Total Access® OC-3 L3 Multiplexer
Installation and Maintenance Practice

CONTENTS

FIGURES

TABLES

1. GENERAL

This practice is an installation and maintenance guide for the ADTRAN Total Access OC-3 (List 3) Multiplexer common module with 28 DS1s and Dual DS3 Add and Drops. The Total Access OC-3 Multiplexer (OC-3 MUX) is illustrated in **Figure 1**.

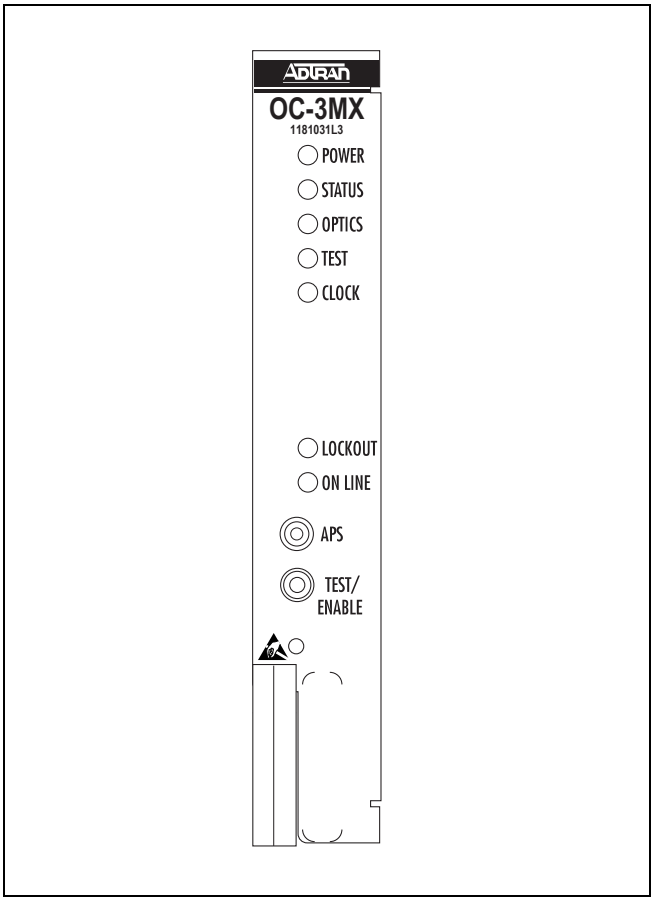


Figure 1. OC-3 MUX

Revision History

This is the initial issue of this practice. Future revisions will be noted in this subsection.

NOTE

References to common, but differing, parameters between the Total Access 3000 and the Total Access 3010, such as number of slots, will be conveyed by the convention a/b. The "a" represents the Total Access 3000 parameter and the "b" represents the Total Access 3010 parameter. For example, the differing number of access slots in the two platforms, 28 for the Total Access 3000 and 22 for the Total Access 3010, would be displayed "28/22."

Features

The OC-3 MUX module (P/N 1181031L3) includes the following features:

- Grooms any one of the three STS-1s within the OC-3 signal, between two standard DS3 interfaces, or 28 DS1 channels (M13 Multiplexer).
- Provides transmit and receive coaxial interfaces via two standard DS3 (44.736 Mb/s). Requires use of Quad BNC module (P/N 1181007L1 or L2).
- Carries DS3 contents via each STS-1, where one STS-1 can be demultiplexed into 28 DS1 channels (VTs not supported).
- Detects and indicates standard SONET alarms and loopback conditions and supports detection and indication of chosen DS3-level alarms and loopback conditions.
- Provides timing modes: External, DS-1, Line from OC-3.
- Provides SONET Minimum Clock (SMC) with ±20 ppm accuracy.
- Supports S1 synchronization status messages on the OC-3 interface.
- Provides a 1+1 OC-3 equipment and facility protection switching relationship.
- Provides a 1:1 DS3 equipment protection switching relationship.
- Supports protection switching of DS3 and DS1 drops on SONET facility, path, and equipment faults.
- Supports OC-3 terminal point-to-point mode only.
- Provides OAM&P interface via System Controller Unit (SCU) OS interface.
- Supports TL1 and SNMP management.
- Provides OC-3 facility (line) and terminal (local) loopback modes.
- Provides DS3 facility and terminal loopback modes.
- Provides a 1:1 access module protection relationship.
- Offers DCC capability on the OC-3 interfaces to provide remote management through TL1 over SONET network.
- Includes the following front panel-mounted controls: APS (Automatic Protection Switching), TEST/ENABLE
- Operates over a standard temperature range of –40ºC to +65ºC.
- Automatically detects operation in Total Access 3000/3010 shelf.
- Meets NEBS Level 3, GR-1089-CORE, and UL 1950 requirements.
- Meets applicable SONET requirements (GR-253-CORE).
- Provides full Performance Monitoring at OC-3 Section, Line, and Path Level.
- Provides Line Performance Monitoring at two subtended DS3s.
- Offers software-upload capability.

2. INSTALLATION

CAUTION!

SUBJECT TO ELECTROSTATIC DAMAGE OR DECREASE IN RELIABILITY.

HANDLING PRECAUTIONS REQUIRED.

After unpacking the OC-3 MUX, inspect it for damage. If damage has occurred, file a claim with the carrier, then contact ADTRAN Customer Service (refer to *Warranty and Customer Service* on page 26). If possible, keep the original shipping container for returning the OC-3 MUX for repair or for verification of shipping damage.

Instructions for Installing the Module

The Total Access OC-3 MUX plugs directly into the Total Access 3000 (23-inch) shelf or the Total access 3010 (19-inch) shelf. Both are rack mounted chassis, with 28 access module slots on the Total Access 3000 and 22 access module slots on the Total Access 3010. Both chassis provide two multiplexer slots (A and B) and a system controller unit slot.

To install the OC-3 MUX, perform the following steps:

1. Pull the ejector tab on the bottom of the OC-3 MUX into the down position.
2. Hold the OC-3 MUX by the front panel while supporting the bottom edge of the access module and align the access module edge with the guide groove in the chassis.
3. Insert the OC-3 MUX halfway into the A or B slot.
4. Connect the RECEIVE fiber to the left SC connector.
5. Connect the TRANSMIT fiber to the right SC connector.

6. Route the fibers such that the fibers exit the MUX through the “notch” at the top of the front panel (See **Figure 2**).

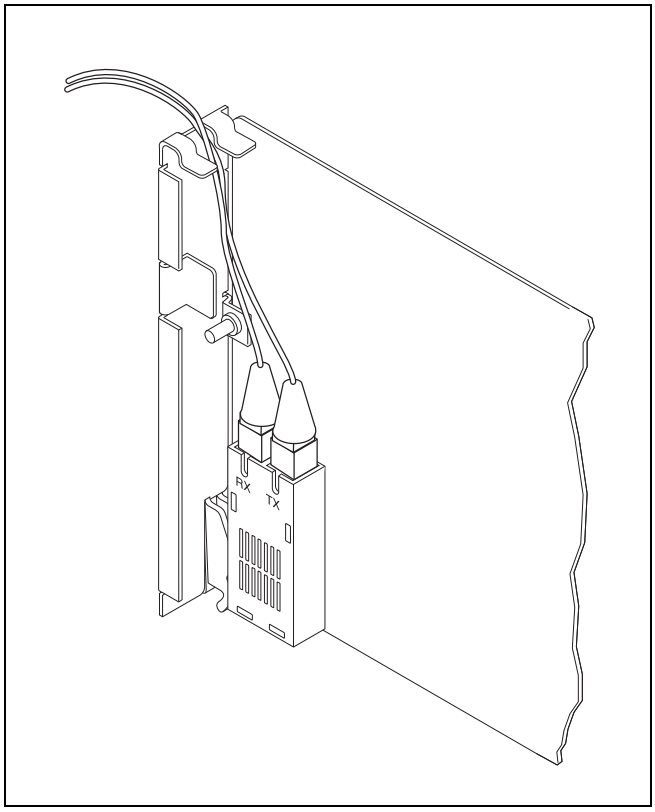


Figure 2. SC Connectors and Fiber Routing

7. Gently but firmly push the OC-3 MUX into the selected multiplexer slot (A or B), being careful not to pinch the fibers between the front panel and the shelf. Simultaneous thumb pressure at the top (above the POWER LED) and at the bottom of the unit will ensure a good seat of the module pins into the backplane connector.
8. Push the ejector tab up and closed against the OC-3 MUX module front panel.

NOTE

For DS3 Terminal Add-Drop operation, the Quad BNC module (P/N 1181007L1 or L2) is required.

Installing the Quad BNC Module

To install the Quad BNC module, attach the Quad BNC module to the lower right corner of the Total Access 3000/3010 backplane, connector J34/J20. For more information, refer to the *Quad BNC Installation and Maintenance Practice* (P/N 61181007L1-5 or 61181007L2-5).

Compliance

Table 1 shows the Compliance Codes for the Total Access **OC-3 MUX.** The **OC-3 MUX** is NRTL listed to the applicable UL standards, and is intended to be installed in Restricted Access Locations only, and only in type “B” or “E” equipment.

Table 1. Compliance Codes

Code	Input	Output
Power Code (PC)	F	C
Telecommunication Code (TC)	–	–
Installation Code (IC)	A	–

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by ADTRAN could void the user’s authority to operate this equipment.

Initial Installation Provisioning Options

Upon initial installation of the OC-3 MUX, the unit will be provisioned to factory default settings.

NOTE

Please refer to the *Factory Default Settings* on page 14

Auto-Provisioning

If Auto-Provisioning is enabled on the SCU, the provisioning of the last occupant of the multiplexer slot will be written to the OC-3 MUX upon installation (if the previous unit was of the same device type as the unit being installed).

Linked Provisioning

If the OC-3 MUX being installed is a standby unit and Linked Provisioning is enabled on both the active and standby units, the provisioning settings of the active unit will be written to the standby unit.

Auto-Provisioning will not overwrite Linked Provisioning settings received on installation. All subsequent provisioning changes are made through the SCU communications link.

3. OPERATION

The OC-3 MUX is a common module that serves as an OC-3 interface to the shelf and provides for the multiplexing/demultiplexing of two DS3s and 28 DS1s to/from the OC-3 signal. Each access module contains the interfaces and the appropriate circuitry to interface with the local loop.

The OC-3 MUX interfaces with a standard OC-3 signal from the network and provides logic-level signals to the access modules from one of the three STS-1s of the OC-3, which is groomed to the 28 DS1 channels. The remaining two STS-1s of OC-3 signal are converted into standard DS3 signals and returned to the network through the 75 Ω Quad BNC interface provided on the backplane. The STS-1 path must carry DS3 contents, and the card does not support VT mapping format.

NOTE

Transmit and receive ports of a DS3 interface not connected to a network should be disabled by unmapping it from an STS-1.

An STS-1 Mapper on the OC-3 MUX routes, as provisioned, two STS-1s of the OC-3 signal to the DS3 standard electrical interfaces. The STS-1 Mapper routes the third provisioned STS-1 to the STS-1/DS1 (M13) multiplexer/demultiplexer module located in the OC-3 MUX module. The STS-1 path terminated or originated by this STS-1/DS1 (M13) multiplexer/demultiplexer access module will be referenced hereafter in this document as DS1 Drops.

The OC-3 MUX will occupy either one or both of the multiplexer slots of the Total Access 3000/3010 chassis. In the dual configuration, the OC-3 MUXs will operate in a 1+1 relationship protection mode.

OC-3/Network Interface

Physical connection to the network interface is via dual SC connectors on the OC-3 MUX. Signal specifications are as follows:

- Fiber Type: Single mode
- Wavelength: 1310 nm
- Optical Budget: 13 dB (minimum)
- Transmit Level: –8 to –15 dBm
- Receive Level: –8 to –28 dBm
- Optics: Intermediate reach

DS3/Network Interface

Physical connections to the network interface are made on the Total Access backplane using two transmit/receiver pairs of 75 Ω BNC connectors.

Subtending Two Total Access 3000/3010 Shelves

The OC-3 MUX terminates one STS-1 path to the shelf in which it is installed. The other two STS-1 paths contained within the OC-3 may be provided to two additional shelves via the optional Quad BNC module (P/N 1181007L1 or L2) that connects to the backplane of the Total Access 3000/3010. Each subtended shelf must contain a DS3 MUX and an appropriate SCU. The subtended shelves accept the DS3 signal via an optional Dual BNC module (P/N 1181004L1). The RS-485 configuration is recommended for connecting subtended shelves in a "cluster topology."

NOTE

When implementing this configuration, the shelf that contains the OC-3 MUX must be equipped with an SCU configured as the "HOST" for the chain, and each subtended shelf must be equipped with SCUs configured as a "Client."

This configuration provides for a host/client or master/slave relationship between the shelves, with the shelf holding the host SCU being the host or master. Communication between shelves is via the RS-485 bus.

Power Interface

The Total Access 3000/3010 backplane delivers –48 VDC to the OC-3 MUX.

External Clock Interfaces

External clock interfaces to the OC-3 MUX are via wire-wrap pins on the Total Access 3000/3010 chassis backplane.

User/Supervisory Interface

Access to the OC-3 MUX is through the SCU, which provides a VT100 interface for a craft terminal.

Provisioning

All provisioning takes place through the SCU communication link. Onboard switches or jumpers are not

needed. The unit retains provisioning in a nonvolatile memory device.

DS3 Line Code
DS3 Line Code is B3ZS as defined in GR-253-CORE.

DS3 Line Build Out
DS3 Line Build Out (LBO) is provisionable as shown in **Table 2**.

Table 2. DS3 Line Build Out Provisioning

LBO	Distance	Option
734A/D	0 to 225 ft	Short
735A	0 to 125 ft	Short
734A/D	225 to 450 ft	Long
735A	125 to 250 ft	Long

Diagnostics
The OC-3 MUX monitors the OC-3 Section, Line, and the STS-1 Paths for the OC-3 and DS3 #1 and DS3 #2 incoming signals. The OC-3 MUX reports the status to the SCU for alarm processing.

Alarms
The following subsections explain the OC-3 MUX alarms.

Loss of Signal (LOS) and Loss of Frame (LOF)
LOS or LOF detected on the incoming OC-3 signal causes DS3 Alarm Indication Signal (AIS) to be substituted in the payloads of the two transmit DS3 signals and DS1 AIS to be sent toward the access modules.

LOS detected on the incoming DS3 signals causes DS3 AIS to be substituted in the payload of the connected STS-1.

LOF detected on the incoming DS3 signal, which is dropped to the local shelf, generates a DS1 AIS toward the access modules.

AIS
Detection of Line AIS on incoming OC-3 signal causes DS3 AIS to be substituted in the payloads of the two transmit DS3 signals, and DS1 AIS to be sent toward the access modules.

Detection of Path AIS on incoming OC-3 STS-1 signal causes DS3 AIS to be substituted in the payload or DS1 AIS sent toward the access modules, depending on the path to which the signal is mapped.

Detection of DS3 AIS being dropped on the local shelf sends DS1 AIS toward the access modules.

Remote Failure Indicator (RFI)
Line and Path RFI are detected on the incoming OC-3 signal. A DS3 RFI is detected on the locally dropped DS3 on the incoming OC-3 signal. When detected, the OC-3 MUX reports the RFI to the SCU for status condition reporting purposes.

The OC-3 MUX sends an RFI to the far end when it determines there is a failure on the incoming signal.

Loopbacks
All loopbacks can be commanded via the OS interface.

OC-3 Line Loopback
A line loopback forces the received STS-3 signal, just after optical-to-electrical conversion and CDR, to be looped back to the transmitter.

OC-3 Local Loopback
A terminal loopback forces the transmit side STS-3 signal, just before electrical-to-optical conversion, to be looped back to the receiver.

DS3 Line Loopback
A line loopback causes the DS3 line interface device to loop the received line data back to the network.

DS3 Local Loopback
A local loopback causes the DS3 line interface device to loop the transmitter output data stream back to the receiver.

DS1 Loopback
Each received DS1 going to the access modules can be looped back to the network on an individual DS1 basis.

Front Panel Indicators
The OC-3 MUX front panel indicators are described and illustrated in **Table 3**. Switch operations are described in **Table 4**.

Performance Monitoring
Performance Monitoring data is collected by both the online and the offline OC-3 MUX modules and stored in their local volatile memory. The data can be retrieved from either module and is not lost if a MUX failure occurs. The OC-3 MUX provides for setting Performance Monitoring alarm threshold and disabling threshold alarm generation. Unmapping any STS-1/DS3 will result in loss of Performance Monitoring data.

Table 3. Front Panel Indicators

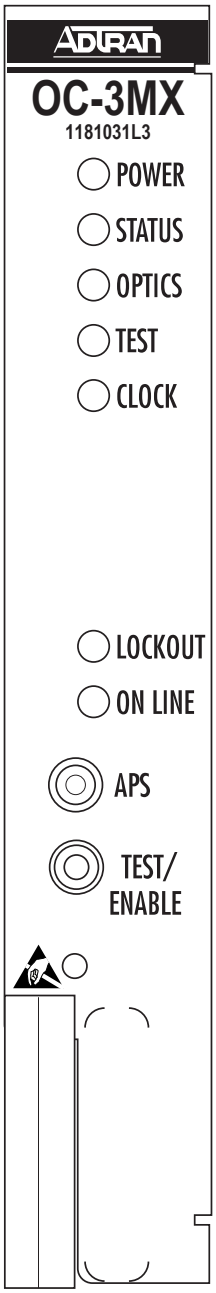
Front Panel	Indicator	Color	Description
	POWER/FAIL	OFF GREEN FLASHING (RED/GREEN) YELLOW FLASHING YELLOW RED	No power is present on the OC-3 MUX. OC-3 MUX is In Service and operating normally. OC-3 MUX is preparing for software upgrade. OC-3 MUX is Out of Service, Maintenance. OC-3 MUX is Out of Service, Unassigned. OC-3 MUX has an Equipment failure.
	STATUS	GREEN YELLOW RED	No alarm condition detected. Remote alarm condition detected. Local and/or remote alarm condition detected.
	OPTICS	OFF RED	No alarm condition detected. Optical interface (facility) failure (LOL, LOS, etc.)
	TEST	OFF YELLOW FLASHING YELLOW	OC-3 MUX is not in Test mode. No loopbacks are present. Loopbacks are active at OC-3 and/or DS3 level and/or DS1 level. Software dowload in progress.
	CLOCK	OFF YELLOW FLASHING YELLOW	No clock alarm condition detected. In Holdover mode or PRI or SEC failure. External Clock. Clock Out of Range or Out of Lock.
	LOCKOUT	OFF YELLOW	APS is enabled. APS is Locked out due to INHIBIT. (Traffic will not switch away from the OC-3 MUX on detection of fault conditions.) NOTE: To turn OFF the LED, and to disable lockout, simultaneously and momentarily activate the APS and the ENABLE switches.
	ON LINE	OFF GREEN	The DS3s from this OC-3 MUX are not being dropped to the Quad BNC module on the backplane. The OC-3 MUX is not the controller of clock source copy switching. Some or all access modules may be receiving DS1 traffic from this OC-3 MUX. Some or all access modules are receiving DS1 traffic from the OC-3 MUX and/or one or both DS3s are being dropped from this OC-3 MUX and/or this OC-3 MUX is the controller of clock source copy switching.

Table 4. Front Panel Switches

Switch	Description
APS	When depressed simultaneously with TEST/ENABLE, forces the OC-3 MUX on-line (receive side only). Pressing these switches together also toggles the LOCKOUT LED state ON and OFF.
TEST/ENABLE	When activated alone, tests all OC-3 MUX LEDs (multi color LEDs appear YELLOW). When activated with the APS switch, refer to APS description above.

Protection Switching

Protection switching is described in the following subsections.

OC-3 Equipment MUX Protection

Equipment protection is provided for the OC-3 network interface through redundant MUX equipment.

OC-3 Facility Protection

Facility protection is provided by each OC-3 MUX module having its transmit and receive over its own pair of fiber facilities. A fiber cut on one module, therefore, can only affect that module.

OC3 Automatic Protection Switching (APS) Facility/Path/Equipment

Each access module independently selects the terminal receive signal from one of the two OC-3 MUX modules. The Total Access shelf provides a single DS3 transmit output for each DS3, and the transmit data stream is provided by one of the two OC-3 MUX modules.

The OC-3 MUX receives three STS-1 paths from the receive OC-3 signal. If a path on the OC-3 MUX is selected to be dropped through either APS or MPS, that path on that OC-3 MUX is assigned the online state. Each path can be online on either module, independent of the others. The APS uses the following criteria to select the data stream from a OC-3 MUX:

- The standby OC-3 MUX detects an equipment failure on the online OC-3 MUX.
- The online OC-3 MUX detects a receive OC-3 facility failure (both DS3s and access modules switch).
- The online OC-3 MUX detects an equipment failure (both DS3s and access modules switch).
- The online OC-3 MUX detects an STS-1 Path failure and the offline OC-3 MUX does not (DS3 or the access modules provisioned to the STS-1 path will switch)
- APS is not inhibited.

On detection of failure and if any one of the above criteria is met, the selected path will switch from the online to the offline MUX, which will then become the online MUX for the path. The APS transition is completed within 60 ms after the switch decision occurs.

APS may be manually locked out through the craft interface, front panel switch, SNMP, or TL1 interface. Refer to Table 4.

The OC-3 MUX MPS may be manually asserted through the craft interface or the front panel switch.

4. MENUS

This section describes the OC-3 MUX menu structure and options. Refer to *Appendix B OC-3 MUX Menu Tree* for a detailed illustration of the OC-3 MUX menus.

Figure 3 represents the OC-3 MUX main menu screen. Use this screen to access the OC-3 MUX module for various functions such as provisioning, performing loopback tests, and mapping.

```
Shelf:  1  Slot:  B           Total Access System              01/06/03 11:13
Unacknowledged Alarms: None

                                Adtran OC-3 L3 Mux

                             1.  Configuration
                             2.  Provisioning
                             3.  Status
                             4.  Alarms
                             5.  Test
                             6.  Performance Monitoring
                             7.  Protection Configuration
                             8.  STS-1 Mapping
                             9.  DS1 Mapping Status
                            10.  Path Trace
                            11.  Synchronization Messages
                            12.  Display Options

                                    Selection:

                              '?' - System Help Screen
```

Figure 3. Main Menu

Configuration Menu

Figure 4 represents the OC-3 MUX Configuration menu. This read-only screen displays configuration data pertaining to the OC-3 MUX. Information such as software revision will change and reflect new software as upgrades are performed.

Provisioning Menu

Figure 5 represents the top level of the Provisioning menu. Traffic-affecting provisioning changes can only be made when the Service State of the OC-3 MUX is in the "Out of Service, Maintenance" mode or the "Out of Service, Unassigned" mode. DS3 Line Build Out can also be changed while the related DS3 is out of service regardless of the OC-3 MUX service state.

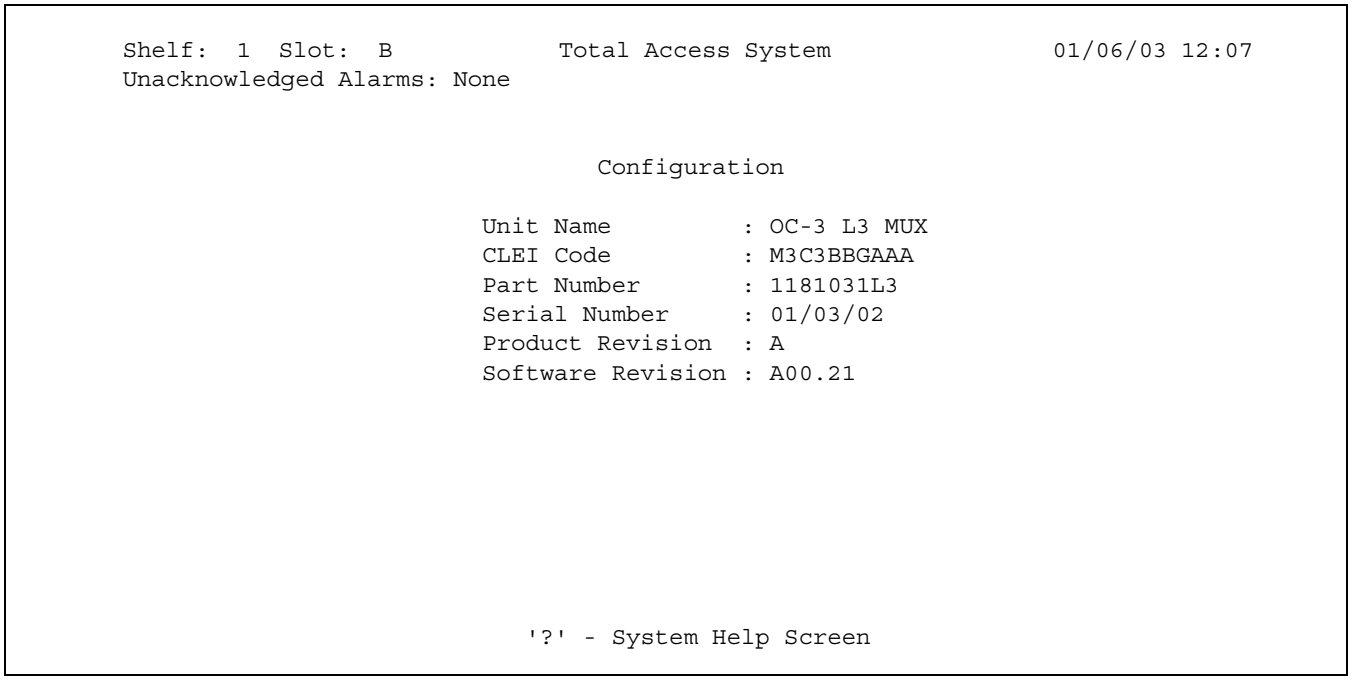


Figure 4. Configuration Menu

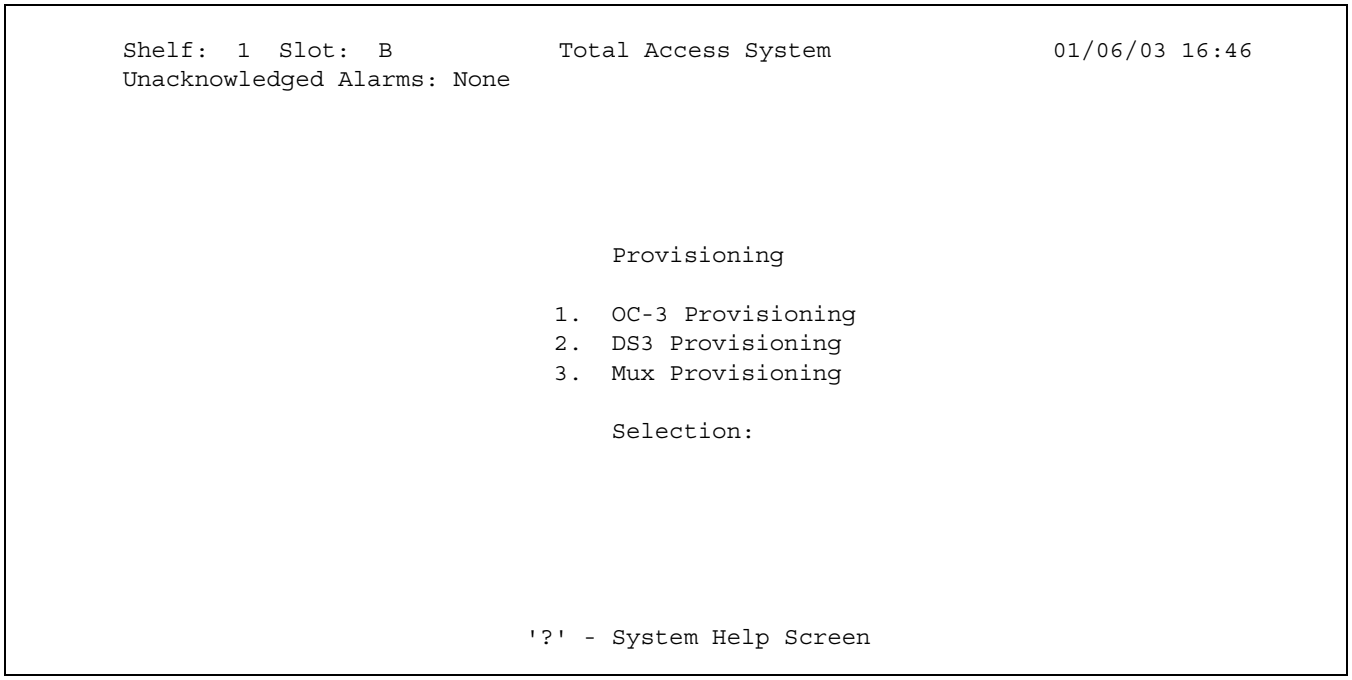


Figure 5. Provisioning Menu

OC-3 Provisioning
The OC-3 Provisioning options, shown in **Figure 6**, are described in the following subsections.

Signal Failure Threshold
Bit Error Rate (BER) at which service is unacceptable for a particular application. Signal Failure (SF) Threshold is provisionable from $1x10^{-3}$ to $1x10^{-5}$. If a protection module is available (with a less severe impairment), the traffic will switch to that module.

Signal Degradation Threshold
BER at which service is "marginal" or "degraded" for a particular application. Signal Degradation (SD) Threshold is provisionable from $1x10^{-5}$ to $1x10^{-9}$. If a protection module is available (with a less severe impairment), the traffic will switch to that module.

OC-3 Transmission Sync Message
Selects whether the transmit OC-3 S1 Sync Message is derived from the clock source or is "Don't Use for Synchronization."

DS3 Provisioning
The DS3 Provisioning options include Service States and Line Build Out for DS3 #1 and DS3 #2 and framing type for the locally dropped DS3. The options are shown in **Figure 7** and explained in the following subsections.

DS3 #1 (DS3 #2) Service States
The DS3 #1 (DS3 #2) Service State options are as follows:

Out of Service, Unassigned
This is a factory default read-only state of the DS3. In order for a DS3 to be in this state the user must un-map it (delete cross connect) or put OC-3 MUX service state to 'Out of Service, Unassigned'. DS3 service state will not be allowed to change when in this state. The system disregards the DS3 provisioning and replaces the payload with DS3 AIS on the transmit DS3 signal. In this state the system will not generate any corresponding DS3 alarms and the user can make LBO changes and activate test modes.

Out of Service,Maintenance
In addition to being assigned this state from the DS3 Provisioning menu (Figure 7), the DS3 interface will go in this state when OC-3 MUX is set to "Out of Service, Maintenance". Data service is available, but alarms are not reported in this state.

In Service
In this state, data service is available and alarms are reported if OC-3 MUX Service State is not "Out of Service, Unassigned" and the related DS3 is still mapped.

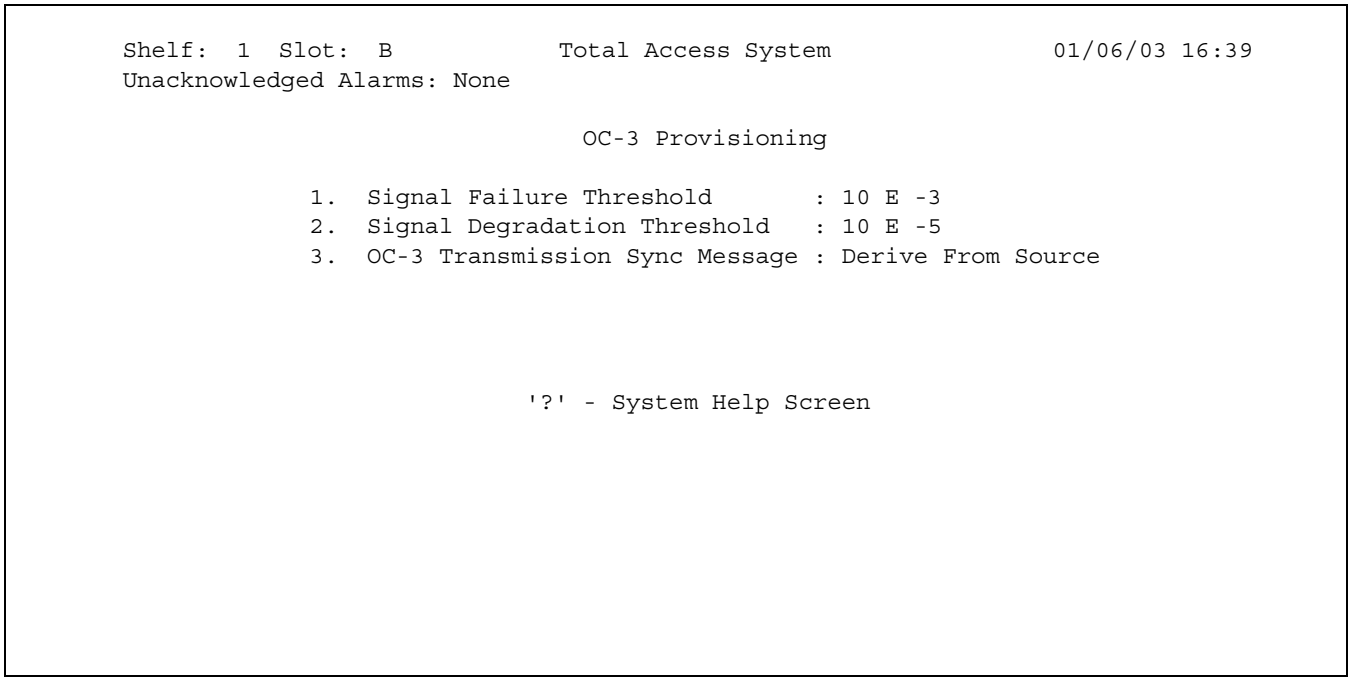


Figure 6. OC-3 Provisioning Menu

DS3 #1 (DS #2) Line Build Out (LBO)
Set the LBO to either Short or Long. Short is defined as less than 225 ft for 728 A or 734 A coax, and less than 125 ft for 735 A coax. For distances greater than these, an LBO of "Long" should be selected.

Local DS3 Framing
The Local DS3 Framing options are C-BIT or M13 Framing. This option is only selectable when OC-3 MUX is not "In Service."

```
Shelf:  1  Slot:  B           Total Access System              01/06/03 16:54
Unacknowledged Alarms: None




                                DS3 Provisioning

                        1.  DS3#1 Service State  : In Service
                            DS3#1 Line Build Out : Short
                        3.  DS3#2 Service State  : In Service
                            DS3#2 Line Build Out : Short
                            Local DS3 Framing    : M13

                                   Selection:
```

Figure 7. DS3 Provisioning Menu

```
Shelf:  1  Slot:  B           Total Access System              01/06/03 17:01
Unacknowledged Alarms: None

                                Mux Provisioning

                1.  Mux Service State        : Out Of Service, Maintenance
                2.  Linked Provisioning      : Enabled
                3.  Clock Source             : Receive OC-3 A & B
                4.  DCC Options
                5.  Clock Out Options
                6.  Restore Factory Defaults
                7.  Start Y-Modem Download
                8.  TFTP File Name           : 118102113_a00.bin
                9.  Start TFTP Download
                    Download Status          :
                    Reboot Into New Software


                                   Selection:

                             '?' - System Help Screen
```

Figure 8. MUX Provisioning Menu

MUX Provisioning
Figure 8 represents the OC-3 MUX Provisioning screen. The options shown on the screen are explained in the following subsections.

MUX Service States
The OC-3 MUX Service States are as follows:

Out of Service, Unassigned
This is the factory default state of the unit. In this state, the system disregards the card provisioning and the card provides unequipped payloads to the transmit OC-3 signal, replaces DS3 payload with DS3 AIS on the two transmit DS3 signals and also sends DS1 AIS to the access modules. In this state, the system will not generate any alarms and the user can make provisioning changes, activate test modes, and download software. Once the MUX is restored to the "Out of Service, Maintenance" or the "In Service" state, all previous provisioning and individual path level service states are restored. However, any mapping or provisioning changes made while in this state supersede the previous provisioning.

Out of Service, Maintenance
In this state, the user can make provisioning changes, activate test modes, and download software. The OC-3 MUX does provide data service in this mode. No alarms except loopback condition alarms will be generated during this time; however, alarms generated during "In Service" state will be cleared if the respective alarm conditions are cleared on the MUX. Once the MUX is restored to the "In Service" state, all previous provisioning and individual path-level service states are restored. However, any mapping or provisioning changes made while in this state supersede the previous provisioning.

In Service
In this state, data services and alarm reporting are available. The user can download software, but provisioning and activation of test modes are NOT allowed. The service states of individual paths are independently controlled and may not be in service.

Linked Provisioning
When enabled, any provisioning changes made to one unit while in a dual configuration will automatically be reflected in the other unit.

WARNING

When Linked Provisioning is enabled, changes made to one card may potentially affect traffic on the other card, even though the other card is in the "In Service" state.

Clock Source
Selects the source of timing for the OC-3 and DS3 transmit clock, also referred to as TX Clock Source. The following options are available:

Receive OC-3 from Both A & B Fibers
This option indicates that timing is derived from the receive OC-3 data.

Receive OC-3 From Fiber A
This option indicates that timing is derived from the receive OC-3 data.

Receive OC-3 From Fiber B
This option indicates that timing is derived from the receive OC-3 data.

Free Run
This option indicates that timing is derived from an onboard oscillator.

External DS1 SF or ESF From Both Inputs
This option indicates that timing is derived from an externally connected DS1 BITS SF or ESF timing source. ESF synchronization status messages are not received with this option.

External DS1 SF or ESF From Primary Input
This option indicates that timing is derived from an externally connected DS1 BITS SF or ESF timing source. ESF synchronization status messages are not received with this option.

External DS1 SF or ESF From Secondary Input
This option indicates that timing is derived from an externally connected DS1 BITS SF or ESF timing source. ESF synchronization status messages are not received with this option.

External DS1 ESF With Sync Messages From Both Inputs
This option indicates timing is derived from an externally connected DS1 BITS ESF framed all ones timing source, which provides synchronization status messages.

External DS1 ESF With Sync Messages From Primary Input
This option indicates timing is derived from an externally connected DS1 BITS ESF framed all ones timing source, which provides synchronization status messages.

External DS1 ESF With Sync Messages From Secondary Input
This option indicates timing is derived from an externally connected DS1 BITS ESF framed all ones timing

source, which provides synchronization status messages.

DCC Options (SONET DCC Provisioning Screen)
Figure 9 represents the top level of the SONET DCC Provisioning screen. The provisioning options are included in the following subsections.

```
Shelf:  1  Slot:  B            Total Access System              01/13/03 09:02
Unacknowledged Alarms: None



                              Sonet DCC Provisioning

                1.  OC-3 DCC
                2.  System ID                : 112233445566
                3.  NSAP Area Address        : 39840F8000000000000000000
                    Terminal ID              : STLSMO42
                5.  Access OSI Stack
                    Reboot Into New Address

                                    Selection:




                                '?' - System Help Screen
```

Figure 9. SONET DCC Provisioning Menu

<u>*OC-3 DCC*</u>
The OC-3 DCC provisioning options are as follows:

DCC Mode – In point-to-point data link communications, one device is the network side (similar to DCE) and the other is the user side (similar to DTE). The provisioned value dictates the value of the command/response (C/R) bit in the address portion of the data link header. Network devices send commands with C/R=0 and responses with
C/R=1. Data link layer communication will not be possible if both devices are configured identically. In addition, this value may be set to "Disabled." In this case, DCC communications will not occur.

Information Transfer Service – In point-to-point data link connections, the communication between peers can be acknowledged (AITS) or unacknowledged (UITS). UITS sends data packets in unacknowledged information frames (datagrams). There is no easy way of knowing if the packet has reached the peer; therefore, lost packet recovery must be handled by higher protocol layers. AITS establishes a connection with its peer. All data packets are sent in information frames and are acknowledged by the peer. Lost packet recovery is handled by the data link.

Window Size – This option identifies the maximum number of sequentially numbered frames that may be outstanding (i.e., unacknowledged) at any given time.

Maximum Retransmissions (N200) – In acknowledged information transfer mode, this option determines the maximum number of times a frame will be transmitted without an acknowledgement being received.

Maximum I-Frame Length (N201) – This option identifies the maximum number of octets that can occur in an information frame. Information frames that exceed this value will be discarded.

Response Time Out (T200) in msec – This timer represents the maximum time allowed without an "acknowledge" before the frame is retransmitted or other recovery action is taken.

Link Inactive Time Out (T203) in msec – This timer that represents the maximum time allowed without frames being exchanged. Typically, a receive ready (RR) supervisory frame will be sent when this timer expires.

<u>*System ID*</u>
Uniquely identifies a router within an OSI area. It is the least significant part of a Network Service Access Point (NSAP) address. For this change to take effect, the

MUX needs to be rebooted. (Refer to *Reboot Into New Address* on page 13.)

NSAP Area Address
The NSAP Area Address option identifies an area within an OSI routing domain. It is the most significant part of a network service access point address. This option requires an alphanumeric input. For this change to be effective, reboot the MUX. (Refer to *Reboot Into New Address* on page 13.)

Terminal ID
This field displays the TL1 logical name for a router within the OSI area. It is a unique name within a routing domain. The Terminal ID is configured in the SCU menu.

Access OSI Stack
For information on the Access OSI Stack, refer to *Appendix A Total Access 3000/3010 SONET SDCC Operation*.

Reboot Into New Address
This option becomes available upon setting new system ID or NSAP area address.

Clock Out Options
The Clock Options for the OC-3 MUX are explained in the following subsections.

Clock Out Enable
This option enables or disables the clock output.

Clock Output
This option is used to select the dual or single clock output mode. The dual mode provides two independent clock outputs: one from MUX A (A-OUT) and another from MUX B (B-OUT). Thus, if MUX A is unplugged, the A output is lost. Likewise, if MUX B is unplugged, the B output is lost. The single mode provides one clock output if the A-OUT and B-OUT terminals are jumpered together (T-to-T and R-to-R). In the single mode, either MUX can be unplugged, and a clock output will be present on the single clock output cable.

Clock Out Line Build Out
This option is used to select the line build out cable length for the DS1 timing clock output.

Clock Out Type
This option is used to select the SF or ESF framing format for the DS1 timing clock output. If ESF is selected, ESF data link synchronization messages are output.

Clock Out Source
This option is used to select the source used to derive the DS1 timing clock output.

Receive OC-3 – A and B clock outputs derive timing from the receive fibers.

External Clock In – A and B clock outputs derive timing from the external clock inputs. This option can be used to daisy chain up to six shelves (A-OUT to B-IN and B-OUT to C-IN) if multiple cable pairs are not available from the BITS clock source. (Use default options for other Clock Out options, except Clock Out Enable should be Enabled.)

Internal Clock – A clock output from MUX A derives timing from the internal clock of MUX A, and the B clock output from MUX B derives timing from the internal clock of MUX B. This is true for any Clock Out Source Copy option. This option provides a phase-filtered output of the selected TX Clock Source. This option should not be used when providing timing to a BITS clock since the timing to a BITS clock must be derived directly from the receive OC-3 data with minimal phase filtering.

Clock Out Source Copy
This option is used to select the copy of the source used to derive the DS1 timing clock output. Copy 0 is defined as either Fiber A or Primary External clock, depending on the Clock Out Source selection. Similarly, Copy 1 is defined as either Fiber B or Secondary External clock, depending on the Clock Out Source selection.

A Output = Copy 0, B Output = Copy 1 – A clock output is derived from Copy 0 and the B clock output is derived from Copy 1. This provides independent timing recommended for most applications.

A and B Outputs = Copy 0 – Both A and B clock outputs derive timing from Copy 0.

A and B Outputs = Copy 1 – Both A and B clock outputs derive timing from Copy 1.

A and B Outputs = TX Clock Source – Both A and B clock outputs derive timing from the currently selected TX Clock Source Copy if the Clock Out Source is the same as the TX Clock Source. If the Clock Out Source is different from the TX Clock Source, Option 1 default operation occurs.

In the GRE-253 CORE document, the recommended application for the DS1 Timing Output clock is to provide Receive OC-3 derived DS1 timing to a BITS clock, while the MUX is externally timed via PRI and SEC DS1s from the same BIT clock. For this case, the

TX Clock Source should be External, the Clock Out Source should be Receive OC-3, and the Clock Out Source Copy should be Option 1. The OC-3 transmit Sync message should be provisioned for "Don't Use For Sync" to avoid a timing loop. (Refer to Appendix B: DS1 BITS Clock to Multiple Shelves.)

Restore Factory Defaults

The Restore Factory Defaults option resets provisioning data back to factory defaults. **Table 5** list the factory default settings for the OC-3 MUX.

Table 5. Factory Default Settings

Parameter	Default
MUX Service State	OUT OF SERVICE, UAS
Linked Provisioning	ENABLE
Signal Fail Threshold	$1x10^{-3}$ (OC-3 Line)
Signal Degrade Threshold	$1x10^{-5}$ (OC-3 Line)
Cock Source	Receive OC-3 A&B
OC-3 Transmission Sync Message	Derive from Source (OC-3)
NSAP Address	Not modified.
System ID	Not modified.
Clock Out Type	DS1 SF
Clock Out LBO	000 - 133 ft
Clock Out Enable	Disabled
Clock Output	Dual output
Clock Output Source	Receive OC-3
Clock Output Source Copy	A Output = Copy 0 B Output = Copy 1
PM Threshold	Disabled
Path Trace Message	Null Message
STS-1 Mapping	Unmapped
DS1 Mapping	Mapped
Local DS3 Framing	M13

WARNING

Disable Linked Provisioning for the other MUX prior to restoring factory default settings. Any traffic being carried by the MUX having factory default settings restored will be lost.

Reprogram Flash Software

Perform a software upgrade by downloading the desired binary file via a Y-Modem or TFTP protocol. This typically requires 5 to 10 minutes. The download process is not service-affecting.

NOTE

If working and protection OC-3 MUX cards are available and both need to be upgraded, the user would be advised to:

(1) Initiate the upgrade process on the MUX card, which doesn't have an "Active OSI Stack" on it. This is due to the fact that rebooting an OC-3 MUX with active OSI stack on it looses DCC communication for 8-10 minutes before DCC being initialized on the mate card. The status of the OSI stack is displayed in the status menu and can also be obtained through SNMP.

(2) After the upgrade and reboot of one card is complete, make sure it boots up properly and carries traffic as intended before initiating an upgrade on the other (mate) MUX card.

Start Y-Modem Download

To start a Y-Modem download perform the following steps:

1. Locate the bin file (1181031L3-xxx.bin) to be used for the software download.
2. Set the download program protocol to Y-Modem.
3. Select the Reprogram Flash Software from the MUX Provisioning menu.
4. After a delay, letter Cs will appear on the craft interface screen to indicate connection attempts.
5. In the download program window, select "Send."
6. Select or type the file path and the file name.
7. Select "Send" to connect and begin transferring the file.

8. If the download is successful, the “Reboot Into New Software” option in the Provisioning menu will become selectable. If the download is unsuccessful, the “Download Status” field will display an explanatory message.
9. To run the MUX with new software, select the “Reboot Into New Software” option, then activate (boot up) newly downloaded software. This option will reset the module.

Start TFTP Download
To start a TFTP download perform the following steps:

1. Locate the bin file to be used for software download.
2. Select the TFTP filename option and write the filename to be uploaded.
3. Enter the TFTP server address on the SCU under Provisioning/Network/Firmware TFTP server.
4. Ensure the TFTP server is ready with the needed file on it.
5. Select “Start TFTP Download.”
6. If the download is successful, the “Reboot Into New Software” option in the Provisioning menu will become selectable. If the download is unsuccessful, the “Download Status” field will display an explanatory message.
7. To run the MUX with new software, select the “Reboot Into New Software” option, then activate (boot up) newly downloaded software. This option will reset the module.

Download Status
The Download Status field displays a message upon successful software download or a brief explanatory message if download was unsuccessful.

Reboot Into New Software
Choose this option to run the MUX with new software, then activate (boot up) newly downloaded software and reset the module.

NOTE

· The “Reboot Into New Software” option is only available following a successful software download. Downloaded software will not take effect until unit is rebooted.
· If OC-3 and/or DS3 traffic is online on this card, traffic will take a hit while rebooting since the online traffic will switch to the mate card. The same will happen when the mate card is rebooted into new software following a successful download, adding up to a maximum of two traffic hits for the software upgrade process.

Status Menu

Figure 10 represents the OC-3 MUX Status menu. This read-only screen provides status information. It displays provisioning data as well as the current status of loopback conditions, APS and OC-3 transmit and receive status for the unit.

MUX Service State
This field displays the Service State of the OC-3 MUX.

Active Loops
This field displays the status of any loopback conditions.

OC-3 DCC
This field displays the status of data communication channel over OC-3. Link can be “Up” or “Down.”

Local DS3 Framing
This field displays the provisional framing type (C-Bit or M13) of a locally dropped DS3.

Clock Status
This field displays the status of the transmit clock as one of the following:

Normal
Normal is displayed when the clock is good.

Holdover
Holdover is displayed when the input timing source (External or Loop timing) is lost. The clock is “held over” at the frequency of the source just before it was lost.

Selected Clock
The Selected Clock field displays the clock source used to time the OC-3 transmit data.

PRI EXT Clock
The PRI EXT Clock field displays the status of the Primary External Clock as one of the following:

Normal
Normal is displayed when an External Clock is present with no external clock alarms.

Fail
Fail is displayed when an External clock failed while provisioned for External Clock Source.

```
Shelf:  1  Slot:  B           Total Access System              01/13/03 09:37
Unacknowledged Alarms: None


                                     Status

Mux Service State     : OOS-M         Clock Status         : Holdover
Active Loops          : No Loops      Selected Clock       : Receive OC-3 A
OC-3 DCC              : Link Down     PRI EXT Clock        : Unused, Unavailable
Local DS3 Framing     : M13           SEC EXT Clock        : Unused, Unavailable
                                       OC-3 Line Status     : RX Fail
Path #1 Service State : OOS-M
Path #2 Service State : OOS-U         DS3 #1 APS Status    : Online/Allow
Path #3 Service State : OOS-U         DS3 #2 APS Status    : Online/Allow
DS3  #1 Service State : OOS-U         DS1 Drops APS Status : Online/Allow
DS3  #2 Service State : OOS-U         Active OSI Stack     : Mux B



                              '?' - System Help Screen
```

Figure 10. Status Menu

Unused, Unavailable
Unused, Unavailable is displayed when no external Clock is present and is not provisioned for External Clock Source.

Unused, Available
Unused, Available is displayed when an External Clock is present but is not provisioned for External Clock Source.

SEC EXT Clock
The SEC EXT Clock field displays the status of the Secondary External Clock. The possible options are the same as those for the Primary External Clock listed above.

OC-3 Line Status
The OC-3 Line Status field displays the status of the OC-3 Line as one of the following:

TX and RX Fail
TX and RX Fail indicates that one or more failures have been detected on both the transmit and receive side.

TX Fail
TX Fail indicates that one or more failures have been detected on the transmit side.

RX Fail
RX Fail indicates that one or more failures have been detected on the receive side.

Normal
Normal indicates that no failures are detected.

APS Status
The APS Status field displays the status of the DS1 Drop (Clock Controller) and the two DS3 interfaces, which in turn provides the setting of the module for APS. The possible settings are as follows:

Online/Allow
Online/Allow indicates that the OC-3 MUX is Online and a standby OC-3 MUX can be switched to upon detection of fault condition.

Online/Inhibit
Online/Inhibit indicates that the OC-3 MUX is online but inhibited from switching to a standby OC-3 MUX upon detection of fault condition.

Offline/Allow
Offline/Allow indicates that the OC-3 MUX is offline, or in standby mode. If the online OC-3 MUX switches over due to a fault condition, the OC-3 MUX is allowed to switch back over to the original online OC-3 MUX upon a subsequent fault condition.

Offline/Inhibit
Offline/Inhibit indicates that the OC-3 MUX is offline, or in standby mode. The offline OC-3 MUX may become the online OC-3 MUX due to a fault condition, but is inhibited from switching back again upon a subsequent fault condition.

Active OSI Stack
Consult Technical Support (*ADTRAN Technical Support* on page 26) for information on this option.

Alarms Menu

Figure 11 represents the OC-3 MUX Alarms menu, which displays real-time alarms for the MUX module. The date, time, and a brief description of the alarm are included. The alarm is displayed until the condition is cleared.

NOTE

This is not an alarm history log. All alarms are logged into an alarm history buffer within the SCU.

```
Shelf:  1  Slot:  B            Total Access System                01/09/03 17:28
Unacknowledged Alarms: None

                                      Alarms

                                  All alarms shown
Date      Time      Description                                          Level
01/03/03  11:10:01  OC-3       Loss of Signal                (LOS)     Critical
01/03/03  11:10:15             Clock in Holdover                       Alert
-------------------------------- END OF ALARMS --------------------------------
\

                                  '?' - System Help Screen
```

Figure 11. Alarms Menu

Test Menu

Figure 12 represents the OC-3 MUX Test menu. In this screen, perform various loopback tests at the OC-3, DS3 #1 and #2, and DS1 levels unless the module is in the "In Service" state, which makes this option unavailable and read-only. Although it is possible to perform loopbacks in both the "Out of Service, Maintenance" and "Out of Service, Unassigned" states, the "Out of Service, Maintenance" state is recommended.

The loopbacks on this menu are described below:

OC-3 Line Loop
This loopback test loops the data from the network back toward the network.

OC-3 Local Loop
This loopback test Loops the multiplexed data from the Access modules back toward the Access modules.

DS3 #1 Line Loop
This loopback test loops the data from the network back toward the network.

DS3 #1 Local Loop
This loopback test loops the data from the OC-3 interface back toward the OC-3 interface.

DS3 #2 Line Loop
This loopback test loops the data from the network back toward the network.

DS3 #2 Local Loop
This loopback test loops the data from the OC-3 interface back toward the OC-3 interface.

DS1 Line Loops
This loopback test loops a DS1 tributary signal from the incoming OC-3 back toward the network.

Remove All Loops
This loopback test drops all active loopbacks within the OC-3 MUX module.

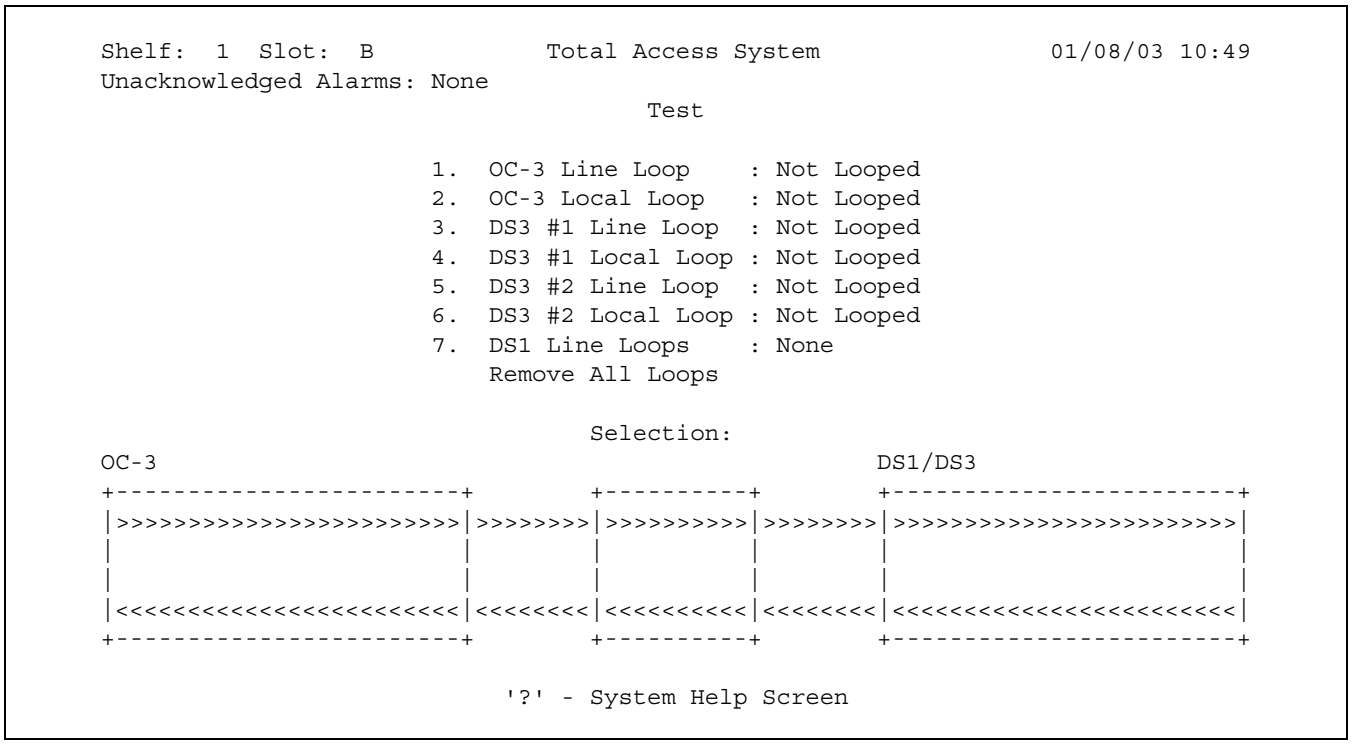


Figure 12. Test Menu

Performance Monitoring Menu

Figure 13 represents the top level of the Performance Monitoring screen. Use this menu to select the performance menus and reset all Performance Monitoring registers. This menu also provides a performance summary for near-end errors and a control to initialize the summary display.

A performance summary is provided for each menu listed below. The display reports if the performance registers have recorded any errors since the error summary was last initialized or the "Reset Performance Registers" command was last asserted.

Menu options/parameters are described in the following subsections.

Clear Error Summary
The Clear Error Summary option initializes all the performance summary registers and displays.

Reset Performance Registers
The Reset Performance Registers option initializes all the performance registers for the entire MUX unit.

OC-3 Section and Line
The OC-3 Section and Line field is used to display the OC-3 Section and Line performance summary. The OC-3 Section and Line performance options are displayed in the STS-1 Path options (see Figure 13).

STS Path and DS3
Figure 14 represents the Performance Monitoring menu associated with each STS-1 Path options. The

Section and Line information provided in the STS-1 Path options is for the OC-3 interface and is identical in the three sub-menus described below.

Figure 15 represents the Performance Monitoring menu associated with each of the DS3 options. The two DS3 menus provide Line-level Performance Monitoring only and do not support far-end Performance Monitoring or thresholds.

Daily
This option is used to display daily counts of multiple Performance Monitoring statistics.

Quarter Hourly
The Quarter Hourly option is used to display Performance Monitoring statistics in 15-minute intervals over a 24-hour period. Navigate from this menu to a menu to choose which statistic to monitor. After a selection is made, a complete log of 15-minute intervals for a 24-hour period (96 intervals) will be displayed.

Far End Daily
The Far End Daily option is used to display multiple daily Performance Monitoring statistics associated with the far end.

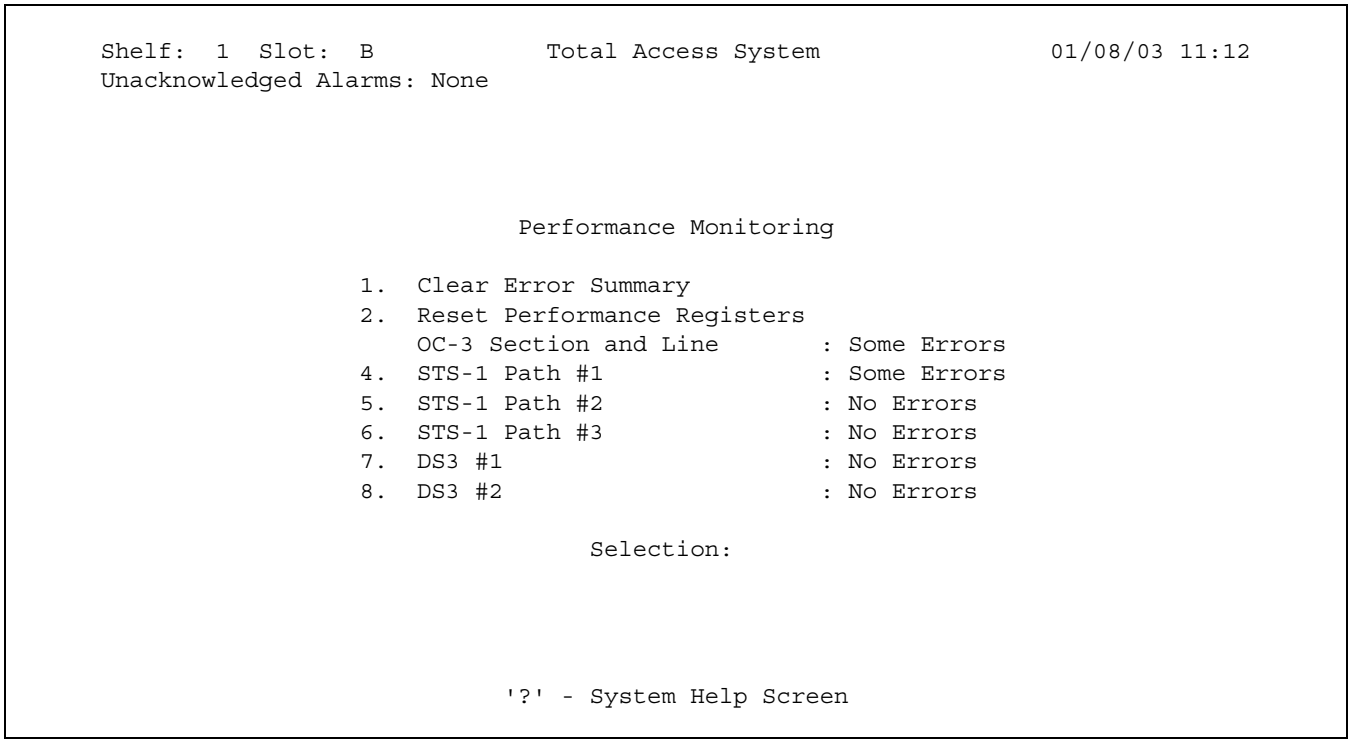


Figure 13. Performance Monitoring Menu

```
Shelf:  1  Slot:  B           Total Access System              01/13/03 09:08
Unacknowledged Alarms: None




                          STS-1 #1 Performance Monitoring

                    1.  STS-1 #1 Daily
                    2.  STS-1 #1 Quarter Hourly
                    3.  STS-1 #1 Far End Daily
                    4.  STS-1 #1 Far End Quarter Hourly
                    5.  STS-1 #1 Daily Thresholds
                    6.  STS-1 #1 Quarter Hourly Thresholds
                    7.  Reset Performance Registers for OC-3

                                Selection:



                              '?' - System Help Screen
```

Figure 14. STS-1 Path Options Menu

```
Shelf:  1  Slot:  B           Total Access System              01/08/03 12:49
Unacknowledged Alarms: None




                             DS3 #1 Performance Monitoring

                  1.  DS3 #1 Daily
                  2.  DS3 #1 Quarter Hourly
                  3.  Reset Performance Registers for DS3 #1

                                Selection:




                              '?' - System Help Screen
```

Figure 15. DS3 Path Options Menu

Far End Quarter Hourly

The Far End Quarter Hourly option is used to display Performance Monitoring statistics in 15-minute intervals over a 24-hour period associated with the far-end.

Daily Threshold
The Daily Threshold option is used to display daily alarm threshold levels for multiple Performance Monitoring statistics. From this menu, navigate to a menu to set the threshold to the desired level and enable an alarm to be issued if that threshold is exceeded.

Quarter Hourly Threshold
The Quarter Hourly Threshold option is used to display Performance Monitoring threshold levels for 15-minute intervals. Thresholds and alarms can be set as described above under "Daily Threshold."

Reset Performance Registers for OC-3
The Reset Performance Register for OC-3 option is used to resets performance registers to N/A (not available), except for the current interval, which is set to "0."

Protection Configuration Menu

Figure 16 represents the OC-3 MUX Protection Configuration menu where Manual Switches and Switch INHIBITS are set. A manual switch will not override a Switch Inhibit. Descriptions of the menu options are explained in the following subsections.

MUX Operational Status
The MUX Operational Status field indicates whether the module is the Active controller of the clock source copy switching (Online) or in Standby mode (Offline).

MUX APS Lockout Status
THe MUX APS Lockout Status indicates whether the clock controller is allowed to switch to the protection (ALLOWED) or are prohibited from switching to protection (INHIBIT). MUX APS Lockout overwrites DS3 APS Lockout.

MUX APS Switch
The MUX APS Switch option is used to manually switch the DS3 traffic and the Clock Controller. When traffic is split, all traffic will follow the Clock Controller. When switching the Clock Controller, the MUX also attempts to force the Access cards to switch to receive the DS1 traffic from the Online MUX.

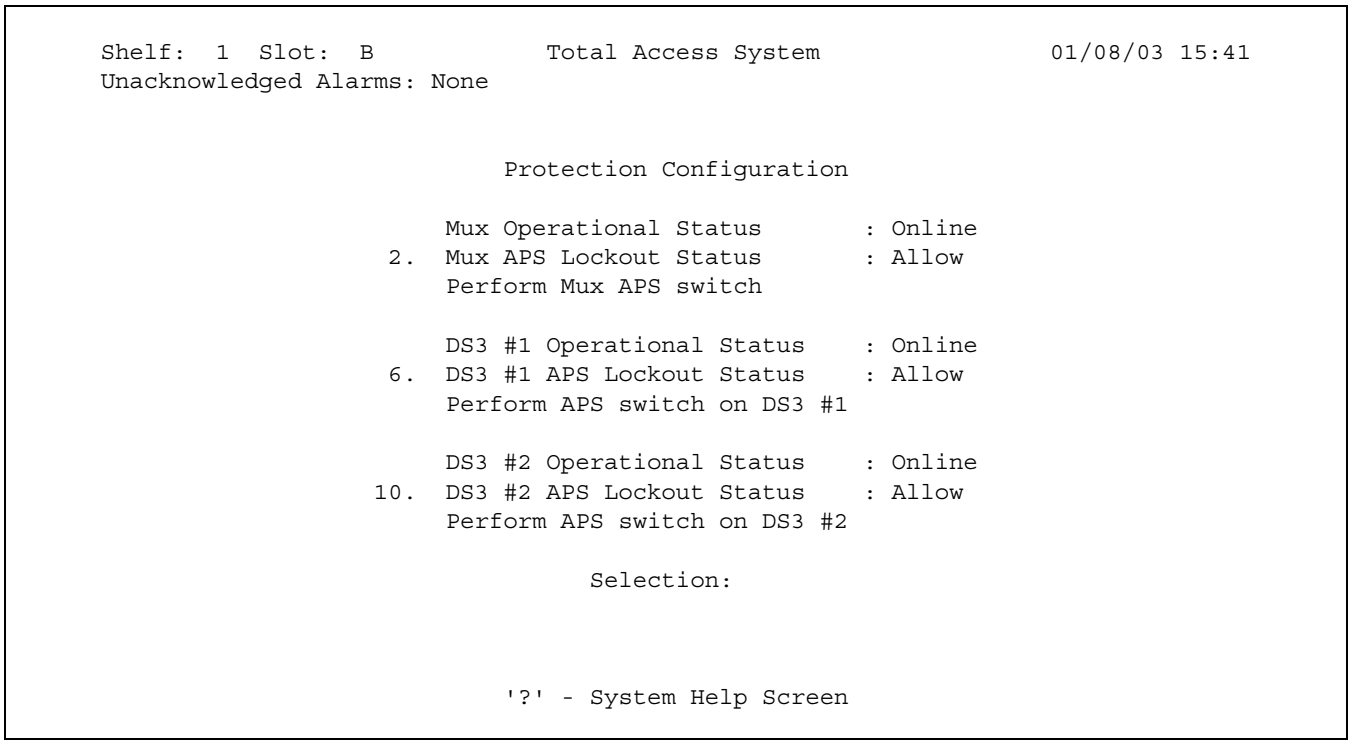


Figure 16. Protection Configuration Menu

DS3 #1 Operational Status
The DS3 #1 Operational Status field indicates whether this unit sources the DS3 #1 transmit traffic to the Quad BNC connector on the backplane (Online) or the unit is in Standby mode (Offline).

DS3 #1 APS Lockout Status
The DS3 #1 APS Lockout Status field indicates whether the STS-1 connected to DS3 #1 is allowed to switch (Allow) on a Section-, Line-, or Path-level fault from the incoming OC-3 signal, or is prohibited (Inhibit).

DS3 #1 APS Switch
The DS3 #1 APS Switch option is used to manually switch the DS3 transmit traffic source. This is also a toggle operation and the DS3 #1 traffic will switch if not inhibited by alarm or APS lockout.

DS3 #2 Operational Status
The DS3 #2 Operational Status field indicates whether this unit sources the DS3 #2 transmit traffic to the Quad BNC connector on the backplane (Online) or the unit is in Standby mode (Offline).

DS3 #2 APS Lockout Status
The DS3 #2 APS Lockout Status field indicates whether the STS-1 connected to DS3 #2 is allowed to switch (ALLOW) on a Section-, Line-, or Path-level fault from the incoming OC-3 signal, or is prohibited (INHIBIT).

DS3 #2 APS Switch
The DS3 #2 APS Switch option is used to manually switch the DS3 #2 transmit traffic source. This is a toggle operation, and the DS3 #2 traffic will switch if it is not inhibited by an alarm or an APS lockout.

STS-1 Mapping Menu

Figure 17 represents the OC-3 MUX graphical interface for mapping the OC-3/STS-1 paths (SPEs) listed on the left side of the rectangle to the DS3 and DS1 Drops paths listed on the right. Any OC-3/STS-1 path can be mapped to any of the paths listed on the right side of the rectangle.

DS1 Mapping Status (Slot Mapping) Menu

Figure 18 represents the OC-3 MUX Channel Mapping menu. This screen displays how the low-speed tributaries of the OC-3 STS-1 mapped to DS1 Drops are mapped to the various slots. Mapping is 1:1 Channel/ Slot.

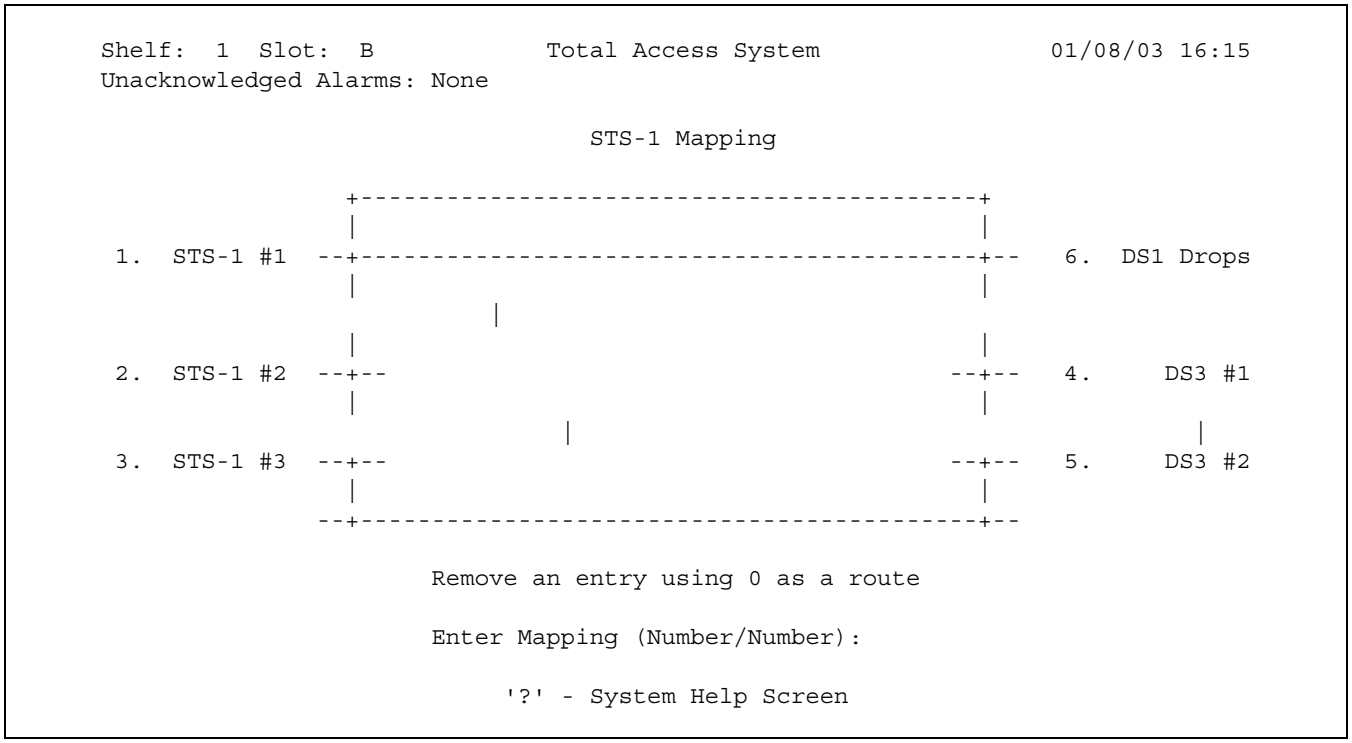


Figure 17. STS-1 Mapping Menu

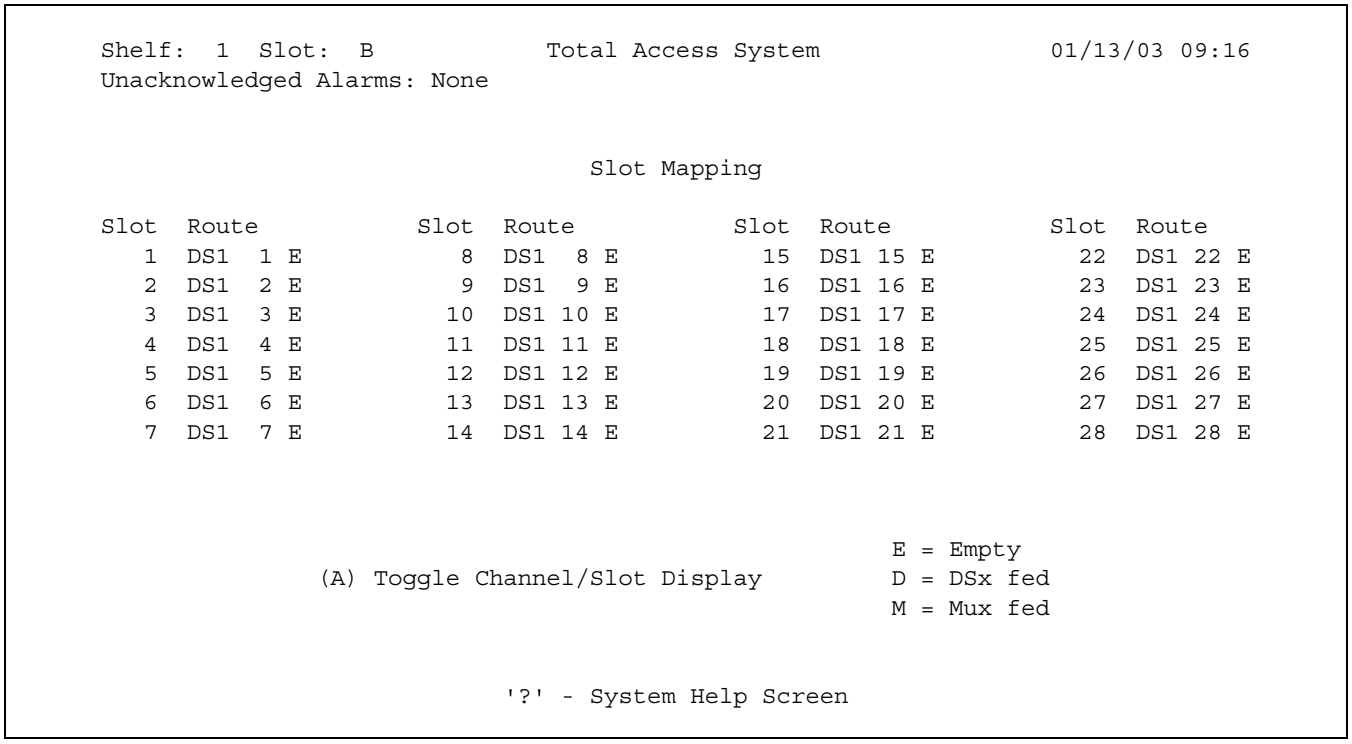


Figure 18. Slot Mapping Menu

Path Trace Menu

Figure 19 represents the OC-3 MUX Path Trace menu. Path Trace messages are used for connectivity information. Only one Path Trace message is allowed to be provisioned, which will be sent on all three STS-1s toward the network. STS-1 #1 Path Trace message will be displayed out of the three STS-1s.

Show Path Trace

The Show Path Trace option is used to display the trace message received from the far-end node. A null message is displayed as a blank line.

Send Path Trace

The Send Path Trace option is used to enter a message that the MUX card should send to the far end.

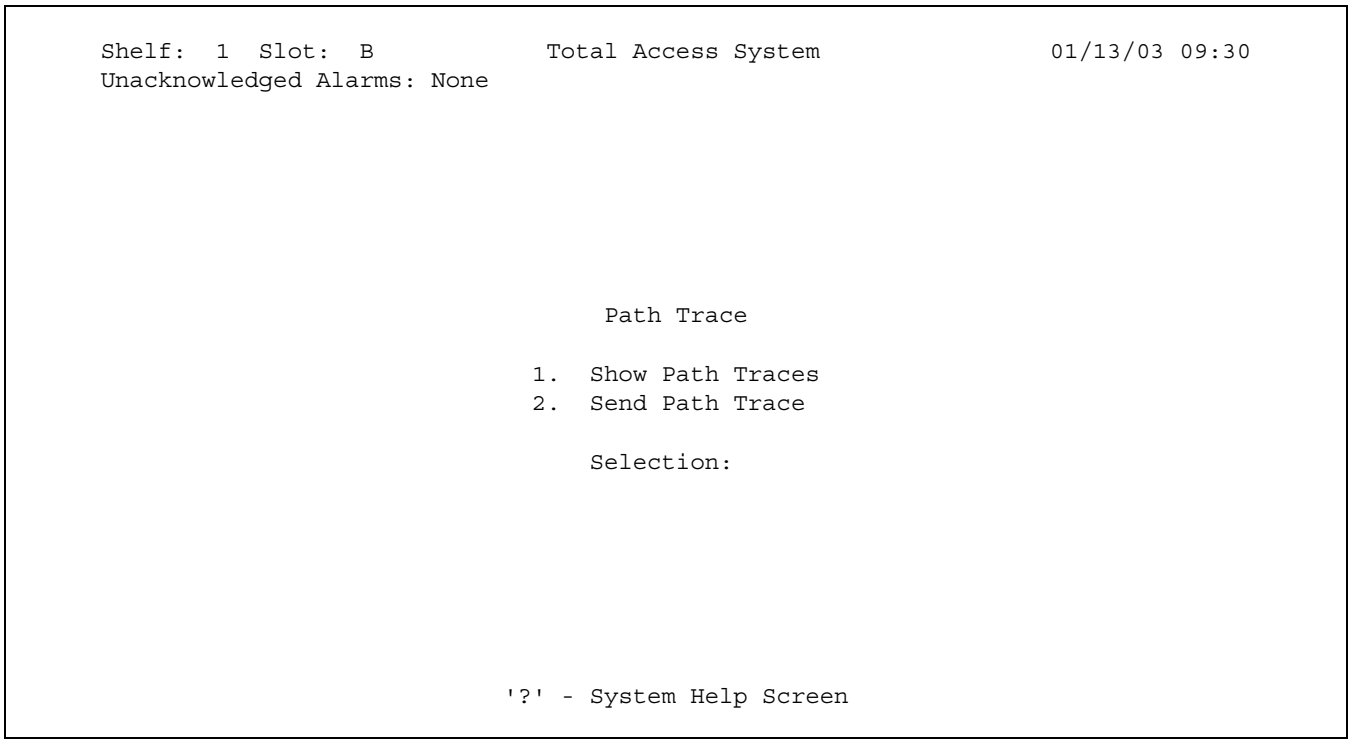


Figure 19. Path Trace Menu

Synchronization Messages Menu

Figure 20 represents the OC-3 MUX Synchronization Messages menu, which displays synchronization messages for the various clocks.

Display Options Menu

Figure 21 represents the Display Options menu. The Display Options are described in the following subsection.

```
Shelf:  1  Slot:  B           Total Access System              01/08/03 16:55
Unacknowledged Alarms: None




                          Synchronization Messages

       Primary External Clock   : Unavailable, Clock Failure
       Secondary External Clock : Unavailable, Clock Failure

       B Fiber Reception        : Unavailable, Clock Failure
       B Fiber Transmission     : DUS  (9) - DON'T USE for Synchronization
```

Figure 20. Synchronization Messages Menu

```
Shelf:  1  Slot:  B           Total Access System              01/09/03 14:44
Unacknowledged Alarms: None




                                Display Options

                     1.  High ASCII Characters : Disabled
                     2.  Screen Height         : 25
                     3.  Screen Width          : 80

                                 Selection:




                              '?' - System Help Screen
```

Figure 21. Display Options Menu

High ASCII Characters

Options to Enable or Disable the High ASCII character set provide an improved display of simple graphics such as boxes, lines, and arrows. For this option, the display terminal must be provisioned to use the High ASCII character set (8-bit ASCII). If the OC-3 MUX Test menu loopback display looks incorrect, the terminal is not set up for High ASCII character set. In this case, change the terminal setup for the High ASCII Character Display Option, or select the High ASCII Character Disable Option.

Screen Height

The Screen Height option is used to enter a screen height in terms of rows. The default screen height is 25 rows.

Screen Width

The Screen Width option is used to enter a screen width in terms of columns. The default screen width is 80 columns.

5. SPECIFICATIONS

Specifications for the Total Access OC-3 MUX Access Module are detailed in **Table 6**. Information provided in this Installation and Maintenance Practice is written based on Application Software revision A00.21.

6. MAINTENANCE

The Total Access OC-3 MUX module requires no routine maintenance for normal operation.

ADTRAN does not recommend that repairs be attempted in the field. Repair services may be obtained by returning the defective unit to ADTRAN. Refer to *Warranty and Customer Service* section for further information.

7. WARRANTY AND CUSTOMER SERVICE

ADTRAN will replace or repair this product within the warranty period if it does not meet its published specifications or fails while in service. Warranty information can be found at www.adtran.com/warranty.

U.S. and Canada customers can also receive a copy of the warranty via ADTRAN's toll-free faxback server at 877-457-5007.

- Request document 414 for the *U.S. and Canada Carrier Networks Equipment Warranty*.
- Request document 901 for the *U.S. and Canada Enterprise Networks Equipment Warranty*.

Refer to the following subsections for sales, support, CAPS requests, or further information.

ADTRAN Sales

Pricing/Availability:
800-827-0807

ADTRAN Technical Support

Pre-Sales Applications/Post-Sales Technical Assistance:
800-726-8663

Standard hours: Monday - Friday, 7 a.m. - 7 p.m. CST
Emergency hours: 7 days/week, 24 hours/day

ADTRAN Repair/CAPS

Return for Repair/Upgrade:
(256) 963-8722

Repair and Return Address

Contact Customer and Product Service (CAPS) prior to returning equipment to ADTRAN.

ADTRAN, Inc.
CAPS Department
901 Explorer Boulevard
Huntsville, Alabama 35806-2807

Table 6. OC3 Multiplexer Specifications

Physical	
Dimensions:	5.2” H x 9.7” D x 1.0” W (Conforms to Total Access 3000/3010 mechanical and pinout.)
Connector:	Future Bus 240-pin female connector
Optical Transmission Device	
Fiber Type:	Single Mode
Wavelength:	1310 nm
Optical Budget:	13 dB (minimum)
Transmit Level:	–8 to –15 dBm
Receive Level:	–8 to – 15 dBm
Optics:	Intermediate Reach
Rate:	155.52 Mb/s
Power	
Input Voltage Range:	–42ºC to +56ºC
Maximum Current Draw:	2.5 A
Maximum Power Dissipation:	17.0 W
Environmental	
Operating Temperature:	–40°C to +65ºC
Storage Temperature:	–40°C to +85ºC
Relative Humidity:	Up to 95% non-condensing
Compliance	
Agency Approvals:	NEBS Level 3 UL1950 GR-1089-CORE
Part Number	
Total Access OC-3 L3 Multiplexer Module:	1181031L3

Appendix A
Total Access 3000/3010 SONET SDCC Operation

ABSTRACT
This appendix contains information regarding communications over the SONET Section Data Communications Channel (SDCC) and its implementation on the ADTRAN Total Access 3000/3010 shelf. Background information regarding the OSI stack and detailed information for configuring the SONET Multiplexer boards has been provided.

NOTE

This Practice assumes the reader is familiar with the SCU Craft Interface.

BACKGROUND
In order to exchange TL1 messages, end-to-end connectivity between an operations system (OS) and a network element (NE) requires two separate connections to be established between:

- An OS and the Gateway NE (GNE) over an X.25 virtual connection (SVC or PVC); a Fujitsu FLM-150 or Lucent DDM 2000 are examples of a GNE.
- The GNE and the target NE over the SONET DCC; the Total Access 3000/3010 is an example of a target NE.

OVERVIEW OF OSI ROUTING
A routing area is the smallest grouping of systems for routing purposes. It is a neighborhood of interconnected systems often called a “Level 1 Area.”

A routing domain is a collection of routing areas, all of which must follow the same routing policies. It is often called a “Level 2 Area.” All systems within the domain must have the same system ID length. All routers within the domain must follow the same identical policies, and must not treat any systems in the area preferentially to others.

OSI networks consist of two types of systems:

- End systems (ES)
- Intermediate systems (IS).

Intermediate Systems perform the relay function where as End Systems do not.

There are two types of Intermediate Systems:

- A Level 1 IS routes packets to a destination within an area or to the nearest Level 2 IS for destinations outside the area.
- A Level 2 IS routes packets between two areas; it also performs Level 1 routing for its current area.

All routing is based on the Network Service Access Point (NSAP) Address. For the purposes of routing, an NSAP is divided into an area address, a system ID, and an N-selector.

The area address identifies an area within the routing domain. The system ID identifies an ES in the area. The N-selector is used by the ES to distinguish between multiple users of the Connectionless Network Service (CLNS), which on the router includes ISO Transport Class 4 and TL1.

LINK STATE ROUTING
One of the most important tasks an IS has to perform consists of detecting its immediate neighbors and memorizing this relationship in a database.

Detection of neighbor End Systems relies on the ES-IS protocol operation. ESs periodically send hello (ESH) packets to their neighbors.

Detection of neighbor Intermediate Systems relies on the IS-IS protocol operation. ISs periodically send hello (ISH) packets to their neighbors.

Each IS spreads knowledge of its direct connectivity (e.g. its neighbors) to all other ISs. Level 1 routers advertise all of their neighbors to all other ISs in the area. Level 2 routers advertise all their Level 2 neighbors to all Level 2 routers in the domain along with their own area IDs.

As a result, each Level 1 IS has a complete picture of the area, in the form of a set of links. Likewise, each Level 2 IS has a complete picture of the set of links that can be used to join areas together into a routing domain. Importantly, every IS in an area or domain has precisely the same picture of the area or domain, once the topology

has stabilized and the routing information has been disseminated.

Using this picture, each IS traverses the entire graph using Dijkstra's Shortest Path First (SPF) algorithm. It finds, for each destination, the next hop to use on the best path to that destination. Level 1 ISs also find the shortest path to the nearest Level 2 IS. For Level 1 routing, the destination is a system ID; for Level 2 routing the destination is an area address.

It is necessary for all ISs in the area (for Level 1) or domain (for Level 2) to have the same picture of the area or domain. Otherwise, routing loops can occur because two ISs may each think that the other is on the shortest path to the destination, sending packets back and forth between each other until the packet lifetime expires.

SONET SDCC SPECIFICATIONS

This section specifies the characteristics of the SONET SDCC as implemented in the OC-3 MUX module.

7-Layer OSI Stack

- Physical Layer
  - SONET SDCC, a 192 Kbps channel carried in 3 section overhead bytes of the first STS-1
  - A separate stack exists per OC-3 MUX; one MUX will be selected to contain the active stack enabling the SDCC to be protected from all facility-related protection switches. Active TL1 sessions will be lost if the MUX containing the active stack is unplugged or is re-initialized after a program download.
- Data Link Layer
  - The protocol is the Link Access Protocol on the D-channel (LAPD) as specified in ITU-T Recommendation Q.921, ISDN user-network interface – Data link layer specification.
  - Acknowledged information transfer service (AITS) is supported. Unacknowledged Information Transfer Service (UITS) is not supported.
  - The SAPI value is fixed at 62. It cannot be changed.
  - Maximum packet size set to 512 octets.
- Network Layer
  - Two NSAP address formats are supported: the ISO DCC format, as defined in GR-253-CORE, and the Private format. The ISO DCC format is 26 hex characters indicated by an Authority Format Identifier (AFI) value of 39 (e.g., 3940F000000000000000000). The Private format is a variable length field indicated by an AFI value of 49 (e.g., 490000).
  - The NSAP area address is user-definable. No default value is supported.
  - The system ID is a fixed-size hex number 12-characters long. It is user definable and has no default value.
  - The Globally Unique Network Layer Quality of Service (QoS) option is not supported.
- Transport Layer
  - Supports both end system (ES) and intermediate system (IS).
- Session Layer
  - Standard implementation.
- Presentation Layer
  - Standard implementation.
- Application Layer
  - TL1 is supported.
  - ACSE, ROSE/CMISE, FTAM, Name/Address Translation Services are not supported.

TOTAL ACCESS DCC REQUIREMENTS

Initial turnup procedures must be performed locally through the craft interface provided on the front (or rear) of the SCU. For simplex configurations, the SCU provisioning must have the MUX Auto Provisioning Option enabled, which will result in a copy of the provisioning on the SCU. Failure to do this will require the DCC system provisioning options to be manually entered whenever the MUX board is replaced.

For duplex configurations, the MUX Provisioning should have the Linked Provisioning and the MUX Auto Provisioning Options enabled on both cards. The Linked Provisioning option will enable changes to "linked parameters" entered on one MUX module to be updated on the other MUX module. If Linked Provisioning is not enabled, changes in the DCC provisioning will have to be made to both copies.

When a MUX board is replaced, it will obtain provisioning from its mate MUX board (if Linked Provisioning is enabled) and/or the SCU (if MUX Auto Provisioning is enabled).

SCU Provisioning Data

The SCU has provisioning that defines the Common Language Location Identifier (CLLI) code. The MUX uses the CLLI code as the TL1 target identifier (TID).

MUX Provisioning Data

System-level provisioning defines the following parameters for the network layer of the protocol stack:

- NSAP Area Address
- System ID
- TL1 Target ID

These parameters are maintained in non-volatile storage, enabling them to survive initializations.

Restoring factory defaults has "no effect" on these parameters. These parameters are linked to the mate MUX.

There are no MIB objects for these parameters; they cannot be set remotely via SNMP.

NSAP Area Address

There is no default for the NSAP Area Address; it must be entered during the turnup process. The NSAP Area Address may be changed as often as desired during the turnup process without having to reboot to effect the change. The "DCC Operation" section explains how to change the area address once the OSI stack has been started.

System ID

There is no default for the System ID. It must be entered during the turnup process. The System ID is 12 hex characters. The value entered is validated according to the format specified in GR-253-CORE. Since system IDs must be unique in a routing area, changing the system ID once it is provisioned is not recommended.

Tl1 Target ID

The TL1 Target ID is provided by the SCU. It is learned during the initialization process. It is equivalent to the CLLI code provisioned on the SCU.

Data Link Provisioning

Data link provisioning defines parameters for the data link layer of the protocol stack.

DCC Mode

Only the DCC Mode can be set. The DCC Mode is Link Provisioned. Changes to DCC Mode will be sent to the linked MUX. The DCC Mode parameter has three possible values:

- Disabled
- User
- Network

If SDCC communications are not needed, the DCC mode should be set to "Disabled." The central office side of the data link is typically the Network side. The customer premises equipment side of the data link is typically the User side. The default value for the OC-3 data link is "User."

NOTE

The parameter can be changed at any time. However, to change from Network to User or vice versa, the parameter must first be changed to "Disabled."

Other data link layer parameters exist but are only displayed for information purposes.

Information Transfer Services

For information transfer service in point-to-point data link connections, the communication between peers can be acknowledged (AITS) or unacknowledged (UITS). This release only supports AITS.

AITS establishes a connection with its peer. All data packets are sent in information frames and are acknowledged by the peer. Lost packet recovery is handled by the data link.

UITS sends data packets in unacknowledged information frames (datagrams). There is no easy way of knowing if the packet reached the peer; therefore, higher protocol layers must handle lost packet recovery.

The following parameters are related to information Transfer Services:

Window Size

This parameter identifies the maximum number of sequentially numbered I-frames that may be outstanding (that is, unacknowledged) at any given time.

Maximum Retransmissions (N200)

In AITS mode, this parameter determines the maximum number of times a frame will be transmitted without an acknowledgement being received.

Maximum Frame Size (N201)

This parameter identifies the maximum number of octets that can occur in an information frame. Information frames that exceed this value will be discarded (set to 576 bytes).

Response Time Out (T200)
In AITS mode, this timer represents the maximum time allowed without an acknowledgement before the frame will be retransmitted or other recovery actions will be taken. The timer is fixed at 200 ms.

Link Inactive Time Out (T203)
In AITS mode, this timer represents the maximum time (in milliseconds) allowed without frames being exchanged. A receive ready (RR) supervisory frame will be sent when the timer expires. The timer is fixed at 10 ms.

DCC Operation

After initialization, the LAPD mode, the NSAP area address, and system ID must be provisioned, and the TL1 target ID must be known in order for the OSI stack to be started. Once the OSI stack is started, the only way to turn it off is to change the LAPD mode to "Disabled."

The NSAP area address or System ID can be changed at any time. Changing the NSAP before the OSI stack has started is non-service affecting and can be done as many times as desired. Changing the NSAP after the OSI stack has started is service-affecting and will require the software to be rebooted in order for the new address to be used.

Special care must be taken when typing in the NSAP area address. Communication with the MUX will terminate if the area address is entered incorrectly.

Follow the steps below to change the NSAP area address once the OSI stack as been started:

1. Move all of the traffic to one of the MUX cards.
2. Change the NSAP area address on the Offline MUX module.
3. Select the option to reboot the software after an address change on the Offline MUX board.
4. Monitor the status of the Offline MUX board. Proceed when the status of the DCC indicates Link Down or Up AITS.
5. Move all of the traffic to the Offline MUX.
6. Repeat steps 2-5 to change the NSAP area address on the other MUX module.

Turnup Sequence

Follow the steps below for turnup:

1. On the SCU, set the MUX Auto Provisioning to "Disable."
2. Plug in the first MUX module.
3. Enter the NSAP area address, system ID, and the DCC mode.
4. Set the Linked Provisioning option to "Enabled."
5. Plug in the second MUX module.
6. After initialization, verify that the NSAP area address, system ID, and DCC mode are identical on both MUX modules.

No provisioning data exists in the serial EPROM and the mate MUX board is provisioned and operational. Provisioning will be downloaded from the mate. The NSAP area address and system ID must be entered via the craft interface connected to the SCU. The MUX board shall request the CLLI code from the SCU. The OSI stack will be started after the CLLI code is received.

State Information (Status)

State information exists only on the main status menu display. It cannot be retrieved remotely via SNMP or TL1.

State definitions are explained in the following subsections.

Disabled
The DCC is not active. The LAPD mode has be set to "Disabled" via the provisioning menu.

Bad NSAP
The DCC cannot be started because the NSAP area address or system ID has not been provisioned.

Wait for TID
The TL1 TID has not been received from the SCU.

Link Down
The DCC has been started but communications are down.

Link Up AITS
The DCC has been started and communication across the DCC is occurring. AITS indicates that the information is acknowledged at the data link layer.

Troubleshooting Link Down Conditions.

The DCC may not be enabled at the other end of the facility. For the OC-3 DCC, the device that is driving the DCC at the other end of the fiber may be at fault. Refer to the appropriate vendor reference documentation.

If the equipment is a Fujitsu FLM, set the LAPD state to "In Service".

The facility may have a physical fault. Retrieve shelf or MUX alarms to determine if there are alarms on the appropriate facility that could adversely affect the DCC.

There may be an LAPD mode mismatch. Retrieve the provisioning for both ends of the DCC and verify the correct LAPD mode settings. The DCC data link layer is not symmetric. One side of the link must be configured for network and the other side must configured for the user. If the equipment is a Fujitsu FLM, set the Cmd/Resp parameter to “Network.”

Appendix B
OC-3 MUX Menu Tree

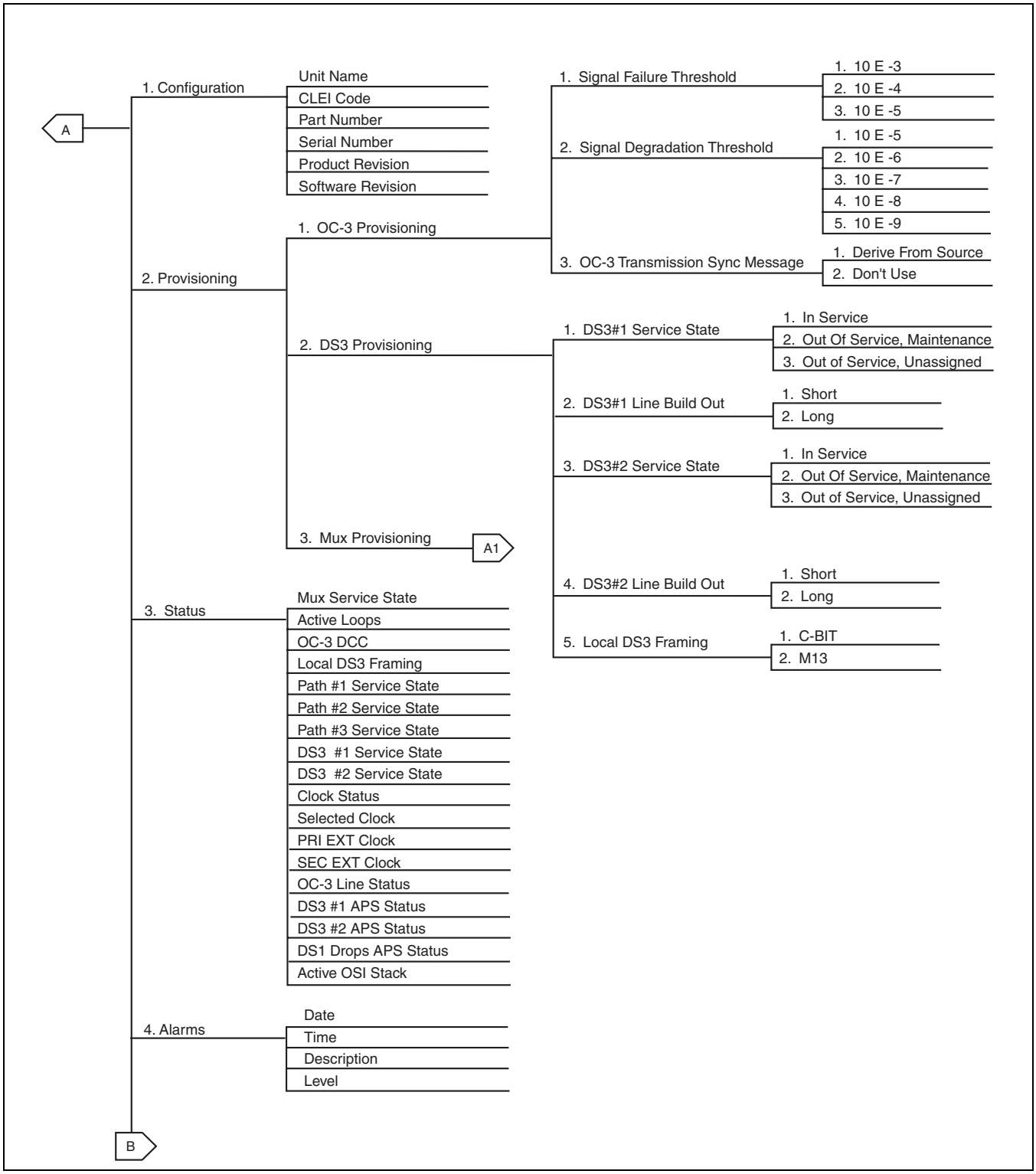


Figure B-1. OC-3 MUX Menu Tree

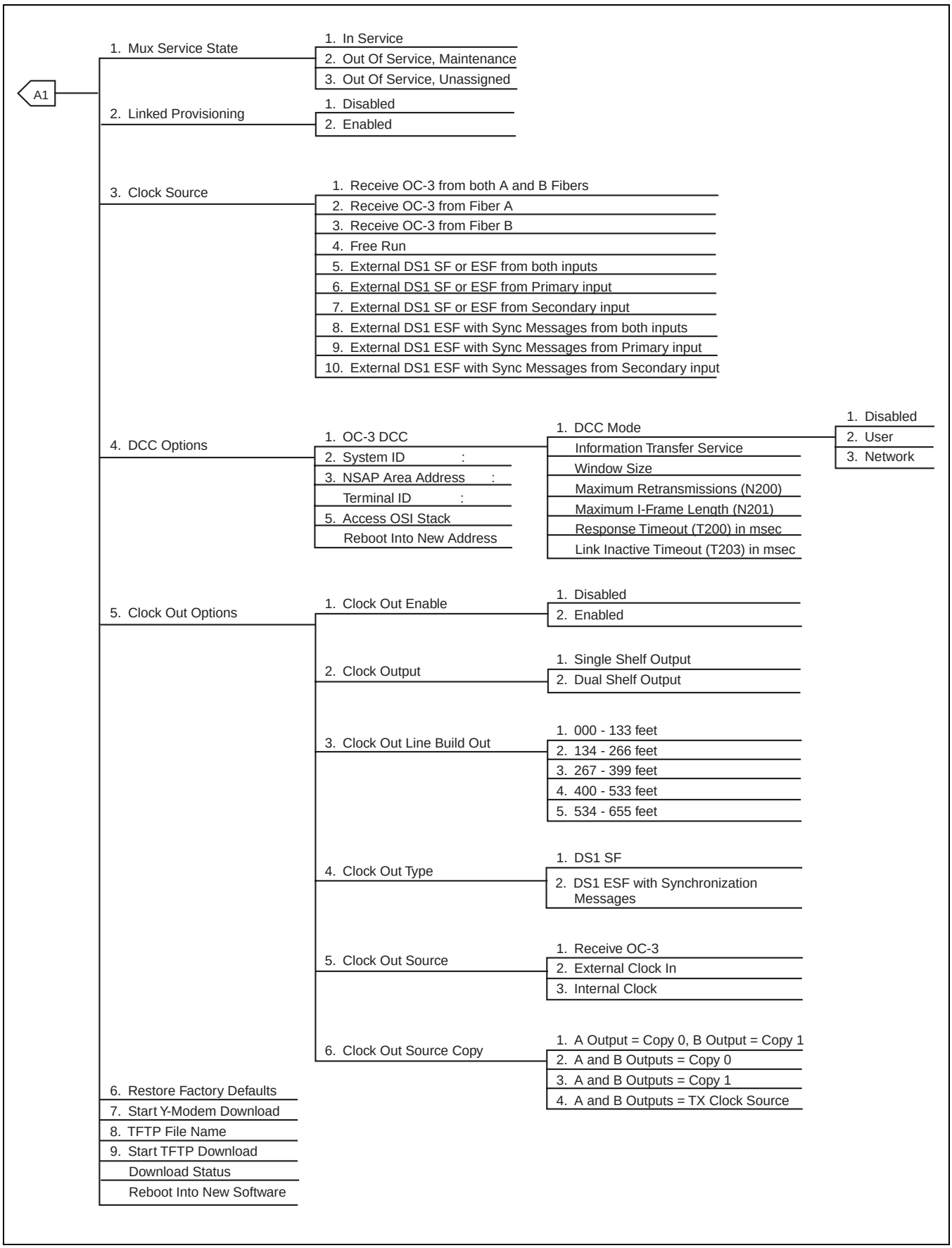


Figure B-1. OC-3 MUX Menu Tree (continued)

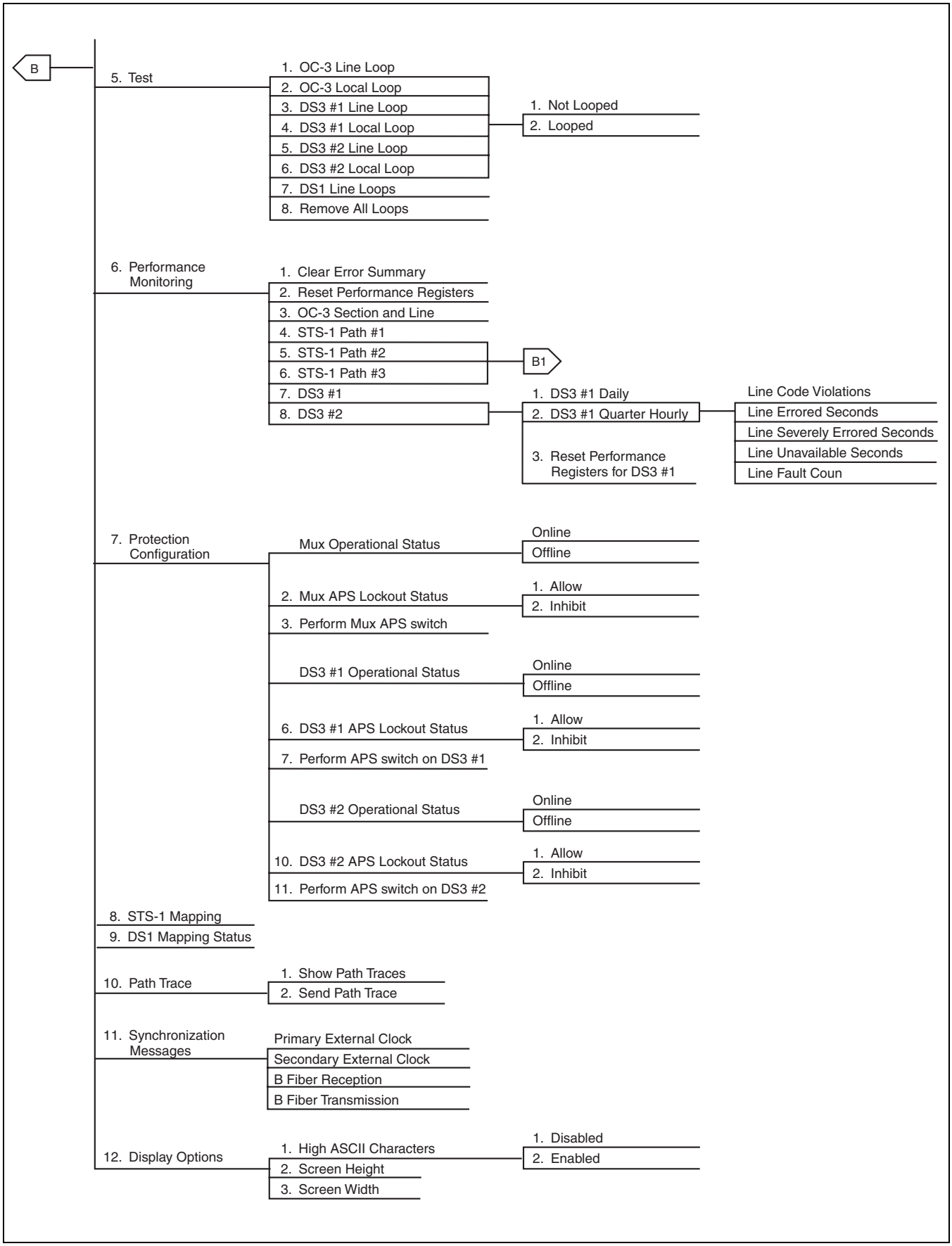


Figure B-1. OC-3 MUX Menu Tree (continued)

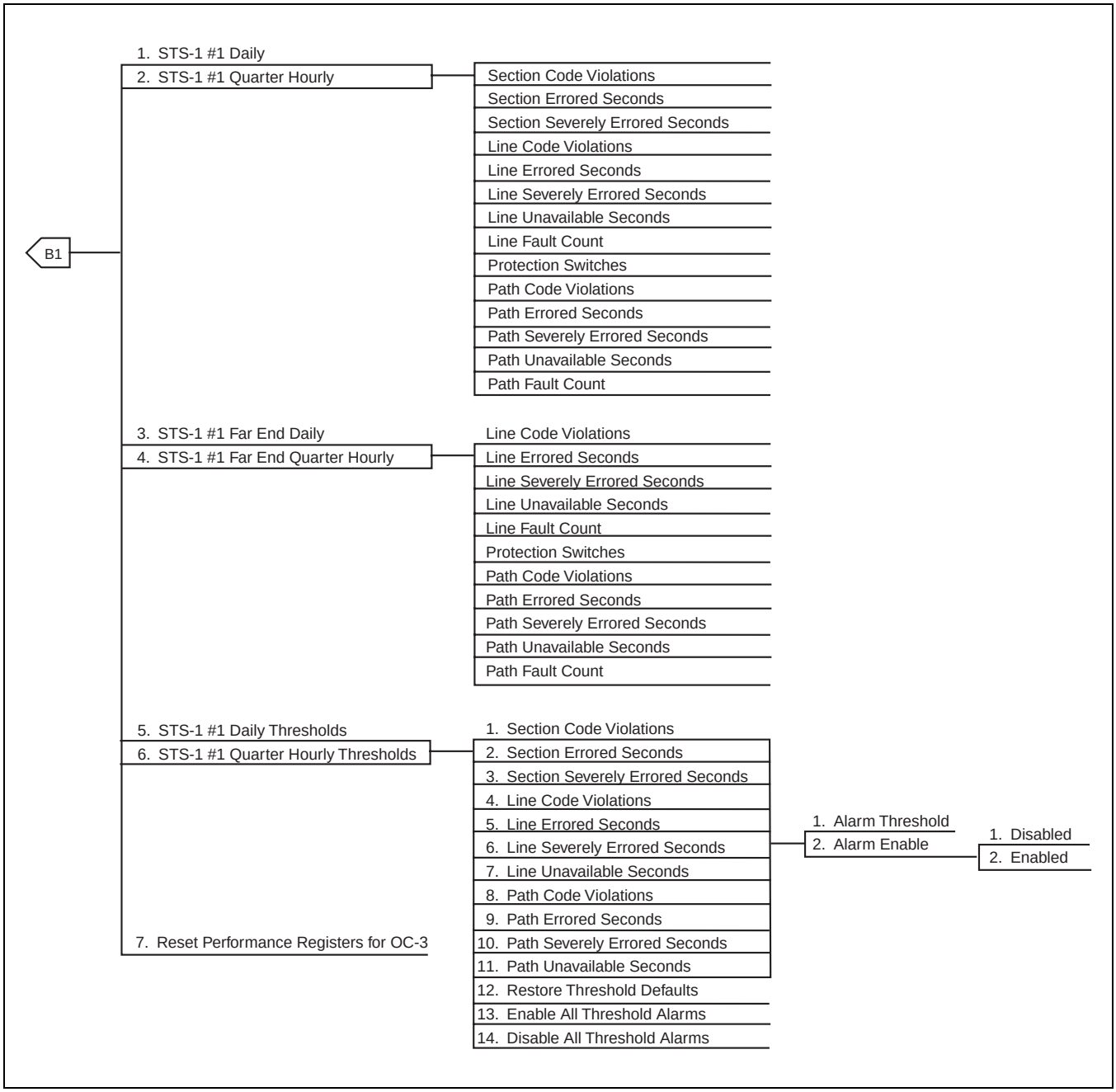


Figure B-1. OC-3 MUX Menu Tree (continued)