key

*Note: The TS220 Test Set does not have *-Mode.

The Menu key is used to bring up the Main Menu Screen. Press the Menu key to gain access to the Main Menu Screen (see Figure 3-21 and Figure 3-22).

Figure 3-21. Main Menu Screen (NT1+TE and TE Mode)

Figure 3-22. Main Menu Screen (LT Mode) (TS250 Only)
The Main Menu Screen allows the user to:

- Perform a BERT test (auto).
- View/send Layer 1 commands.
- View U Interface (EOC, NEBE/FEBE).
- View S/T Interface (Q Channel, Power Source) (TS250 only).
- View status (BERT, Call A/B, software version).
- Change modes (TS250 only).
- Perform automatic functions.
- Make adjustments to the following options: LCD Contrast Control, Receiver Volume Control, Ringer Control, Defaults, or install a software upgrade (TS250 only).
- Centrex features.

Bit Error Rate Test (BERT)

BERT allows the user to identify the number of bit errors to the total number of bits being sent in the data transmission from one location to another. The bit rate (BR) is the number of bits transferred in a given time interval. Bits per second is a measure of the rate at which bits are transmitted.

Setting BERT Parameters in NT1+TE or TE Mode

To set BERT parameters for NT1+TE or TE Mode:

1. Verify the correct mode (NT1+TE or TE Mode) has been selected. If not, select the correct mode (see Mode Selection for further information).

2. At the Main Menu Screen (see Figure 3-21), press 1 to select BERT. The BERT Screen for NT1+TE or TE Mode is displayed (see Figure 3-23).

![Figure 3-23. BERT Screen](image-url)
3. To make changes to BERT parameters, press F1 to select Setup. The BERT Setup Screen for NT1+TE or TE Mode is displayed (see Figure 3-24).

4. Press 1 or 4 to select the rate (64K or 56K) at which BERT will be run.

5. To set the length of time to execute BERT, press F1 to select Time. The BERT Time Screen for NT1+TE or TE Mode is displayed (see Figure 3-25).

6. Press F2 to select Clear, then enter time for BERT.

7. Press F3 to select Save and return to the previous screen.

Setting BERT Parameters in LT Mode

There are two basic applications for LT mode:

- The test set has the capability of requesting loopback from a generic NT1 (see Figure 3-26). When a Loopback Test is requested, the unit can then perform a 1B or 2B BERT.
The test set allows communication between two test sets (see Figure 3-27). One configured as an NT1+TE and the other as an LT. In this configuration, the test sets have the capability to handle a voice call (dry loop), request loop functions via EOC Channel, and perform 1B or 2B BERT.

To set BERT parameters in LT Mode:

1. Verify the correct mode (LT Mode) has been selected. If not, select the correct mode (see Mode Selection for further information). The LT Mode Home Screen is displayed (see Figure 3-28).
2. Press the Menu key. The Main Menu Screen (LT Mode) is displayed (see Figure 3-22).

3. Press 1 to select BERT. The BERT Screen for LT Mode is displayed (see Figure 3-29).

4. To make changes to BERT parameters, press F1 to select Setup. The BERT Setup Screen for LT Mode is displayed (see Figure 3-30).

5. Press 1 or 4 to select the rate (64K or 56K) at which the BERT test will be run.

6. Press 2, 5, or 8 to select the B Channel(s).

7. To set the length of time to execute BERT, press F1 to select Time. The BERT Time Screen for LT Mode is displayed (screen is the same as Figure 3-25, except for LT in the upper right hand corner).

8. Press F2 to select Clear, then enter time for BERT.

9. To change the EOC address, press F2 to select ADDR. The EOC Address Screen is displayed (see Figure 3-31).
10. Press **F2** to select `<BkSp` to delete EOC address shown on display. The cursor moves backward to delete the existing EOC. Press and hold `<BkSp` to delete multiple digits.

11. Use the keypad to enter the new EOC address of the device you want to BERT. Only addresses 0 through 7 are valid.

12. Press **F3** to select **Save** and return to the previous screen.

For Dry Loop Operations (LT Mode or NT1+TE Synced to a Harris LT) (see Figure 3-27), BERT parameters may be set as follows:

1. Verify the units are in Dry Loop Operations and sync has been established (see Figure 3-32).

2. Press **F1** on either unit to select **BERT**. The BERT Screen for LT Mode is displayed (see Figure 3-29).

3. To make changes to BERT parameters, press **F1** to select **Setup**. The BERT Setup Screen for LT Mode is displayed (see Figure 3-30).

4. Press 1 or 4 to select the rate (64K or 56K) at which BERT will be run.

5. Press 2, 5, or 8 to select the B Channel loopbacks.
To set the length of time to execute BERT, press **F1** to select **Time**. The BERT Time Screen for LT Mode is displayed (screen is the same as Figure 3-25, except for LT in the upper right hand corner).

7. Press **F2** to select **Clear**, then enter time for BERT.

8. Press **F3** to select **Save** and return to the previous screen.

Making a Single BERT Test in NT1+TE or TE Mode

Figure 3-33 shows a block diagram of a single loop back.

![SINGLE LOOP BACK](image)

To make a single BERT in NT1+TE or TE Mode:

1. Verify the correct mode (NT1+TE or TE Mode) has been selected. If not, select the correct mode (see **Mode Selection** for further information).

2. Verify the correct SPIDs/DNs and Switch have been entered. If not, enter correct SPIDs/DNs or Switch (see Assigning Service Profile Identifier/Directory Number, Selecting the Switch Type, and Assigning a Terminal Equipment Identifier).

3. Verify the correct Rate and Channel have been entered. If not, enter the correct Rate and/or Channel (see Identifying the Rate or Selecting the B Channel).

4. Go off hook and dial the 108 (loopback) number assigned by the Central Office. When the user enters the assigned 108 (loopback) number, the number will automatically enter loop back. When connected the Connection Screen is displayed (see Figure 3-34).
5. Press the Menu key to go to the Main Menu Screen. At the Main Menu Screen (see Figure 3-21), press 1 to select BERT. The Single BERT Screen is displayed (see Figure 3-35).

6. Press F2 to select Start. The Errors Screen for NT1+TE or TE Mode is displayed (see Figure 3-36).

Note: The status information will be updated.

7. Press F1 to insert one or more bit errors. Errors may be inserted to verify continuity of the bit stream.
8. Press F2 to select **Stop**. The Stop Screen for NT1+TE or TE Mode is displayed (see Figure 3-37). If stop is not selected, the BERT will automatically stop after the BERT duration.

![Figure 3-37. Stop Screen](image)

9. To end the call, press the **On/Off Hook** key.

10. Press F3 to select **Clear** and return to the Home Screen (see Figure 3-3).

### Making a BERT in LT Mode

There are three ways to run BERT in LT mode: through the BERT function key, through the Auto function key, or through the Main Menu.

1. Verify the correct mode (LT Mode) has been selected. If not, select the correct mode (see Mode Selection for further information).

2. Wait for Sync (green light is displayed under Sync on LCD).

3. At the LT Mode Home Screen (in Sync) (see Figure 3-32) select one of the following options:

   a. Press F1 to select **BERT** or press the Menu Key then press 1 to select **BERT**. The BERT Screen for LT Mode (see Figure 3-29) is displayed on the LT test set. The display on the NT1+TE test set does not change (see Figure 3-32).

   b. Press F3 to select **AUTO** or press the Menu Key then press 4 to select **AUTO**.

   **Note:** BERT test may be started from either test set.

4. Press F2 to select **Start**. The Errors Screen is displayed on the LT test set (see Figure 3-36). The Loopback Screen (see Figure 3-38) is displayed on the NT1+TE test set.
Note: The status information will be updated.

5. Press F1 to insert one or more bit errors. Errors may be inserted to verify continuity of the Bit stream.

6. Press F2 to select Stop. The BERT Screen for LT mode is displayed (see Figure 3-29) on the LT test set. The Return to Normal Screen is displayed on the NT1+TE test set (see Figure 3-39). If stop is not selected, the test will continue for the BERT function (see Setting BERT Parameters).

7. Press F3 to select PREV and return to the previous screen or the Menu Key to return to the LT Mode Home Screen.

Dual BERT Call Yourself

The Auto function key on the Main Menu allows the test set to call from one B channel to the other channel, then answer the incoming call and initiate a 2B BERT. Figure 3-40 shows a block diagram of a dual BERT.

Figure 3-38. Loopback Screen

Figure 3-39. Return To Normal Screen

Figure 3-40. Block Diagram of a Dual BERT
There are two ways to perform a BERT auto call yourself in NT1+TE or TE Mode: through the Auto option or through the BERT option on the Main Menu.

Method 1: through the Auto Option (see Figure 3-21):

1. Verify the correct mode (NT1+TE, TE, or LT Mode) has been selected. If not, select the correct mode (see Mode Selection for further information).

2. Verify the correct SPIDs/DNs have been entered. If not, enter correct SPIDS and/or DN (see Assigning Service Profile Identifier/Directory Number).

3. Verify the correct Rate, Channel, and TEI have been entered. If not, enter correct Rate, Channel and/or TEI (see Identifying the Rate, Selecting the B Channel, or Assigning a TEI).

4. At the Main Menu Screen (see Figure 3-21 or Figure 3-22), press 4 to select Auto. The number is dialed and the Connection Screen is displayed (see Figure 3-34).

5. The unit will automatically start to perform a 128K (or 112K for 56K BERT rate) BERT and enter the Errors Screen (see Figure 3-36).

6. Press F1 to insert one or more BERT errors. Errors may be inserted to verify continuity of the bit stream.

7. Press F2 to select Stop. The Stop Screen is displayed (see Figure 3-37). If stop is not selected, the BERT will automatically stop after running for the BERT duration.

8. To end the call, press the On/Off Hook key.

9. Press F3 to select Clear and return to the Home Screen (see Figure 3-3).

Method 2: through the BERT option (see Figure 3-21).

1. Verify the correct mode (NT1+TE or TE) has been selected. If not, select the correct mode (see Mode Selection for further information).

2. Verify the correct SPIDs/DNs have been entered. If not, enter correct SPIDS and/or DN (see Assigning Service Profile Identifier/Directory Number).

3. Verify the correct Rate, Channel, and TEI have been entered. If not, enter the correct Rate, Channel and/or TEI (see Identifying the Rate, Selecting the B Channel, or Assigning a TEI).
4. At the Main Menu Screen (see Figure 3-21), press 1 to select **BERT**. The Dual BERT Screen is displayed (see Figure 3-41).

```
64K BERT B1
Duration 03:00
```

**Figure 3-41. Dual BERT Screen**

5. Press **F2** to select **Auto**. The number is dialed and the Connection Screen is displayed (see Figure 3-34).

6. The unit will automatically start to perform a 128K (or 112K for 56K BERT rate) BERT and the Errors Screen is displayed (see Figure 3-36).

```
-note: The status information will be updated.
```

7. Press **F1** to insert one or more BERT errors. Errors may be inserted to verify continuity of the bit stream.

8. Press **F2** to select **Stop**. The Stop Screen is displayed (see Figure 3-37). If stop is not selected, the BERT will automatically stop after running for the BERT duration.

9. To end the call, press the **On/Off Hook** key.

10. Press **F3** to select **Clear** and return to the Home Screen (see Figure 3-3).

---

**Layer 1 (NT1+TE and LT Mode)**

**NEBE/FEBE**

Near End Block Error (NEBE) and Far End Block Error (FEBE) status detects line problems that produce digital data errors. NEBE/FEBE monitors two specific bits for accuracy. Test readout displays the number of errors that occur over a specific time span.

A FEBE is a block error detected by the Far End and reported back.

A NEBE is a block error detected by the Near End.

Selection of NEBE/FEBE presents three choices to the user:

- Set duration of test time.
- Insert bit errors.
- Clear sets NEBE/FEBE errors and Esec to zero, and the timer to zero.

To access NEBE/FEBE:

1. Verify the correct mode (NT1+TE or LT Mode) has been selected. If not, select the correct mode (see Mode Selection for further information).

2. Wait for Sync (green or amber light is displayed under Sync above LCD), then press the Menu key.

3. At the Main Menu Screen (see Figure 3-22), press 2 to select Layer 1. The Layer 1 Menu is displayed (see Figure 3-42).

4. Press 1 to select NEBE/FEBE. The NEBE/FEBE Test Screen is displayed (see Figure 3-43).

5. To set the length of time to execute the NEBE/FEBE test, press F1 to select Time. The NEBE/FEBE Time Screen is displayed (see Figure 3-44).
6. Press **F2** to select **Clear**, then enter the time for the NEBE/FEBE test.

7. Press **F3** to select **Save** and return to the previous screen.

8. Press **F2** to select **Start**. The NEBE/FEBE Errors Screen is displayed (see Figure 3-45).

![Figure 3-45. NEBE/FEBE Errors Screen](image)

9. Press **F1** to insert one or more errors in the outgoing data. Errors may be inserted to verify continuity of the bit stream. Inserted errors will increase the FEBE count.

10. To abort the call, press **F2** to select **Stop** and return to the previous screen.

11. When the test is complete, the NEBE/FEBE Test Complete Screen is displayed (see Figure 3-46).

12. Press **F3** to select **Clear** and return to the previous menu.

![Figure 3-46. NEBE/FEBE Test Complete Screen](image)

**40 KHz Tone Generation**

Basic Rate ISDN Service is a nonloaded loop, single pair of copper wires. From the CO to the customer location there is a loop limitation of 18,000 feet. Basic Rate ISDN (BRI) transmission, over 18,000 feet has a 42 dB loss at 40 KHz. If the loop is within this limit, it is said to be loop qualified for ISDN Basic Rate Service.

The TS220 and TS250 Test Sets have the capability of generating a reference 40 kHz tone, 0 dBm. The 40 kHz tone can be used to help prequalify ISDN lines. Prequalifying an ISDN loop requires two technicians: one to generate the 40 kHz tone and the second to measure the 40 kHz loss. When measuring the tone, with a 135 ohm ±1% termination, the tone level will drop to -60 dBm ±1 dBm.
To access the 40 KHz tone:

1. Verify the correct modes (NT1+TE or LT Mode) have been selected. If not, select the correct mode (see Mode Selection for further information).

2. At the Main Menu Screen (see Figure 3-21 or Figure 3-22), press 2 to select Layer 1. The Layer 1 Menu is displayed (see Figure 3-42).

3. At the Layer 1 Menu (LT Mode), press 4 to select 40 kHz Tone. If the test set had Sync, an Action Screen is displayed (see Figure 3-47).

4. Press F1 to select YES. The 40 kHz Screen is displayed (see Figure 3-48). Pressing F2 to select NO will return you to the Layer 1 Menu (LT Mode) (see Figure 3-42).

5. Press F3 to select Stop.

6. Press F3 to select Previous and return to the previous menu.

Embedded Operations Channel

The Embedded Operations Channel (EOC) is a communications channel between the NT1 and the CO (see Figure 3-49). Embedded in the maintenance channel on the U Interface, it is used for maintenance information and testing. The LT Mode commands are listed in Table 3-1. When in LT Mode, the commands are issued. When in NT1+TE Mode, the test set acts as a monitor and commands are responded to (see Table 3-2).
Table 3-1. LT Mode Commands

<table>
<thead>
<tr>
<th>Message</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>2B+D Loopback</td>
<td>All three channels are transparently looped back to the U interface.</td>
</tr>
<tr>
<td>B1 Loopback</td>
<td>Directs NT to loop back the B1 Channel to the U interface.</td>
</tr>
<tr>
<td>B2 Loopback</td>
<td>Directs NT to loop back the B2 Channel to the U interface.</td>
</tr>
<tr>
<td>Request Cyclic Redundancy Check (CRC)</td>
<td>Requests that corrupt CRCs be sent toward the network until cancelled</td>
</tr>
<tr>
<td></td>
<td>by a Return to Normal.</td>
</tr>
<tr>
<td>Notify Corrupt CRC</td>
<td>Notifies the NT that the network will send intentionally corrupted</td>
</tr>
<tr>
<td></td>
<td>CRCs until cancelled by a Return to Normal.</td>
</tr>
<tr>
<td>Return to Normal</td>
<td>Notifies the NT to release all outstanding EOC controlled operations</td>
</tr>
<tr>
<td></td>
<td>and reset the EOC processor to its initial state.</td>
</tr>
<tr>
<td>Hold State</td>
<td>Sent by the network to maintain previously invoked EOC functions.</td>
</tr>
<tr>
<td>Unable to Comply</td>
<td>Confirmation that the NT has validated the receipt of an EOC command,</td>
</tr>
<tr>
<td></td>
<td>but that the EOC command is not one which the NT may perform.</td>
</tr>
</tbody>
</table>

Table 3-2. NT1+TE Mode Responses

<table>
<thead>
<tr>
<th>Message</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hold State</td>
<td>Sent by the NT toward the network to indicate that the NT has received</td>
</tr>
<tr>
<td></td>
<td>an EOC frame with an address other than its own (000 or 111).</td>
</tr>
<tr>
<td>Unable to Comply</td>
<td>Sent when it cannot support a requested EOC function.</td>
</tr>
</tbody>
</table>
To send EOC commands:

1. Verify the LT mode has been selected. If not, select the correct mode (see Mode Selection for further information).

2. Wait for Sync (green or solid amber light is displayed under Sync above LCD), then press the Menu key.

3. At the Main Menu Screen (LT Mode) (see Figure 3-22), press 2 to select Layer 1. The Layer 1 Menu (LT Mode) is displayed (see Figure 3-42).

4. Press 7 to select EOC Commands (LT Mode). The EOC Mode Command Screen is displayed (see Figure 3-50).

![Figure 3-50. EOC Mode Command Screen](image)

5. Press F2 to select FWD to scroll forward through the EOC Commands.

6. Press F1 to select Send the selected EOC Command to another test set or to another standard NT1 unit.

7. To exit after all desired commands have been sent, press F3 to select Prev and return to the previous menu.

To monitor EOC commands:

1. Verify the NT1+TE mode has been selected. If not, select the correct mode (see Mode Selection for further information).

2. Wait for Sync (green or solid amber light is displayed under Sync above LCD) then press the Menu key.

3. At the Main Menu Screen (NT1+TE Mode) (see Figure 3-21), press 2 to select Layer 1. The Layer 1 Menu (NT1+TE Mode) is displayed (see Figure 3-42).

4. Press 7 to select EOC Monitor (NT1+TE Mode). The EOC Monitor Screen is displayed (see Figure 3-51).
Figure 3-51. EOC Monitor Screen

5. When done monitoring, press **F3** to select **Prev** and return to the previous menu.

**EOC Address**

The EOC address is the address of the device you want to talk to on a line. The address ranges from 0 to 7. Every time an address is changed, the test set broadcasts a return to normal. The address is not saved when you power down.

To enter, change or detect an EOC address:

1. Verify the LT mode has been selected. If not, select the correct mode (see **Mode Selection** for further information).

2. Wait for Sync to light any color, then press the **Menu** key.

3. At the Main Menu Screen (LT Mode) (see **Figure 3-22**), press 2 to select **Layer 1**. The Layer 1 Menu (LT Mode) is displayed (see **Figure 3-42**).

4. Press * to select **EOC Address** (LT Mode). The EOC Address Screen is displayed (see **Figure 3-31**).

5. Press **F2** to select **BkSp** to delete EOC address shown on display. The cursor moves backward to delete the existing EOC. Press and hold **BkSp** to delete multiple digits.

6. Enter EOC address and press **F3** to select **Save** and return to the previous menu.

7. To determine what EOC addresses, if any, are on a line, press **F1** to select **Detect**.

8. The detection test will be run to see if devices respond to EOC address (see **Figure 3-52**). Press **F2** to select **Start**. The test is usually run in under 2 seconds, but may take a maximum of 7 seconds. The highest detected address will be displayed on the EOC Detected Screen (see **Figure 3-52**).
9. If no address is detected or the test has not been performed, the EOC Not Detected Screen will appear (see Figure 3-53).

10. To check other addresses repeat Step 8 and press F2 to select Start.

11. When address checking is complete, press F3 to return to the previous menu.

Layer 1 (TE Mode)

Power Source

Figure 3-54 illustrates the various power sources that can be provided.
The power sources are:

- **Power Source 1 (PS1)** - Phantom feed power supplied by an external NT1 to the TE. The transmit pins are pins 3 and 6. The receive pins are pins 4 and 5.

- **Power Source 2 (PS2)** - A direct power source supplied by an external NT1 to the TE.

- **Power Source 3 (PS3)** - Power supplied to the TE or NT1 by an external power supply. The power supply may be a stand alone unit or part of an external TE.

- The Volt indicator can be programmed to give status on the power sources.

To make changes to the power configurations:

1. Verify the correct mode (TE mode) has been selected. If not, select the correct mode (see Mode Selection for further information).

2. At the Main Menu Screen (see Figure 3-21), press 2 to select **Layer 1**. The Layer 1 Menu (TE Mode) is displayed (see Figure 3-55).
3. Press 1 to select **Power Sources**. The Power Source Screen is displayed (see Figure 3-56).

   1-PS1=None (Light) 4-PS2=None (Light) 7-PS3=None (Light)
   Any

   Figure 3-56. Power Source Screen

   4. Press 1, 4, 7, or press F1 to select **ANY**.

   5. If 1, 4 or 7 is pressed, the word **Light**, in parentheses, is placed after the PS entry. If Any is selected, the word **Light** is placed after all of the entries (see Figure 3-56) and one of the following conditions will occur:

   - **Note:** The LED will follow the light.

   a. If one or more of the PS entries has a positive voltage (positive indicator), the Volt light will turn green (see Figure 3-57).

   b. If one or more of the PS entries does not have voltage (negative indicator), the Volt light will remain red (see Figure 3-57).

   c. If there is a combination of positive and negative power sources, the Volt light will remain red.

   6. Press F3 to return to the previous screen.
Q Channel

The S/T Maintenance Channel (Q Channel) is the maintenance signaling channel provided from a TE to an NT1 over the S/T interface (ANSI T1.605-1991). The Q Channel allows signaling control functions over layer 1 (e.g., B1, B2 or 2B loopbacks). The maintenance channel functions are listed in Table 3-3.

Table 3-3. Q Channel Messages

<table>
<thead>
<tr>
<th>Message</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idle Channel (NORMAL)</td>
<td>Default state of the S/T maintenance channel.</td>
</tr>
<tr>
<td>Loopback B1</td>
<td>Requests NT1 to loop back Channel B1.</td>
</tr>
<tr>
<td>Loopback B2</td>
<td>Requests NT1 to loop back Channel B2.</td>
</tr>
<tr>
<td>Loopback 2B</td>
<td>Requests NT1 to loop back both channels.</td>
</tr>
<tr>
<td>Loss-of-Power Indicator</td>
<td>An indicator to the TEs that the NT has lost power.</td>
</tr>
<tr>
<td>Request Self Test</td>
<td>The TE can request that the NT perform a self test. The scope of the self test is not defined. The self test report returning from the NT1 indicates pass (STP) or fail (STF).</td>
</tr>
</tbody>
</table>

To send Q Channel commands:

1. Verify the TE Mode has been selected. If not, select the correct mode (see Mode Selection for further information).
2. At the Main Menu Screen (see Figure 3-21), press 2 to select Layer 1. The Layer 1 Menu (TE Mode) is displayed (see Figure 3-55).
3. Press 4 to select Q Channel. The Q Channel Screen is displayed (see Figure 3-58).
4. Press F2 to select Fwd and scroll forward through the Q Channel messages (see Table 3-3).

Figure 3-58. Q Channel Screen

5. Press F1 to select Send.
6. To exit after all desired Q channel commands have been sent, press F3 to return to the previous screen.
96 KHz Tone Generation

In this mode of operation, the TS250 Test Set has the capability to generate a 96 kHz tone (1.5 Volts peak to peak nominal, when terminated with 100 ohms) per ANSI T1.605 (1991). The tone can be used as a tracer tone.

To access the 96 kHz tone:

1. Verify the correct mode (TE mode) has been selected. If not, select the correct mode (see Mode Selection for further information).

2. At the Main Menu Screen (see Figure 3-21), press 2 to select Layer 1. The Layer 1 Menu (TE Mode) is displayed (see Figure 3-55).

3. Press 7 to select 96 kHz. If the test set had Sync, an Action Screen is displayed (see Figure 3-47).

4. Press F1 to select YES. The 96 kHz Screen is displayed (see Figure 3-59). Pressing F2 to select NO will return you to the Layer 1 Menu (TE mode) (see Figure 3-42).

5. Press F3 to select Stop.

6. Press F3 to select Prev and return to the previous menu.

Mode Selection

The TS220 provides one main mode of operation and the TS250 provides three main modes of operation. The modes of operation are:

- NT1+TE mode for U Interface Testing (TS220 and TS250 Test Sets).
- TE mode for S/T Interface Testing (TS250 Test Set only).
- LT mode for Dry Loop Mode Downstream Testing (TS250 Test Set only).
NT1+TE Mode

NT1+TE mode (see Figure 3-60) allows the user to:

- Make voice and data calls.
- Perform BERT tests.

![Figure 3-60. NT1+TE Mode (TS220 and TS250)](image)

Line Termination (LT) Mode

Line Termination (LT) mode (see Figure 3-61) allows the user to look like the line card inside the CO. In this mode the user can perform (physical layer) testing down stream.

- Make X.25 D Packet calls.
- Monitor the maintenance channel.
- Display various data information.

TE Mode

Notes: 1. TE Mode is not available on the TS220 Model.

2. Only one device should be terminated on passive bus configuration and it should be the farthest device from the NT1.

TE Mode can be either terminated or unterminated. In terminated mode, the receiver and the transmitter are terminated with 100 ohms. In a unterminated phase, there is not 100 ohms across the receiver and the transmitter. Figure 3-62 shows where the S/T is terminated, behind the NT1. TE mode allows the user to:

- Display various data information.
- Perform BERT test.
- Make a voice or data call.
- Make X.25 D Packet calls.
- Send command via Q Channel.
Note: LT Mode is not available on the TS220 Model.

Figure 3-61. LT Mode

Figure 3-62. TE Mode
Figure 3-63 illustrates the standard line cord and the various line cord accessories, and the physical connections.

Figure 3-63. Line Cord and Accessories

Setting/Changing Modes

To set or change modes (TS250 only):

1. At the Main Menu screen (see Figure 3-21 or Figure 3-22), press * to select Mode. The Mode Setup screen is displayed (see Figure 3-64).

2. Press one of the following numbers:
   a. 1 to select NT1+TE.
   b. 4 to select TE Terminated.
   c. 7 to select TE Unterminated.
   d. * to select LT.

Figure 3-64. Mode Setup Screen
Centrex

Centrex is a business telephone service or a Private Branch Exchange (PBX), offered by local telephone companies from local central offices. It is similar to the individual lines delivered to individual desks with special features on the lines (e.g., intercom, call forwarding, call transfer, etc.). When dialing from a centrex setup, it is often necessary to dial 9 (or another prefix) to get an outside line.

If enabled, the Centrex function can insert a prefix of up to 10 digits. The user may edit the number to dial out. The prefix insertion is only active when activating memory dial or call yourself BERT and the Centrex function is on. For example:

- Set the prefix to 9.
- Store the number 527-8729 in location 1.
- Recall location 1 and select dial.
- The number dialed out is 9-527-8729.

To access the Centrex function:

1. Verify the correct mode (NT1+TE or TE Mode) has been selected. If not, select the correct mode (see Mode Selection for further information).

2. At the Main Menu Screen (see Figure 3-21), press 8 to select Centrex. The Centrex Edit Screen is displayed (see Figure 3-65).

![Figure 3-65. Centrex Edit Screen](image)

3. Press F1 to turn feature on or off. A C icon will appear on the screen and remain on subsequent screens to indicate when Centrex is on.
4. Press **F2** to select `<BkSp>` to delete the number shown on the display. The cursor moves backward to delete the existing number.

5. Press **F3** to select **Save** and return to Main Menu Screen.

**View**

The View function key stores information on the last call attempt that took place on Call A, Call B, and/or Call D and Cause Messages (see **Cause Messages** Section for more information) about what happened in that attempt. View also provides the results of previous BERTs, previous data from self tests, and the current version of software being used in the test set.

**NT1+TE or TE Mode**

To access the View key in NT1+TE or TE Mode:

1. Verify the correct mode (NT1+TE or TE Mode) has been selected. If not, select the correct mode (see **Mode Selection** for further information).

2. At the Main Menu Screen (NT1+TE or TE Mode) (see **Figure 3-21**), press **7** to select **View**. The View Screen (NT1+TE or TE Mode) is displayed (see Figure 3-66).

![Figure 3-66. View Screen](image)

3. Select one of the following options (see Figure 3-66):
   
a. Press **1** to view BERT results.

b. Press **2** to see what version of software is currently being used.

c. Press **4** to view results of Call A attempts.

d. Press **5** to view self test results.

e. Press **7** to view results of Call B attempts.
f. Press 8 to view NEBE/FEBE (NT1+TE) test results.

g. Press ✪ to view results of Call D attempts.

**LT Mode**

To access the View key in LT Mode:

1. Verify the correct mode (LT Mode) has been selected. If not, select the correct mode (see Mode Selection for further information).

2. At the Main Menu Screen (LT Mode) (see Figure 3-22), press 7 to select View. The View Screen (LT Mode) is displayed (see Figure 3-67).

![Figure 3-67. View Screen (LT Mode)](image)

3. Select one of the following options:
   a. Press 1 to view BERT results.
   b. Press 2 to see what version of software is currently being used.
   c. Press 4 to view results of call attempts.
   d. Press 5 to view self test results.
   e. Press 8 to view results of NEBE/FEBE tests.

**Options for Feature Adjustments**

All adjustments to contrast control, receiver volume level, or ringer volume (for all modes) can be made from an Options Screen (see Figure 3-68) which is accessed by pressing 5 to select Options from the Main Menu Screen (see Figure 3-21 or Figure 3-22).
LCD Contrast Control

To adjust the contrast of the LCD display:

1. At the Options Screen (see Figure 3-68), press 1 to select **Contrast**. The Contrast Setting Screen is displayed (see Figure 3-69).

   ![Contrast Setting Screen](image1)

   Figure 3-69. Contrast Setting Screen

2. Press F1 to select **Less** contrast or F2 to select **More** contrast.

3. Press F3 to return to the previous screen.

Receiver Volume Control

*Note: The speaker volume is controlled with the Speaker key.*

The volume level for the receiver may be set by the user. The volume level selected by the user is saved when the unit is powered down and restored on next power up.

To set or adjust the receiver’s volume level:

1. At the Options Screen (see Figure 3-68), press 2 to select **Rcv Vol**. The Receiver Volume Setting Screen is displayed (see Figure 3-70).

   ![Receiver Volume Setting Screen](image2)

   Figure 3-70. Receiver Volume Setting Screen
2. Press 1, 4, or 7 to adjust the volume.

3. Press F3 to return to the previous screen.

**Auto Off**

The Auto Off is a feature that allows the user to save battery power when the user has inadvertently left the unit on (adapter is not plugged in or there is no keys pressed and Sync light is not on). It takes 5 minutes of inactivity before a test set will automatically power down. Prior to powering down the unit, a 5 minute warning tone will be heard followed by a message that appears on the screen (see Figure 3-71) before power down begins. After the warning tone is sounded and the message appears, the user has 10 seconds to press any key before the unit powers down.

![Automatic Power Down](image)

Figure 3-71. Power Down Warning Screen

1. At the Options Screen (see Figure 3-68), press 4 to select **Auto Off**. The Auto Setup Screen is displayed (see Figure 3-72).

![Automatic Power Down](image)

Figure 3-72. Automatic Setup Screen

2. Press 1 to select **Enable** and activate the warning feature.

3. Press 4 to select **Disable and** override the automatic power down feature when there is no key activity.

4. Press F3 to return to the previous screen.

**Ringer Volume**

To set the ringer volume:

1. At the Options Screen (see Figure 3-68), press 5 to select **Ringer**. The Ringer Setting Screen is displayed (see Figure 3-73).
2. Press 1, 4, or 7 to set the ringer volume.
3. Press F3 to return to the previous screen.

### Audible Key Beep

The Key Beep feature allows the user to hear the keys that are being pressed when the Speaker key is activated.

To access the Key Beep feature:

1. At the Options Screen (see Figure 3-68), press 7 to select **Key Beep**. The Key Beep Screen is displayed (see Figure 3-74).

2. Press 1 to select **Enable** and turn the audible feature on.
3. Press 4 to select **Disable** and turn the audible feature off.
4. Press F3 to return to the previous screen.

### Software Upgrade

*Note: Software upgrade is not available on the TS220.*

The TS250 Test Set can be upgraded as new releases become available. Contact Customer Service for obtaining software upgrades. Instructions for installing the upgrades are provided with the software upgrade.

Do not use the Software Upgrade Screen (see Figure 3-75) unless you are going to perform a software upgrade.
If you accidentally enter the Software Upgrade Screen, press F2 to select No and return to the Main Menu Screen.

If you accidentally press F1 for Yes and get into the software upgrade program, power down the unit and then restart the test set. Any unsaved data will be lost.

 Defaults

The Defaults feature allows you to restore the factory default settings and power down the test set.

To view the factory defaults:

1. At the Options Screen (see Figure 3-68), press F1 to select More. An Additional Options Screen is displayed (see Figure 3-76).

2. Press 1 to select Defaults. The Defaults Screen is displayed (see Figure 3-77).

Figure 3-75. Upgrade Screen

Figure 3-76. Additional Options Screen

Figure 3-77. Defaults Screen
3. Press **F1** to select **Yes** to restore the factory default settings and power the unit down.

4. Press **F2** to select **No** if you do not want to restore the default settings. Pressing No will return you to the previous menu.

**Auto Answer and Loopback**

To configure the test set to an auto answer and loopback calls:

1. At the Options Screen (see Figure 3-68), press **F1** to select **More**. An Additional Options Screen is displayed (see Figure 3-76).

2. Press 4 to select **Auto Ans**. The Auto Answer Screen is displayed (see Figure 3-78).

![Auto Answer Screen](image)

**Figure 3-78. Auto Answer Screen**

*Note: While the test set is in auto answer and loopback mode, the test set may not originate a call.*

3. Press 1 to select **Enable** and activate the auto answer feature. Selecting Enable allows the user to receive calls only, not make outgoing calls.

4. Press 4 to select **Disable** and override the automatic answer feature.

5. Press **F3** to return to the previous screen.

**Dialing**

1. At the Options Screen (see Figure 3-68), press **F1** to select **More**. An Additional Options Screen is displayed (see Figure 3-76).

2. Press 2 to select **Dialing**. The Dialing Options Screen is displayed (see Figure 3-79).

![Dialing Options Screen](image)

**Figure 3-79. Dialing Options Screen**
3. Selecting one of the following options:
   a. Press 1 for 7 digit telephone numbers.
   b. Press 4 for 10 digit telephone numbers.
   c. Press 7 for 11 digit telephone numbers.

4. Press F3 to return to the previous screen.

**Backlight**

The backlight feature allows the user to set the length of time that the backlight will stay illuminated before it will turn off.

1. At the Options Screen (see Figure 3-68), press F1 to select More. An Additional Options Screen is displayed (see Figure 3-76).

2. Press 5 to select BkLight. The Backlight Screen is displayed (see Figure 3-80).

![Backlight Timeout](image)

**Figure 3-80. Backlight Screen**

*Note: The shorter the backlight period, the longer the batteries may last.*

3. Select one of the following options:
   a. Press 1 for 30 seconds.
   b. Press 4 for 5 minutes.
   c. Press 7 for none.

4. Press F3 to return to the previous screen.

**Recall (Speed Dial) Key**

*Note: This function not available for Dry Loop Operation.*

The Recall key provides access to stored speed dial numbers. To access the Recall functions:

1. When the Home Screen (see Figure 3-3) is displayed, press the Recall key. The Recall Screen is displayed (see Figure 3-81).
2. To dial a number, press any keys 01 to 20.

3. Press F2 to select FWD to scroll forward. The Location Setup Screen is displayed (see Figure 3-82). Up to 20 locations may be stored in the test set.

4. Press F1 to select Back to scroll backward to location 20. The Location Setup Screen is displayed (see Figure 3-82).

5. At the Location Setup Screen, press F2 to select FWD to scroll forward through the locations.

6. Press F1 to select Back to scroll back through the locations.

7. When the desired location is reached, press * to dial the number stored in the location currently displayed.

8. Press the pound (#) key to select Edit. The Recall Edit Screen is displayed (see Figure 3-83).
9. Press **F2** to select `<BkSp` to delete a number shown on the display. The cursor moves backward to delete the existing number.

10. Enter new number and press **F3** to select **Save** and return to the previous.

11. Press **F3** to select **Exit**.

### LNR Key

*Note:* This function not available for Dry Loop Operation.

*Note:* The LNR key may be pressed while either on hook and off hook.

The Last Number Redial (LNR) key is used to redial the last number dialed. To access the recall functions:

When the Home Screen (see Figure 3-3) is displayed and the Sync light is green, the user may then press the LNR key, or at the dial tone, press the LNR key to automatically redial the last number. The LNR Screen is displayed (see Figure 3-84).

![Sync Active](image)

**Figure 3-84. LNR Screen**

### Assist Key

The Assist Key can be used in the following manner:

- To bring up relevant information on the LCD for explaining the current menu item.
- To alphabetically bring up relevant information on the LCD on all topics in the Test Set.
- To access cause messages.

While assist is active, a question mark (?) icon is displayed on the right hand side of the display.

To access information about a menu item:

1. Press the Assist Key. The Assist Information Screen is displayed (see Figure 3-85).
Figure 3-85. Assist Information Screen

2. Press **F2** to select **Fwd** to scroll forward to the next information screen (see Figure 3-86).

Figure 3-86. Next Assist Information Screen

3. Press **F2** to select **Fwd** to scroll forward to the next information screen (see Figure 3-86).

4. Press **F1** to select **Back** to scroll backward through the information screens.

5. Press **F3** to select **Exit**.

**Selecting Topics Alphabetically**

To **alphabetically select topics**, press the Assist Key twice. The Alphabetical Topic Screen is displayed (see Figure 3-87).

Figure 3-87. Alphabetical Topic Screen
Information about a topic can be accessed either by:

1. Pressing **F2** to select **FWD** and scrolling forward alphabetically through the list of topics; or
2. Pressing a number to go directly to a topic (see Figure 3-88). For example:
   a. Press 2 once to go to topics beginning with the letter A.
   b. Press 2 twice to go to topics beginning with the letter B.
   c. Press 2 three times to go to topics beginning with the letter C.

![Amber Sync Light](image)

**Figure 3-88. Topic Screen**

At the Topic Screen:

1. Press the asterisk (⋆) key to see the topic or repeat step 2 to go to another topic.
2. Press **F1** to select **Back** to scroll backward through the information screens.
3. Press **F2** to select **Fwd** to scroll forward through the information screens.
4. Press **F3** to select **Exit**.

### Cause Messages

Cause Messages are ISDN protocol Layer 3 information elements. They briefly describe a reason or cause for an action. A Cause Message identifies error conditions or describes normal events occurring in the call process. **Table 3-4** provides a summary of possible Cause Messages.
Table 3-4. Cause Messages

<table>
<thead>
<tr>
<th>No.</th>
<th>Meaning</th>
<th>No.</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unallocated or unassigned number.</td>
<td>63</td>
<td>Service or option not available, unspecified.</td>
</tr>
<tr>
<td>2</td>
<td>No route to specified transit network.</td>
<td>65</td>
<td>Bearer capability not implemented.</td>
</tr>
<tr>
<td>3</td>
<td>No route to destination.</td>
<td>66</td>
<td>Channel type not implemented.</td>
</tr>
<tr>
<td>6</td>
<td>Channel unacceptable.</td>
<td>69</td>
<td>Requested facility not implemented.</td>
</tr>
<tr>
<td>7</td>
<td>Call awarded and being delivered in an established channel.</td>
<td>70</td>
<td>Only restricted digital information bearer capability is available.</td>
</tr>
<tr>
<td>16</td>
<td>Normal call clearing.</td>
<td>79</td>
<td>Service or option not implemented, unspecified.</td>
</tr>
<tr>
<td>17</td>
<td>User busy.</td>
<td>81</td>
<td>Invalid call reference value.</td>
</tr>
<tr>
<td>18</td>
<td>No user responding.</td>
<td>82</td>
<td>Identified channel does not exist.</td>
</tr>
<tr>
<td>19</td>
<td>No answer from user.</td>
<td>83</td>
<td>A suspended call exists, but this call identity does not.</td>
</tr>
<tr>
<td>21</td>
<td>Call rejected.</td>
<td>84</td>
<td>Call identity in use.</td>
</tr>
<tr>
<td>22</td>
<td>Number changed.</td>
<td>85</td>
<td>No call suspended.</td>
</tr>
<tr>
<td>26</td>
<td>Nonselected user clearing.</td>
<td>86</td>
<td>Call once the requested call identity has been cleared.</td>
</tr>
<tr>
<td>27</td>
<td>Destination out of order.</td>
<td>88</td>
<td>Incompatible destination.</td>
</tr>
<tr>
<td>28</td>
<td>Invalid number format.</td>
<td>91</td>
<td>Invalid transit network selection.</td>
</tr>
<tr>
<td>29</td>
<td>Requested facility rejected.</td>
<td>95</td>
<td>Invalid message unspecified.</td>
</tr>
<tr>
<td>30</td>
<td>Response to STATUS ENQUIRY.</td>
<td>96</td>
<td>Mandatory information element is missing.</td>
</tr>
<tr>
<td>31</td>
<td>Normal, unspecified.</td>
<td>97</td>
<td>Message type nonexistent or not implemented.</td>
</tr>
<tr>
<td>34</td>
<td>No circuit/channel available.</td>
<td>98</td>
<td>Message not compatible with call state or message type nonexistent or not implemented.</td>
</tr>
<tr>
<td>38</td>
<td>Network out of order.</td>
<td>99</td>
<td>Information element nonexistent or not implemented.</td>
</tr>
<tr>
<td>41</td>
<td>Temporary failure.</td>
<td>100</td>
<td>Invalid information element contents.</td>
</tr>
<tr>
<td>42</td>
<td>Switching equipment congestion.</td>
<td>101</td>
<td>Message not compatible with call state.</td>
</tr>
<tr>
<td>43</td>
<td>Access information discarded.</td>
<td>102</td>
<td>Recovery on timer expired.</td>
</tr>
</tbody>
</table>
To access information about a Cause Message:

1. When a Cause Message occurs, it is displayed on the LCD (see Figure 3-89), press the Assist key to retrieve information about the Cause Message.

2. Press F2 to select Fwd to scroll forward through the Information Screens. Information about the Cause Message is displayed on succeeding screens (see Figure 3-89) until the entire message is displayed.

3. Press F1 to select Back to scroll back through the Cause Message Information Screens.

4. Press F3 to select Exit back to the initial Cause Message Information Screen (see Figure 3-89).

5. Press F3 to select Clear.

<table>
<thead>
<tr>
<th>No.</th>
<th>Meaning</th>
<th>No.</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>Requested circuit/channel not available.</td>
<td>111</td>
<td>Protocol error, unspecified.</td>
</tr>
<tr>
<td>47</td>
<td>Resources unavailable, unspecified.</td>
<td>112</td>
<td>Progress in-band.</td>
</tr>
<tr>
<td>49</td>
<td>Quality of service unavailable.</td>
<td>113</td>
<td>Invalid SPID value.</td>
</tr>
<tr>
<td>50</td>
<td>Requested facility not subscribed.</td>
<td>115</td>
<td>Terminal unregistered.</td>
</tr>
<tr>
<td>57</td>
<td>Bearer capability not authorized.</td>
<td>127</td>
<td>Interworking, unspecified.</td>
</tr>
<tr>
<td>58</td>
<td>Bearer capability not presently available.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Single Voice Call NT1+TE or TE Mode

To make a voice call in NT1+T or TE Mode:

1. Verify the correct mode (NT1+TE or TE) has been selected. If not, select the correct mode (see Mode Selection for further information).

2. Verify the correct SPIDs/DNs and Switch have been entered. If not, enter the correct SPIDs/DNs or Switch (see Assigning Service Profile Identifier/Directory Number or Selecting the Switch Type).
3. Verify the correct Rate, Channel, and TEI have been entered. If not, enter the correct Rate, Channel and/or TEI (see Identifying the Rate, Selecting the B Channel, or Assigning a TEI).

Note: If Sync does not go to Green, there is a problem with the SPID or the Switch type.

4. Press the On/Off Hook key to go off hook. The off hook LED will turn Green.

5. Listen for dial tone and enter the number using the keypad. The screen displays the number entered and channel selected (see Figure 3-90).

![SYNC Active]

Off Hook Call A
Dialtone
3892283

Figure 3-90. Voice Call Screen

6. When a connection is made, the Connection Screen is displayed (see Figure 3-34).

7. To end a voice call, go on hook. The Clear Screen (NT1+TE or TE Mode) is displayed (see Figure 3-91).

![Call A Cleared]

Cause #16
Normal, Clearing
Clear Screen>

Figure 3-91. Clear Screen (NT1+TE or TE Mode)

8. Press F3 to select Clear.

Dry Loop/LT Mode Voice Call (Test Set to Test Set)

To make a voice call in LT Mode:

1. Verify the correct mode (LT Mode) has been selected. If not, select the correct mode (see Mode Selection for further information).
2. At the LT Mode Home Screen (in Sync) (see Figure 3-32), press F2 to select Hook or press the On/Off Hook key on either test set to go off hook. The off hook LED will turn Green.

3. Go Off Hook. When the other test set rings, answer it. When a connection is made, the Connection Screen (Dry Loop) is displayed (see Figure 3-92).

![Figure 3-92. Connection Screen (Dry Loop)](image)

4. To end and clear a voice call, go back on hook. The Clear Screen (Dry Loop) is displayed (see Figure 3-93) on both test sets.

![Figure 3-93. Clear Screen (Dry Loop)](image)

**Dual Voice Call**

As a result of ISDN lines having multiple channels, the TS220 and TS250 Test Sets maintain calls on both B1 and B2 Channels from time to time. Because there is one set of hardware call control elements (CODEC, receiver, transmitter), managing multiple calls consists of placing one call on hold while taking the other call. When both B1 and B2 Channels are active, the user must select one or the other as the active call.
When an incoming call occurs and there is already an active call, an abbreviated ringing tone, similar to a call waiting tone, is sounded so as to not interrupt the user's current call, yet still provide adequate notification of the incoming call.

To make a voice call:

1. Verify the correct mode (NT1+TE or TE) has been selected. If not, select the correct mode (see Mode Selection for further information).

2. Verify the correct SPIDs/DNs and Switch have been entered. If not, enter the correct SPIDS/DNs or Switch (see Assigning Service Profile Identifier/Directory Number or Selecting the Switch Type).

3. Verify the correct Rate, Channel, and TEI have been entered. If not, enter the correct Rate, Channel and/or TEI (see Identifying the Rate, Selecting the B Channel, or Assigning a TEI).

4. Press the On/Off Hook to go off hook. The off hook LED will turn Green.

5. Listen for dial tone and enter the number using the keypad. LCD screen displays the number entered and channel selected (see Figure 3-90). The first call is on Call A.

6. When a connection is made, the Connection Screen is displayed (see Figure 3-34).

7. To make a call on Call B, press F3 to select GoTo B. The Dual Call Setup Screen is displayed (see Figure 3-94).

8. Verify the correct Rate has been selected. If not correct, select the correct Rate (see Identifying the Rate).

9. To go off hook on Call B, press F2 to select Hook B. The user is now able to make another call.

Note: If Sync does not go to Green, there is a problem with the SPID or the Switch type.
10. Listen for dial tone and enter the number using the keypad. LCD screen displays the number entered and channel selected.

11. When a connection is made, the Connection Screen is displayed (see Figure 3-34).

12. Press F3 to select GoTo A and switch between the B Channels. The LCD display indicates which call the user is currently connected to.

13. To end a dual voice call, go on hook for both calls. The Clear Screen (NT1+TE or TE Mode) is displayed (see Figure 3-91).


**NT Maintenance Mode (Quiet Mode/Insertion Loss)**

*Note: Maintenance equipment is located inside the CO. A common maintenance tester is the Mechanized Loop Tester (MLT) manufactured by Lucent Technologies.*

The ISDN Test Set has the capability of recognizing both AC and DC signaling generated by a maintenance tester. The TS220 and TS250 Test Sets conform to T1.601-1992.

Depending on the test initiated by the maintenance tester, either the Quite Mode Screen (see Figure 3-95) or the Insertion Loss Screen (see Figure 3-96) is displayed. The test set will automatically display the current test being run.

![Figure 3-95. Quite Mode Screen](image-url)

![Figure 3-96. Insertion Loss Test Screen](image-url)
When running Quite Mode or the Insertion Loss Measurement Test, all functions of the test are disabled. Once the test has been completed, the test set will return to its previous state.

In the Quiet Mode, the test set ceases all transmission, and does not attempt startup for approximately 75 seconds.

During the Insertion Loss Measurement Test, the test set generates a scrambled, 2B1Q frame signal for a duration of 75 seconds.
The TS220 and TS250 Basic Rate ISDN Test Sets are capable of communication over an Integrated Services Digital Network (ISDN) using ITU X.25 formatted Layer Access Protocol D channel (LAPD) packet data (D packets). X.25 packet data calls are not supported on the B channel.

A D packet call may be originated or received by a TS220 and TS250 Test Set in NT-1/TE (Network Termination-Terminal Equipment) or TE (Terminal Equipment) modes. LT Mode does not support D packet calls.

The TS220 and TS250 Test Sets are capable of performing the following functions:

- Call configuration.
- Single D packet call.
- D packet self call.
- D packet transmission.
- Display of received D packets.

Call Configuration

The TS220 and TS250 Test Sets accept user input and uses the following X.25 parameters:

- Directory Number (DN).
- User Data.
Preparing for an X.25 Call

Note: The phone numbers used throughout this document are for illustration purposes only and are not to be used as phone numbers.

1. At the Home Screen (see Figure 4-1), press F1 to select Call. The Call Selection Screen (see Figure 4-2) is displayed. From this screen, changes can be made to the call type.

Note: X.25 does not function with 5ESS Point-to-Point.

2. Press 7 to select X.25 D Pkt.

3. Press F3 to return to the X.25 Home Screen (see Figure 4-3).
Assigning a Directory Number

The test set maintains a separate DN for D packet calls. The DN is a numeric string of up to 10 digits with a default value of empty.

To assign a DN:

1. At the X.25 Home Screen (see Figure 4-3), press F3 to select DN/LCN. The DN/LCN Setup Screen is displayed (see Figure 4-4).

2. Press 1 to select DN. The DN Edit Screen (see Figure 4-5) is displayed.

3. Press F2 to select <BkSp to delete a DN shown on the display. The cursor will move backwards as it deletes the existing DN digits. Pressing and holding F2 results in repeated backspaces.

4. Enter the new DN using the keypad.

5. Press F3 to select Save and return to the previous menu.
Assigning a Logical Channel Number

The Logical Channel Number (LCN) is used to identify which circuit is used for D packet receipt and transmission. The test set uses one LCN per call. LCN values of 1 to 15 are valid. The default value is 1.

To assign an LCN:

1. At the DN/LCN Setup Screen (see Figure 4-4), press 2 to select LCN. The LCN Edit Screen (see Figure 4-6) is displayed.

2. Press F2 to select <BkSp to delete a LCN shown on the display. The cursor will move backwards as it deletes the existing LCN digits. Pressing and holding F2 results in repeated backspaces.

3. Enter the new LCN using the keypad. Only values between 1 and 15 are allowed.

4. Press F3 to select Save and return to the previous menu.

Assigning a Terminal Equipment Identifier (TEI)

The Terminal Equipment Identifier (TEI) is used by both the switch and the test set to identify the terminal that the D packet data is transmitted to or originates from. The default value is Auto. Valid values for user entry are 0 to 63 and Auto.

To enter a TEI:

1. At the DN/LCN Setup Screen (see Figure 4-4), press F2 to select TEI. The TEI Setup Screen (see Figure 4-7) is displayed.
2. Press 1 to edit TEI. The TEI Edit Screen is displayed (see Figure 4-8).

3. Press F1 to select Auto. Auto will set the TEI to 127 (broadcast) and return you to the previous menu.

4. Press F2 to select <BkSp> to delete a TEI shown on the display. The cursor will move backwards as it deletes the existing TEI digits. Pressing and holding F2 results in repeated backspaces.

Note: Only TEI numbers between 0 and 63 and 127 (auto) are valid.

Configuring a Call

To configure a call:

1. At the X.25 Home Screen (see Figure 4-3), press F1 to select Call. The Call Selection Screen (see Figure 4-2) is displayed.

2. Press F2 to select Config. The Configuration Setup Screen is displayed (see Figure 4-9).
The Closed User Group (CUG) value indicates which private user group the D packet call belongs to. If a value has been entered for the CUG, the test set may only make or receive packet calls from devices in the same CUG. The test set accepts four digit CUG values between 0 and 9999 or None, with None being the default.

To set up user groups (CUG):

1. At the Configuration Setup Screen (see Figure 4-9), press 1 to select CUG. The Closed User Group Setup Screen is displayed (see Figure 4-10).

2. Press F1 to select None, if the CUG is not required.

3. If a CUG is required, press F2 to select <BkSp to delete a CUG shown on the display. The cursor will move backwards as it deletes the existing CUG digits. Pressing and holding F2 results in repeated backspaces.

4. Enter a new four-digit CUG number using the keypad.

5. Press F3 to select Save and return to the previous menu.

Figure 4-10. Closed User Group Setup Screen
Reverse Charge

The Reverse Charge field indicates which party is to be charged for the call. The test set allows for user entry of Reverse Charge On or Off, with a default value of Off.

To reverse the charge so that the other party will accept the charge for the call:

1. At the Configuration Setup Screen (see Figure 4-9), press 2 to select **RevCharge**. The Reverse Charge Screen is displayed (see Figure 4-11).

![Reverse Charge Screen](image)

Figure 4-11. Reverse Charge Screen

2. Pressing F1 toggles the Reverse Charge on or off.
3. Press F3 to select **Save** and return to the previous screen.

User Data

User Data is a data packet of up to 12 bytes that may be sent with the initial D packet Call Request message. The user can enable and disable the transmission of user data with the D packet Call Request message. The default value is user data disabled.

To enter user data:

1. At the Configuration Setup Screen (see Figure 4-9), press 5 to select **UserData**. One of two User Data Screens are displayed (see Figure 4-12 and Figure 4-13). User Data is optional data that can be any combination of alphanumeric digits. Up to 12 characters can be used.
2. Press **F1** to toggle between the alpha and numeric modes.

3. Press **F2** to select `<BkSp` to delete user data shown on the display. The cursor will move backwards as it deletes the existing data. Pressing and holding F2 results in repeated backspaces.

4. To enter alpha letters (see Figure 4-13):
   a. Press the number key of the letter you want to enter. Press the key once for the first letter, twice for the second letter, and three times for the third letter. Pressing 0 (zero) three times will result in a space between words.
   
   b. Press the 1 number key to select the current character and space over to the next letter.
   
   c. Press the asterisk (*) key to change the alpha letter from upper to lower case letters or from lower to upper case letters.

5. To enter numerical data (see Figure 4-12), enter the desired numeric digits using the keypad.

6. Press **F3** to select **Save** and return to the previous menu.
Registered Private Operating Agency

The Registered Private Operating Agency (RPOA) option is used to determine which agency will carry the D packets. The test set shall accept RPOA values between 0 and 9999 or None, with None being the default.

To select the agency that will carry the D packets (e.g., long distance service):

1. At the Configuration Setup Screen (see Figure 4-9), press 4 to select RPOA. The RPOA Screen is displayed (see Figure 4-14).

![Registered Private Operating Agency Screen](image)

Figure 4-14. RPOA Screen

2. Press F1 to select None, if the RPOA is not required.

3. If a RPOA is required, press F2 to select <BkSp to delete a RPOA shown on the display. The cursor will move backwards as it deletes the existing RPOA digits. Pressing and holding F2 results in repeated backspaces.

4. Enter a new four-digit RPOA number using the keypad.

5. Press F3 to select Save and return to the previous screen.

Data Packet

The Data Packet (DataPkt) option is used to select the size of the data packet that will be transmitted and the terminating sequence of the data. Some networks do not allow for more than 16 or 32 bytes.

To select or change the size of the data packet:

1. At the Configuration Setup Screen (see Figure 4-9), press 7 to select DataPkt. The DataPkt Screen is displayed (see Figure 4-15).
2. Select one of the following options:
   a. Press 1 to select 16 bytes.
   b. Press 2 to select 32 bytes.
   c. Press 4 to select 48 bytes.
   d. Press 5 to select 64 bytes.

   Note: Some packet echo stations will not echo unless the packet ends in LF or CR.

3. To add a line feed (LF) and carriage return (CR) to the end of the packet, press F1 to select LF/CR. Pressing F1 toggles between line feed and carriage return.

4. Press F3 to return to the previous screen.

Single D Packet Call

With the exception of the D packet self call, the test set handles one X.25 D packet call at a time. The test set can:

- Handle both call origination and call reception (see Figure 4-16).
- Provide the user with call progress screen and a scrolling call progress view similar to those of circuit switched calls.
Originating a Call

The TS250 Test Set is able to originate a call by one of the following three methods:

- Manual Dialing.
- Speed Dialing.
- Redial.

An originated call attempt may be aborted (or released) by the user at any time by using the On/Off Hook key.

Manual Dialing

Manual dialing is performed from the Off Hook state. Digits may be entered using the keypad. The send key may be used to originate the call.

Speed Dialing

Speed dialing is performed from either the On Hook or Off Hook state provided that there is no other call in progress. Speed dial numbers are selected from the Recall button. If the sync light is not green, the D packet call is deferred until the sync light has turned green.
Redial

Redialing is performed from either the On Hook or Off Hook state provided that there is no other call in progress. Redial numbers are selected from the Redial button. If the sync light is not green, the D packet call is deferred until the sync light has turned green.

Menu Key

The Menu key is used to bring up the Main Menu Screen. Press the Menu key to gain access to the Main Menu Screen (see Figure 4-17).

| 1-BERT | 2-Layer 1 | N7 |
| 4-Auto | 5-Options |
| 7-View | 8-Centrex |
| *- Mode | Exit |

Figure 4-17. Main Menu Screen (NT1+TE and TE Mode)

The Main Menu Screen allows the user to:

- View Layer 1 commands.
- View U Interface (EOC, NEBE/FEBE).
- View S/T Interface (Q Channel, Power Source).
- View status (BERT, Call A/B, software version).
- Change modes.
- Perform automatic functions.
- Make adjustments to the following options: LCD Contrast Control, Receiver Volume Control, Ringer Control, Defaults, or install a software upgrade.

The Bit Error Rate Test (BERT) and Centrex functions are not available when the X.25 D Packet is selected.
Auto

Note: For the Auto Function to work, the line under test must support two logical channels.

To perform an Auto function call:

1. At the Main Menu Screen (see Figure 4-17), press 4 to select Auto. The Incoming Call Screen is displayed (see Figure 4-18). The call will be automatically answered and the caller ID will be displayed (see Figure 4-19).

![Figure 4-18. Incoming Call Screen](image)

2. Press F2 to select Tx Pkt. The test set will increment the total number of packets (TX:00) that have been transmitted (see Figure 4-20). The counter will roll over at 99. The packet received is shown in Figure 4-20. If the packet is correctly passed through the network, the display will contain the packet number followed by a colon (:) and the phrase shown in Figure 4-20.

![Figure 4-19. Caller ID Screen](image)

![Figure 4-20. Tx Pkt Information Screen](image)
3. Press **F3** to select **Reset**. The Reset Screen is displayed (see Figure 4-21). Reset causes the counter to reset to zero and all X.25 protocol counters to be reset. Reset may be used to force the sender and receiver to resynchronize.

![lazy dog.
Call D Reset
DTE Originated
TX: 00](Figure 4-21. Reset Screen)

4. Press the **On/Off Hook** Key. The Call is released and the Clear Screen is displayed (see Figure 4-21).

![Call D Cleared
DTE Originated
Call D Cleared
Clear Screen >](Figure 4-22. Clear Screen)

5. Press **F3** to select **Clear** and return to the X.25 Home screen.

### View

The View function key stores information on the last call attempt that took place on Call A, Call B, and/or Call D. View also provides the results of previous BERTs, previous results from self tests, and the current version of software being used in the test set.

To access the View Screen in X.25 (see Figure 4-23):

1. At the Main Menu Screen (see Figure 4-17), press **7** to select **View**. The View Screen is displayed (see Figure 4-23).
Figure 4-23. View Screen

2. Select one of the following options:
   
a. Pressing 1 will allow you to view previous BERT results performed in other modes.
   
b. Press 2 to see what version of software is currently being used.
   
c. Press 4 to view results of Call A attempts.
   
d. Press 5 to view self test results.
   
e. Press 7 to view results of Call B attempts.
   
f. Press 8 to view the NEBE/FEBE test results.
   
g. Press * (asterisk) to view results of Call D attempts.

Verifying an X.25 Line

To verify that the line is X.25 capable or to establish a Layer 2 data link:

1. Connect the test set to an ISDN line.

2. Make sure the test set is powered ON, the line cord is plugged in and the test set is properly configured.

3. When the Sync LED is amber, physical Sync is established.

4. When the Sync LED turns green, X.25 Layer 2 is established.

Note: If Sync does not go to Green, there is a problem with the SPID, the Switch type, or the line is not provisioned for X.25.

Note: On some lines it may be necessary to set the Call D TEI (see Assigning a Terminal Equipment Identifier [TEI]) value to establish Layer 2.
Making a Self or Auto Call

The test set can originate and receive the same D packet call (see Figure 4-24). A self call can only occur when no other calls are active. A self call is recognized only when the called party and calling party in the X.25 Call Request message are identical and a D packet call is originated. The test set automatically accepts the D packet self call. The call progress information for both the incoming and outgoing ends of the D packet self call are displayed on a single call progress display screen. When the user goes On Hook, the call is terminated.

![Figure 4-24. X.25 Self Call](image)

To make a self or auto X.25 call:

1. Press the **On/Off Hook** to go off hook. The Off Hook LED will turn Green. The X.25 Dialing Screen is displayed (see Figure 4-25).

![Figure 4-25. X.25 Dialing Screen](image)

2. Enter the number using the keypad. The LCD screen displays the number entered and channel selected (see Figure 4-25).
3. Press **F2** to select `<BkSp` to delete number shown on the display. The cursor will move backwards as it deletes the existing number. Pressing and holding F2 results in repeated backspaces.

4. Press **F1** to select **Send**. The number is dialed (see Figure 4-26).

![Figure 4-26. Dialing Screen](image)

5. When the call is answered, the Call Connect Screen is displayed (see Figure 4-27). A remote ring indication will sound until the call is answered or released.

![Figure 4-27. Call Connect Screen](image)

6. Press **F2** to select **Tx Pkt**. The test set will increment the total number of packets (TX:00) that have been transmitted (see Figure 4-28). The counter will roll over at 99. A message will appear indicating the packet number sent (see Figure 4-28), where 01 is the packet number.

![Figure 4-28. TX Pkt Transmitted Display](image)

7. To obtain information about the keys on the screen, press the **Assist Key**. The Assist Information Screen is displayed (see Figure 4-29). The Assist Key can be used to bring up relevant information on the LCD for explaining the current menu item.
Figure 4-29. Assist Information Screen

a. Press F2 to select Fwd to scroll forward to the next information screen (see Figure 4-30).

Figure 4-30. Next Assist Information Screen

b. Press F1 to select Back to scroll backward through the information screens.

c. Press F3 to select Exit and return to the previous screen.

8. Press F3 to select Reset. The Reset Options Screen on an outgoing call is displayed (see Figure 4-31). Reset causes the transmit counter to reset to zero and all X.25 protocol counters to be reset. Reset may be used to force the sender and receiver to resynchronize.

Figure 4-31. Reset Options

9. Press the On/Off Hook Key. The Call is released and the Clear Screen is displayed (see Figure 4-32).
Receiving an Incoming Call

The test set can accept an incoming D packet call, provided there are no active calls. The test set only acknowledges an incoming D packet call while on hook and in the idle state (no other activity). If the Test Set is idle and properly configured when a D packet call comes in, the test set will go to D packet mode. The test set will ring indicating receipt of a valid X.25 call. The ring will continue until the call is answered by going off hook.

To receive an incoming call:

1. The test set will begin ringing. The Incoming Call Screen is displayed (see Figure 4-33) with the incoming caller ID followed by its call user data. A question mark (?) indicates an unprintable user data character.

2. At the Call Display Screen, press F2 or the On/OFF Hook key to Answer. The Receiving Call Connect Screen is displayed (see Figure 4-34).
3. Press **F2** to select **Tx Pkt**. The test set will increment the total number of packets (TX:00) that have been transmitted (see Figure 4-35). The counter will roll over at 99.

![Figure 4-35. TX Pkt Transmitted on Receiving Call](image)

4. To obtain information about the keys on the screen, press the **Assist Key** (refer to Making an Outgoing Call for procedures on using Assist).

5. Press **F3** to select **Reset**. The Reset Options Screen is displayed (see Figure 4-31). Reset causes the counter to reset to zero and all X.25 protocol counters to be reset. Reset may be used to force the sender and receiver to resynchronize.

6. Press the **On/Off Hook** Key. The call is released and the Clear Screen for the receiving call is displayed (see Figure 4-36).

![Figure 4-36. Clear Screen for Receiving Call](image)

7. Press **F3** to select **Clear** and return to the X.25 Home screen.

### Rejecting an Incoming Call

To reject an incoming call:

1. When the test set rings, the Incoming Call Screen is displayed (see Figure 4-18).

2. At the Incoming Call Screen, press **F3**. The Reject Call Screen is displayed (see Figure 4-37).
3. Press **F3** to select **Clear** and return to the X.25 Home screen.
General Care

⚠️ CAUTION:
Do not use CRC Cable Clean® or any similar chlorinated solvent on the TS220 or TS250 Test Set. Doing so will damage the Test Set.

Line Cord

Line cords are usually wrapped around the body of the test set and clipped through the belt clip when not in use. The line cords are the most used part of test set and care must be taken when unwinding the cord. Prolonged wear and tear can cause small openings and allow moisture to penetrate the cord. This is the largest source of static and noise. Changing the line cord on a regular basis can prevent this.

Keypad

Daily use of your test set results in various liquids, dirt, and other foreign material building up in your keypad. The keypad may be cleaned by using a soft toothbrush with soap and water. Do not use a petroleum-based cleaning agent as it will harm the keypad.
Belt Clip

A Test Set's belt clip is in constant use and can wear out with prolonged use. Belt clips are field replaceable and easily changed when they become loose.

Battery

A low battery condition is indicated to the user through the use of a Low Battery icon on the LCD (see Figure 5-1). A flashing icon indicates the test set has reached its first warning level. When the Low Battery icon appears on the LCD display, you have approximately 30 minutes of operating time left before the test set automatically powers off. The second level occurs when the icon is solid. At this level, the test set is not functional.

The battery icon blinks on and off when the test set is about to power itself down.

![Low Battery Icon](image)

Figure 5-1. Low Battery Icon

If the test set is operated in rain, remove the battery door and make sure the inside of the unit is dry. If necessary, blow dry the inside of the test set.

Safety Precautions

To reduce the risk of fire or injury, read and follow these instructions when recharging, replacing, or otherwise handling the batteries for the TS220 or TS250 Test Set:

- **DO NOT** mix batteries of different types, sizes, or from different manufacturers in this product.
- **DO NOT** mix old and new batteries in this product.
- DO NOT dispose of batteries in a fire. The batteries may explode. Check with local codes for special instructions.

- DO NOT attempt to recharge Alkaline batteries. The batteries may leak corrosive electrolyte or explode.

- DO NOT open or mutilate the batteries. Released battery electrolyte is corrosive and may cause damage to the eyes or skin. Released electrolyte may be toxic and can cause poisoning if swallowed.

- **Exercise care** in handling the batteries to avoid shorting batteries with conducting materials such as rings, bracelets, or keys. The battery or shorting conductor could overheat and cause burns.

- Remove the batteries from the TS220 or TS250 Test Set if you do not plan to use it for a long period of time (60 days or more). Batteries could leak in the Test Set during long-term storage.

### Charging the NiCad Batteries

Normally, the TS220 or TS250 Test Set is powered by the NiCad batteries supplied with the instrument.

To prolong the life of the batteries, use the adapter/charger to power the unit while the batteries are installed. Only the NiCad batteries automatically charge whenever the AC adapter/charger is connected.

To charge the NiCad batteries:

1. Connect the AC adapter/charger to the TS220 or TS250 Test Set (see Figure 5-2).

2. Plug the AC adapter/charger into a 120 VAC wall plug (ordinary household current).

3. During fast charge mode, a yellow LED will come on.

4. When fast charge is complete, the test set switches to trickle charge mode and the LED will change from yellow to green. The unit will remain in trickle charge until DC power is removed.
Battery Replacement

Use only the following type and size of batteries:

- 4 NiCad rechargeable batteries supplied with the TS220 or TS250 Test Set.
- 4 AA-size alkaline batteries.

To replace the batteries:

1. Turn the TS220 or TS250 Test Set off and disconnect the AC adapter/charger from the Test Set, if attached (see Figure 5-3).
2. Place the TS220 or TS250 Test Set on a protected work surface, face down.

Note: Cover screws are not removable.

3. Using a flat-blade screwdriver, loosen the four screws attaching the battery door cover to the back of the TS220 or TS250 Test Set (see Figure 5-4).
4. Remove the battery door cover (see Figure 5-5).
5. Remove the old batteries from the TS220 or TS250 Test Set (see Figure 5-6) and properly discard.
Figure 5-3. Removing the Adapter

Figure 5-4. Rear View of Test Set

Figure 5-5. Test Set Door Cover
6. Insert 4 new NiCad batteries into the TS220 or TS250 Test Set. When inserting batteries, observe the proper polarity or direction for all batteries. Reverse insertion of one or more batteries can create a charging circuit for the other batteries, which may result in leakage or explosion. Place the batteries in the compartment so that their positive contacts point towards the plus (+) symbol.

7. If replacing NiCad batteries with Alkaline batteries, first pull the movable wall out of its slot (see Figure 5-7) and move the wall forward to the first slot. Make sure the wall fits correctly into the slot. Be careful not to break the leads of the white cable ribbon behind the wall.

8. Insert new Alkaline batteries.

Note: Failure to securely fasten battery door, could result in the batteries not charging.

9. Place the battery door cover on the TS220 or TS250 Test Set (see Figure 5-5) and fasten the four screws securely (see Figure 5-4).

10. Turn the Test Set over and turn the Power button ON.
Belt Clip Replacement

The TS220 or TS250 Test Set belt clip can be replaced by the user if it becomes damaged or wears out. To obtain a replacement belt clip contact your local distributor or Harris Corporation at the location given in the Warranty Section and order part number P3218-249.

To replace the belt clip assembly:

1. Using a Phillips screwdriver, remove the two screws that secure the belt clip to the TS220 or TS250 Test Set housing (see Figure 5-8).

2. Remove the old belt clip and replace with a new one.

3. Secure the belt clip assembly to the Test Set housing with the original screws. Be careful not to over tighten the screws.
Line Cord Replacement

The line cord can be replaced by the user. To obtain a replacement line cord contact your local distributor or Harris Corporation at the location given in the Warranty Section and order part number P3218-234.

Removing the Line Cord

To remove the old line cord:

1. Turn the TS220 or TS250 Test Set off and disconnect the AC adapter/charger from the Test Set, if attached (see Figure 5-3).

2. Place the TS220 or TS250 Test Set on a protected work surface, face down.

3. Using a flat-blade screwdriver, loosen the four screws attaching the battery door cover to the back of the Test Set (see Figure 5-4).

4. Remove the battery door cover (see Figure 5-5).

5. Remove one battery on each side of the line cord relief strap.

Note: Cover screws are not removable.
6. Using a screwdriver or needle-nose pliers, pry up the plastic clip (see Figure 5-9) that holds the line cord relief strap in place and remove clip (see Figure 5-10).

![Figure 5-9. Prying Up the Plastic Clip](image)

7. Disconnect the RJ-45 modular connector from housing on TS220 or TS250 Test Set (see Figure 5-11).

8. Slip the line cord out through the hole in the end of the TS220 or TS250 Test Set.
Line Cord Installation

To install a new line cord:

1. Carefully slide the modular connector of a new line cord through the hole in the end of the TS220 or TS250 Test Set. Do not damage the connector pins or plastic tab.

2. Lay the line cord inside the groove in the bottom of the TS220 or TS250 Test Set housing (see Figure 5-12).

3. Connect the RJ-45 modular connector of the line cord in the housing on the TS220 or TS250 Test Set (see Figure 5-11).
4. Insert the plastic clip over the line cord strain relief at the base of the TS220 or TS250 Test Set housing (see Figure 5-10) and snap tightly into place.

5. Replace the previously removed batteries on each side of the line cord strain relief.

6. Place the battery door cover (see Figure 5-5) on the TS220 or TS250 Test Set and fasten the four screws (see Figure 5-4).

Warranty

Harris warrants that the TS220 or TS250 Test Set shall be free of any defects in parts or workmanship, for a period of 18 months from date of manufacture and the line cord for a period of 90 days from the date of purchase, if used under Harris operating specifications.

THIS IS THE ONLY WARRANTY MADE BY HARRIS CORPORATION AND IS MADE EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

Should any parts or workmanship prove defective, Harris will repair with “not used” or reconditioned parts, or replace the Product, at Harris’ option, at no cost to the Buyer except for shipping costs from the Buyer’s location to Harris’ location. This is the Buyer’s SOLE AND EXCLUSIVE REMEDY under the agreement.

All incidental or consequential damages shall be excluded.

This warranty does not extend to products which have been subjected to neglect, accident or improper use, nor to units which have been altered or repaired by other than authorized Harris personnel.
Return of Equipment

To return the Test Telephone to Harris, first obtain a Return Authorization (RA) Number from our Customer Service. This RA number must be clearly marked on the shipping label, or the container will not be accepted by Harris. See the sample label below:

To: HARRIS CORPORATION
809 Calle Plano
Camarillo, California, USA 93012-8516
Attention: Customer Support, RA #XXXXXX