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## 2571 and 2572 T1 Echo Canceller Modules

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CLEI\* codes: 2571 — ESCEAALA  
2572 — ESCEABLA

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### Revision Notice

This document has been revised to include information about Feature Package 1.3, which includes the following new features, modes, and options:

- CLEARCALL Noise Reduction (NR) feature — operates with the installation of the optional 82.25VX5 Subassembly
- Mode 38 — Send Side Echo Cancellation
- Mode 48 — ACE Noise Injection
- Options 2 and 3 for Mode 65, Idlecode Logic
- Options 3 and 4 for Mode 67, Active Channel Logic for CAS
- Options 4 and 5 for Mode 70, Data Tone Disabler Detection
- Mode 76 — ALC Double Talk Detection

## Reference Documentation

For more information about the 257 T1 Echo Canceller System, see the following Tellabs documents, which can be obtained through your Tellabs representative.

- 253B Mounting Assembly technical manual . . . . . 76.810253B
- 253C Mounting Assembly technical manual . . . . . 76.810253C
- 255A Mounting Assembly technical manual (wire wrapping pins) . . . . . 76.810255A
- 255D Mounting Assembly technical manual (telco connectors) . . . . . 76.820255D
- 257D 23-Inch Mounting Assembly technical manual . . . . . 76.810257D
- 2555/A Alarm and Access Module technical manual . . . . . 76.812555
- 2555S Alarm/Access Module with Autonomous Reporting technical manual . 76.822555S
- 2557 T1 Test Access Module technical manual . . . . . 76.812557
- 2574G/H Endpath Delay Subassemblies technical manual . . . . . 76.812574G/H
- 257 T1 Echo Canceller User Interface Document. . . . . 76.U81257X
- 257 T1 Echo Canceller System Release Notes . . . . . 76.8225VX1-3
- 257 Self-Study Training Manual . . . . . A1.0257ECHOSS

The 257 Self-Study Training Manual is a self-paced training document that includes a tutorial on echo cancellation, as well as step-by-step instructions for installing, optioning, and maintaining the echo canceller. Self-checks are included for each topic to ensure that the reader has thoroughly understood the material that is presented.

## 1. Description

The 2571 and 2572 T1 Echo Canceller Modules (referred to throughout this document as the 257X Module, except where differentiation is necessary) are intended for use in local, long-distance, and private networks. The module protects T1 facilities against annoying echo caused by 4wire-to-2wire conversions within the Public Switched Telephone Network (PSTN). It incorporates echo cancellation, tone disabling (for data compatibility), power conversion, and front panel controls on a single plug-in module.

The 2571 Module accommodates endpaths up to 32ms (expandable to 64ms) and the 2572 Module accommodates endpaths up to 64ms (expandable to 128ms).

## Features

The 257X Module offers these primary features:

- 34dB of Echo Return Loss Enhancement (ERLE) (Non Linear Processor [NLP] off)
- FLEXWARE™ performance options enhance NLP control
- CLEARCALL quality enhancements (optional)
  - Automatic Level Control (ALC)
  - Dynamic Noise Substitution (DNS)
  - Acoustic Coupling Elimination (ACE)
  - Noise Reduction (NR)
- Dynamic Signal Transfer (DST)™ NLP
- 0, 3, and 6dB minimum Echo Return Loss (ERL) settings
- Expandable endpath delay configurations
- FLASHLOAD™ system firmware that can be downloaded through the Maintenance Serial Communication Port (SCP)
- Front panel displays and controls
- On-board maintenance and provisioning menus

continued . . .

- Backwards plug compatible with all 253, 255, and 257 Mounting Assemblies
- G.164 and G.165 data tone disablers (user selectable)
- Fully compliant with ITU-T Recommendation G.168
- Switched-56 data disabler for 56kbit/s switched services
- Standard Super Frame (SF), Extended Super Frame (ESF), and Ericsson Mobile Both-Way Line Termination (MBLT) framing
- Signaling Tone Disabler for ITU-T No. 5 signaling, 2600Hz SF signaling, and ITU-T No. 6 and No. 7 Voice Path Assurance (VPA) check tones
- Per-channel busy/idle detection via A/B signaling or idle codes

## Mounting Assemblies

The 257X Module occupies one position of a 253, 255, or 257 Mounting Assembly (shelf). Table 1-1 lists those shelves and their accessories.

For more information on the shelves, see their individual technical manuals (see list of manual part numbers under **Reference Documentation** on page 2).

| Shelf | Description               | Accessories  | Part No.  |
|-------|---------------------------|--|-----------|
| 253B  | 8-position 19-inch shelf  | Mounting adapter ears for 23-inch relay rack   | 80.0360   |
|       |                           | Blank module — fills unequipped module positions                                     | 2530      |
|       |                           | Rear cover for backplane subassembly   | 81.1624RC |
| 253C  | 2-position 19-inch shelf  | Blank module — fills unequipped module positions                                     | 2530      |
|       |                           | Mounting adapter ears for 23-inch relay rack   | 14.9008   |
|       |                           | Wall-mount bracket   | 81.1779   |
|       |                           | Cable for PCM connection to T-Coder <sup>®</sup> shelf                               | 50.0281   |
|       |                           | 120VAC to –48VDC power supply (mounts in a type-10 apparatus case)                   | 81.8020   |
| 255A  | 16-position 19-inch shelf | 19-inch heat baffle  | 80.2098   |
|       |                           | 23-inch rack adapter kit   | 80.2120   |
|       |                           | 23-inch rack adapter kit for heat baffle   | 80.2121   |
|       |                           | Rear protective cover  | 81.1624RC |
| 255D  | 16-position 19-inch shelf | 50-pin wire-wrap adapter for the T1 ports (four required per shelf)                  | 51.0102   |
|       |                           | 16-pair ABAM cable (four required per shelf)   | 50.11XXX  |
|       |                           | Electromagnetic Interference (EMI) door assembly for FCC Part 15, Class A (optional) | 80.2094   |
|       |                           | 19-inch heat baffle  | 80.2098   |
|       |                           | 23-inch rack adapter kit   | 80.2120   |
|       |                           | 23-inch rack adapter kit for the heat baffle   | 80.2121   |
| 257D  | 20-position 23-inch shelf | 50-pin wire-wrap adapter for the T1 ports (four required per shelf)                  | 51.0102   |
|       |                           | 25-pair ABAM cable (four required per shelf)   | 50.162XX  |
|       |                           | EMI door assembly (optional)   | 80.7248   |
|       |                           | 23-inch heat baffle  | 80.7249   |

**Table 1-1 Shelves and Accessories**

## Selecting the Appropriate 257 Components

The 257 System includes a series of T1 echo canceller modules, alarm and access modules, a test access module, shelves, and optional subassemblies. Table 1-2 lists these components.

| Model    | Description                                       | Application  |
|----------|---|--|
| 2571     | 32ms T1 Echo Canceller Module                     | Provides echo cancellation on endpaths with up to 32ms of delay  |
| 2572     | 64ms T1 Echo Canceller Module                     | Provides echo cancellation on endpaths with up to 64ms of delay  |
| 2574G    | 32ms Endpath Expansion Subassembly                | Extends 2571 Module maximum endpath to 64ms  |
| 2574H    | 64ms Endpath Expansion Subassembly                | Extends 2572 Module maximum endpath to 128ms   |
| 2555     | Alarm and Access Module                           | Provides SCPs and shelf alarms   |
| 2555A    | Alarm and Access Module                           | Provides SCPs, shelf alarms, and flash programming voltage   |
| 2555S    | Alarm and Access Module with Autonomous Reporting | Provides shelf alarms, flash programming voltage, polling operations, and supports operation with the Tel/mor™ Element Management System |
| 2557     | T1 Test Access Module                             | Provides test access to the Send and Receive T1 facilities   |
| 255A     | 16-position, 19-inch shelf                        | T1 connections via wire-wrapping pins  |
| 255D     | 16-position, 19-inch shelf                        | T1 connections via 50-pin telco connectors   |
| 257D     | 20-position 23-inch shelf                         | T1 connections via four 50-pin female telco connectors   |
| 82.25VX1 | Unidirectional ALC/ACE Subassembly                | Provides unidirectional ALC feature or ACE feature (Receive path only) for 257 Modules   |
| 82.25VX2 | Bidirectional ALC/ACE Subassembly                 | Provides bidirectional ALC or unidirectional ALC feature or ACE feature (Receive path only) for 257 Modules                              |
| 82.25VX3 | Bidirectional ALC/ACE Subassembly                 | Provides bidirectional ALC feature and ACE feature (Receive path only) for 257 Modules   |
| 82.25VX5 | Bidirectional ALC/ACE/NR Subassembly              | Provides bidirectional ALC feature, ACE feature (Receive path only), and NR feature for 257 Modules                                      |

**Table 1-2 257 System Components**

### 2555/A Alarm and Access Module

The 2555 and 2555A (2555/A) Alarm and Access Modules provide access to the shelf SCP links, as well as providing shelf-level major and minor alarm contacts and indicators. A universal Alarm Cut Off (ACO) pushbutton on the modules' front panel silences external alarms connected to the major and minor alarm contacts.

The 2555 and 2555A Modules function identically, except that the 2555A Module also provides programming voltage to the echo cancellers' flash PROM during firmware download.

### 2555S Alarm/Access Module with Autonomous Reporting

The 2555S Alarm/Access Module with Autonomous Reporting provides shelf-level major and minor alarm contacts and indicators. A universal ACO pushbutton on the module's front panel silences external alarms connected to the major and minor alarm contacts. The module continuously polls the echo cancellers installed in a daisy chain and originates alarm and status reports via the Control port connector on the mounting assembly using a Smart Alarm Message Protocol. This module supports operation with the Tel/mor EMS.

## 2557 T1 Test Access Module

The 2557 T1 Test Access Module provides convenient test access to any T1 facility that is cabled to a 253, 255, or 257 Shelf. The 2557 Module installs in any echo canceller slot position and provides bantam jack access to the Send and Receive T1 facilities. Both monitor and breaking jacks are provided.

## 2574 Endpath Expansion Subassemblies

The optional 2574 Endpath Expansion Subassemblies allow field upgrade of the 257X Module's maximum endpath capabilities:

- 2574G, 32ms Endpath Expansion Subassembly — expands the 2571 Module to 64ms maximum endpath delay
- 2574H, 64ms Endpath Expansion Subassembly — expands the 2572 Module to 128ms maximum endpath delay

## Voice Band Enhancement (VBE) Subassemblies

See Table 1-2 for a listing of the VBE subassemblies and their applications.

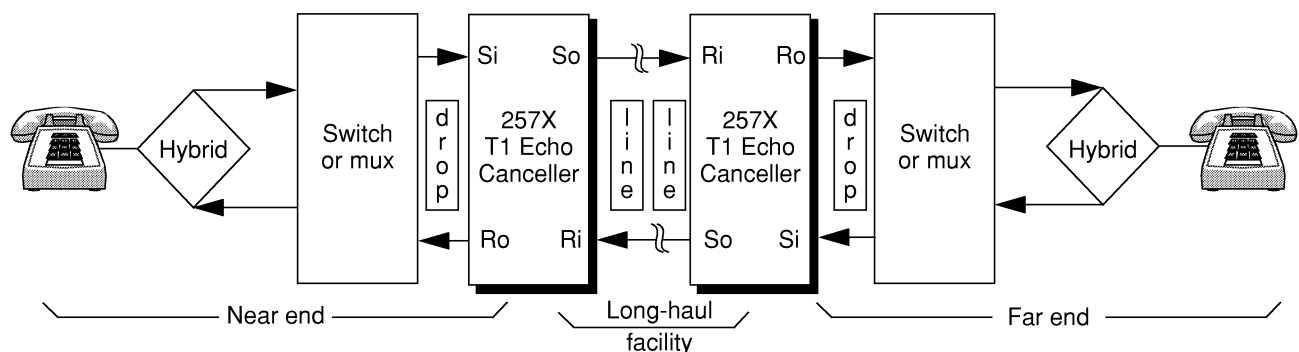
## 2. Long-Distance Network Applications

This section provides information on long-distance network applications and deployment of the 257X Module.

### Applications

A typical long-distance application is shown in Figure 2-1. The module removes echo that occurs when delays caused by long transmission facilities, switching, or voice processing cause signals being fed back by the hybrid to become audible as echo. Typically, round-trip delays (from near end telephone to far end hybrid and back) exceeding approximately 30ms result in audible echo.

In this application, the near end 257X Module provides echo-free service to the far end subscriber by removing echo of their own voice that is present at the Send-in port of the echo canceller. Likewise, the far end module provides echo-free service to the near end subscriber by removing echo of their own voice that is present at its Send-in port.



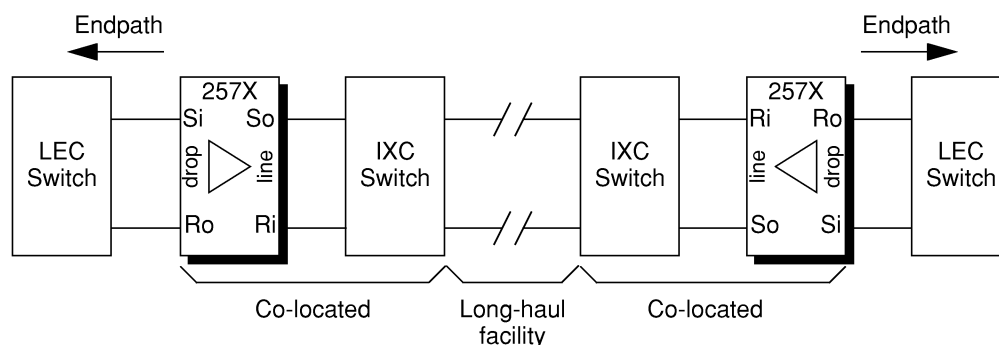
**Figure 2-1 Typical Long-Distance Application**

## Deployment

The 257X Modules can be deployed on access or intermachine trunks.

### Access Trunk

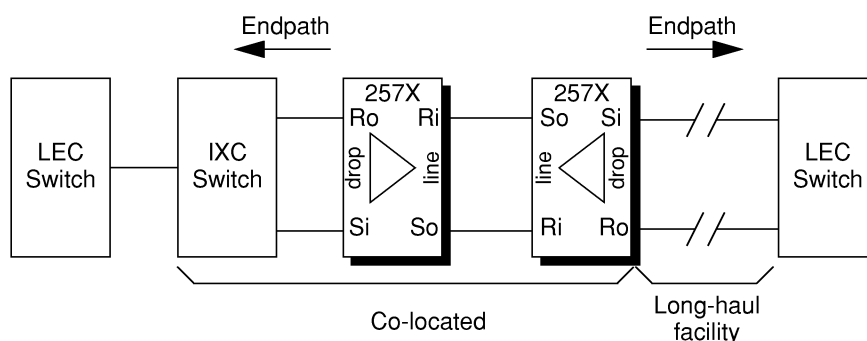
Figure 2-2 shows a typical application using access trunk deployment. In this method, a 257X Module is placed on the access facilities between the switch and the PSTN. This method provides protection for both inter and intraswitch call traffic and is used for networks that maintain a “zero-mile” plan — i.e., networks where echo protection is placed on all facilities regardless of route mileage.



**Figure 2-2 Typical Application Using Access Trunk Deployment**

### Back-to-Back on Access Trunk

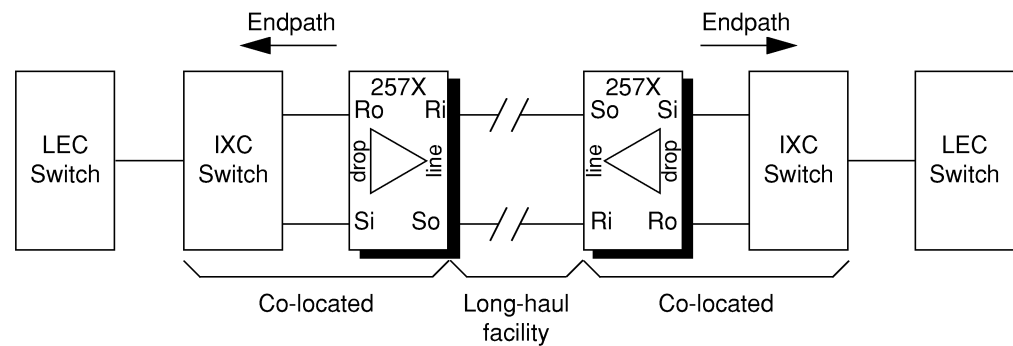
Figure 2-3 shows back-to-back deployment on access trunks. This method places two echo cancellers on the access trunk facilities with their line side connections cross-connected. This approach is best suited for networks where the lack of a distant end switch dictates the placement of both echo cancellers at the near end switch.



**Figure 2-3 Back-to-Back Deployment on Access Trunks**

### Intermachine Trunk

Figure 2-4 shows a typical application using intermachine trunk deployment. In this method, a 257X Module is placed on the intermachine trunk facilities between switches. This method provides echo protection for interswitch call traffic only. This method is best suited for networks where route mileage and delay on intraswitch calls are not high enough to cause echo complaints.



**Figure 2-4 Typical Application Using Intermachine Trunk Deployment**

### 3. Wireless Network Applications

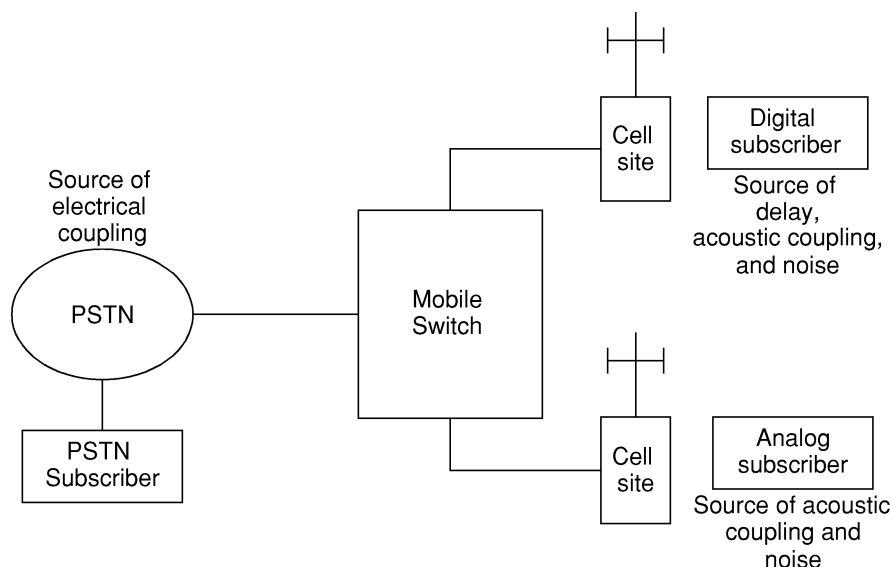
This section provides information on wireless network applications and deployment of the 257X Module.

#### Applications

The 257X Module is used in mixed analog/digital cellular networks such as the one shown in Figure 3-1. In this type of network, the digital subscriber must be protected from echo that is caused by the combination of long processing delays (introduced by the digital vocoder) and electrical reflections or acoustical coupling.

Electrical reflections occur when the digital subscriber's voice is "leaked" from the Receive path onto the Transmit path when their call terminates into a 2wire-to-4wire converter located in a local telephone exchange. The 2wire-to-4wire converter, commonly referred to as a hybrid, provides insufficient ERL to protect the digital subscriber from echo.

Acoustical coupling occurs when the digital subscriber's call terminates onto an analog mobile phone that does not incorporate any form of echo control. Although acoustical coupling can occur on analog mobile handsets, it is more commonly encountered on analog mobile hands-free systems. In both cases, insufficient ERL is present to protect the digital subscriber from echo.



**Figure 3-1 Typical Mixed Analog/Digital Cellular Network**

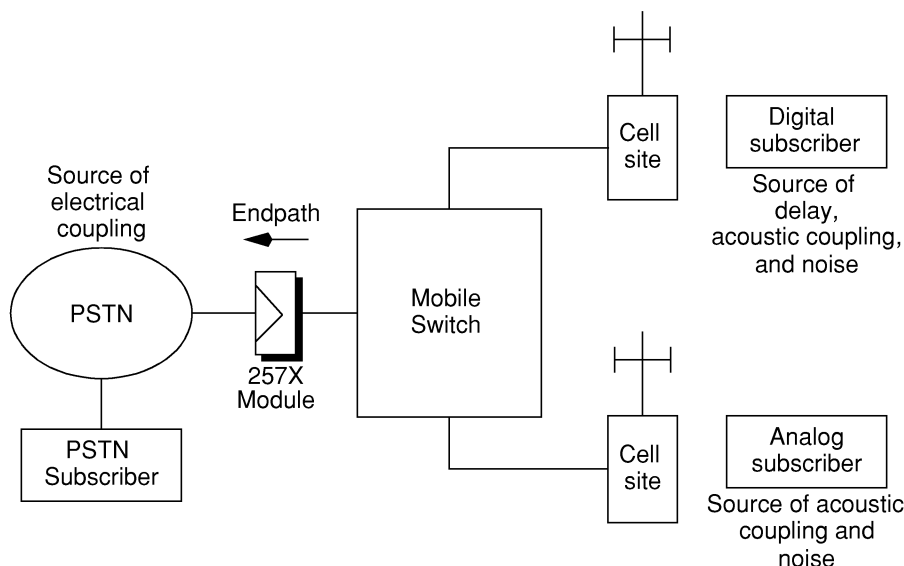
## Deployment

The 257X Module can be deployed in one of three methods. Each method has its corresponding advantages and drawbacks. The three methods are known as:

- PSTN In-Line method
- Pooled method
- Mobile Trunk method

### PSTN In-Line Method

In this approach, a 257X Module is installed on each T1 facility between the mobile network and the PSTN, as shown in Figure 3-2.



**Figure 3-2 PSTN In-Line Method**

This deployment method has three advantages that make it ideal for mobile networks that include only digital phones:

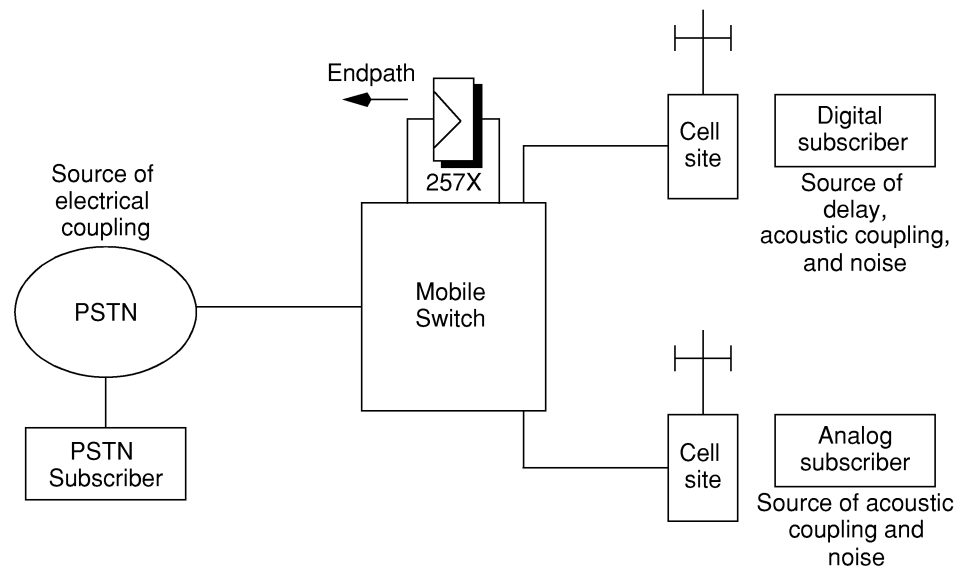
- No reconvergence during hand-offs because the same echo canceller protects the digital subscriber for the duration of the call.
- A/B signaling is present for busy/idle control of the echo canceller on a per-channel basis.
- Default options are usually suitable.

This deployment method is not suitable for mixed analog/digital cellular networks because no echo canceller is present in the connection for mobile-to-mobile calls. Therefore, the digital subscriber is not protected from echo when they call an analog mobile phone on the same system.

### Pooled Method

In this method, a pool of 257X Modules is installed on the switch, as shown in Figure 3-3. Special switch software is required that detects whether or not the mobile call is originating or terminating on a digital mobile phone. If the software detects that the call includes a digital mobile phone, then the switch routes the call across the pool of echo cancellers. Calls that originate on an analog mobile and terminate to the PSTN or another analog mobile are not routed across the pool since these calls do not require echo cancellation.





**Figure 3-3 Pooled Method**

Advantages of this method include:

- Digital subscribers are protected from echo on mobile-to-land as well as mobile-to-mobile calls.
- Start-up cost for echo cancellers is lower than other methods since echo protection is only provided for digital subscribers.

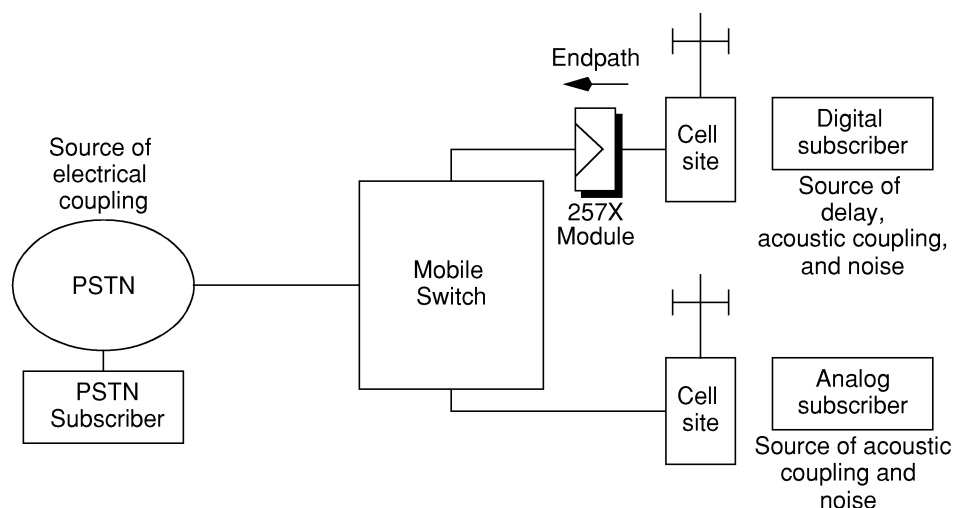
The primary disadvantage of this method is, as the number of digital subscribers increases, the long-term cost is greater than other methods since two additional switch port cards are required for each echo canceller added to the pool.

### Mobile Trunk Method

This approach is similar to the PSTN In-Line method, but the echo cancellers are installed on the mobile side of the switch, as shown in Figure 3-4.

Advantages of this method include:

- Digital subscribers are protected from echo on mobile-to-land as well as mobile-to-mobile calls.
- Low initial cost since echo cancellers are only required for the backhauled T1 facilities that carry digital cell site traffic.



**Figure 3-4 Mobile Trunk Method**

## 4. Installation

This section describes:

- How to install the 257X Module in the shelf
- Initial power-up sequence
- How to ensure that the 257X Module is properly cabled to the network

**Caution:** **STATIC-SENSITIVE EQUIPMENT!** The 257X Module is shipped in a protective antistatic bag. When handling a module at any time, be sure to wear a grounded wrist strap to protect it from possible static discharge damage.

**Note:** Inspect the equipment upon its arrival to detect any possible shipping damage. If damage is found, immediately file a claim with the carrier. If the equipment has been in storage, reinspect it prior to installation.

### Installation of a Shelf

Since the 257X Module is completely backward plug compatible with 253, 255, and 257 T1 Echo Canceller Shelves, all T1, power, alarm, and remote control connections should be made in the same manner.

**Note:** Only the Control SCP is available on the 253-Series and 255A Shelves. Both the Control and Maintenance SCPs are available only on the 255D and 257D Shelves.

Installation instructions for the shelves can be found in their respective technical manuals; see the list of manual part numbers under **Reference Documentation** on page 2.

## Installing the 257X Module

To install a module into a shelf:

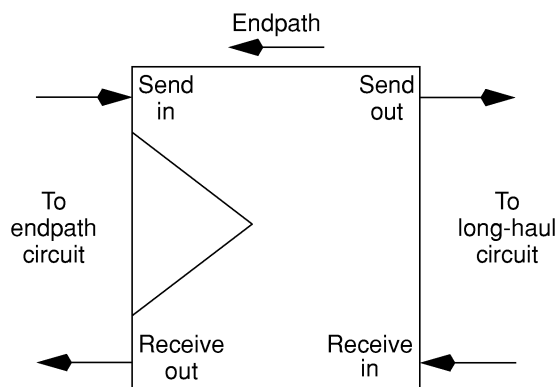
1. Insert the module into the shelf and ensure that it is firmly seated in its edge connector.
2. Observe the module's front panel for the following:
  - The **power** LED lights.
  - A flashing bar is present in the **Mode** and **Option** displays for approximately 45 seconds.
3. If no Digital Signal Level One (DS1) is applied to the module, then both the Send- and Receive-in local alarms flash for 2.5 seconds and then glow steadily.
4. If DS1 is applied to the module and it has been optioned correctly, only the **power** LED will be on.

### Self-Test Failure

If the initial power-on sequence fails, the **fault** LED will light. The module should be considered defective and returned to Tellabs for repair or replacement. See Section 15.

## Network Orientation

To ensure that the 257X Module has been properly connected to the network, verify that the line side (the long-haul facility) has been connected to the Receive-in and Send-out ports. Also verify that the drop side (the endpath facility) has been connected to the Send-in and Receive-out ports (see Figure 4-1). For a complete set of acceptance tests, see Section 12.



**Figure 4-1** Network Orientation

## Optioning the 257X Module

The module can be optioned from either the front panel controls or via menus on the SCPs. For front panel optioning, see Section 5. To option the module via the maintenance menus, see Section 7.

## 5. Front Panel Optioning

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This section provides:

- Descriptions of the front panel controls and displays
- A table listing all of the front panel display codes
- Descriptions of the front panel modes and their options

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**Note:** The system and channel parameters can be optioned from the front panel controls. Performance monitoring statistics can only be accessed via the SCPs.

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### Getting Started

There are three types of front panel modes:

- The OP Mode — lists firmware revisions and any installed subassemblies
- The Channel Modes — c.xx, d.xx, E.xx, and n.xx
- The System Level Configuration Modes — 00 through 89

To access the channel and system parameters from the front panel, always start by pressing the **Mode** pushbutton first. The **Mode** pushbutton increments the top display through the modes listed in the **Mode** column of Table 6-1.

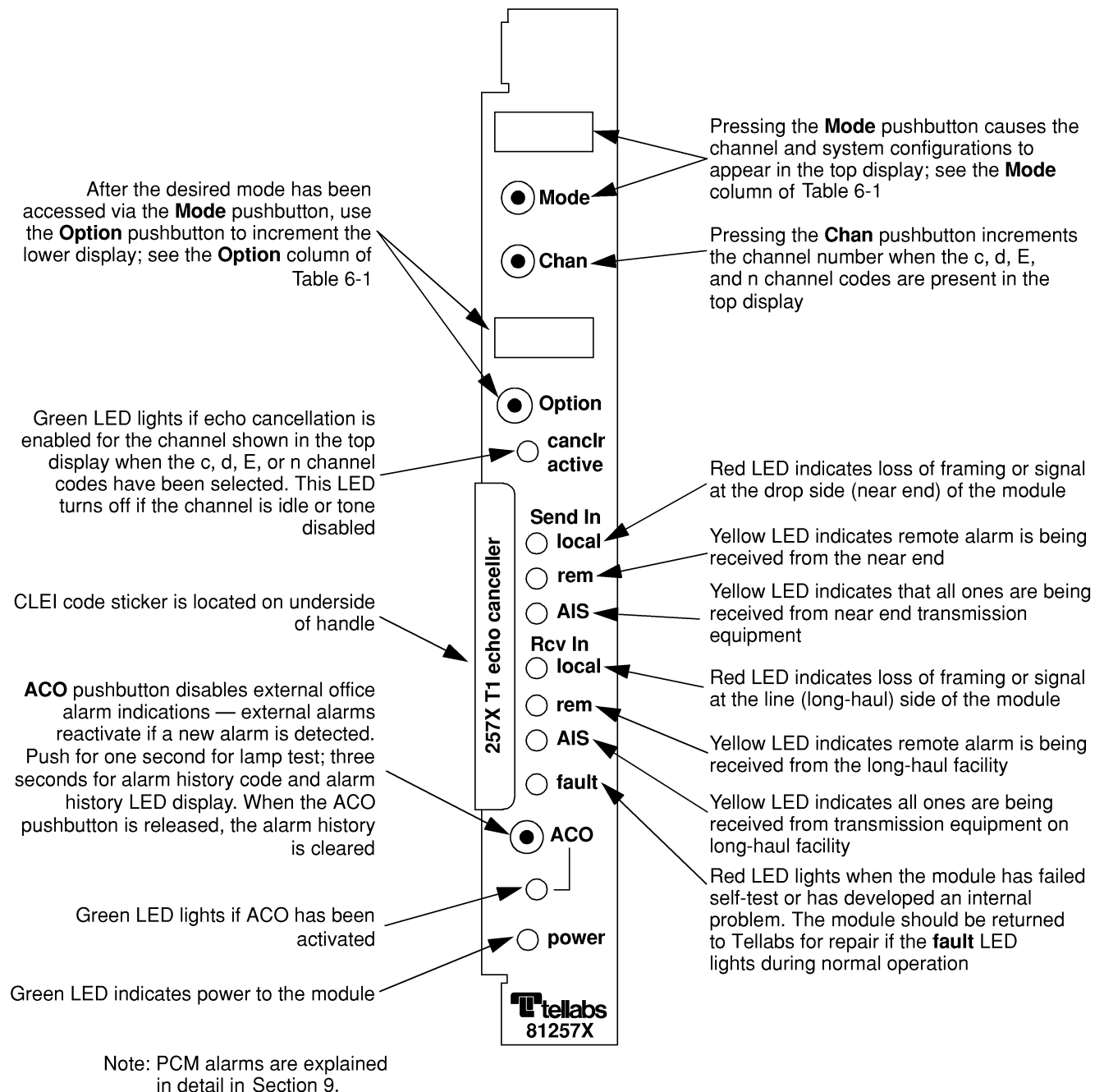
After the desired mode has been accessed via the **Mode** pushbutton, use the **Option** pushbutton to increment the lower display through the choices listed in the **Option** column of Table 6-1.

There are three options available to return to a blank front panel display:

- Push both the **Mode** and **Chan** pushbuttons simultaneously.
- Scroll through all the modes.
- Automatic blanking (timeout) after five minutes.

## 6. Front Panel Displays and Indicators

The front panel displays and indicators are shown in Figure 6-1.



**Figure 6-1 Front Panel Displays and Indicators**

## Front Panel Modes

Table 6-1 lists the front panel modes that are used to option the 257X Module. Options in **bold** in the shaded rows are the default settings.

| Selection  | Mode | Option | Description                                    |
|--|------|--------|--|
| Systems Software/Flash Firmware Revision   | OP   | F.xx   | Shows system software/flash firmware revisions |
| Boot Software/Boot Block Firmware Revision   |      | b.xx   | Shows boot software/firmware revision          |
| 2574 Endpath Expansion*  |      | 1.0    | Not Installed                                  |
|  |      | 1.1    | 2574G, 32ms Installed                          |
|  |      | 1.2    | 2574H, 64ms Installed                          |
| Subassembly*   |      | 2.0    | No Subassembly Installed                       |
|  |      | 2.5    | 25VX1 Subassembly Is Installed                 |
|  |      | 2.6    | 25VX2 Subassembly Is Installed                 |
|  |      | 2.5A   | 25VX1 ACE-Enabled Subassembly Is Installed     |
|  |      | 2.6A   | 25VX2 ACE-Enabled Subassembly Is Installed     |
|  |      | 2.7A   | 25VX3 ACE-Enabled Subassembly Is Installed     |
|  |      | 3.31   | 25VX5 Subassembly Is Installed                 |
| Channel Configuration (per channel)<br>Notes: 1. xx is channel number<br>2. 00 indicates all channels<br>3. Options 03, 04, 05, 06 only appear if CAS is selected — e.g., by Mode 63.0<br>Important: The Forced Active Mode is to be used for diagnostic purposes only. Using the Forced Active Mode during normal operation allows echo at the beginning of the call. | c.xx | 00     | E&M/Idlecode Detection                         |
|  |      | 01     | Forced Bypass (Clear Channel)                  |
|  |      | 02     | Forced Active (Always Cancel)                  |
|  |      | 03     | FXO-GS   |
|  |      | 04     | FXO-LS   |
|  |      | 05     | FXS-GS   |
|  |      | 06     | FXS-LS   |
| Data Tone Disabling Control (per channel)<br>Notes: 1. xx is channel number<br>2. 00 indicates all channels  | d.xx | 00     | Disable  |
|  |      | 01     | Enable   |
| Non Linear Processor (NLP) Control (per channel)<br>Notes: 1. xx is channel number<br>2. 00 indicates all channels   | n.xx | 00     | Disable  |
|  |      | 01     | Enable   |
| CLEARCALL Enhancement Control (per channel)*<br>Notes: 1. xx is channel number<br>2. 00 indicates all channels   | E.xx | 00     | Disable  |
|  |      | 01     | Enable   |
| *Indicates that the mode and/or one or more of the options appear only when the associated hardware to support the setting is installed.   |      |        |  |
| continued . . .  |      |        |  |

**Table 6-1 Front Panel Control Modes**

| Selection   | Mode | Option | Description  |
|---|------|--------|--|
| Functional Test Mode<br><i>Warning: These are out-of-service test configurations; changing this mode may interrupt service.</i>                                 | LPb  | 0      | In Service (all functional test modes deactivated) |
|   |      | 1      | Facility Loopback                                  |
|   |      | 2      | Clear Channel Transparency                         |
|   |      | 3      | Metallic Bypass                                    |
|   |      | 4      | Drop Side Payload Loopback                         |
|   |      | 5      | Line Side Payload Loopback                         |
| Maintenance Port Baud Rate<br>Notes: 1. This mode does not appear in a 253-Series or 255A Shelf.<br>2. This option is not affected by the Set Defaults command. | 00   | 1.2    | 1200 Baud  |
|   |      | 2.4    | 2400 Baud  |
|   |      | 4.8    | 4800 Baud  |
|   |      | 9.6    | 9600 Baud  |
|   |      | 19.2   | 19200 Baud   |
|   |      | 38.4   | 38400 Baud   |
| Control Port Baud Rate<br>Note: This option is not affected by the Set Defaults command.  | 01   | 1.2    | 1200 Baud  |
|   |      | 2.4    | 2400 Baud  |
|   |      | 4.8    | 4800 Baud  |
|   |      | 9.6    | 9600 Baud  |
|   |      | 19.2   | 19200 Baud   |
|   |      | 38.4   | 38400 Baud   |
| Line Side (Send-Out) Equalization   | 10   | 133    | 0 - 133 Feet                                       |
|   |      | 256    | 133 - 256 Feet                                     |
|   |      | 399    | 256 - 399 Feet                                     |
|   |      | 533    | 399 - 533 Feet                                     |
|   |      | 655    | 533 - 655 Feet                                     |
| Drop Side (Receive-Out) Equalization  | 11   | 133    | 0 - 133 Feet                                       |
|   |      | 256    | 133 - 256 Feet                                     |
|   |      | 399    | 256 - 399 Feet                                     |
|   |      | 533    | 399 - 533 Feet                                     |
|   |      | 655    | 533 - 655 Feet                                     |
| Framing Format  | 20   | 3      | SF (Standard Super Frame) Format                   |
|   |      | 4      | MBLT (F <sub>T</sub> ) Format                      |
|   |      | 5      | ESF (Extended Super Frame) Format                  |
| SCP Module Address (Viewable Only)  | 30   | xxx    | xxx is 1 - 128                                     |
| Address Mode  | 31   | 1      | Shelf Auto   |
|   |      | 2      | Shelf 255D   |
| continued . . .   |      |        |  |

**Table 6-1 Front Panel Control Modes**

| Selection  | Mode | Option | Description   |
|--|------|--------|---|
| Send Side Echo Cancellation*   | 38   | 0      | Disable   |
|  |      | 1      | Enable  |
| FLEXWARE Performance Options*  | 39   | 1      | Universal   |
|  |      | 2      | Mobile  |
|  |      | 3      | Gateway   |
| Non Linear Processor Double Talk Operation   | 40   | 1      | Off During Doubletalk (as per ITU-T recommendation) |
|  |      | 2      | Always On   |
| Dynamic Signal Transfer Control  | 41   | 0      | Off   |
|  |      | 1      | On  |
| Minimum ERL  | 42   | 0      | 0dB   |
|  |      | 3      | 3dB   |
|  |      | 6      | 6dB   |
| Noise Reduction (NR)*  | 44   | 0      | Disable   |
|  |      | 1      | Enable at Low Percentage                            |
|  |      | 2      | Enable at Normal Percentage                         |
|  |      | 3      | Enable at Maximum Percentage                        |
| Acoustic Coupling Elimination (ACE) Activation*  | 45   | 0      | Disable   |
|  |      | 1      | Enable  |
| ACE Minimum Weighted Acoustic Echo Path Loss (WAEPL)*  | 46   | 1      | 25dB  |
|  |      | 2      | 35dB  |
|  |      | 3      | 45dB  |
| ACE Cellular Network Type*   | 47   | 1      | GSM (Global System for Mobile Communications)       |
|  |      | 2      | TDMA (Time Division Multiple Access)                |
|  |      | 3      | CDMA (Code Division Multiple Access)                |
| ACE Noise Injection*   | 48   | 0      | Disable   |
|  |      | 1      | Enable  |
| Maximum Endpath Delay*   | 50   | 32     | 32ms (Default for 2571 Module)                      |
|  |      | 64     | 64ms (Default for 2572 Module)                      |
|  |      | 96     | 96ms (Requires 2574H) (2572 Module only)            |
|  |      | 128    | 128ms (Requires 2574H) (2572 Module only)           |
| Line Coding  | 60   | 0      | AMI With Bit 7 Stuffing                             |
|  |      | 1      | B8ZS  |
|  |      | 2      | AMI Transparent                                     |
| *Indicates that the mode and/or one or more of the options appear only when the associated hardware to support the setting is installed. |      |        |   |
| continued . . .  |      |        |   |

Table 6-1 Front Panel Control Modes



| Selection   | Mode | Option | Description                                |
|---|------|--------|--|
| Fault Operation   | 61   | 0      | Bypass On Fault                            |
|   |      | 1      | AIS On Fault                               |
| Framing/CRC Error Transparency Control  | 62   | 0      | Errors Are Corrected                       |
|   |      | 1      | Errors Are Passed Through (Regenerated)    |
| Busy/Idle Detection Method<br>Notes: Changing this mode causes defaults to be set on Mode c:xx.<br>A/B bit integrity is <b>NOT</b> maintained if Option 1, Idlecode Detection, is selected. | 63   | 0      | CAS  |
|   |      | 1      | Idlecode Detection                         |
|   |      | 2      | Idlecode Detection With CAS Pass-Through   |
| Channel Idlecode Pattern  | 64   | 0      | 7F   |
|   |      | 1      | 7F or FF                                   |
|   |      | 2      | F7   |
|   |      | 3      | FF   |
| Idlecode Logic  | 65   | 0      | Detection On Send OR Receive Side          |
|   |      | 1      | Detection On Send AND Receive Sides        |
|   |      | 2      | Detection On Send Side Only                |
|   |      | 3      | Detection On Receive Side Only             |
| Signaling Disabler  | 66   | 0      | Off  |
|   |      | 1      | ITU-T No. 5                                |
|   |      | 2      | ITU-T No. 6 or No. 7                       |
|   |      | 3      | 2600Hz (SF)                                |
| Active Channel Logic for CAS  | 67   | 1      | Detection On Send OR Receive Side          |
|   |      | 2      | Detection On Send AND Receive Sides        |
|   |      | 3      | Detection On Send Side Only                |
|   |      | 4      | Detection On Receive Side Only             |
| Data Tone Disabler Detection  | 70   | 0      | G.164 With Hold-Band                       |
|   |      | 1      | G.165 With Hold-Band                       |
|   |      | 2      | G.164 With Switched-56K                    |
|   |      | 3      | G.165 With Switched-56K                    |
|   |      | 4      | G.164 With Hold-Band/CLEARCALL End-Of-Call |
|   |      | 5      | G.165 With Hold-Band/CLEARCALL End-Of-Call |
| Data Tone Disabler Release Mode Control   | 71   | 0      | Hold-Band                                  |
|   |      | 1      | End-Of-Call                                |
| continued . . .   |      |        |  |

Table 6-1 Front Panel Control Modes

| Selection  | Mode | Option | Description   |
|--|------|--------|---|
| ALC Double Talk Detection*   | 76   | 0      | Disable Both Send and Receive Sides                                     |
|  |      | 1      | Enable Receive Side Only  |
|  |      | 2      | Enable Send Side Only   |
|  |      | 3      | Enable Both Send and Receive Sides                                      |
| ALC Step Size*   | 77   | 3      | 3dB Increments  |
|  |      | 3-6    | 6dB Increments  |
| Receive Side ALC Target Audio Level (TAL)*   | 78   | -15    | -15dBm  |
|  |      | -18    | -18dBm  |
|  |      | -21    | -21dBm  |
|  |      | -24    | -24dBm  |
|  |      | ---    | Off   |
| Send Side ALC TAL*   | 79   | -15    | -15dBm  |
|  |      | -18    | -18dBm  |
|  |      | -21    | -21dBm  |
|  |      | -24    | -24dBm  |
|  |      | ---    | Off   |
| Dynamic Noise Substitution (DNS)*†   | 85   | 0      | Disable   |
|  |      | 1      | Enable Receive Side Only  |
|  |      | 2      | Enable Send Side Only   |
|  |      | 3      | Enable Both Send and Receive Sides                                      |
| Set System Defaults  | 88   | 0      | At least one system default parameter is not set to its default setting |
|  |      | 1      | All system defaults settings are currently active                       |
| Front Panel Lockout  | 89   | 0      | Off (Optioning Allowed)   |
|  |      | 1      | On (View Only Mode Active)  |
| *Indicates that the mode and/or one or more of the options appear only when the associated hardware to support the setting is installed. |      |        |   |
| †The DNS feature is not supported when the 25VX5 Subassembly is installed.   |      |        |   |

**Table 6-1 Front Panel Control Modes**

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## OP Mode

The OP Mode provides the system boot Read-Only Memory (ROM) and flash memory revision levels, as well as a list of installed optional subassemblies.

---

## Channel Modes

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**Caution:** The Forced Active Mode is to be used for diagnostic purposes only. Using the Forced Active Mode during normal operation allows echo at the beginning of the call.

---

The c.xx (Channel Configuration), d.xx (Per-Channel Data Tone Disabler Enable/Disable), E.xx (Per-Channel Voice Band Enhancement Enable/Disable), and n.xx (Per-Channel Non Linear Processor Enable/Disable) Modes provide individual channel configuration for signaling type, tone disabler, VBE, and NLP control. When one of these modes is present in the top display, the **Chan** pushbutton may be used to increment the channel number (xx) from 00 (all channels) to 24. After the desired channel has been chosen, the **Option** pushbutton may be used to select from the options listed in the **Option** column for Modes c.xx, d.xx, E.xx, and n.xx. The **Chan** pushbutton has an auto-advance feature — keep the **Chan** pushbutton depressed to quickly cycle through the channel numbers.

Each 257X Module channel can be in one of two states: active or disabled. In the active state the module provides complete echo cancellation for the channel. When a channel is disabled, four activities occur:

- Echo cancellation and non linear processing are completely disabled.
  - The echo estimator's H-register is reset.
  - Self-test diagnostics are performed on the echo cancellation and non linear processing circuitry associated with the channel.
  - The transmission paths are placed into clear channel.
- 

## LPb Mode

---

**Caution:** Exercise caution when using this option. Selecting any of the out-of-service modes may drop any calls in progress.

---

When the LPb Mode is present in the top display, the **Option** pushbutton is used to choose one of six out-of-service tests listed in the **Option** column of Table 6-1.

If the front panel display times out while in this mode, the top and bottom displays flash a code if a loopback was in place at timeout. For a list of front panel display timeout indications, see Section 9.

## System Level Configuration Modes

The 257X Module includes a number of user-selectable system level modes that can be accessed via its front panel controls or via menus using an asynchronous American Standard Code for Information Interexchange (ASCII) terminal. These options affect the:

- T1 network interface
- Method of per-call control
- Type of disabling tone(s) detected
- NLP operation
- Module default settings
- Front panel access

---

## Modes 10 and 11: Send- and Receive-Out Equalization

The Send- and Receive-out ports include Central Office (CO) equalizers that should be adjusted for the distance between the respective module output and the cross-connect frame. Five options are available that allow up to 655 feet of 22AWG ABAM cable to be present between the module and the Digital Signal Cross-Connect (DSX). Regardless of the type of cable used, the setting that achieves the best fit within the pulse mask should be selected from the front panel controls or via the SCPs.

---

## Mode 20: Framing Format

The network interface can be optioned to accept one of three framing formats: SF, ESF, or Ericsson MBLT Framing.

SF, also known as D3/D4 framing, consists of 12 frames. The sixth and twelfth frames are known as signaling frames, since the least significant bit of each voice channel in these frames is “robbed” and replaced with the A and B signaling bits. The 257X Module can be optioned to monitor these signaling bits to determine the busy/idle state of each channel.

ESF consists of 24 frames; however, the least significant bit of each voice channel is also robbed in the eighteenth and twenty-fourth frames for the C and D signaling bits. The 257X Module does not monitor the C and D bits, but it does pass these signaling bits through unaltered.

Ericsson MBLT Framing is similar to standard framing, but the  $F_s$  bits are not used. When the 257X Module is optioned for this method of framing, only the  $F_t$  bits are used for frame synchronization.

---

### Notes:

1. Since signaling frame alignment cannot be maintained with this format, the 257X Module should not be optioned to detect A and B signaling when it is optioned for MBLT framing.
  2. For error code information, see Section 9.
-

## Mode 31: Address Mode

The Address Mode has two settings: Shelf Auto (default) and Shelf 255D. The Shelf Auto setting allows the 257X Module to automatically determine what type of shelf it is in and adjust the interpretation of its system unit number accordingly. The Shelf Auto setting should only be used when 257X Modules are not being mixed with 255 Modules within a shelf.

If 255 and 257X Modules are mixed within a shelf, the Shelf 255D setting should be used. This setting forces the 257X Module to interpret its system unit number as if it were in a 255D Shelf. If the Shelf 255D setting is not active when mixing 255 and 257X Modules within a shelf, the serial port addressing will not operate properly.

The 257X Modules can have this setting controlled via the serial port user interface as well as via the front panel. To set all 257X Modules (that are connected to the same serial link) to the Shelf Auto setting, the following sequence should be sent: @257<cr>, where <cr> indicates a carriage return. Consequently, to set all 257X Modules (that are connected to the same serial link) to the Shelf 255D setting, the sequence @255<cr> should be sent.

---

**Note:** This mode is not reset when the default option is selected.

---

## Mode 38: Send Side Echo Cancellation

This mode allows Send side echo cancellation to be enabled or disabled. The default setting is **enable**.

## Mode 39: FLEXWARE Performance Options

The 257 System provides customers worldwide with the flexibility to “fine-tune” the cancellers’ performance to their unique network applications. Three settings are available:

- Universal (default) — provides the best overall performance. It excels in doubletalk and echo control performance under normal to extremely harsh network conditions. This mode also features good tandem performance.
- Mobile — provides the best tandem performance. Overall doubletalk performance and echo control is outstanding under normal network conditions. Also, this mode provides the best performance for calls where high levels of background noise can be encountered, such as in wireless networks.
- Gateway — provides good overall performance, and excellent performance in networks where conditions of high or mismatched levels with possible low ERLs may exist. Tandem performance is good, but not outstanding. This mode provides very stable performance under many conditions.

## Modes 40 and 41: Non Linear Processor Operation

Due to the quantizing noise present in the  $\mu$ -law encoded PCM used on T1 facilities, some residual echo may remain after the echo estimators have removed the majority of the echo present in the Send path. The state-of-the-art NLP removes the residual echo. Two options are provided that affect the removal of residual echo — Response During Doubletalk and Dynamic Signal Transfer non linear processing. Both options are explained in the following paragraphs.

#### Mode 40: Non Linear Processor Double Talk Operation

The NLP can be optioned to remain active during doubletalk or to deactivate when doubletalk is detected. Leaving the NLP on during doubletalk reduces the likelihood of the far end caller hearing residual echo, and provides better performance when the ERL is close to the minimum ERL selected, but may increase distortion of near end speech. Conversely, deactivating the NLP during doubletalk (as recommended by ITU-T G.165) can reduce distortion of the near end signals transmitted to the far end, but may allow some residual echo to be untreated. Note that neither option affects the operation of the NLP during singletalk; the NLP is always active during singletalk unless it has been turned off from the front panel or SCP.

#### Mode 41: Dynamic Signal Transfer Control

A fundamental drawback to traditional center clipper NLPs has been their tendency to block low level signals from the endpath circuits. The activation of the NLP by far end speech (at the Receive-in port) often resulted in audible noise modulation (noise pumping) of idle channel noise and squelching of ambient room noises.

DST non linear processing eliminates this problem by providing background signal transparency to low level signals from the endpath circuits. DST non linear processing may be enabled or disabled.

---

#### Mode 44: Noise Reduction

This mode allows the NR feature to be enabled or disabled. The mode can be enabled at either a low, normal, or maximum percentage. The default setting is **disable**.

---

#### Mode 45: ACE Activation

This mode allows the ACE feature to be enabled or disabled. The default setting is **disable**.

---

#### Mode 46: ACE Minimum WAEPL

This mode allows the user to select the desired outgoing audio level. One of three can be selected:

- 25dB
- **35dB** (default)
- 45dB

---

#### Mode 47: ACE Cellular Network Type

This mode allows selection of the desired network type. One of three can be selected:

- **GSM** (default) — Global System for Mobile Communications
- TDMA — Time Division Multiple Access
- CDMA — Code Division Multiple Access

---

#### Mode 48: ACE Noise Injection

This mode allows ACE noise injection to be enabled or disabled. The default setting is **enable**.

## Mode 60: Line Coding

The network interface can also be optioned to accept one of three different line codes: Alternate Mark Inversion (AMI) with bit 7 stuffing, AMI transparent, and Binary Eight With Zero Substitution (B8ZS).

When optioned for AMI with bit 7 stuffing, the 257X Module maintains ones density by bit 7 stuffing. When the module detects an all zero word (eight zeros) on the incoming bit stream, bit 7 is set high at the associated output. AMI with bit 7 stuffing should not be used in digital data applications requiring 64kbit/s clear channels, since bit 7 stuffing can result in data errors. However, it can be used in digital data applications requiring 56kbit/s clear channels as long as the digital service unit holds bit 8 high for the duration of the call.

AMI transparent disables bit 7 stuffing and can be used in digital data applications where 64kbit/s clear channels are required. Since the 257X Module does not maintain ones density when this option is selected, care should be taken to ensure that another network element is providing zero code suppression.

B8ZS suppresses all zero words by inserting a predetermined set of Bipolar Violations (BPVs) on the outgoing bit stream. If the receiving equipment is optioned for B8ZS, these BPVs are decoded and the original bit pattern is recreated. Since complete bit integrity is recovered after decoding, B8ZS can be used in all digital data applications.

## Mode 61: Fault Operation

When the module detects a system fault (a fault that affects all 24 channels), this mode allows the module's Pulse Code Modulation (PCM) data to be either:

- Substituted with an AIS being transmitted out both the Send and Receive sides, or
- To bypass both Send and Receive sides

These conditions are dependent on the option setting:

- Bypass on fault (default setting)
- AIS on fault

If a system fault has occurred and the Fault Operation Mode is provisioned to AIS on fault while an H-Reset or H-Hold are active on any channel, transmission of AIS is overridden and channels are bypassed (on a per-channel basis) when self-test results indicate that the channel is failing.

## Mode 62: Framing/CRC Error Transparency Control

The 257X Module can be optioned to correct framing bit or Cyclic Redundancy Check (CRC) checksum errors on the Send and Receive PCM streams. Conversely, in applications where a switching system or other network element is gathering statistics on these errors, the module can be optioned to pass the errors uncorrected.

## Modes 63, 64, 65, 67: Per-Call Control

The echo cancellation process can be automatically enabled or disabled on a per-channel basis in four different manners through detection of:

- Channel Associated Signaling (CAS) (A and B signaling bit states) — to be used on trunks deploying MF signaling.
- Idle channel codes — to be used on trunks deploying ISDN User Part (ISUP) signaling.
- Common Channel Signaling (CCS) commands at the Control SCP.
- In-band signaling and data disabling tones.

In addition, echo cancellation can be manually disabled on a per-channel basis via Mode c.xx.

## Mode 63 (Option 0): Channel Associated Signaling Detection

When the 257X Module is optioned for CAS (also known as robbed-bit and A/B signaling), it monitors the state of the A and B signaling bits on the Receive and Send paths. The detection of the A and B signaling bits is the most common method of echo cancellation control. When busy signaling is detected, echo cancellation is enabled. Likewise, when idle signaling is detected, echo cancellation is disabled.

---

**Note:** The CAS detection option should be used with trunks deploying MF signaling.

---

### Idle Channel States

Table 6-2 lists the idle states of the A and B signaling bits that cause echo cancellation to be disabled for E&M and Foreign Exchange services when it is optioned for CAS.

| Drop Side<br>Channel Card | Send-In |       | Receive-In |       |
|---------------------------|---------|-------|------------|-------|
|                           | A Bit   | B Bit | A Bit      | B Bit |
| E&M                       | 0       | 0     | 0          | 0     |
| FXO-GS                    | 1       | 1     | 0          | 1     |
| FXS-GS                    | 0       | 1     | 1          | 1     |
| FXO-LS                    | 0       | 1     | 0          | 1     |
| FXS-LS                    | 0       | 1     | 0          | 1     |

**Table 6-2** A and B Bit Detection for Idle Channel

### Self-Test Diagnostics

When the 257X Module detects an idle channel condition, it performs self-test diagnostics on the channel's echo cancellation and non linear processing circuitry. Since the channel is idle, echo cancellation is disabled, resulting in a 56 or 64kbit/s (depending on line coding) clear channel. As stated earlier, when the module detects an active channel condition, echo cancellation is activated and self-test is halted.

### Mode 63 (Options 1 and 2): Idlecode Detection

In networks using CCS, such as Signaling System No. 7, A and B signaling bits may not be present in the Send and Receive T1 facilities. In these networks, the 257X Module can be optioned for Idlecode Detection. When Idlecode Detection has been selected, the module no longer monitors the states of the A and B signaling. Instead, it monitors for the presence of an idlecode pattern sent by the switch or PCM multiplexer.

---

#### Notes:

1. A/B bit integrity is **NOT** maintained if Idlecode Detection is selected.
  2. Idlecode Detection should be used on trunks deploying ISUP signaling.
- 

## Mode 64: Channel Idlecode Pattern

The 257X Module can be optioned to disable when it detects one of three idle codes: 7F, F7, or FF. This is useful for applications where 7F may be the idle code on one transmission path, and FF on the other, as may be the case when different brands of switching systems are used at each end of the network.



---

**Mode 65: Idlecode Logic**

The 257X Module can also be optioned as follows:

- Disable if idle code is present on either the Send OR Receive path for applications where idle code is present in one direction only.
- Disable only when idle code is present on the Send AND Receive paths.
- Disable only when idlecode is present in the Send path.
- Disable only when idlecode is present in the Receive path.

**Mode 67: CAS Active Channel Logic**

This mode controls the manner in which the 257X Module is activated by CAS (A/B Signaling). Four options are present within this mode:

- OR-Logic (default) — intended for use in networks using Signaling System No. 7 that control the module with CAS.
- AND-Logic — detects the busy channel state; intended for use in networks using Multi-frequency (MF) signaling that control the module with CAS.
- Detection on Send side only.
- Detection on Receive side only.

---

**Mode 66: Signaling Disabler**

The 257X Module can be optioned to automatically detect and disable upon the presence of tones associated with:

- ITU-T No. 5 signaling (2400/2600Hz tones)
- ITU-T No. 6 and No. 7 signaling (2000Hz VPA check tones)
- 2600Hz SF signaling

**ITU-T No. 5 Signaling**

When used in networks that make use of No. 5 signaling, the module should be optioned for ITU-T No. 5 signaling and for Forced Active operation. When configured in this manner, echo cancellation is disabled when the No. 5 signaling tones are present on either the Send or Receive T1 streams. When these tones are not present, echo cancellation is activated because the Forced Active option has been selected.

**ITU-T No. 6 and No. 7 Signaling**

When used in networks that make use of No. 6 or No. 7 signaling, the 257X Module may need to be optioned to detect and disable upon the presence of the VPA check tone under certain conditions.

## Busy/Idle Detection Priority

Since a channel may be disabled by several different methods, the 257X Module uses the priority listed in Table 6-3 to determine if a channel should be ultimately disabled.

| Priority Level | Busy/Idle Control Method   | Source  | Priority  |
|----------------|--|---|---|
| 1              | Alarm or system fault  | PCM stream  | Highest priority, overrides all other priority levels |
| 2              | In-band signaling and data disabling tones                       | Modems, digital service units, various signaling schemes          | Overrides all other busy/idle control methods         |
| 3              | Forced bypass and forced active                                  | User input from front panel controls or SCPs                      | Overrides CCS commands, CAS, and Idlecode Detection   |
| 4              | CCS commands via the SCP   | Digital switch or adjunct controller connected to the Control SCP | Overrides CAS and Idlecode Detection                  |
| 5              | Monitoring of A and B signaling bits (CAS) or idle channel codes | Digital switch, PBX, or channel bank                              | Lowest priority method for busy/idle control          |

**Table 6-3** *Busy/Idle Control Hierarchy*

## Modes 70 and 71: Tone Disabling

Tone disabling is most commonly used to assure compatibility with voice band (analog), fax, Switched-56 digital data, and in-band signaling schemes. Tone disabling may also be used to disable the echo canceller for in-band signaling schemes such as ITU-T No. 5 signaling, 2600Hz SF signaling, or during the VPA tests of ITU-T No. 6 and No. 7 signaling.

### Voice Band (Analog) Data

The 257X Module can be optioned to disable upon receipt of 2100Hz modem disabling tones per ITU-T Recommendation G.164 (with or without phase reversals) or G.165 (with phase reversals only). When the module is optioned for G.165, it allows for the maximum performance of modems and fax machines that use either phase-reversed or nonphase-reversed 2100Hz tone.

### Fax Transmission

Successful fax transmission requires that network echo cancellers be enabled to ensure that the transmitting fax machine is not disturbed by echo of its own data during image transmission. Fax machines generate a 2100Hz disabling tone (CED) without phase reversals at the start of the call. However, when the 257X Module is optioned for G.164 tone disabling and Hold-Band operation, pauses in the fax training sequence cause the echo canceller to re-enable just prior to the start of image transmission, providing successful fax transmission. When the 257X Module is optioned for G.165 tone disabling, echo cancellation is enabled for the entire fax transmission, since the module only responds to 2100Hz with periodic phase reversals.

---

**Mode 70: Data Tone Disabler Detection**

If optioned for G.164 tone disabling, the 257X Module disables echo cancellation when a nominal 2100Hz tone (with or without phase reversals) is detected in the Send or Receive path. If optioned for G.165 tone disabling, the module disables only upon the receipt of a nominal 2100Hz tone with periodic phase reversals. This type of disabling tone is transmitted by modems that use the V.25 answer sequence.

**Mode 71: Data Tone Disabler Release Mode Control**

Four data tone disabler release mode options are available:

- Hold-Band
- End-Of-Call
- Switched-56K
- Hold-Band/CLEARCALL End-Of-Call

**Hold-Band**

When the data tone disabler release mode is optioned for Hold-Band (as recommended by ITU-T), echo cancellation and the CLEARCALL features remain disabled as long as the voice band data energy meets the Hold-Band specifications of the tone disabler. If the Hold-Band requirements are not met, then echo cancellation is re-enabled.

**End-Of-Call**

When the data tone disabler release mode is optioned for End-Of-Call, the Hold-Band requirements are removed and echo cancellation and the CLEARCALL features remain disabled for the remainder of the call, as determined by A and B signaling or Idlecode Detection.

---

**Note:** Since echo cancellation is not re-enabled until a new call is set up, End-Of-Call should not be used in applications where data and voice may be present on the same call.

---

**Switched-56K**

When the data tone disabler release mode is optioned for Switched-56K and a switched 56kbit/s digital data call commences, the Data Service Unit (DSU) transmits 2100Hz while holding bit 8 in a high state. The 257X Module monitors the state of bit 8 when a 2100Hz disabling tone is detected. If bit 8 remains high, the module maintains a 56kbit/s clear channel for the remainder of the call, regardless of whether or not the data meets the Hold-Band specifications of the tone disabler. If bit 8 goes to the low state, then the Hold-Band specifications of the data tone disabler must be met in order for echo cancellation and the CLEARCALL features to remain disabled.

**Hold-Band/CLEARCALL End-Of-Call**

When the data tone disabler release mode is optioned for Hold-Band/CLEARCALL End-Of-Call, the data tone disabler is optioned for Hold-Band. Echo cancellation remains disabled as long as the voice band data energy meets the Hold-Band specifications of the tone disabler. If the Hold-Band requirements are not met, then echo cancellation is re-enabled. CLEARCALL features, however, remain bypassed for the remainder of the call, as determined by A and B signaling or Idlecode Detection.

## Common Channel Signaling Via the Control Serial Communications Port

In applications where no signaling bits or idle channel codes are available, or in applications requiring 64kbit/s clear channels for N X 64 services, busy/idle channel control can also be accomplished via the Control SCP using a series of four-character CCS commands.

The Control SCP is an RS-232-D compatible serial port that can be accessed on the rear of the shelf. To ensure that CCS commands are acknowledged quickly, commands received at the Control SCP take priority over those received at the Maintenance SCP.

The 257X Module accepts CCS commands at all times. The selection of CAS, Idlecode Detection, or in-band signaling disabling has no effect on the module's acknowledgment or response to the CCS commands.

---

## Mode 76: ALC Double Talk Detection

This mode allows the ALC Double Talk Detection capability to be enabled on both the Send and Receive sides, enabled on the Receive side only, enabled on the Send side only, or disabled on both the Send and Receive sides. The default setting is **disable** on both the Send and Receive sides.

---

## Mode 77: ALC Step Size

This mode affects the rate at which the ALC feature adjusts the outgoing audio level to the Target Audio Level (TAL) selected in Mode 76. This mode allows 3dB or 6dB step-size adjustments. If the 3dB selection is made, only 3dB adjustments are made to the outgoing audio level. When the 6dB step-size is selected, 6dB adjustments are made initially, and then 3dB adjustments are still made as the outgoing audio level approaches the TAL. The default setting is **3dB**.

---

## Mode 78: Receive Side ALC TAL

This mode allows the ALC feature to be enabled or disabled on the Receive path. One of five settings can be selected:

- -15dBm
  - -18dBm
  - -21dBm
  - -24dBm
  - **Off** (default)
- 

## Mode 79: Send Side ALC TAL

This mode allows the ALC feature to be enabled or disabled on the Send path. One of five settings can be selected:

- -15dBm
  - -18dBm
  - -21dBm
  - -24dBm
  - **Off** (default)
- 

## Mode 85: Dynamic Noise Substitution

This mode allows the DNS feature to be enabled or disabled on the Receive and Send sides. The default setting is **disable** for both paths.

---

---

## Mode 88: Set System Defaults

When Mode 88 is present in the top display, pressing the **Option** pushbutton causes the bottom display to change from 0 to 1, which resets all options to their original factory defaults, except the two SCP baud rates. This option cannot be toggled back to 0 after 1 has been selected.

---

**Caution:** Exercise caution when using this option. Previous customer configurations cannot be recalled and complete reoptioning of the 257X Module will be required.

---

## Mode 89: Limiting Access to Front Panel Option Changes

Mode 89 prohibits any changes to front panel options. Options may be viewed when the 89.1 Mode has been selected, but cannot be changed. Choose Mode 89.0 for complete view and change capabilities. A period is displayed on the right side of both displays when front panel optioning is disabled.

---

## 7. Serial Communications Port Optioning

---

This section includes information concerning:

- SCPs
- Maintenance menus
- ASCII commands

---

**Note:** For additional information on SCP optioning, see the *257 T1 Echo Celler User Interface Document*.

---

## Serial Communications Ports

### Communication Parameters

The 257X Module can be optioned and controlled from two SCPs. Each SCP is a full duplex asynchronous link configured for Data Communications Equipment (DCE) that operates with:

- One start bit
- One stop bit
- Seven data bits
- Even parity
- Remote character echo
- Flow control off

Each of the SCPs can be independently optioned to operate at any one of the following baud rates: 1200, 2400, 4800, 9600, 19200, or 38400.

One 2555, 2555A, or 2555S Module per shelf is required for communication with the echo cancellers.

## Autobaud Determination

The 257X Module automatically adjusts to the baud rate of the Data Terminal Equipment (DTE) attached to either of the SCPs by sending a <BREAK>, followed by a <RETURN>, from the DTE to the module. Autobaud eliminates the need to manually set the baud rate of the two SCPs. The default mode for Autobaud is **disable**.

---

**Note:** Autobaud may need to be disabled in applications where the module is controlled via a packet switch that uses the <BREAK> character for other purposes. Autobaud can be disabled from the Serial Port Parameters submenu or by sending the ASCII autobaud Disable command to the module.

---

## Serial Communications Port Cabling

The Maintenance SCP (available only on the 255D and 257D Shelves) can be accessed at a DB25 female connector on the rear of the shelf or via an RJ-11 jack on the front panel of the 2555, 2555A, or 2555S Module. A straight-through RS-232-D cable is required when accessing the rear mounted DB25 connector. When accessing the RJ-11 jack, a standard modular telephone cable can be used.

The Control SCP can also be accessed at a DB25 female connector on the rear of the shelf. Although the maintenance menus can be accessed from the Control SCP, this SCP is intended for applications where the switching system or an adjunct processor issues ASCII commands to enable and disable echo cancellation.

## Serial Communications Port Module Addressing

For proper communication to all 257X Modules installed on an SCP link, each module must be assigned a unique SCP address. SCP addresses are automatically assigned by position within the shelf. A shelf is assigned a range of SCP addresses via DIP switches or wire-wrap pins, depending upon the shelf used. See the appropriate shelf technical manual for addressing instructions.

---

**Note:** 253-Series technical manuals refer to this addressing as RS-232-D Module Addressing.

---

See the information under **Mode 31: Address Mode** on page 28 for instructions on what to do if 255 and 257 Modules are being mixed within a shelf.

---

## Maintenance Menus

The 257X Module contains a complete set of built-in menus that are self-prompting and self-explanatory. The menus are best viewed on a terminal capable of 80 columns by 24 lines. The menus do not utilize screen control, thus, they can be used on any asynchronous terminal. Sample menus follow in this section.

---

**Caution:** Since the menus only respond to UPPERCASE letters, enable the terminal's caps lock key before proceeding.

---

**Note:** For additional information on menus, see the *257 T1 Echo Canceller User Interface Document*.

---

## Accessing the Menus

To access the menus, enter @XXX<cr>, where XXX is the module address as displayed in the front panel Mode 30, and <cr> is a carriage return (see Note below). For example, to log into the 257X Module installed in the twelfth mounting slot (counted from the left) in a 255A or 255D Shelf (that has been assigned addresses 1-16), enter @12 and press the return or enter key.

---

**Note:** When the SCP address is under 100 (three digits), it is only necessary to enter the two-digit address. Up to three digits are allowed.

---

## Main Menu

After entering @12<cr>, the first menu to appear is the Main Menu (Figure 7-1).

```
TELLABS OPERATIONS, INC. 257 T1 ECHO CANCELLER MENUS

      FLEXWARE and Dynamic Signal Transfer are
      U.S. Trademarks of Tellabs Operations, Inc.

Use CONTROL-H or DEL to make entry corrections.
Use CONTROL-E to exit menu access from any point.
Use CONTROL-C to return to this menu from any point.

When entering letters, use UPPERCASE only.

FUNCTION:

1) Module Status
2) Module Configuration
3) Channel Status/Configuration
4) Performance Monitoring
E) Exit Menus

[CANCELLER 001] Enter Option >1
```

**Figure 7-1** Main Menu

## Module Status Menu

Entering 1<cr> from the Main Menu gets you to the Module Status Menu (Figure 7-2). This menu contains information on the module's current status, such as whether or not the module is currently in service. This menu also indicates the presence of any PCM alarms.

```

MODULE STATUS:

Module Status.....IN SERVICE
Module Alarm State.....NONE
Accumulated Power On Hours..... 11079.25
Channel Test History.....NO FAILURES

PCM ALARMS (Current/History)
  Send.....LOS / NONE
  Receive.....LOS / NONE

Alarm Cutoff.....INACTIVE

1) Display Current Status
2) Display Module Identification
3) Display Serial Port Statistics
4) Activate Alarm Cutoff
5) Clear Channel Test History
E) End

[CANCELLER 001] Enter Option >2

```

**Figure 7-2 Module Status Menu**

## Module Identification Menu

Entering 2<cr> from the Module Status Menu gets you to the Module Identification Menu (Figure 7-3). This menu contains the issue level and product revision of the module, as well as the firmware and hardware revision levels. This menu also includes manufacturing information.

```

MODULE IDENTIFICATION:

Product Revision Levels:
Systems Software.....A July 7, 1999
Boot Software.....A
81.2571 Mother Board PCB Rev.....B
Optional Subassembly.....82.25VX5 Rev C
Endpath Extension Option.....Not Installed
ESF Data Link Processor.....Not Installed

Build Information:
Product Revision (Original/Current)..A/A
Serial Number.....IL12345678
Date Module Tested.....DD/MM/YY
Manufacturing Test Station.....9999
Manufacturing Test Revision Level ...TBD

1) Display Current Status
2) Display Module Identification
E) End

[CANCELLER 001] Enter Option >

```

**Figure 7-3 Module Identification Menu**



## Module Configuration Menu

Entering 2<cr> from the Main Menu gets you to the Module Configuration Menu (Figure 7-4). This menu contains the system level options.

### MODULE CONFIGURATION:

- 1) Service State.....IN SERVICE
- 2) Network Interface.....SF B7 L0-133 D0-133 Corr BYPonF
- 3) Non-linear Processor Mode.....Always On
- 4) Minimum Echo Return Loss.....6 dB
- 5) Maximum Endpath Delay.....32 MS
- 6) Data Tone Disabler (TD1).....ITU-T G.165 End of Call Mode
- 7) Signalling Tone Disabler (TD2).....C6/C7
- 8) Idle Channel Detection.....Robbed Bit Signalling, OR
- 9) Front Panel Optioning.....Enabled
- 10) Serial Port Parameters.....CTL-9600 MAINT-9600
- 11) ESF Maintenance Link Communication....Link Is Transparent
- 12) CLEARCALL Enhancements.....DST On,DNS N/A,ALC Off,ACE Off,NR On
- 13) FLEXWARE(tm) Performance Options.....Universal
- R) System RESET
- D) Default ALL Parameters (ex baudrates)..Off
- E) End

[CANCELLER 001] Enter Option >

**Figure 7-4 Module Configuration Menu**

## Channel Status/Configuration Menu

Entering 3<cr> from the Main Menu gets you to the Channel Status/Configuration Menu (Figure 7-5). This menu provides a summary of the channel status/configuration for all 24 channels of the DS1 facility.

| STATE | TONE   |         |     |     |     |     |   | C | T | N | T | C | STATE | TONE   |         |     |     |     |     |   | C | T | N | T | C |   |
|-------|--------|---------|-----|-----|-----|-----|---|---|---|---|---|---|-------|--------|---------|-----|-----|-----|-----|---|---|---|---|---|---|---|
| C     | ACT(+) | DISABLE |     |     |     |     |   | F | D | L | S | C | C     | ACT(+) | DISABLE |     |     |     |     |   | F | D | L | S | C |   |
| H     | BYP(-) | TD1     | TD2 | CFG | CCS | CAS | G | 1 | P | T | E |   | H     | BYP(-) | TD1     | TD2 | CFG | CCS | CAS | G | 1 | P | T | E |   |   |
| ----- |        |         |     |     |     |     |   |   |   |   |   |   |       |        |         |     |     |     |     |   |   |   |   |   |   |   |
| 1     | -      |         | -   |     |     |     | + |   | 0 | 1 | 1 | . | 1     | 13     | -       |     |     |     |     | - |   | 0 | 1 | 1 | . | 1 |
| 2     | -      |         |     |     |     |     | - |   | 0 | 1 | 1 | . | 1     | 14     | -       |     |     |     |     | - |   | 0 | 1 | 1 | . | 1 |
| 3     | -      |         |     |     |     |     | - |   | 0 | 1 | 1 | . | 0     | 15     | -       |     |     |     |     | - |   | 0 | 1 | 1 | . | 1 |
| 4     | -      |         |     |     |     |     | - |   | 0 | 1 | 1 | . | 1     | 16     | -       |     |     |     |     | - |   | 0 | 1 | 1 | . | 1 |
| 5     | -      |         |     |     |     |     | - |   | 0 | 1 | 1 | . | 1     | 17     | -       |     |     |     |     | - |   | 0 | 1 | 1 | . | 1 |
| 6     | -      |         |     |     |     |     | - |   | 0 | 1 | 1 | . | 1     | 18     | -       |     |     |     |     | - |   | 0 | 1 | 1 | . | 1 |
| 7     | -      |         |     |     |     |     | - |   | 0 | 1 | 1 | . | 1     | 19     | -       |     |     |     |     | - |   | 0 | 1 | 1 | . | 1 |
| 8     | -      |         |     |     |     |     | - |   | 0 | 1 | 1 | . | 1     | 20     | -       |     |     |     |     | - |   | 0 | 1 | 1 | . | 1 |
| 9     | -      |         |     |     |     |     | - |   | 0 | 1 | 1 | . | 1     | 21     | -       |     |     |     |     | - |   | 0 | 1 | 1 | . | 1 |
| 10    | -      |         |     |     |     |     | - |   | 0 | 1 | 1 | . | 1     | 22     | -       |     |     |     |     | - |   | 0 | 1 | 1 | . | 0 |
| 11    | -      |         |     |     |     |     | - |   | 0 | 1 | 1 | . | 1     | 23     | -       |     |     |     |     | - |   | 0 | 1 | 1 | . | 1 |
| 12    | -      |         |     |     |     |     | - |   | 0 | 1 | 1 | . | 1     | 24     | -       |     |     |     |     | - |   | 0 | 1 | 1 | . | 1 |

### Channel Status/Configuration:

- 1) Configure One Channel
  - 2) Configure All Channels
  - 3) Toggle Menu
  - E) End
- H-Hold (all channels): Off  
L) Screen Legend

[CANCELLER 001] Enter Option >

**Figure 7-5 Channel Status/Configuration Menu**

**Note:** Option L (Screen Legend) in the Channel Status/Configuration menu takes you to another menu that explains the column headings shown. For more information, see the *257 T1 Echo Canceller User Interface Document*.

## Performance Monitoring Menu

Entering 4<cr> from the Main Menu gets you to the Performance Monitoring Menu (Figure 7-6). This menu shows counts of PCM performance statistics for the Receive and Transmit bit streams. Complete descriptions of the performance monitoring capabilities are given in Section 8.

| PCM PERFORMANCE STATISTICS:       |                |           |                |           |
|-----------------------------------|----------------|-----------|----------------|-----------|
|                                   | SEND           |           | RECEIVE        |           |
|                                   | TOTAL          | PREV.24HR | TOTAL          | PREV.24HR |
| Errored Seconds                   | 5              | 5         | 0              | 0         |
| Bursty Errored Seconds            | 3              | 3         | 0              | 0         |
| Severely Errored Seconds          | 3              | 3         | 0              | 0         |
| Unavailable Seconds               | 0              | 0         | 29             | 29        |
| Loss of Frame Events              | 1              | 1         | 1              | 1         |
| Slip Events (Seconds)             |                |           | 0              | 0         |
|                                   |                |           |                |           |
| Error Events                      | 9              |           | 513            |           |
| Loss of Signal Events             | 1              |           | 1              |           |
| Loss of Frame Sync. Events        | 0              |           | 0              |           |
| Framing Bit Error Events          | 0              |           | 0              |           |
| Bipolar Coding Violations         | 9              |           | 513            |           |
| Current Status                    | CLEAR          |           | CLEAR          |           |
|                                   |                |           |                |           |
| Time Since Reset (DDDDD+HH:MM:SS) | 00000+18:41:14 |           | 00000+18:41:14 |           |
|                                   |                |           |                |           |
| 1) Send Side Interval Data        |                |           |                |           |
| 2) Receive Side Interval Data     |                |           |                |           |
| 3) Clear                          |                |           |                |           |
| E) End                            |                |           |                |           |
|                                   |                |           |                |           |
| [CANCELLER 001] Enter Option >    |                |           |                |           |

**Figure 7-6 Performance Monitoring Menu**

## ASCII Commands

The 257X Module can be optioned and controlled via a series of ASCII commands, as listed in Table 7-1. These commands are intended for applications requiring automated control of the module. Most commands are backwards compatible with the Issue 1 series of 255 T1 Echo Cancellers.

**Note:** For additional information on ASCII commands, see the *257 T1 Echo Cancellor User Interface Document*.

| Command   | ASCII Char. | 81.2551X Compatible?  | Front Panel Mode                            |
|---|-------------|---|---|
| Set Configuration Parameter Defaults                  | !           | Yes   | 88.x  |
| Front Panel Lockout Enable                            | "           | Yes   | 89.1  |
| Front Panel Lockout Disable/Set Baud Rate             | #           | Yes   | 89.0/00,01                                  |
| Self-Test Failure History                             | \$          | Yes   | None  |
| PCM Alarm History                                     | %           | Yes   | <b>ACO</b> pushbutton                       |
| Set Global Selection                                  | &           | Yes   | None  |
| Data Tone Disabler/Signaling Disabler On              | (           | Yes   | 66.1-3/d.xx/70.x                            |
| Data Tone Disabler Off                                | )           | Yes   | 66.0/d.xx                                   |
| Abbreviated Alarm Status                              | *           | Yes   | Front panel LEDs                            |
| Data Tone Disabler Status                             | +           | Yes   | d.xx/ <b>cancelr active</b> LED             |
| Receive Side Detailed Performance Monitoring          | ,           | Yes   | None  |
| Send Side Detailed Performance Monitoring             | -           | Yes   | None  |
| Performance Monitoring Status                         | .           | Yes   | None  |
| E&M Signaling Control Select                          | /           | Yes   | c.xx/63.0                                   |
| Receive Side Detailed Performance Monitoring (32 Bit) | 3           | No  | None  |
| Send Side Detailed Performance Monitoring (32 Bit)    | 4           | No  | None  |
| Performance Monitoring Status Data (32 Bit)           | 5           | No  | None  |
| CLEARCALL Control                                     | 6           | Yes<br>(Exception: Modes 78.x and 79.x are not 81.2551X compatible) | 45.x/46.x/47.x/77.x/<br>78.x/79.x/85.x/E.xx |
| FLEXWARE Control                                      | 6           | No  | 39.x  |
| FXS-LS Signaling                                      | :           | Yes   | c.xx  |
| FXO-LS Signaling                                      | ;           | Yes   | c.xx  |
| Channel Signaling Status                              | <           | Yes   | c.xx  |
| Module Information                                    | =           | Yes   | OP  |
| FXS-GS Signaling                                      | >           | Yes   | c.xx  |
| FXO-GS Signaling                                      | ?           | Yes   | c.xx  |
| Dynamic Signal Transfer                               | @           | Yes   | 41.x  |
| Framing Format  | A           | Yes   | 20.x  |
| Clear Channel   | B           | Yes   | c.xx  |
| NLP Off   | C           | Yes   | n.xx  |
| NLP On  | D           | Yes   | n.xx  |
| Clear Channel Status                                  | E           | Yes   | c.xx  |
| Test Configurations                                   | F           | Yes   | LPb.1-5                                     |
| In-Service  | G           | Yes   | LPb.0                                       |
| H-Hold On   | H           | Yes   | None  |
| H-Hold Off  | I           | Yes   | None  |
| continued . . .                                       |             |   |   |

Table 7-1 ASCII Command Set

| Command  | ASCII Char. | 81.2551X Compatible?  | Front Panel Mode             |
|--|-------------|---|------------------------------|
| Busy/Idle Status                                     | J           | Yes   | None                         |
| Forced Active Status                                 | K           | Yes   | c.xx                         |
| Endpath Delay/ERL                                    | L           | Yes   | 50.x/42.x                    |
| Alarm Status   | M           | Yes   | Front panel LEDs             |
| Forced Active  | N           | Yes   | c.xx                         |
| Alarm Cut Off  | O           | Yes   | <b>ACO</b> pushbutton        |
| Re-Run Power-Up Diagnostics                          | P           | Yes   | None                         |
| H-Reset Off  | Q           | Yes   | None                         |
| H-Reset On   | R           | Yes   | None                         |
| Single Channel Status                                | S           | Yes   | None                         |
| Self-Test Result Status                              | T           | Yes   | Front panel displays         |
| CCS Busy   | U           | Yes   | None                         |
| Disable CCS  | V           | Yes   | None                         |
| CCS Idle   | W           | Yes   | None                         |
| Line Coding/F-Bit Error/CO Equalizer/Fault Operation | X           | Yes<br>(Exception: Mode 61.x is not<br>81.2551X compatible) | 60.x/61.x/62.x/<br>10.x,11.x |
| CCS Busy/Idle Status                                 | Y           | Yes   | None                         |
| Module Configuration Status                          | Z           | Yes   | None                         |
| CAS/Idle Code Control                                | [           | Yes   | 63.x/64.x/65.x/67.x          |
| NLP Operation During Doubletalk                      | \           | Yes   | 40.x                         |
| Data Tone Disabler Release Mode Control              | ]           | Yes   | 71.x                         |
| Disabling Tone Detected Status                       | —           | Yes   | None                         |

**Table 7-1 ASCII Command Set**

## 8. Performance Monitoring

This section describes:

- Performance monitoring capabilities of the 257X Module
- Statistics gathered by the 257X Module

### Basic Operation

The module gathers performance statistics for the T1 facilities as summarized in Table 8-1. These statistics can be accessed through the SCPs via either the maintenance menus or the ASCII commands. See Section 7.

| Statistics               |  |
|--------------------------|--|
| Errored seconds          | Loss of signal events                                      |
| Bursty-errored seconds   | Loss of frame sync events                                  |
| severely-errored seconds | Framing bit error events (when Mode 20 is optioned for SF) |
| Unavailable seconds      | ESF CRC error events (when Mode 20 is optioned for ESF)    |
| Loss of frame events     | Bipolar coding violations                                  |
| Slip events (seconds)    | Current status   |
| Error events             |  |

**Table 8-1 Performance Monitoring Summary**

### Errored Seconds

This performance parameter is defined as the total number of seconds during which an error event occurred on a given port. Errored seconds are not counted during unavailable seconds. This count is defined since the performance log was last reset (or power was applied to the module).

### Bursty-Errored Seconds

This performance parameter is a count of seconds during which the error event counter was incremented by greater than one, but less than 320. Bursty-errored seconds are not counted during unavailable seconds.

### Severely-Errored Seconds

This performance parameter is defined as the total number of seconds during which the errored event counter was incremented by 320 or more or if a loss of frame occurred during that one-second interval on a given port. Severely-errored seconds are not counted during unavailable seconds.

### Unavailable Seconds

This performance parameter is defined as the total number of seconds during which the port is in an unavailable state. This count reflects the 10 consecutive seconds during which the unavailable state was integrated, but does not reflect the 10 consecutive nonseverely-errored seconds during which the unavailable state was being de-integrated.

### Loss of Frame Events

This performance parameter is defined as the total number of times a local or Alarm Indication Signal (AIS) condition is declared on each port.

## **Slip Events (Seconds)**

This performance parameter is defined as the total number of controlled slips (either skips or repeats) between the Send and Receive ports since the performance log was last reset (or power was applied to the module).

---

## **Error Events**

This performance parameter is defined as the total number of CRC and Out-Of-Frame (OOF) error events in ESF, or the total number of framing bit errors and OOF error events in SF, for a given port since the performance log was last reset (or power was applied to the module).

---

## **Loss of Signal Events**

This performance parameter is defined as the total number of loss occurrences for the T1 signal or carrier.

---

## **Loss of Frame Sync Events**

This performance parameter is defined as the total number of complete losses of frame synchronization for a given port since the performance log was last reset (or power was applied to the module). When loss of frame synchronization occurs, the count is incremented by one. The time between loss of frame synchronization and regaining synchronization is considered to be an OOF period.

---

## **Framing Bit Error Events (Mode 20, Option SF) or ESF CRC Error Events (Mode 20, Option ESF)**

This performance parameter is defined as the total number of framing bits detected in error for a given port since the performance log was last reset (or power was applied to the module).

---

## **Bipolar Coding Violations**

This performance parameter is defined as the total number of BPVs detected for a given port since the performance log was last reset (or power was applied to the module).

---

## **Current Status**

The current status parameter declares the port to be either clear or unavailable. The port is initially declared to be clear. After 10 consecutive severely-errored seconds, it is declared unavailable. It remains unavailable until 10 consecutive nonseverely-errored seconds have occurred before returning to the clear state.

---

## 9. PCM Alarms

---

This section describes:

- System alarms
- Automatic self-test
- PCM alarms
- Alarm cut off
- Alarm history
- Error codes
- Front panel display timeout indications

---

### System Alarms

The 257X Module provides two system level alarms: major and minor. LED indicators for both alarms can be found on the front panel of the 2555/A Module. Two sets of Form-C relay contact closures can be found for both alarms on the rear of the 253, 255, and 257 Shelves (see the appropriate shelf technical manuals for more details).

#### Major Alarm

A major alarm is activated if any of the following events occur:

- Automatic self-test failure on all 24 channels
- Local alarm at the Send- or Receive-in port
- Failure of both power feeds

#### Minor Alarm

A minor alarm is activated if any of the following events occur:

- Automatic self-test failure on less than 24 channels
- Remote alarm at the Send- or Receive-in port
- AIS at the Send- or Receive-in port

---

### Automatic Self-Test

When the 257X Module determines that a channel is bypassed for any reason — e.g., detection of disabling tones — self-test is performed on the echo cancellation circuitry associated with the idle channel. Self-test immediately stops once the channel is determined to be active.

Self-test failure causes the following to occur:

- F appears in the top display
- Failing channel number(s) appears in the bottom display
- **fault** LED is lit
- Minor alarm relay is activated

Self-test failure on all 24 channels causes the following to occur:

- F appears in the top display
- 00 appears in bottom display
- **fault** LED is lit
- Major alarm relay is activated

The failing channel(s) remains bypassed (no echo cancellation) for the duration of the failure. Since no active echo cancellation occurs, the module with a failing channel(s) should be removed from service and replaced as soon as possible to reduce the possibility of echo complaints.

An intermittent self-test failure causes the following to occur:

- F flashes in the top display
- Failed channel number(s) flash in the bottom display
- **ACO** LED flashes

Although intermittent self-test failure indications can be cleared by pressing the **ACO** push-button for at least one second, an intermittent failure should be treated as a fault condition and the module should be returned to Tellabs for service. See Section 15.

## PCM Alarms

The 257X Module behaves much like network transmission equipment; that is, declaration of an alarm at the Send-in port results only in consequent alarm transmission at the Send-out port. Likewise, the declaration of an alarm at the Receive-in port causes a consequent alarm only at the Receive-out port.

The 257X Module detects local, remote, and AIS conditions at the Send- and Receive-in ports, and declares these alarms as outlined below:

- A local alarm is caused by lack of framing or signal at the Send- or Receive-in port.
- A remote alarm indication is the result of the module detecting consecutive bit 2s in the high (1) state when it is optioned for standard frame, or the detection of the yellow alarm pattern (a repeated pattern of eight zeros and eight ones) in the facility data link when optioned for ESF.
- An AIS condition is the result of the detection of unframed all ones.

Alarm indications, consequent actions, and resulting system alarms are listed in Table 9-1.

| Port       | Alarm LED Indication | Probable Cause   | Consequent Action                                | System Alarm |
|------------|----------------------|--|--|--------------|
| Send-in    | Local                | Lack of signal or framing at the Send-in port of the module                              | AIS (all ones) transmitted at Send-out port      | Major        |
|            | Remote               | Lack of signal or framing at the near end terminating equipment (channel bank or switch) | Remote alarm transmitted at the Send-out port    | Minor        |
|            | AIS                  | Lack of signal or framing at upstream transmission equipment in the near end facility    | AIS transmitted at the Send-out port             | Minor        |
| Receive-in | Local                | Lack of signal or framing at the Receive-in port (long-haul side) of the module          | AIS transmitted at the Receive-out port          | Major        |
|            | Remote               | Lack of signal or framing at the far end terminating equipment                           | Remote alarm transmitted at the Receive-out port | Minor        |
|            | AIS                  | Lack of signal or framing at transmission equipment in the long-haul facility            | AIS transmitted at the Receive-out port          | Minor        |

**Table 9-1 Alarm Indications and Consequent Actions**



## Alarm Cut Off

Major and minor alarm relays can be restored to their normal state by pressing the **ACO** pushbutton on the front panel of the 257X Module or 2555/A Module. The **ACO** LED lights when ACO has been activated. ACO may also be activated from the SCPs via the menus or an ASCII command.

## Alarm History

When the **ACO** LED is flashing, the 257X Module has captured an intermittent alarm. To view alarms that have occurred but are no longer present, press and hold the **ACO** pushbutton. The module performs lamp test and then the appropriate PCM alarm LEDs light to indicate the last alarm detected at the Send- and Receive-in ports. The 9.xy code also appears in the lower display. The x represents the Receive-in port and y represents the Send-in port. Table 9-2 lists the xy codes that are displayed.

| xy | Last Alarm Detected |
|----|---------------------|
| 0  | No previous alarm   |
| 1  | Loss of signal      |
| 2  | Loss of framing     |
| 3  | Remote              |
| 4  | AIS                 |

**Table 9-2 Intermittent Alarm (xy) Codes**

The last alarm detected status is always cleared when the **ACO** pushbutton is released following display of the last alarm detected status.

Intermittent automatic self-test failure indications are cleared when the alarm history is accessed via the **ACO** pushbutton.

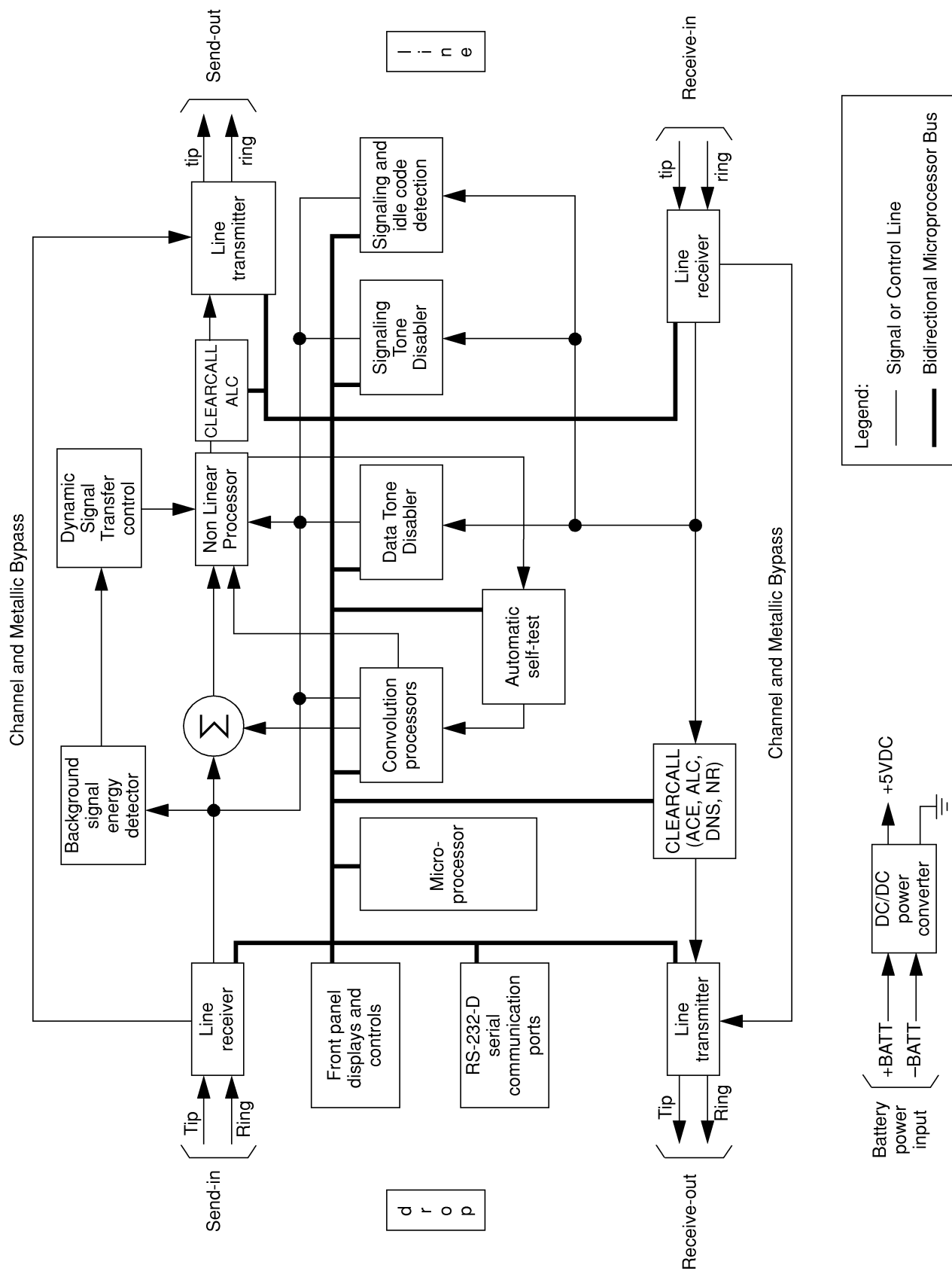
## Error Codes

| Error Code | Explanation   |
|------------|---|
| E.40       | This error code is displayed if the 257X Module has detected that CAS and MBLT Framing have been selected concurrently.<br>Note: MBLT Framing does not support CAS. |
| E.60       | This error code is displayed if the 257X Module has detected that one power feed has failed.  |

## Front Panel Display Timeout Indications

| Indication | Explanation   |
|------------|---|
| L 1        | This indication is displayed if the 257X Module is in Facility Loopback Functional Test Mode at timeout.          |
| L 2        | This indication is displayed if the 257X Module is in Clear Channel Transparency Functional Test Mode at timeout. |
| L 3        | This indication is displayed if the 257X Module is in Metallic Bypass Functional Test Mode at timeout.            |
| L 4        | This indication is displayed if the 257X Module is in Drop Payload Loopback Functional Test Mode at timeout.      |
| L 5        | This indication is displayed if the 257X Module is in Line Payload Loopback Functional Test Mode at timeout.      |

## 10. Block Diagram



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## 11. Circuit Description

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This section will familiarize you with the 257X Module for applications purposes only. Attempts to troubleshoot the module at the component level are strongly discouraged and will void your Tellabs warranty.

---

### Receive Path

Incoming T1 is converted from bipolar T1 to Complementary Metal Oxide Semiconductor (CMOS) levels by the line receiver. The line receiver derives clock and recovers data and frame alignment from the Receive-in port. Once frame alignment has been achieved, the 24 voice channels and their associated signaling can be extracted.

The aligned Receive data, referred to as X signal, is used by the convolution processors to generate the echo estimate. The convolution processors are Application Specific Integrated Circuits (ASIC) that have been developed by Tellabs specifically for echo cancellation.

The Receive path's line transmitter takes the same clock and data present at the output of the line receiver and converts it back to bipolar form suitable for transmission at the Receive-out port.

The CO Equalization Mode affects the amplitude of the outgoing bipolar pulses generated by the line receiver. The Framing Format and Line Coding Modes affect the manner in which the line receiver and line transmitter interface to the T1 bit stream.

---

### Send Path

The Send path line receiver and line transmitter circuits operate in the same manner as the Receive path circuitry. The Send path contains the digital signal processing circuitry that removes echo from all 24 channels. When the module detects that a channel is no longer idle, it begins the convergence process and very rapidly computes a precise model of the endpath's impulse response. This model becomes the R signal, which is then subtracted from the Send-in or Y signal. The result is the almost echo-free E signal.

Due to limitations of the eight-bit PCM used on T1 facilities, the E signal from the convolution processor still contains some echo. The small amount of echo that remains, known as residual echo, is removed by the NLP. The NLP present on the 257X Module includes a control circuit unique to Tellabs echo cancellers. DST control adjusts the NLP thresholds continuously to provide background signal transparency and to eliminate the noise pumping, distortion, and squelching associated with traditional NLP designs.

---

### Tone Disabling

The standard tone disabler independently monitors each channel of the Send and Receive paths for the presence of 2100Hz disabling tones. The Data Tone Disabler can be optioned for G.164 or G.165 operation. When the tone disabler is optioned for G.164 operation, the detection of a 2100Hz disabling tone just prior to the data transmission causes the microprocessor to bypass voice band data around all signal processing circuitry, including the convolution processors and the NLP. After data transmission has started, the tone disabler monitors the data transmission level. If the tone disabler has been optioned for Hold-Band, the microprocessor continues to bypass the data as long as the data transmission level is within the tone disabler's Hold-Band range.

When optioned for G.165, bypass occurs only if the 2100Hz disabling tone includes periodic phase reversals; disabling tones without phase reversals do not disable the echo cancellation circuitry.

The 257X Module can be optioned to detect 2400/2600Hz tones used by ITU-T No. 5 signaling, or the 2000Hz VPA check tones used by ITU-T No. 6 and No. 7 signaling.

## Signaling and Idlecode Detection

Depending on the method of busy/idle detection selected, the Signaling and Idlecode Detection circuitry monitors each channel's A and B signaling bits or monitors for the presence of idle code. When a channel is determined to be idle or tone disabled, the microprocessor starts automatic self-test of the convolution processor and NLP circuitry associated with the idle channel. As soon as the channel is busy, the microprocessor stops self-test and enables echo cancellation.

## 12. Acceptance Testing

---

This section provides the recommended procedures for implementing acceptance tests for the following echo canceller functions:

- A and B signaling
- Idlecode detection
- Tone disabling
- Echo cancellation

---

### A and B Signaling

To ensure that the 257X Module is recognizing the presence of A and B signaling:

1. Push the **Mode** pushbutton repeatedly until c.00 appears in the top display. Use the **Chan** pushbutton to select the desired channel under test.
2. Toggle the A and B signaling bits on the Send and Receive PCM streams. When the module is optioned for CAS, the **cancelr active** LED lights when A or B is equal to one.
3. Refer back to Table 6-3 for foreign exchange signaling busy/idle detection.

---

### Idlecode Detection

To ensure that the 257X Module has been optioned for the correct idle code pattern:

1. Verify that the **cancelr active** LED is off when no call is in progress on the channel under test.
2. Place a call on the channel under test and verify that the **cancelr active** LED lights.

---

### Tone Disabling

To test the tone disabler for proper operation, perform the following steps:

1. Activate cancellation on the channel under test via the A and B signaling bits. The **cancelr active** LED lights.
2. Apply a tone in the range of 2010 to 2240Hz to the channel under test at the Send-in port. The **cancelr active** LED extinguishes.
3. Repeat this procedure at the Receive-in port.

## Echo Return Loss Enhancement Test

To ensure that the echo cancellation circuitry is operating correctly, perform the following test. With the module connected as shown in Figure 12-1, 32dB of echo cancellation should be obtained with the NLP disabled.

1. Disable the NLP.
2. Place the channel under test in the idle state via the A and B signaling bits or idle code.
3. Set the attenuator for 10dB of loss.
4. Set the noise generator for 5kHz bandwidth and two-sigma clipping level. Verify that all transmission level point shifts have been taken into account.
5. Adjust the noise generator for a 80dBrc0 output level. The transmission measurement set should now read 70dBrc0.
6. Activate cancellation via the A and B signaling bits. Allow time for full convergence. The transmission measurement set should read less than or equal to 38dBrc0.

**Note:** If the module has been optioned for Idlecode Detection, 34dB of ERLE should be obtained; that is, the transmission measurement set should read less than or equal to 36dBrc0.

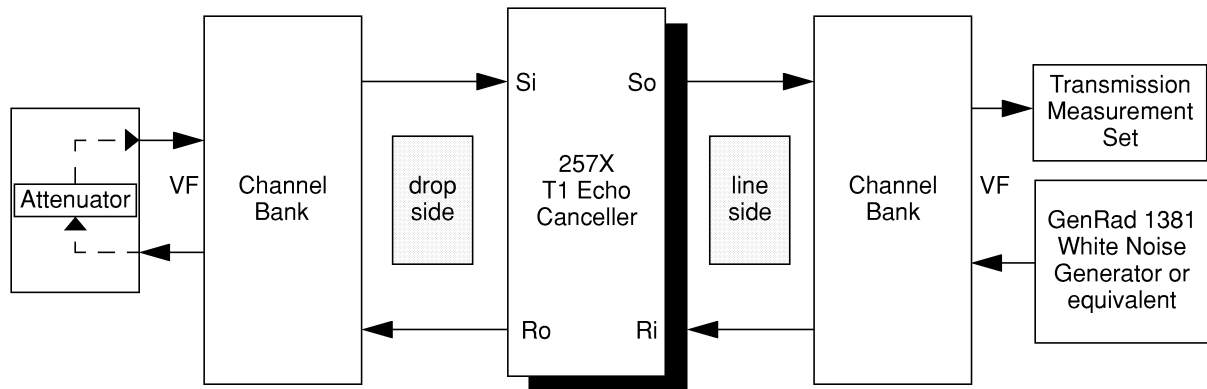


Figure 12-1 Echo Cancellation Test Diagram

## 13. Module Specifications

### Cancellation Circuits

|                                       |   |
|---------------------------------------|---|
| <i>ERLE</i>                           | <ul style="list-style-type: none"> <li>• &gt;34dB with no A/B signaling</li> <li>• &gt;32dB with A/B signaling</li> <li>• Infinite with NLP enabled</li> </ul>                |
| <i>Minimum ERL</i>                    | <ul style="list-style-type: none"> <li>• 0, 3, or 6dB minimum (user selectable)</li> </ul>  |
| <i>Convergence Rate</i>               | <ul style="list-style-type: none"> <li>• &gt;30dB of combined ERL + ERLE (Acom) in 50ms</li> </ul>  |
| <i>Maximum Endpath Delay</i>          | <ul style="list-style-type: none"> <li>• 2571 Module — 32ms (expandable to 64ms with 2574G)</li> <li>• 2572 Module — 64ms (expandable to 96ms or 128ms with 2574H)</li> </ul> |
| <i>Background Signal Transparency</i> | <ul style="list-style-type: none"> <li>• Via DST non linear processing</li> </ul>   |
| <i>Channel Self-Test</i>              | <ul style="list-style-type: none"> <li>• Automatic comprehensive self-test of echo cancellation circuitry when channel is idle</li> </ul>                                     |

continued . . .

## Busy/Idle Control

|                        |   |
|------------------------|---|
| <i>In-Band Control</i> | <ul style="list-style-type: none"> <li>• A/B signaling bits (E&amp;M or foreign exchange)</li> <li>• Idle codes (F7, 7F, FF, or 7F/FF)</li> </ul> |
| <i>Remote Control</i>  | <ul style="list-style-type: none"> <li>• ASCII commands via a RS-232-D compatible SCP</li> </ul>  |

## Channel Disabling

|   |   |
|---|---|
| <i>Voice Band Data</i>                      | <ul style="list-style-type: none"> <li>• Per ITU-T G.164 or G.165 (user selectable)</li> <li>• Fully compliant with ITU-T Recommendation G.168</li> </ul> |
| <i>Switched-56</i>                          | <ul style="list-style-type: none"> <li>• Via bit-8 2100Hz monitoring</li> </ul>   |
| <i>ITU-T No. 5 Signaling</i>                | <ul style="list-style-type: none"> <li>• 2400/2600Hz tones</li> </ul>   |
| <i>ITU-T No. 6 and No. 7 VPA Check Tone</i> | <ul style="list-style-type: none"> <li>• 2000Hz tones</li> </ul>  |

## Network Interface

|   |  |
|---|--|
| <i>Line Rate</i>                        | <ul style="list-style-type: none"> <li>• 1.544Mbit/s</li> </ul>  |
| <i>Framing Format</i>                   | <ul style="list-style-type: none"> <li>• Standard SF per ITU-T G.733, ANSI T1.403</li> <li>• ESF per ANSI T1.403</li> <li>• Ericsson MBLT Framing</li> </ul> |
| <i>Line Coding</i>                      | <ul style="list-style-type: none"> <li>• AMI with bit 7 stuffing, AMI transparent, or B8ZS</li> </ul>  |
| <i>PCM Encoding</i>                     | <ul style="list-style-type: none"> <li>• Segmented <math>\mu</math>law per ITU-T G.711</li> </ul>  |
| <i>Input Level</i>                      | <ul style="list-style-type: none"> <li>• 0.75V to 3.7V base to peak</li> </ul>   |
| <i>Output Level</i>                     | <ul style="list-style-type: none"> <li>• 3V to 6V base to peak, adjustable</li> </ul>  |
| <i>Jitter Tolerance</i>                 | <ul style="list-style-type: none"> <li>• Per AT&amp;T 62411, December, 1991</li> </ul>   |
| <i>Port Impedances</i>                  | <ul style="list-style-type: none"> <li>• 100 percent nominal, balanced per ITU-T G.703, ANSI T1.403</li> </ul>   |
| <i>Performance Monitoring</i>           | <ul style="list-style-type: none"> <li>• Per ANSI T1.403 and T1.231</li> </ul>   |
| <i>Alarm Detection and Transmission</i> | <ul style="list-style-type: none"> <li>• Per Bellcore TA-TSY-000191</li> </ul>   |

## Serial Communications Ports

|                                      |   |
|--------------------------------------|---|
| <i>Signal Format</i>                 | <ul style="list-style-type: none"> <li>• Serial transmission compatible with Electronics Industries Association (EIA) standard RS-232-D (ITU-T V.24)</li> </ul> |
| <i>Control and Maintenance Ports</i> | <ul style="list-style-type: none"> <li>• Seven-bit, even parity, one stop bit, one start bit; 1200 to 38.4kbit/s (user selectable)</li> </ul>                   |
| <i>Machine-to-Machine Interface</i>  | <ul style="list-style-type: none"> <li>• ASCII commands</li> </ul>  |
| <i>User Interface</i>                | <ul style="list-style-type: none"> <li>• English-text maintenance menus</li> </ul>  |

## Electrical

|                            |   |
|----------------------------|---|
| <i>Power Consumption</i>   | <ul style="list-style-type: none"> <li>• 2571 Module — 6.24W typical; 9W maximum</li> <li>• 2572 Module — 8.25W typical; 11W maximum</li> </ul> |
| <i>Input Voltage Range</i> | <ul style="list-style-type: none"> <li>• -44 to -56VDC</li> </ul>   |

## Physical

|                                 |  |
|---------------------------------|--|
| <i>Dimensions (each module)</i> | <ul style="list-style-type: none"> <li>• Height: 6.5 inches (165mm)</li> <li>• Width: 1.0 inch (25.4mm)</li> <li>• Depth: 12.9 inches (327mm)</li> </ul> |
| <i>Weight (each module)</i>     | <ul style="list-style-type: none"> <li>• 1.8 pounds (816g)</li> </ul>  |

continued . . .

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**Environmental**


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*Operating Temperature* • +32° to +122° F (0° to +50° C)

*Shipping and Storage Temperature* • –58° to +185° F (–50° to +85° C)

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**14. Acronyms**


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The following is a list of acronyms used throughout this document.

|       |  |
|-------|--|
| ACE   | Acoustic Coupling Elimination                      |
| ACO   | Alarm Cut Off                                      |
| AIS   | Alarm Indication Signal                            |
| ALC   | Automatic Level Control                            |
| AMI   | Alternate Mark Inversion                           |
| ANSI  | American National Standards Institute              |
| ASCII | American Standard Code for Information Interchange |
| ASIC  | Application Specific Integrated Circuit            |
| B8ZS  | Binary Eight With Zero Substitution                |
| BPV   | Bipolar Violation                                  |
| CAS   | Channel Associated Signaling                       |
| CDMA  | Code Division Multiple Access                      |
| CCS   | Common Channel Signaling                           |
| CED   | Called station identification                      |
| CMOS  | Complementary Metal Oxide Semiconductor            |
| CO    | Central Office                                     |
| CRC   | Cyclic Redundancy Check                            |
| DCE   | Data Communications Equipment                      |
| DNS   | Dynamic Noise Substitution                         |
| DS1   | Digital Signal Level One                           |
| DST   | Dynamic Signal Transfer                            |
| DSU   | Data Service Unit                                  |
| DSX   | Digital Signal Cross-Connect                       |
| DTE   | Data Terminal Equipment                            |
| EIA   | Electronics Industries Association                 |
| EMI   | Electromagnetic Interference                       |
| ERL   | Echo Return Loss                                   |
| ERLE  | Echo Return Loss Enhancement                       |

continued . . .

|                |   |
|----------------|---|
| ESF            | Extended Superframe   |
| F <sub>s</sub> | Framing Synchronization Bit   |
| F <sub>t</sub> | Framing Terminal Bit  |
| FCC            | Federal Communications Commission   |
| FXO-GS         | Foreign Exchange Office-End With Ground Start Operation                           |
| FXO-LS         | Foreign Exchange Office-End With Loop Start Operation                             |
| FXS-GS         | Foreign Exchange Station-End With Ground Start Operation                          |
| FXS-LS         | Foreign Exchange Station-End With Loop Start Operation                            |
| GSM            | Global System for Mobile Communications   |
| ISDN           | Integrated Services Digital Network   |
| ISUP           | ISDN User Part  |
| ITU-T          | International Telecommunications Union — Telecommunication Standardization Sector |
| MBLT           | Mobile Both-way Line Termination  |
| MF             | Multifrequency  |
| MRA            | Material Return Authorization   |
| NLP            | Non Linear Processor  |
| NR             | Noise Reduction   |
| OOF            | Out-Of-Frame  |
| PCM            | Pulse Code Modulation   |
| PSTN           | Public Switched Telephone Network   |
| ROM            | Read-Only Memory  |
| SCP            | Serial Communications Port  |
| SF             | Standard Superframe   |
| TAL            | Target Audio Level  |
| TDMA           | Time Division Multiple Access   |
| VBE            | Voice Band Enhancement  |
| VPA            | Voice Path Assurance Check Tone   |
| WAEPL          | Weighted Acoustic Echo Path Loss  |

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## 15. Technical Assistance, Repair and Return

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For acceptance testing procedures, see Section 12. If a situation arises that is not covered in this document, contact Tellabs Technical Assistance. The Technical Assistance table on page 49 provides phone numbers.

If when testing the equipment it seems to be defective, substitute new equipment (if possible) and test the substitute. If the substitute operates correctly, the original should be considered defective and returned to Tellabs as directed under **Repair and Return** on page 50.

We strongly recommend that no internal (component-level) testing or repairs be attempted on the equipment; unauthorized testing or repairs may void its warranty.



## Technical Assistance

Contact Tellabs Technical Assistance as follows:

| Location  | Telephone                                       | FAX                |
|---|---|--------------------|
| <b>Argentina</b> — Tellabs International, Inc., Sucursal Buenos Aires   | +54.11.4345.9000                                | +54.11.4345.9601   |
| <b>Australia</b> — Tellabs Pty Ltd., Milson's Point NSW, Sydney   | +61.2.9966.1043                                 | +61.2.9966.1038    |
| <b>Austria</b> — Tellabs Austria, Vienna, Austria   | +43.1.516.333.123 or .146                       | +43.1.516.333.037  |
| <b>Brazil</b> — Tellabs International, Inc., Rio de Janeiro   | +55.21.518.2224                                 | +55.21.516.7063    |
| <b>Brazil</b> — Tellabs International, Inc., Sao Paulo  | +55.11.5505.3009                                | +55.11.5506.7175   |
| <b>Canada</b> — Tellabs Comm. Canada Ltd., Mississauga, Ontario   | 905.858.2058                                    | 905.858.0418       |
| <b>China</b> — Tellabs International, Inc., Beijing   | +86.10.6510.1871                                | +86.10.6510.1872   |
| <b>China</b> — Tellabs International, Inc., Shanghai  | +86.21.6218.8660                                | +86.21.6218.8999   |
| <b>Colombia</b> — Tellabs International, Santa Fe de Bogota   | +571.623.3162 or .3216                          | +571.623.3047      |
| <b>Dubai</b> — Tellabs International, Dubai, U.A.E.   | +971.4.819608                                   | +971.4.819606      |
| <b>England</b> — Tellabs U.K. Ltd., Bucks   | +44.1494.555800                                 | +44.1494.555801    |
| <b>Finland</b> — Tellabs Oy, Espoo  | +358.9.413.121-main #                           | +358.9.4131.2815   |
| <b>France</b> — Tellabs SAS, Guyancourt   | +33.1.345.20838                                 | +33.1.309.60170    |
| <b>Germany</b> — Tellabs GmbH, Munich   | +49.89.54.90.05.+ext. or 0 (switchboard)        | +49.89.54.90.05.44 |
| <b>Hong Kong</b> — Tellabs H.K. Ltd.  | +852.2821.9100                                  | +852.2866.2965     |
| <b>Hungary</b> — Tellabs GmbH Rep. Office, Budapest   | +36.1.2681220                                   | +36.1.2681222      |
| <b>India</b> — Tellabs International, Inc., Bangalore   | +91.80.2261807, .2266850, .2250456, or .2253373 | +91.80.2262170     |
| <b>India</b> — Tellabs International, Inc., New Delhi   | +91.11.6859824, .6522417, or .6960702           | +91.11.6526931     |
| <b>Ireland</b> — Tellabs, Ltd., County Clare  | +353.61.703000                                  | +353.61.703333     |
| <b>Italy</b> — Tellabs Italia SRL, Roma   | +39.6.367.12335                                 | +39.6.367.12502    |
| <b>Japan</b> — Tellabs International, Inc., Tokyo   | +81.03.5408.3721                                | +81.03.5401.0911   |
| <b>Lebanon</b> — Tellabs Oy, Dbayah   | +961.4.525.929                                  | +961.4.525.171     |
| <b>Mexico</b> — Tellabs de Mexico   | +525.241.9800                                   | +525.241.9801      |
| <b>Netherlands</b> — Tellabs Netherlands b.v.   | +31.30.6004070                                  | +31.30.6004090     |
| <b>Philippines</b> — Tellabs International, Inc., Sucat, Muntinlupa City  | +63.2.838.0970                                  | —                  |
| <b>Singapore</b> — Tellabs Singapore Pte, Ltd.  | +65.336.7611                                    | +65.336.7622       |
| <b>Republic of South Africa</b> — Tellabs Pty Ltd., Hennopsmeer   | +27.12.672.8025                                 | +27.12.672.8024    |
| <b>South Korea</b> — Tellabs International, Inc., Seoul   | +82.2.589.0667                                  | +82.2.589.0669     |
| <b>Spain</b> — Tellabs Southern Europe s.a., Madrid   | +34.91.323.9920                                 | +34.91.315.7770    |
| <b>Sweden</b> — Tellabs AB, Stockholm   | +46.8.440.4340                                  | +46.8.440.4341     |
| <b>Thailand</b> — Tellabs International, Inc., Bangkok  | +662.642.7817                                   | +662.642.7820      |
| <b>USA and Puerto Rico</b>  | 800.443.5555*                                   | 630.512.7097       |
| *All other <b>Caribbean</b> and <b>South American</b> locations, or if the toll-free number is busy, telephone 630.378.8800 |   |                    |

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## Repair and Return

If equipment needs repair, contact Tellabs' Product Services Department with the equipment's model and issue numbers and warranty date code. You will be issued a Material Return Authorization (MRA) number and instructions on how and where to return the equipment.


| Location  | Telephone   | FAX                 |
|---|---|---------------------|
| <b>Finland</b> — Tellabs Oy, Espoo                              | +358.9.413.121-main #   | +358.9.4131.2815    |
| <b>Canada</b> — Tellabs Comm. Canada Ltd., Mississauga, Ontario | 905.858.2058  | 905.858.0418        |
| <b>Ireland</b> — Tellabs, Ltd., County Clare                    | +353.61.703000  | +353.61.703333      |
| <b>Lisle, IL USA</b> — Tellabs Operations, Inc.                 | 800.443.5555 (USA and Puerto Rico only)<br>630.378.8800 (other International) | 630.512.7097 (both) |

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Repair service includes an attempt to remove any permanent markings made by customers on Tellabs equipment. If equipment must be marked, it should be done with nonpermanent materials and in a manner consistent with the correct handling of electrostatically sensitive devices.



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