TimePlex Group

Synchrony®
Cell Exchange User's Guide

MC17358

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TimePlex Group Products

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NOTICE

Telecommunications products must be installed and operated in compliance with the relevant National Regulatory requirements summarized in the “REGULATORY” section of this manual. READ IN FULL, PRIOR TO INSTALLATION, any product-specific National Regulatory requirements applicable to the country of installation.

TimePlex Group User Manual Change Document

This change document revises information contained in the:

Synchrony® Cell Exchange User's Guide (MC17358)

The information in this document supports Release 4.0.1 of the *Synchrony* Cell Exchange.

Insert this document directly after the title page of your manual as a record of the change(s).

This change document addresses the following product features and other changes:

- Dual Synchronous Legacy (DSL/DSL+) Module
- Structured E1 Legacy (SEL) Module
- Network Management (LANE and IP Configuration)

Front Matter

(1) Under "About This Manual," the information should read:

This manual supports Release 4.0.1 of the *Synchrony* Cell Exchange system.

Chapter 1. Overview

(1) Page 1-11, in the first line of the paragraph titled, "Adaptive Timing," change "DSL" to "DSL/DSL+:"

Chapter 2. Installation

(1) Page 2-5, replace the section titled, "Software Upgrade Requirements," with the following:

Software Upgrade Requirements

Software upgrade requires:

- IBM/compatible PC running Windows 95, Windows 98 or Windows NT
- Terminal emulation software: HyperTerminal located in Windows 95, Windows 98 or Windows NT Accessories
- At least 5MB of hard disk space

CX Release 4.0.1 supports the FTP feature, which allows users to remotely update software versions. The FTP feature allows CX users to save and restore databases and upload new software from a remote location. The FTP feature requires use of an FTP Client application. Most simple off-the-shelf FTP Client applications hosted on a PC or Unix workstation will work.

To upgrade a Cell Exchange device and configure a workstation to manage it:

- Save the existing CX database, upgrade the software, and restore the CX database.
- For detailed information on creating and restoring backups, see "Saving a Database Using FTP" and "Restoring a Database Using FTP" in the "Operation" chapter of the *Synchrony Cell Exchange User's Guide*.
- For detailed information on upgrading Cell Exchange software, see the *Synchrony* Cell Exchange 4.0.1 release notes.

However, not all off-the-shelf FTP Client applications can be used with the CX. The CX has difficulty keeping up with FTP clients that send the FTP Server multiple segments at a time. These sophisticated FTP Clients can be used only if configured to send one segment at a time.

The software upload feature requires use of both a telnet session and the FTP Client. Through the Software Ver Menu screen the user selects the name of the new software version. The CX will inform the user first, that it is erasing flash memory, and then, that it is ready to accept software. Once the user sees the second prompt from the telnet screen the new software image can be sent to the CX via the FTP Client. The following ftp command, **FTP>put CPUROM.BIN**, sends the software image to the CX.

Chapter 3. Modules

(1) Page 3-4, Table 3-1, add the following:

Structured E1 Legacy Interface Module (SEL)	• Accepts synchronous non-cell (legacy) traffic and converts the data to ATM CBR cells • Places the cells on the ATM cell bus • Monitors the physical interface • Collects module performance statistics

(2) Page 3-51, delete the title and "Overview" paragraph and replace with the following:

Dual Synchronous Legacy Interface Module (DSL/DSL+)

Overview

The Dual Synchronous Legacy Interface Module (DSL/DSL+) is the gateway for synchronous non-ATM traffic into the ATM network. The DSL/DSL+ module provides an EIA RS-530 interface, converts legacy traffic into ATM cells, and establishes circuit emulation over the ATM network in AAL1 unstructured mode. The DSL module supports data rates from 8 Kbps to 2.048 Mbps in 8 Kbps increments. The DSL+ module supports enhanced data rates of 1200 bps, 2400 bps, 4800 bps, 9600 bps, and 16 Kbps – 2.048 Mbps (in 8 Kbps increments). Adaptive Clock Recovery timing allows the module to be highly tolerant of network timing ambiguities. The modules are differentiated by the addition of the "+" character on the faceplate of the DSL+. A front panel view of the Dual Synchronous Legacy Interface Module is shown in Figure 3-39 (DSL shown).

(3) Page 3-53, under Jumper Settings, insert the word "DSL" between "The" and "jumper" in the first line. Add the following after the table and table note: "DSL+: There are no configurable jumper settings."

(4) Page 3-53, under Specifications/Data Rates, change the entry to read, "DSL: 8 Kbps – 2.048 Mbps (in 8 Kbps increments), DSL+: 1200 bps, 2400 bps, 4800 bps, 9600 bps, and 16 Kbps – 2.048 Mbps (in 8 Kbps increments)."

(5) Page 3-53, insert the following note after Data Rates:

NOTE: The lower port speeds will result in significantly increased cellification delays. At 1200 bps, each cell is filled in ~313 ms. Assuming a 3-cell delay end-to-end, there is a one-way delay of one second, as measured from the input RS-530 port to the output of the remote RS-530 port. If additional cell delay is introduced due to ATM switching equipment, etc., then additional delays will be incurred. The delays for the higher port rates are proportionately lower.

(6) Page 3-83, under Specifications/Port Speed, change to read, "8 Kbps – 4.096 Mbps (in 0.8 Kbps increments)."

(7) After page 3-87, insert the following new information:

Structured E1 Legacy Module (SEL)

Overview

The Structured E1 Legacy Module (SEL) functions identically to the Structured T1 Legacy Module except that it operates at 2.048 Mbps, and the framing format operates with 32 channels rather than 24. The structured E1 Legacy Module terminates four (4) or eight (8) E1 interfaces, accesses the DS0s within each E1, converts individual voice DS0s or individual/contiguous data DS0s to individually addressable VPI/VCIs and converts them to AAL1-CBR formatted ATM cells to be inserted into the ATM network.

The SEL Module allows voice and data contained in E1 channel groups (one or more 64KHz channels) to be passed to and from ATM cell bearing equipment. The SEL Module supports either four or eight E1 interfaces. Both Channel Associated Signaling (CAS) and CAS+CRC4 framing formats are supported (E1 interface configuration is discussed in the following section). Figure 3-68 shows the front panel of the SEL Module.

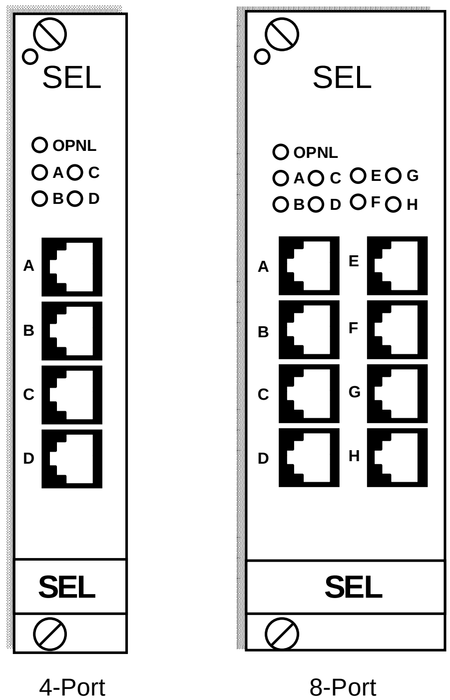


Figure 3-68. Structured E1 Legacy Interface Module (SEL)

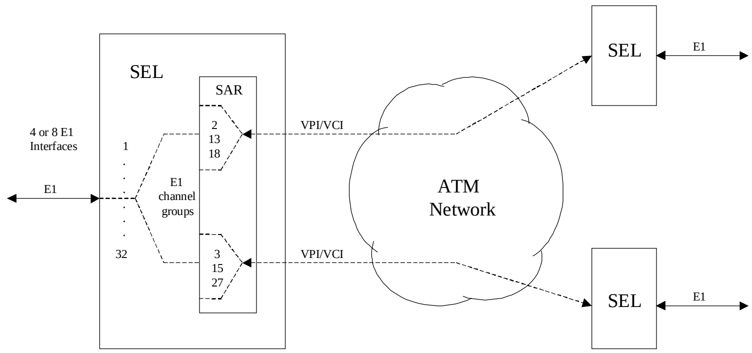
Channel groups are configured as either voice or data. For voice connections, the SEL enables CAS (ABCD signaling bits for each channel) to be passed through the ATM network.

The user defines the various voice and data channel groupings via the SEL interface configuration menu described in Chapter 5. Each channel group consists of one or more channels. The channels can be either contiguous or non-contiguous.

SEL connections are established via the connection management menu (See "Configuring Connections" in Chapter 5). The Cell Exchange allows any channel group to be connected to:

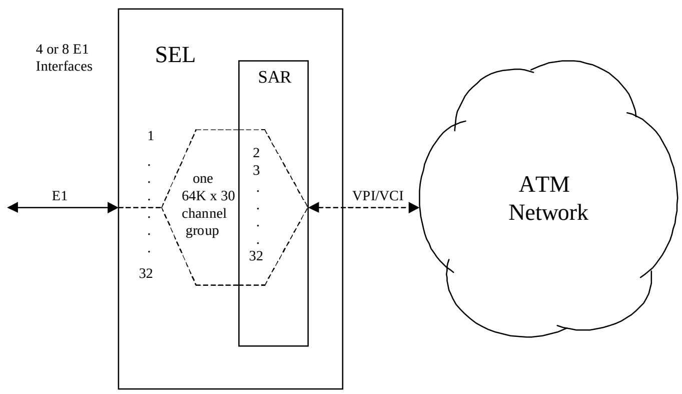
- Any VPI/VCI of any configured cell bearing interface
- Any “compatible” SEL channel group (any channel group that carries the same type of traffic (voice or data) and contains the same number of channels)

The SEL utilizes an AAL1 Segmentation And Reassembly (SAR) processor to pass data to and from the ATM network. In Figure 3-69, two connections have been established between an E1 interface and the ATM network. In this example, E1 channels 2, 13, and 18 are mapped to one VPI/VCI pair, and channels 3, 15, 27 are mapped to another VPI/VCI pair. Figures 3-70 and 3-71 show other possible connections.



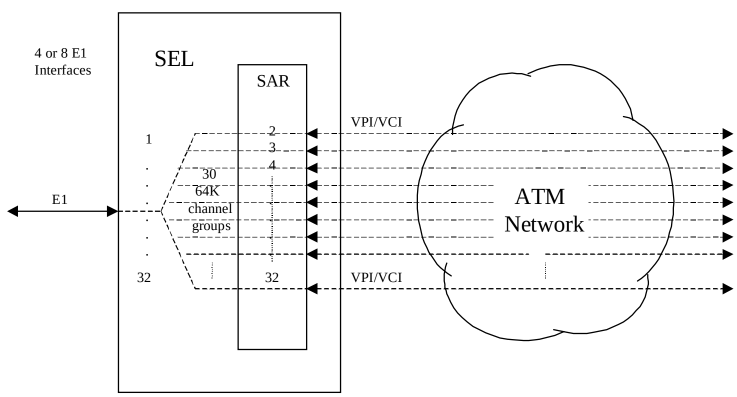
Two SEL-to-VPI/VCI connections

Figure 3-69. SEL Connection Using Two VPI/VCI Pairs



All 30 E1 (payload) timeslots mapped to one VPI/VCI pair
(non-payload timeslots 1 and 16 carry framing and signaling, respectively)

Figure 3-70. SEL Connection with Mapped Payload to One VPI/VCI Pair



Each E1 (payload) timeslot mapped to different VPI/VCI pairs
(non-payload timeslots 1 and 16 carry framing and signaling, respectively)

Figure 3-71. SEL Connection with Mapped Payloads to Different VPI/VCI Pairs

For SEL-to-SEL connections, the actual channel numbers of each group may differ at each end as long as each group contains the same number of channels. The ordering of channels passed from the source channel group to the destination channel group is always preserved. In other words, the first channel of the destination receives the data from the first channel of the source; the second channel of the destination receives the data from the second channel of the source, and so on.

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the SEL Interface Module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Motorola 68340 microprocessor
- Capacitor filtering, provided for control and noise suppression

Unique Functionality Section

The SEL Interface Module includes the following unique functions:

- Module equipped with one complete independent synchronous channel
- Connectors are RJ-45 female type
- High-speed AAL1 segmentation and reassembly function

A functional block diagram of the SEL Interface Module is shown in Figure 3-72.

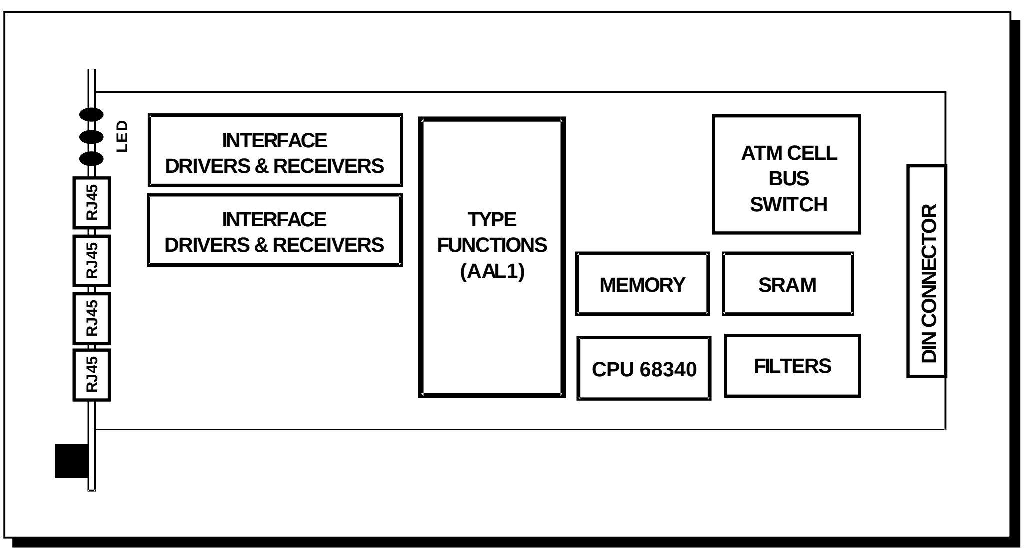


Figure 3-72. Structured E1 Legacy Interface Module Functional Block Diagram

Specifications

Port Capacity:	Four or eight
Media:	Shielded Multi-twisted pair cable, low capacitance
Electrical:	EIA 530, DCE
Connector:	RJ-45
Line Format:	Balanced
Data Format:	ATM Cells
Line Build Out:	75 Norm, 120 Norm, 75 P.R., 120 P.R., 75 HRL1, 75 HRL2, and 120 HRL
Framing:	CAS+CRC4 or CAS
Port Speed:	2.048 Mbps
Granularity:	8 Kbps increments
Timing:	Synchronous Receive Timing, Adaptive Receive Timing, Internal or External Transmit Timing Reference
Virtual Connections:	8 Port-Max. 240 AAL-1 type CBR, VPI/VCI connections
Timing:	Recovered, Internal, Reference, Onboard
Conditioning:	Trunk Conditioning Data Code (Idle (UAC) or MUX-OOS), Trunk Conditioning Signaling (Idle (0)/Busy (1) or Busy (1)/Idle (0)), Idle Channel Conditioning (Voice Idle or Data Idle)
Status & Statistics:	Standard status and statistics provided
Diagnostics:	Facility Loopback, Terminal Loopback
Alarm – Surveillance:	FIFO Overrun/Underrun
Translation Capacity:	256 VPIs, 10,240 VCIs
Power:	≤ 7 Watts
Standards Compliance:	ITU G.703, G.804, af-vtoa-0078.000 Channel Emulation Service

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	On Steady - Indicates that module is operational and has successfully received configuration from CPU for at least one E1 interface On Blinking - Downloading program Off - No power to module, no port configured, or CPU failed
LED	A thru D (4 port) or A thru H (8 port)	Green	Indicates that a configured port has achieved frame synchronization with the received E1 when lit, loss of frame synchronization when extinguished

Pinouts

Pinouts for the RJ-45 connector are shown in Figure 3-73 and the accompanying table.

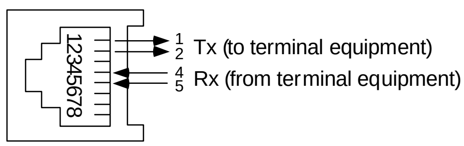


Figure 3-73. SEL RJ-45 Pinouts

Pin	Direction	Signal
1	**To TE**	**Tx-R**
2	**To TE**	**Tx-T**

Pin	Direction	Signal
4	**To SEL**	**Rx-R**
5	**To SEL**	**Rx-T**

Chapter 4. Operation

(1) Page 4-46, change "DSL" to "DSL/DSL+" wherever it appears.

(2) Page 4-46, add the following note at the bottom of the page:

> ***NOTE**: On the module status screen, the same statistics will be displayed for both modules. The only difference is that the DSL+ module will display "DSL+" instead of "Sync Legacy."*

(3) Following page 4-57, insert the following new information:

Structured E1 Legacy Interface Module

To view the statistics for the Structured E1 Legacy Interface Module (SEL), select **Module Status** from the **View** menu.

The window that appears provides a top-level view of the hardware installed in the chassis. Information is available for each slot, including module type and module status. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This action will bring up the logical interface screen shown in Figure 4-60.

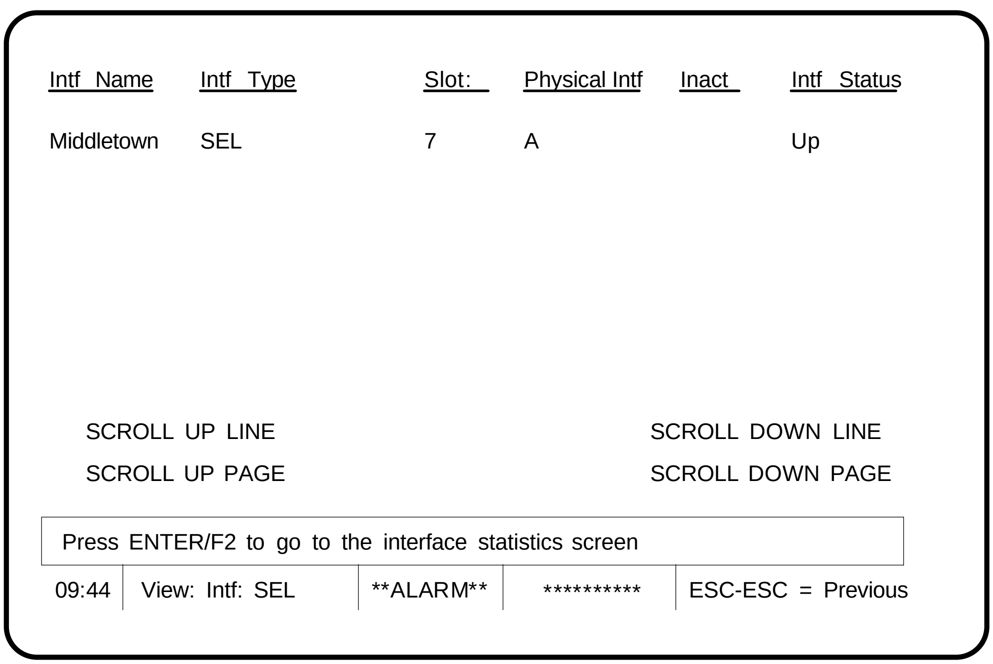


Figure 4-60. Logical Interface Status Window - SEL

The logical interface status window displays status information for each logical interface defined for a specific module. In addition to configuration information (name, type, slot, physical interface, active), the status of the interface is shown. This represents a snapshot of the current state of the interface – up or down. Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**. The screen shown in Figure 4-61 will appear. This screen contains information that is tailored to the interface.

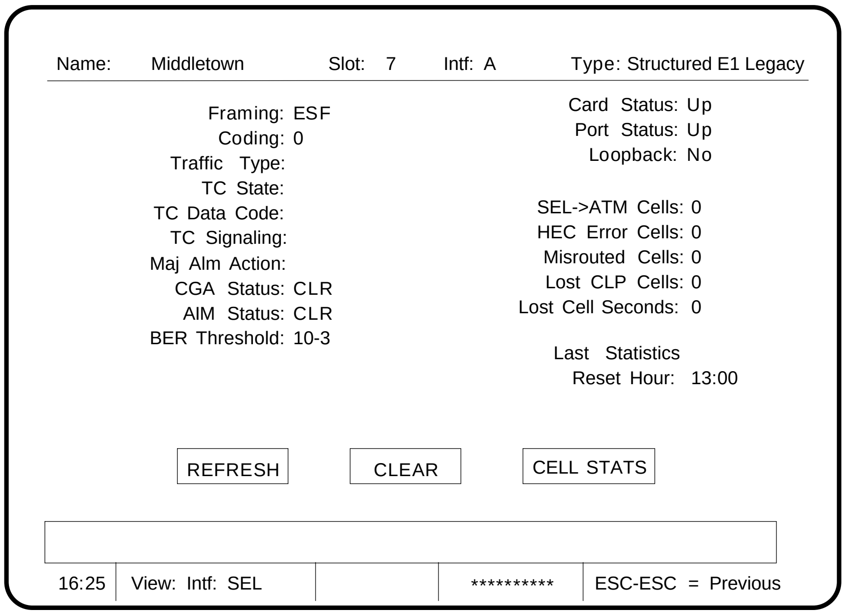


Figure 4-61. Specific Interface Window—SEL

To view module activity for the past 8 hours, select the **<CELL STATS>** button and press **<ENTER>**. This will bring up the screen shown in Figure 4-62.

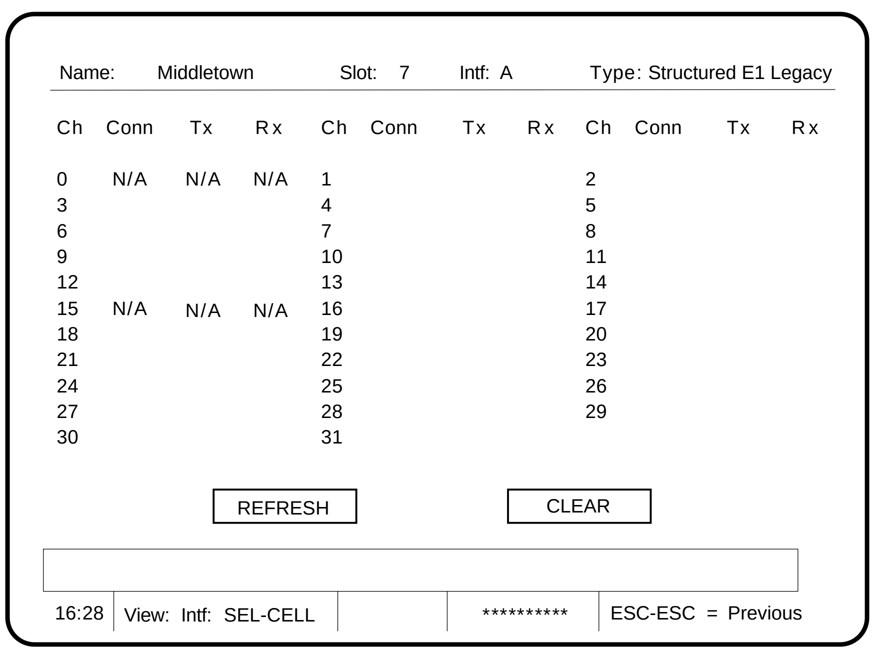


Figure 4-62. Interface Statistics Window—SEL

For each configured channel, a connection identifier and the number of cells transmitted and received is displayed under the corresponding headings.

Chapter 5. Configuration

(1) Page 5-28, change the Data Rate bullet to read, "Data Rate (edit field, "DSL: 8 Kbps – 2.048 Mbps (in 8 Kbps increments), DSL+: 1200 bps, 2400 bps, 4800 bps, 9600 bps, and 16 Kbps – 2.048 Mbps (in 8 Kbps increments))."

(2) Page 5-28, insert the following note after the Data Rate bullet:

NOTE: The lower port speeds will result in significantly increased cellification delays. At 1200 bps, each cell is filled in ~313 ms. Assuming a 3-cell delay end-to-end, there is a one-way delay of one second, as measured from the input RS-530 port to the output of the remote RS-530 port. If additional cell delay is introduced due to ATM switching equipment, etc., then additional delays will be incurred. The delays for the higher port rates are proportionately lower.

(3) Page 5-53, change the Data Rate bullet to read, "Data Rate (edit field, 8 Kbps – 4.096 Mbps in 0.8 Kbps increments)

(4) Following page 5-60, add the following new information:

Structured E1 Legacy Interface Module Configuration

Configuring Interfaces

To configure a new Structured E1 Legacy Interface Module (SEL) interface, follow the steps described in "Configuring Physical Interfaces" to enter the name, the interface type, the slot, the physical interface and the active status indication. Press **<F2>** to enter the interface configuration menu. Figure 5-56 shows the interface configuration menu with all fields set to the default values.

Intf Name: Middletown   Slot: 7   Intf: A   Intf Type: Structured E1

Framing: CAS+CRC4
Line Build Out/Equal: 75 Norm
% Err Sec Threshold: 100%
Tx Clock Out: On Board

Trunk Conditioning Data Code: Idle (UAC)
Trunk Conditioning Signaling: Idle (0)/Busy (1)
Idle Channel Conditioning: Voice Idle
ATM CES: w/cas

Channel:	0	1	2	3	4	5	6	7
Conn:	N/A	I	I	I	I	I	I	I
Channel:	8	9	10	11	12	13	14	15
Conn:	I	I	I	I	I	I	I	I
Channel:	16	17	18	19	20	21	22	23
Conn:	N/A	I	I	I	I	I	I	I
Channel:	24	25	26	27	28	29	30	31
Conn:	I	I	I	I	I	I	I	I

Aggregate data rate for channel grouping: EXECUTE

Press ENTER To update the config database and return to the Main Menu

09:52 | CFG: Intf: SEL | | ********** | ESC-ESC = Previous

Figure 5-56. Interface Configuration Window – SEL

The arrow keys are used to move between the different fields. Beginning at the "Framing" field, the down arrow key can be used to move the cursor through each field in the following order (the space bar is used to move through the possible selections, which are given below in parentheses starting with the default):

- Framing (CAS+CRC4, CAS)
- Line Build Out/Equal (75 Norm, 120 Norm, 75 P.R., 120 P.R., 75 HRL1, 75 HRL2, 120 HRL)
- % Err Sec Threshold (100%, 10%, 25%, 50%, 75%)
- Tx Clock Out (On Board, Recovered, Ref Clock, Internal)
- Trunk Conditioning Data Code (Idle {UAC}, MUX-OOS)
- Trunk Conditioning Signaling (Idle {0}/Busy {1}, Busy {1}/Idle {0})
- Idle Channel Conditioning (Voice Idle, Data Idle)
- ATM CES (w/cas, basic)

When done, move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu.

E1 Transmit Clock Configuration

For each configured SEL interface, one of four possible E1 transmit clock sources must be selected in the interface configuration menu:

- On Board (the default)
- Recovered
- Internal
- Reference

On board means the E1 transmit clock is supplied by the SEL's on board clock source.

Recovered means the E1 transmit clock is derived from the received E1 signal.

Internal means the E1 transmit clock is supplied by the main CPU board.

Reference means the E1 transmit clock is supplied by the currently configured reference clock source (see Chapter 1, "System Timing"). Note that an SEL interface can be selected as the reference clock source for the system.

It is important to note that SEL interfaces not configured to use recovered E1 transmit clock must share the same E1 transmit clock configuration. For example, selecting Reference for one interface automatically changes the clock configuration of all of the interfaces that are not configured for recovered clock.

When done, move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu.

Configuring Channel Groups

The SEL interface configuration menu provides a channel assignment (data entry) field for each of the 30 E1 "payload" channels. E1 timeslots 1 and 17 (channels 0 and 16) are reserved for framing and signaling, respectively, and cannot be assigned to channel groups. These two channels are marked N/A in the interface configuration menu. Whenever the cursor is positioned in one of the channel assignment fields, the user is prompted as follows:

```
Channel assignment: Valid choices: I (idle), D1-D30
(data), V1-V30 (voice)
```

To configure a channel group, choose a unique channel group ID and enter it into each of the channel assignment fields of the group. Channel group IDs for data channels begin with "D" and channel group IDs for voice channels (signaling enabled) begin with "V." Only one ID can be assigned to a particular channel. An **idle channel** (a channel that does not belong to a group) is configured by entering an "I" in the channel assignment field. All channels are initially idle when a new interface is configured.

Configuring Connections

Connections are configured via the Connection Management menus. Figures 5-57 and 5-58 show the configuration maps for SEL interfaces.

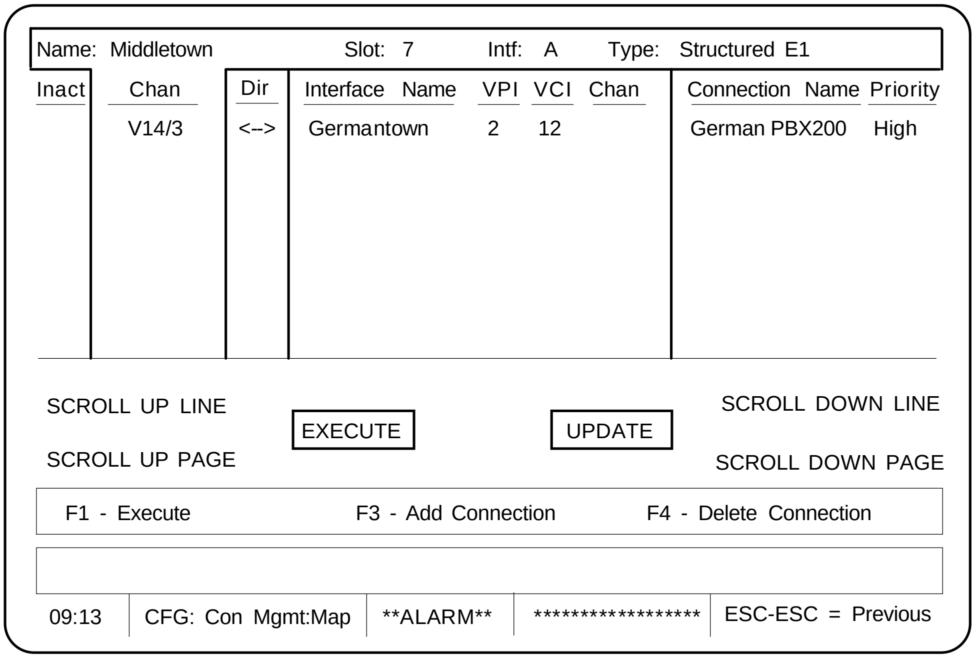


Figure 5-57. Connection Management Mapping Window – SEL to Cell Bearing

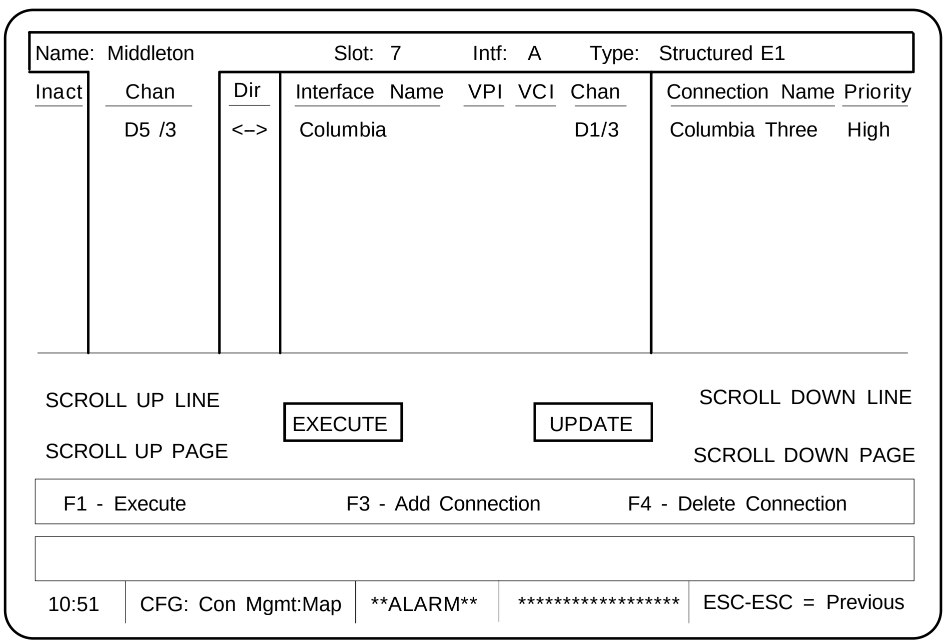


Figure 5-58. Connection Management Mapping Window – SEL to SEL

Configuring connections to and from SEL interfaces is very similar to configuring other connections (see “Configuring Interface Connections”).

1. Select the Connect Mgmt command from the Configure menu.
2. To configure the connections, move the cursor to highlight one of the interfaces.
3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.

4. Use the Up/Down arrow key to move to the **Inact** field.
5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in “Configuring Interface Connections” to add new connections.
6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

Network Management – Cell Exchange Networks

To manage *Synchrony* Cell Exchange devices, the devices must be configured for either LANE or Classical IP management. For additional information, refer to "Configuring Cell Exchanges Devices for LANE or Classical IP" below.

Configuring Cell Exchange Devices for LANE or Classical IP

The following sections provide introductory information on LANE and Classical IP and procedures for configuring a CX network to use LANE or Classical IP.

LAN Emulation (LANE)

Many organizations are migrating networks to ATM to meet rising demands for bandwidth. The challenge is how to support existing Ethernet and Token Ring LANs while migrating to ATM or integrating ATM only for parts of the network. Users want applications to run transparently over the network, whether it is an Ethernet, Token Ring, or ATM LAN.

LAN switches are an economical way to increase bandwidth without requiring expensive changes to adapters, wiring, network software, or applications. LAN switches can deliver high-speed, dedicated connections to individual users and combine bandwidth for better performance. LAN switches also enable the creation of virtual LANs (VLANs), groupings of users based on logical function rather than physical location.

In networks that incorporate both ATM and existing LAN technology, LAN-to-ATM conversion functions become important. LAN Emulation (LANE) provides one option for this conversion.

LANE is a bridging protocol that makes a connection-oriented ATM network look and behave like a shared, connectionless Ethernet or Token Ring LAN segment. LANE can handle both routable protocols such as TCP/IP, IPX, and DECnet as well as non-routable protocols such as NetBIOS and SNA.

LANE offers several advantages:

- Users can take advantage of the higher speeds supported by ATM and access ATM devices without replacing their investment in current LAN hardware, software, and applications.
- Ethernet, Token Ring, and ATM endstations continue to communicate as if they were on the same LAN using standard procedures, because the ATM backbone is transparent to the user.

- The LANE protocol defines how endstations communicate with each other across an ATM network and how ATM-attached servers communicate with devices on Ethernet and Token Ring LANs.

LANE works as a bridging protocol at layer 2 of the Open Systems Interconnection (OSI) model. It does not emulate all of the actual media access control (MAC) protocols. The LANE protocol focuses on emulating a single LAN segment by providing the connectionless broadcast service required by network layer protocols, performing the necessary conversion of data between LAN packets and ATM cells, and resolving MAC to ATM addressing.

LANE provides a translation layer between the higher-level connectionless protocols and the lower-level connection-oriented ATM protocols. The ATM adaptation layer (AAL) sits above the ATM layer. The AAL formats data into the 48-byte ATM cell payload, a process known as segmentation. Once the ATM cells reach their destination, they are reconstructed into higher-level data and transmitted to the respective local devices, a process called reassembly. Because ATM can carry multiple traffic types, several adaptation protocols, each operating simultaneously, can exist at the adaptation layer. AAL Type 5 is used for LAN Emulation.

LANE sits above AAL5 in the protocol hierarchy. It masks the connection setup and handshaking fluctuations required by the ATM network from the higher protocol layers and is independent of upper-layer protocols, services, and applications. It maps the MAC address-based data networking protocols into ATM virtual connections so that the higher-layer protocols think they are operating on a connectionless LAN.

Two primary applications utilize the LANE protocol:

- Centralizing servers and using ATM adapters to attach them directly to an ATM network.
- Integrating existing LANs over an ATM transport backbone.

ATM switches that perform cell relay and use standard ATM signaling protocols to set up virtual connections are not aware of the LANE protocol. LANE services can be co-located in an ATM switch, but the switch fabric does not directly perform any of the emulation functions. The ATM switch maintains the virtual connections and performs the cell-relay necessary for communication over the ATM network.

LANE follows a client/server model, with multiple clients connecting to LAN Emulation components. A LAN Emulation Client (LEC) provides data forwarding and address resolution services. The LEC provides standard Ethernet or Token Ring LAN interfaces to any higher-layer entity, such as the layer 3 IP and IPX protocols. Each ATM adapter, router, or LAN switch can support multiple instances of an LEC, with a separate LEC for each connected Emulated LAN (ELAN).

Clients are typically implemented on devices such as adapters or LAN switches, while LANE clients and LAN Emulation Servers (LES) can be implemented together in a router, LAN or ATM switch, or a standalone ATM equipped host. ATMARP (Address Resolution Protocol) Servers can also be distributed on different routers, switches or hosts across the ATM network.

LANE defines three different types of server components: the LAN Emulation Server (LES), the Broadcast and Unknown Server (BUS), and the LAN Emulation Configuration Server (LECS). These servers provide the following services:

- Resolve MAC addresses to ATM addresses (LES)
- Perform direct unicast data transfers and multi/broadcast data distribution among LAN Emulation clients on the emulated LANs (ELANs) (BUS)
- Maintain the relationship between emulated LANs and VLANs (LECS)

The LAN Emulation Server (LES) provides address resolution services (or "directory assistance") that resolve Ethernet or Token Ring MAC addresses to ATM addresses. The LES itself is identified by a unique ATM address. LECs can communicate directly with each other only when they are connected to the same LES. Multiple LESs can exist on the same physical ATM LAN, each LES supporting a different emulated LAN.

The Broadcast and Unknown Server (BUS) receives all broadcast and multicast packets and transmits these messages to every member of the emulated LAN. A LEC is associated with only a single BUS for each emulated LAN. Each BUS is identified by a unique ATM address, which the LES associates with a broadcast MAC address.

The LAN Emulation Configuration Server (LECS) maintains configuration information about the ATM network and supplies the address of the LES to a LEC when it is initialized. With this information, LECs can perform their own configuration and join networks automatically. The LECS also enables network administrators to control which physical LANs are combined to form VLANs. The LECS assigns individual LANE clients to emulated LANs through the LES. One LECS serves all emulated LANs within an administrative domain.

The LECS is responsible for dynamically assigning different LECs to different emulated LANs. It provides the clients with the address of the most appropriate LES and maintains a database of the resultant associations. It can assign a LEC to an emulated LAN based on either physical location, as specified by the LEC's ATM address, or by logical association. A single LECS can manage the configuration information for a very large ATM network, since its responsibilities are limited to initial configuration. LECs communicate with the LAN Emulation service functions through two different types of VCCs:

- Control connections carry administrative messages, such as requests for initial configuration and for addresses of other LECs.
- Data connections handle all other communications. In particular, they link clients to each other for data-direct unicast communications, and they link clients to the BUS for broadcast and multicast messages.

While legacy LANs make heavy use of multipoint-to-multipoint broadcast, ATM supports only point-to-point (unicast) and point-to-multipoint (broadcast or multicast) connections. The LES and BUS work together to transfer unicast and broadcast traffic:

- The LES handles address resolution and control information. Its primary job is to register and resolve MAC addresses to ATM addresses.
- The BUS is designed for carrying broadcast data, such as TCP/IP address resolution broadcasts or Novell Service Advertising Protocol (SAP) messages. It also handles all multicast traffic. Finally, it broadcasts the initial unicast frames sent by the LEC while the

LES works in tandem to provide the appropriate ATM address for establishing a data-direct VCC.

Joining an ATM Network

When a LEC first powers up, it must obtain configuration information from the LECS in order to join an emulated LAN. The LANE specification offers several options for locating the LECS:

- The LEC can use a "well-known address" as defined by the ATM Forum. The Well Known Address for finding the LECS is:

  ICD - (Old) - 47.00.79.00.00.00.00.00.00.00.00.00.00.00.A0.3E.00.00.01.00

  ICD - (New) - C5.00.79.00.00.00.00.00.00.00.00.00.00.00.A0.3E.00.00.01.00

- The LECS can also be bypassed completely by configuring the ATM address of a LES in the LEC.

Once the LEC locates the LECS, it sets up a connection and forwards some useful information, such as its ATM address, its MAC address, its LAN type, and its maximum frame size. The LECS responds with the actual LAN type, the actual maximum frame size, and the ATM address of a LES. By providing a LES address, the LECS implicitly assigns the LEC to an emulated LAN.

Joining an Emulated LAN

Once a LEC knows the ATM address of the LES, it sets up a connection to the LES. When the LES receives the connection setup message from the client, it learns the LEC's ATM address from the calling party field in the message. Typically, it responds by adding the LEC as a leaf node on a point-to-multipoint connection.

The LEC then registers its MAC address and associated ATM address with the LES, and the LES assigns the client an LEC ID. The specification allows the LES to either discard the address or store it for future reference. At this point, the LEC now can resolve MAC addresses to ATM addresses.

Classical IP

Classical IP over ATM (CLIP) integrates IP and ATM technologies and minimizes the changes required to accommodate the technology in existing routers, switches, and hosts. The end-to-end IP routing architecture is the same as with legacy LAN technologies such as Ethernet. Classical IP over ATM is a straightforward protocol that is easy to understand and implement for net managers familiar with configuring IP nets. Classical IP can run over both ATM permanent virtual circuits (PVCs) and switched virtual circuits (SVCs). It also supports logical IP subnets and allows net managers to define ATM quality of service features on a subnet-by-subnet basis.

Perhaps the most significant virtue of Classical IP over ATM is its simplicity. In a simple PVC network, IP addresses are mapped to virtual circuits, or virtual connections, manually. The user configures each station with a local address table that specifies which virtual connection corresponds to each IP address on the ATM network.

Classical IP over ATM requires no changes to a conventional router-based internetwork. Classical IP can be routed in the same way as conventional IP--packets are forwarded from the originator to a router and from router to router until reaching the final destination. Along the way, the IP header and upper-layer protocols and data remain essentially unchanged.

The prerequisite for two ATM stations to communicate with each other over an ATM network is that each station knows the other station's ATM address. When a workstation starts up, it does not know which other workstations are on the network, and, as it cannot broadcast to every station on the network, another way of doing this is needed.

The ARP server performs the function of giving out the ATM address of stations on the ATM network. It is a software-based process, and can reside on either a switch or a server/host. There can only be one ARP Server per Logical IP Subnet (LIS), but one LIS can support more than one LIS.

Hosts that are incapable of supporting Classical IP over ATM must have static entries made in the ARP server's cache, with a mapping of IP address to an appropriate PVC. This will allow a CLIP host to talk to a non-CLIP host. In order that communication may take place in the opposite direction, static entries must be made in the opposite direction for every CLIP host that the non-CLIP host wishes to communicate with.

Because ATM is a connection oriented technology, the traditional Address Resolution Protocol used on broadcast networks is no longer sufficient. To use SVCs, end-stations must have a way of mapping IP addresses into ATM addresses and virtual connections automatically on demand. CLIP solves this problem by specifying an ATMARP server, which performs address resolution for network endpoints. The ATMARP server may be a software module running on a file server or workstation, or it may be built into a router or ATM switch on the network.

Configuring the CX Network

The following subsections provide information on:

- Configuring the CX network to use either LANE or classical IP
- Configuring the network for TELNET connections

Connecting the Workstation Using LANE

SVC/LANE management support is provided by incorporating a LANE Client onto the Cell Exchange (CX). This allows any standard SNMP manager to manage the CX. However, to take advantage of the Cell Exchange GUI SNMP manager, it must be connected as shown in Figure 5-59. The SNMP platform connects via the same ATM OC-3 NIC as used in previous releases, but connects to the ATM network cloud versus directly to a CX node.

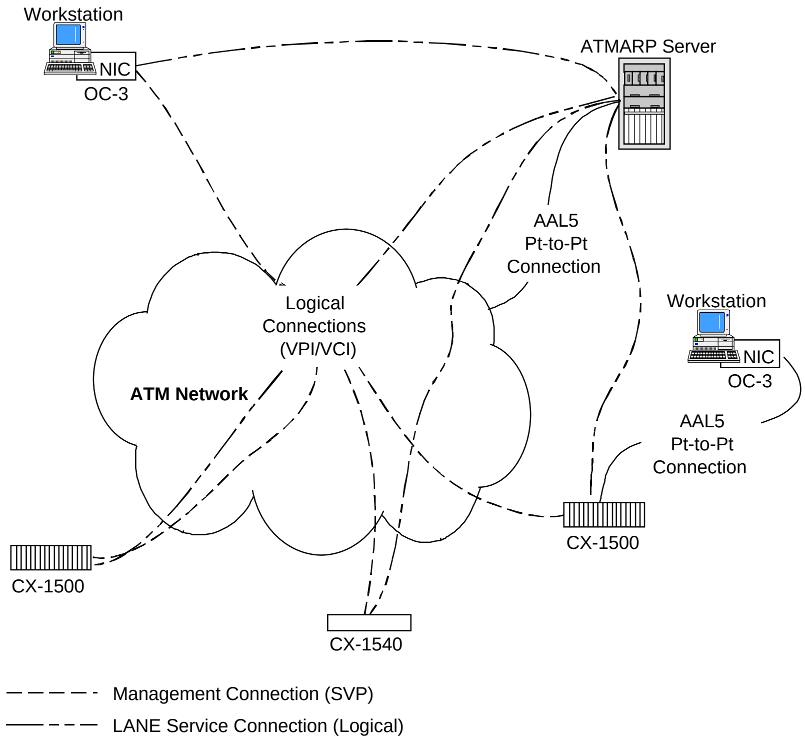


Figure 5-59. Logical Connectivity for LANE

Incorporating SVC and LANE allows management via IP addresses versus PVCs. *An ATM network with LANE must have an "ATMARP Server" in the network.* The ATMARP Server provides the function of tabling and/or converting IP and ATM addresses. ATM Gateways provide the LES, LECS, and BUS services required for LANE operation. The ATMARP Server and ATM Gateway can be the same ATM device. A "Lane Client" resides in both the Cell Exchange and the ATM SNMP management platform in order to "communicate" via the ATMARP Server.

The network management workstation connection to the ATMARP Server is through an OC3 interface. This can be a CX-1500/CX-1540/CX-1580 OC3 module or an OC3 interface on a Fore switch ATMARP Server.

Other devices can connect to the network using OC3 interfaces or non-OC3 interfaces for their SNMP channels. For example, you could route an SNMP channel to a DS3 interface on a Fore switch ATMARP Server.

To establish network management using LANE, you must:

1. Add an ATMARP Server to your ATM Network.
2. Configure the SNMP connection to the ATMARP Server (may be OC3 interface on CX or on Fore switch).
3. Configure LANE connections for the network.
4. Connect the network management workstation to the OC3 interface.
5. Install and configure HP OpenView and *Synchrony* SNMS+ software on the network management workstation.

Adding an ATMARP Server to your ATM Network

TimePlex has qualified Fore Systems ForeRunner ATM switches for use as ATMARP Servers. This includes the ASX-200 and the ASX-1200. For more information, contact your TimePlex sales representative.

Configuring the SNMP Connection to the ATMARP Server

The network management workstation connection to the ATMARP Server is through an OC3 interface. This can be a CX-1500/CX-1540/CX-1580 OC3 module or an OC3 interface on a Fore switch ATMARP Server. The sample procedure below pertains to an OC3 interface on a CX-1500/CX-1540/CX-1580. For information on configuring SNMP connections for other equipment types, see the user documentation for the ATMARP Server hardware you have chosen.

To configure the SNMP connection to the ATMARP Server:

1. From the CX-1500/CX-1540/CX-1580 craft display, select the SNMP command from the Configuration menu.
2. Tab to Logical Intf and toggle the field until the OC3 module appears (use the space bar for toggling).
3. Move to the Service Type field and toggle to IP.
4. Move to the Telnet Disconnect Timeout and enter a timer expiration in seconds (60 to 999).
5. Move to the IP button and press **<ENTER>**.
6. When the next window appears, tab to the VPI field and enter a VPI (e.g., 0).
7. Tab to the VCI field and enter a VCI (e.g., 33).

NOTE: *If the CPU is directly connected to the HRIM, the VPI/VCI values cannot be modified.*

8. Tab to Execute and press **<ENTER>**.

The OC3 is now configured to route SNMP data on VPI/VCI 0/33.

Configuring LANE Connections

To configure LANE connections, perform the following:

1. From the CX-1500/CX-1540/CX-1580 craft display, select the SNMP command from the Configuration menu.
2. Tab to Logical Intf and toggle the field to select the SNMP interface (normally this is an OC3).
3. Move to the Service Type field and toggle to LANE.
4. Move to the Telnet Disconnect Timeout and enter a timer expiration in seconds (60 to 999).
5. Move to the LANE button and press **<ENTER>.**

6. When the LANE configuration window opens, enter the ATM Address (the CX MAC address).

NOTE: *If the address appears as 00000000000000 (14 zeros), the user should go back and assign a MAC address:*

- *Go to the login screen (shift Q or remove/reinsert serial cable).*
- *Enter the password: macman*
- *Enter the 12 digit hex code for the MAC address (009010 followed by the CPU serial number). This only applies to the ACTIVE CPU in a redundant CPU configuration.*

NOTE: *The user does not have to modify this field if the MAC address is set. It will be retained automatically.*

7. Enter an IP address for this CX device.
8. Enter the subnet mask (e.g. 255.0.0.0).

NOTE: *In Step 9 below, any LANE component (LES, LECS, or BUS) you are not required to enter must already be defined in the network.*

9. Select the LECS ADDR Method (AUTO, PROG, ILMI, or NONE).
   - AUTO – user does not enter LECS, LES or ELAN (use well-known address).
   - PROG – user enters LECS only.
   - ILMI – not currently implemented
   - NONE – user enters LES address.
10. Enter the gateway IP address.
11. Enter the IP address(es) to which to send traps.
12. Enter the name of the Emulated LAN to join.

Connecting the Workstation to an OC3 Interface

Establishing a LANE connection to a network management workstation requires:

- Fore ATM Network Interface Card (NIC) (200E/OC3SC).
- An OC3 module on the CX-1500/CX-1540/CX-1580 device or an OC3 interface on the ATMARP Server.
- A multimode fiber-optic cable to connect the NIC card to the OC3 module

You must:

- Install the FORE ATM NIC card on the network management workstation
- Install and configure the driver software on the network management workstation
- Connect the NIC card to an OC3 interface using a multimode fiber-optic cable.

Included with the NIC card is a CD-ROM ForeRunner 200E ATM Network Adapters for UNIX that includes ForeThought 4.1.

For information on installing the NIC card and installing and configuring the corresponding software, see the *ForeRunner SBA-200E ATM SBus Adapter User's Manual* included on the CD-ROM.

Connecting the Workstation Using Classical IP

IP management support is provided by incorporating Classical IP into the Cell Exchange (CX). This allows any standard SNMP manager to manage the CX. The SNMP platform connects via 10BaseT Ethernet to the HRIM module of the CX root node. To take advantage of the Cell Exchange GUI SNMP manager, connections must be established as described below:

- Static route between HRIM and the CPU at the root node (Figure 5-60).
- Remote node CPUs to the HRIM in the CX root node (Figure 5-61).

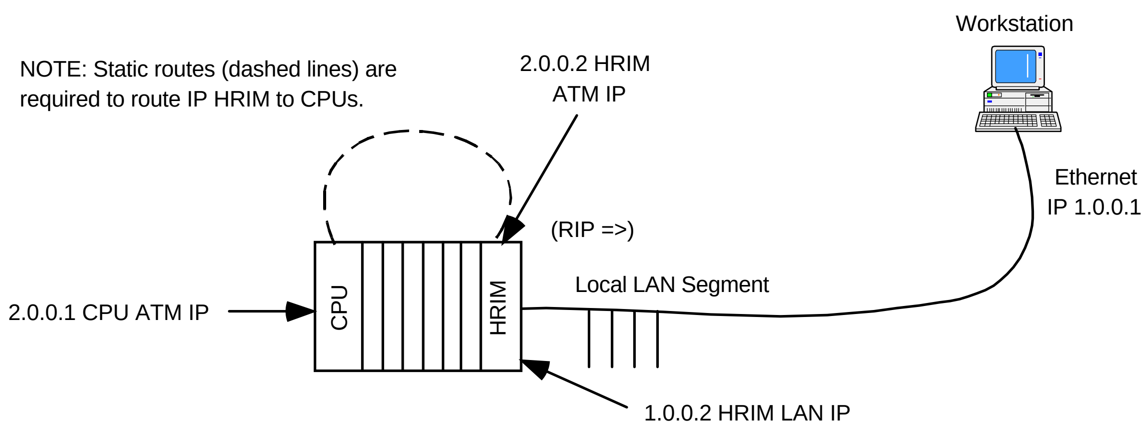


Figure 5-60. Classical IP Workstation Connectivity (Root Node)

The HRIM broadcasts RIP towards the local LAN segment and dynamically discovers the routes for LAN devices on the local LAN segment. In order to pass IP across the network, static routes must be configured into the HRIM for each remote LAN route. A static route must also be defined between the HRIM and the CPU in order to pass SNMP from the workstation to the CPU module. Static routes must be configured from HRIM to HRIM and from HRIM to CPU (within a CX node).

The HRIM supports 32 static routes. Therefore, only 32 CX nodes can be managed using Classical IP.

NOTE: *The IP address of the ATM side of the local HRIM must be on the same IP subnet as all participating CPUs and remote HRIMs.*

In the configuration shown in Figure 5-61:

- The SNMP platform connects via 10 base-t Ethernet to the HRIM module of the CX root node. The ATM OC-3 NIC card *is not* required for this connection.
- The originating PC/NMS system must have an IP address that is on the same IP subnet as the HRIM.
- The originating PC/NMS system must have a static route from the HRIM to the node(s) being managed.
- The HRIM supports a maximum of 32 static routes, including the HRIM to HRIM and HRIM to CPU. This means only 32 CX nodes can be managed using Classical IP.

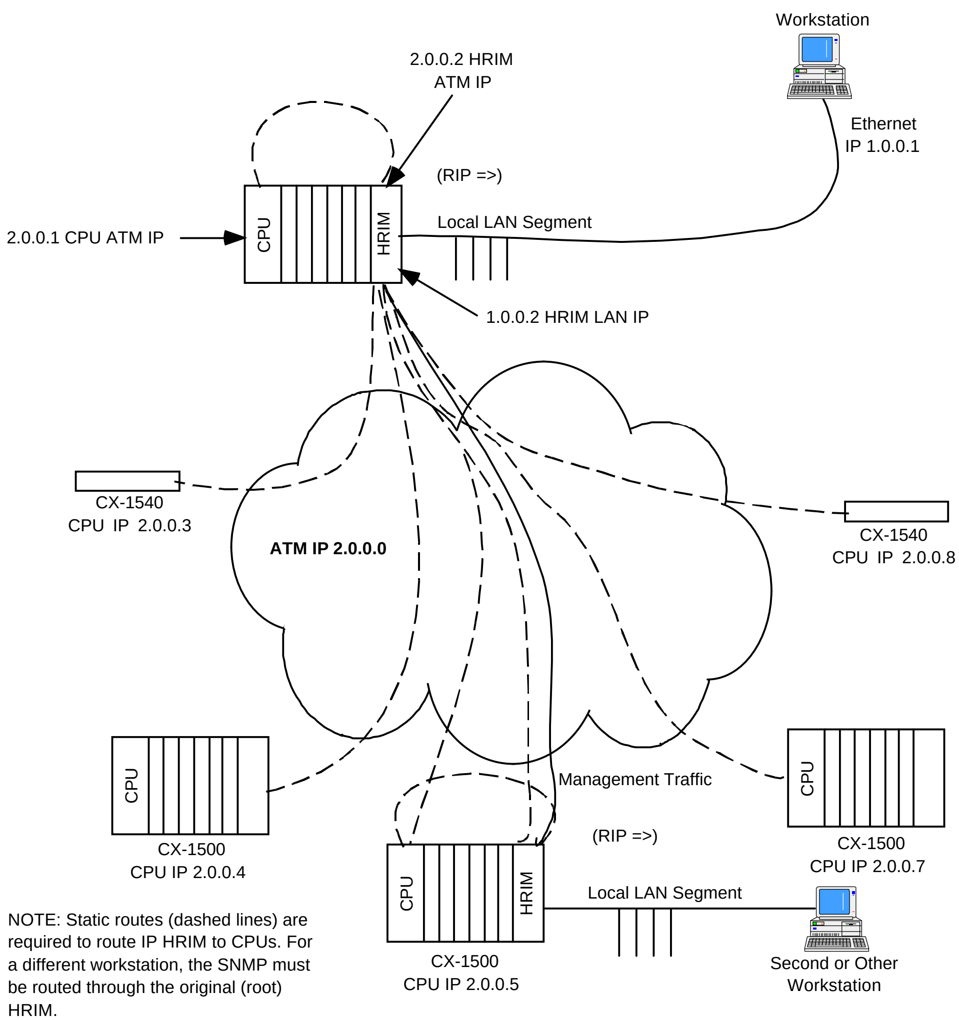


Figure 5-61. Classical IP Workstation Connectivity (Additional Nodes)

Chapter 6. Troubleshooting

(1) Page 6-1, delete the bullets listed under "Traps" and replace with the following:

- Power Supply UP
- Power Supply DOWN
- Board UP
- Board DOWN
- Incorrect Board Configured
- Interface UP
- Interface DOWN
- Management Validation Bad
- LEC UP
- LEC DOWN
- Incorrect Password
- Software System FULL
- Software Version Removed
- Download Good
- Download Bad
- Multicast Connection
- Validation Bad
- CPU ACTIVE
- Standby CPU Active
- CPU Manual Switchover
- CPU Manual Switchover Enabled
- CPU Manual Switchover Disabled
- CPU Switchover Requested
- CPU Enable Switchover Requested
- CPU Disable Switchover Requested
- AXS Failure
- AXS Cleared
- AXS Bad Location
- AXS Bad Address
- AXS Bad Configuration
- Incorrect OC3 timing
- Crypto parameters
- Alarm Array members
- CPU Not Ready
- CPU Ready

Appendix B. Cable Diagrams

(1) Page B-2, replace Table B-2 with the following:

Table B-2. Cable Applicability Matrix – Legacy

		Module Type									
Part Number	**Description**	**STL**	**SEL**	**DSL**	**HSL**	**HRIM**	**LSAL**	**UTEL**	**HSSL**	**UD3L**	**UE3L**
613008-X	HDB-26 (M) to DB-25 (M), RS-530			X	X						
613009-X	HDB-26 (M) to DB-25 (F), RS-530			X	X						
613004-X	HDB-26 (M) to DB-25 (M)			X	X						
613005-X	HDB-26 (M) to DB-37 (M)			X	X						
613006-X	HDB-26 (M) to DB-37 (F)			X	X						
613003-X	HDB-26 (M) to DB-34 (M)			X	X						
613007-X	HDB-26 (M) to DB-34 (F)			X	X						
610127-X	RJ-45 to RJ-45 (Straight)	X	X					X			
610126-X	RJ-45 to RJ-45 (Crossover)	X	X					X			
612751-X	HSSI (M) to DCE (M)								X		
612529-X	HSSI (M) crossover (M)								X		
613013-X	RJ-45 (M) to 25-pin DTE (M)						X				
613014-X	RJ-45 (M) to 25-pin DTE (F)						X				
613015-X	RJ-45 (M) to 9-pin DTE (M)						X				
613016-X	RJ-45 (M) to 9-pin DTE (F)						X				
61359	DB-15 (M) to DB-15 (M)	X									
61362	RJ-45 to DB-15 (F)	X									
120405-X	BNC (M) to BNC (M)					X		X		X	X
COMATPX-1013	RJ-45 (M) to RJ-45 (M) Straight					X					

(2) Pages B-3 and B-4, replace Table B-3 with the following:

Table B-3. Cable Index

Part No.	Cable Model	Connector	Figure	Description
650252-X	CPU-VT100/9F	9 Pin DB (F) –9 Pin DB (F)	B-1A	CPU craft interface to VT100 terminal
650074-X	CPU-VT100/25F	9 Pin DB (F) – 25 Pin DB (F)	B-1B	CPU craft interface to VT100 terminal
650075-X	CPU-VT100/25M	9 Pin DB (F) – 25 Pin DB (M)	B-1C	CPU craft interface to VT100 terminal
610133-X	ST/NCP-MDM	9 Pin DB (F) – 25 Pin DB (M)	B-2	CPU craft interface to VT100 terminal via modem
613008-X	DSC-530M	26 Pin HDB (M) – 25 Pin DB (M)	B-3	DSC Module (DTE) to RS-530 ATM facility DSL/ HSL Modules (DCE) and SCM Module to V.11 (RS-530)
613009-X	DSC-530F	26 Pin HDB (M) – 25 Pin DB (F)	B-3	DSC Module (DTE) to RS-530 ATM facility DSL/HSL Modules (DCE) and SCM Module to V.11 (RS-530)
613004-X	DSL/HSL-ILC	26 Pin HDB (M) – 25 Pin DB (M)	B-4	DSL/HSL Modules to LINK/2+ or entréeLINK+ ILC Module
613005-X	DSL/HSL/SCM-449M	26 Pin HDB (M) – 37 Pin DB (M)	B-5	DSL/HSL Modules to LINK/100+ DLI.0 Module and RS-449 SCM Module to RS-449
613006-X	DSL/HSL/SCM-449F	26 Pin HDB (M) – 37 Pin DB (F)	B-5	DSL/HSL/SCM Modules to RS-449
613003-X	DSL/HSL/SCM-V35M	26 Pin HDB (M) – 34 Pin DB (M)	B-6	DSC/DSL/HSL/SCM Modules to V.35 Winchester
613007-X	DSL/HSL/SCM-V35F	26 Pin HDB (M) – 34 Pin DB (F)	B-6	DSC/DSL/HSL/SCM Modules to V.35 Winchester
61362	BADP	8 Pin Mod – 15 Pin DB (F)	B-9	STL Module to ST Dpanel-4/DSX-1 via BIM/PBX cable (61359) T1C Module to CSU/Smart Jack (straight) via DSX-1/CSU cable (61385)
61359	BIM-PBX-F	15 Pin DB (M) – 15 Pin DB (M)	B-10	STL Module (via BADP cable) to ST Dpanel-4/DSX-1
61385	DSX-1/CSU	15 Pin DB (M) – 15 Pin DB (M)	B-11	T1C Module (via BADP cable) to CSU/Smart Jack
120405-X	TX3-DS3	Male/Male BNC	B-12	DS3 Module to DS3 (45Mbps) facility (ANSI T1.107) E3C Module to E3 equipment (34 Mbps) E1C/UTEL Modules to G.703 unbalanced (via Balun) HRIM Module to 10Base 2 Ethernet UD3L/UE3L

Table B-3. Cable Index (Cont'd)

Part No.	Cable Model	Connector	Figure	Description
610126-X	ST/MOD-XFR	8 Pin Mod – 8 Pin Mod	B-8	T1C Module to CSU/Smart Jack (crossover) E1C/SEL Module to E1 equipment (crossover) UTEL Module to non-framed E1 or T1 equipment (crossover)
610127-X	ST/MOD-MOD	8 Pin Mod – 8 Pin Mod	B-7	STL Module to LINK/2+ BFM/BIM.1, LINK/100+ DLI.1 Module, entréeLINK+ CSU Module, or ST Dpanel-4/PRI (T1M/E1M) T1C Module to CSU/Smart Jack (straight) E1C/SEL Modules to E1 equipment (straight) UTEL Module to non-framed E1 or T1 equipment (straight)
612529-X	CXHSSI-XVR	HSSI (M) crossover (M)	B-22	HSSL Module crossover, HSSI 50-pin connector
612751-X	CXHSSI-DCE	HSSI (M) to DCE (M)	B-21	HSSL Module to DCE, HSSI 50-pin connector
613012-X	DSC – X.21	26 Pin HDB (M) – 15 Pin DB (M)	B-15	DSC Module to V.11/X.21 (DCE)
613013-X	LSAL-RJ45-25DTE-M	RJ-45 (M) to 25-pin DTE (M)	B-17	LSAL Module to 25-pin DTE (for PCs or workstations)
613014-X	LSAL-RJ45-25DTE-F	RJ-45 (M) to 25-pin DTE (F)	B-18	LSAL Module to 25-pin DTE (for most non-PC DTEs)
613015-X	LSAL-RJ45-9DTE-M	RJ-45 (M) to 9-pin DTE (M)	B-19	LSAL Module to 9-pin DTE (for most non-PC DTEs)
613016-X	LSAL-RJ45-9DTE-F	RJ-45 (M) to 9-pin DTE (F)	B-20	LSAL Module to 9-pin DTE (for PCs or workstations)
COMATPX 1013	10 BASE T	RJ-45 (M) – RJ-45 (M)	B-16	HRIM Module to hub, 10Base-T Ethernet (straight)
FOXN0004	OC3-SM	SC SM (M) – ST SM (M)	B-13	OC3 Module to 155 Mbps single mode service (SONET)
FOXN0005	OC3-MM	SC MM (M) – SC MM (M)	B-14	OC3 Module to 155 Mbps multimode service (SONET)

Appendix C. Cable Applications

(1) Page C-5, change the title of Figure C-9 to read, "E1C/SEL Module Cabling."

WARNING NO OPERATOR SERVICEABLE PARTS ARE INSIDE THIS EQUIPMENT. SERVICE MUST BE PERFORMED BY QUALIFIED SERVICE PERSONNEL.

VORSICHT NICHT VOM BENUTZER REPARIERBARE TEILE IM GEHÄUSE. BITTE WENDEN SIE SICH AN QUALIFIZIERTES WARTUNGSPERSONAL.

ATTENTION CET APPAREIL NE CONTIENT AUCUN ELÉMENT QUE L'UTILISATEUR PUISSE RÉPARER. CONFIER LA MAINTENANCE À UN PERSONNEL TECHNIQUE QUALIFIÉ.

WARNING: THIS EQUIPMENT MAY HAVE MORE THAN ONE POWER SUPPLY CORD. DISCONNECT ALL POWER SUPPLY CORDS BEFORE SERVICING TO AVOID ELECTRICAL SHOCK.

VORSICHT: DIESES GERÄT HAT MEHERE NETZANSCHLÜßE. ZUR WARTUNG ALLE NETZKABEL TRENNEN UM ELEKTRISCHEN SCHLAG ZU VERHINDERN.

ATTENTION: CET APPAREIL COMPORT PLUS D'UN CORDON D'ALIMENTATION AFIN DE PRÉVENIR LES CHOCS ÉLECTRIQUES. DÉBRANCER TOUS LES CORDONS D'ALIMENTATION AVANT LA MAINTENANCE.

About This Manual

This manual supports Release 4.0 of the *Synchrony* Cell Exchange system.

The *Synchrony Cell Exchange User's Guide* is part of the *Synchrony* library.

The primary purpose of the *Synchrony Cell Exchange User's Guide* is to assist in installation, initial configuration, and operation of a Cell Exchange system.

This manual is intended to supplement–not replace–formal training. Timeplex, Inc. recommends that users obtain formal training prior to using this product. Contact the Registrar at 1-954-846-6434 for information.

NOTES: *Throughout this manual the term* ***"system"*** *and the expression "****Cell Exchange system"*** *are used to apply to the CX family of Cell Exchange Models, collectively.*

The term ***"module"*** *is used throughout this manual to represent component cards that have specific application and have been designed for use in the CX family of systems.*

Organization of This Manual

This manual describes the *Synchrony* Cell Exchange system. This covers the physical design, basic and expanded configurations, and the available modules to expand the system to meet the user's parameters.

The information is organized as follows:

- **Chapter 1, Overview,** provides a brief summary of ATM service, the family of Cell Exchange models, common and interface modules, timing (or clocking), cooling and performance characteristics.
- **Chapter 2, Installation,** provides procedures for installing the Cell Exchange systems.
- **Chapter 3, Modules,** describes each of the interface modules that can be used in the Cell Exchange.
- **Chapter 4, Operation,** describes basic procedures for operating the Cell Exchange system.
- **Chapter 5, Configuration,** provides procedures for configuring individual Cell Exchange modules.
- **Chapter 6, Troubleshooting,** provides an overview of diagnostic procedures used to locate the cause of malfunctions in Cell Exchange applications.

- **Chapter 7, Replacement Procedures,** provides step-by-step procedures for removing and replacing field replaceable units.

Appendixes

- **Appendix A, Asynchronous Transfer Mode Overview,** describes basic asynchronous transfer mode (ATM) concepts.
- **Appendix B, Cable Diagrams**, provides an index of Cell Exchange cables and cable wiring diagrams.
- **Appendix C, Cable Applications,** includes diagrams showing the types and applications of cables used in a Cell Exchange system.
- **Appendix D, Field-Replaceable Units,** provides an index of Cell Exchange field replaceable items.

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Service

For service in the U.S. and Canada, contact Customer Support at 1-800-366-0126.

For service outside the U.S. and Canada, contact Customer Support at 44 (0) 1256 763911.

Information required for service is:

Model No. ________________________ Serial No. ______________________________

Warnings, Precautions, and Notes

Be sure that you understand all directions, warnings, and limitations before using this product. In this manual:

- **WARNINGS** present information or describe conditions, which if not observed could result in injury.
- **PRECAUTIONS** reflect conditions that could cause product damage or data loss.
- **NOTES** describe limitations on the use of the equipment or procedure.

If Product Is Received Damaged

Forward an immediate request to the delivering carrier to perform an inspection and prepare a damage report. SAVE container and packing material until contents are verified.

Concurrently, report the nature and extent of damage to Customer Support so that action can be initiated to repair or replace damaged items or instructions issued for returning items.

The responsibility of the manufacturer ends with delivery to the first carrier. ALL CLAIMS for loss, damage, or nondelivery must be made against the delivering carrier WITHIN 10 DAYS OF RECEIPT of shipment.

To Return Product

Please obtain instructions from Customer Support before returning any item(s). Report the fault or deficiency along with the model, type, and serial number of the item(s) to Customer Support. Upon receipt of this information, Customer Support will provide service instructions or a Return Authorization Number and other shipping information. All items returned under this warranty must be sent to the manufacturer with charges prepaid.

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Chapter 1

Overview

Asynchronous Transfer Mode (ATM) networking is a technology that provides high bandwidth and low delay, using packet-like switching and multiplexing techniques. Usable capacity is segmented into 53-byte, fixed-size cells, consisting of header and information fields, allocated to services on demand. Data is sent asynchronouly with respect to the network and other data channels.

In the U.S., ATM technology was first used mostly in local area networks (LANs) but is increasingly being deployed for applications in wide area networks (WANs) and for applications involving both private and public network operations within the enterprise. ATM is a technology-enabling infrastructure that provides a global networking platform from which to connect all forms of communications applications. See Appendix A for a more detailed discussion of ATM technology.

The Cell Exchange family of ATM products provides flexible, modular, scaleable and cost effective “multi-access” solutions to WAN connectivity for emerging ATM networks. Multi-access means that these products allow users to transition into the new ATM technology at their own pace, while preserving their investment in the existing application infrastructure. These Cell Exchange products provide the user with an ATM Cell platform that serves on the “network edge” to multiplex and concentrate cell bearing (ATM) and legacy traffic (Frame Relay, IP, Ethernet, TDM, asynchronous, bi-synchronous, SNA). These systems are ideal for the wide range of ATM applications because of their flexible architecture and diversified interface designs. In addition, powerful ATM service capabilities result with maximum network efficiency when full traffic management and “Any-to-Any” connectivity are combined in their operation.

The CX-1500 Family of Cell Exchange Systems

The CX-1500 family of Cell Exchange systems provides a versatile, scaleable, secure, and cost effective ATM cell platform. The Cell Exchange systems provide for expansion of today’s totally ubiquitous ATM networking concept by using ATM technology at lower bit rates, while at the same time continuing to make use of existing equipment.

The Cell Exchange system is designed on a modular hierarchy of functionality that allows the user to add features and functionality on a “need only” basis. Thus, the user has the freedom to “size” the equipment to the requirements of the application. The architecture of the Cell Exchange system is shown in Figure 1-1.

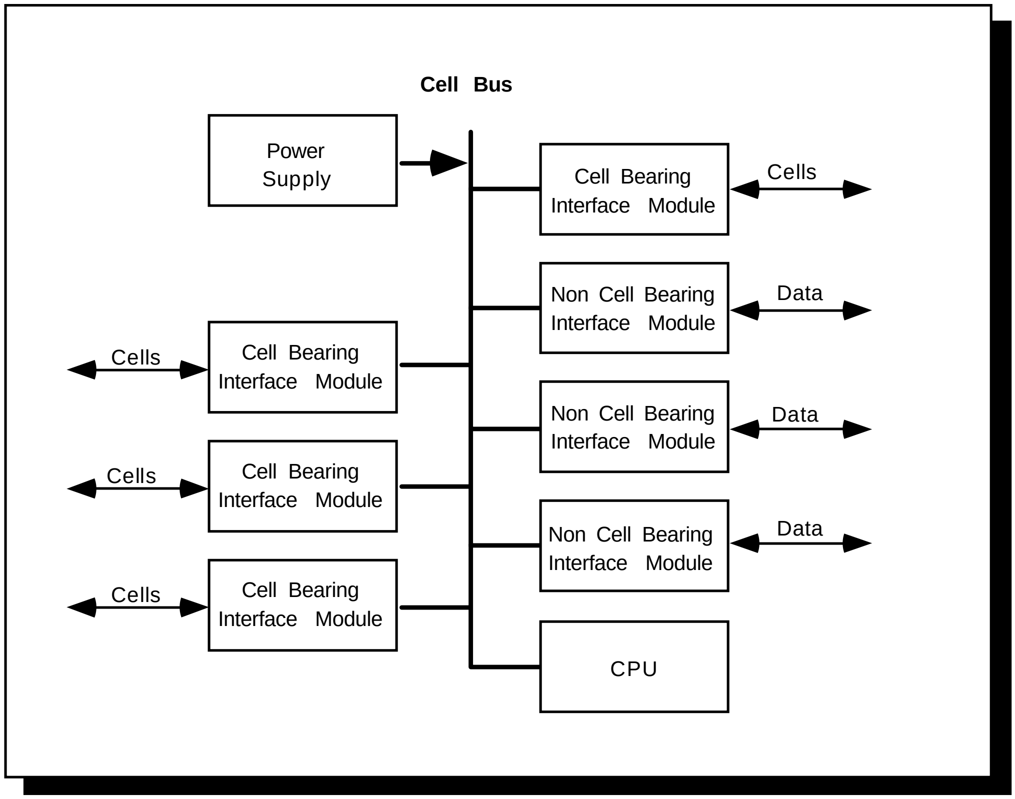


Figure 1-1. Cell Exchange System Architecture

The Cell Exchange system is a modular and scaleable ATM cell multiplexer that operates by using an ATM Cell Bus architecture. The system is physically constructed and integrated into a card frame sub-chassis. The Cell Exchange system comes standard with a shelf, power supply module and CPU module. Other modules can be integrated into the systems. The user has a variety of modules to choose from. Once a Cell Exchange system is populated with the modules chosen by the user for a particular application, all communications between modules is through the ATM Cell Bus located on the backplane. The Cell Exchange uses a passive backplane design that includes the ATM cell bus and dual power and ground tracks.

Modules and Services

The Cell Exchange system extends ATM networks to sites and applications that do not support native ATM interfaces (non-ATM protocols are referred to as “legacy systems” in this manual). This is accomplished through the use of various Interface Modules. A typical example is illustrated in Figure 1-2.

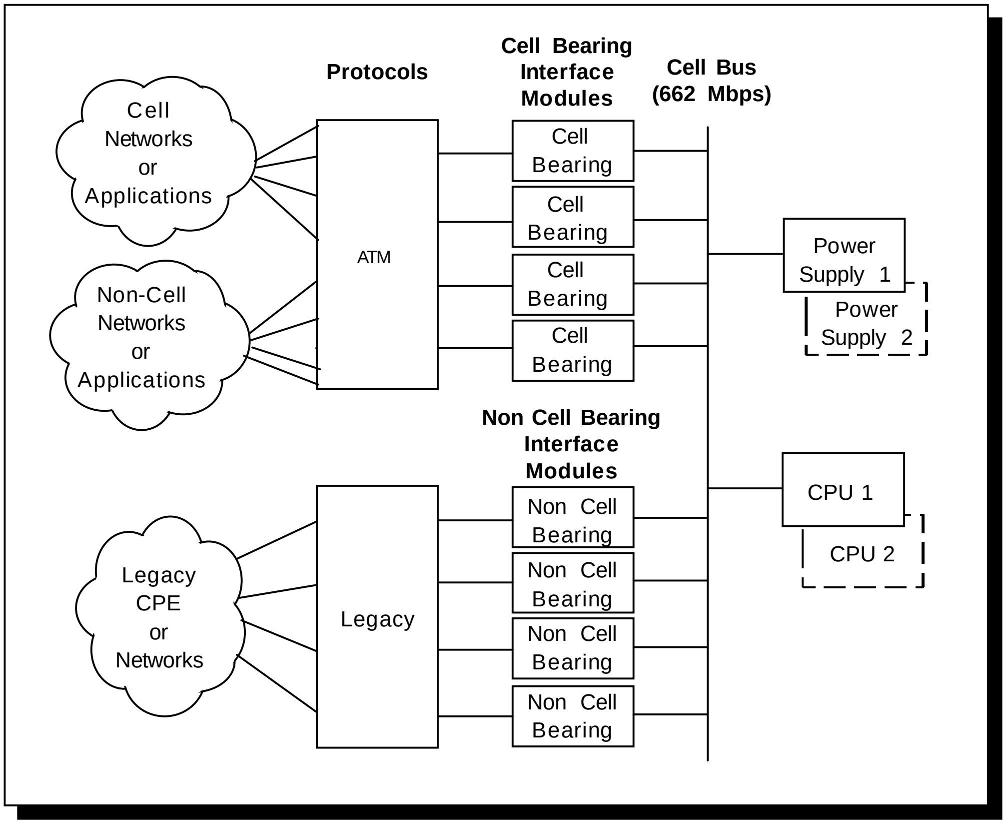


Figure 1-2. Cell Exchange System Interfaces

Table 1-1 shows the modules that are currently available for use with the Cell Exchange system.

Table 1-1. Cell Exchange System Modules

Type	Ports	Rate
Common System Modules		
CPU Module	—	—
Station Clock Module	—	—
Power Supply Module	—	—
Cell Bearing Interface Modules		
T1 Cell Interface Module (T1C)	2	1.544 Mbps
OC3 Cell Interface Module (OC3)	1	155 Mbps
OC3C Cell Interface Module (OC3C)	1	155 Mbps
Dual Synchronous Cell Interface Module (DSC)	2	32 Kbps - 20 Mbps
DS3 Cell Interface Module (DS3)	1	45 Mbps
E1 Cell Interface Module (E1C)	2	2.048 Mbps
E3 Cell Interface Module (E3C)	1	34.368 Mbps

Table 1-1. Cell Exchange System Modules (Cont'd)

Type	Ports	Rate
Non-Cell Bearing Interface Modules		
Structured T1 Legacy Interface Module (STL)	4 or 8	1.544 Mbps
Dual Synchronous Legacy Interface Module (DSL)	2	16 Kbps - 2.048 Mbps
High Speed Synchronous Legacy Interface Module (HSL)	1	1 Mbps - 20 Mbps
High Speed Serial Interface Module (HSSL)	1	52 Mbps
Hub Router Interface Module (HRIM)	4 or 8 RJ45 + 1 BNC	10 Mbps
Low Speed Asynchronous Legacy Interface Module (LSAL)	8	75 bps – 38.4 Kbps
Unstructured T1/E1 Legacy Interface Module (UTEL)	1	1.544 Mbps (T1)/2.048 Mbps (E1)
Unstructured DS3/T3 Legacy Interface Module (UD3L)	1	44.736 Mbps
Unstructured E3 Legacy Interface Module (UE3L)	1	34.368 Mbps
Basic Interface Module (BIM)	Application Specific	Application Specific
4-Wire EML Module (EML)	2	64 Kbps

Equipment Description

The Cell Exchange system is available in several physical modular designs that can integrate with a variety of ATM interface modules to provide the versatility and scalability needed to accommodate the rapidly growing ATM market, today and in the future. The CX-1500 system has a 15-slot chassis, the CX-1540 system a 4-slot chassis, and the CX-1580 system an 8-slot chassis (the CX-1580 is available only as a custom build). All chassis accommodate the same modules, both "common functionality" modules needed to provide basic unit operation and interface modules. The common modules are the CPU, Power Supply and Station Clock modules. The CX-1500 comes standard with a chassis, passive backplane, CPU module and AC power supply module. The CX-1540 operates from a single internal AC Power Supply Module. The CX-1540 comes standard with a chassis, passive backplane, internal AC power supply, and a CPU module. The CX-1580 comes standard with a chassis, passive backplane, and a CPU module. The CX-1580 does not have a power supply. Power is supplied from an external source.

CX-1500

The CX-1500 is based on a passive backplane design, which allows all modules to be inserted from the front. The chassis has slots for 15 modules (including the CPU), plus two slots for power supply modules. It is designed for easy rack mounting in a standard 19-inch rack, but because it is fully enclosed, it may also be used in a desktop environment. Figure 1-3 shows a front-panel view of the CX-1500 system with redundant Power Supply Modules.

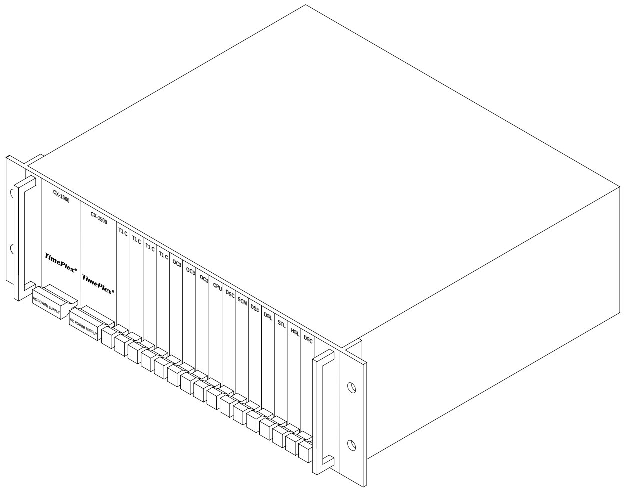


Figure 1-3. CX-1500 Cell Exchange System

Chassis Specifications	
Size:	5.25 inches high, 19 inches wide, 13 inches deep
Input Power:	90 to 230 VAC, 47 to 63 Hz, 2.0 amps -38 to –60 VDC, 5.0 amps

The power supply slots are located in the left-most part of the chassis. The remaining slots may be populated with any type module. The CPU Module *must be installed in slot 8* for non-redundant operation *and in slots 7 and 8* for redundant operation, and the remaining slots should be populated from the center outward.

PRECAUTION: ***The CPU must not be installed in slot 1 of any Cell Exchange. Slot 1 is an initialization slot. Installing the CPU in this slot will erase (initialize) the database.***

Except for the Power Supply module, all Cell Exchange modules are composed of two sections: the ATM Cell Bus control section, containing the Microprocessor and memory; and the module functionality section, which contains the components needed to perform the module's unique function. All interface modules (exclusive of the CPU Module) have an identical ATM Cell Bus, Microprocessor, and memory sections. For additional information on individual modules, see Chapter 3, "Modules."

CX-1540

The CX-1540 is also based on a passive backplane design, which allows all modules to be inserted from the front. It has slots for 4 modules (including the CPU). The CPU may be installed in any slot except slot 1 (See precaution above). The AC power supply is integrated with the chassis. The

CX-1540 may be rack mounted, used on a desktop or, with optional hardware, wall mounted. A typical front panel view of the CX-1540 is shown in Figure 1-4.

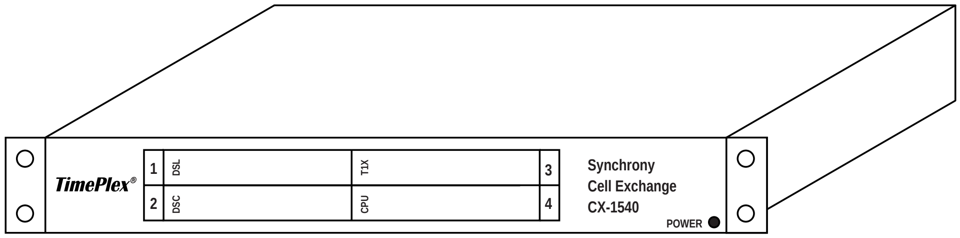


Figure 1-4. CX-1540 Cell Exchange System

Chassis Specifications	
Size:	1.75 inches high, 19 inches wide, 13 inches deep
Input Power:	90 to 230 VAC, 47 to 63 Hz, 0.8 amps

CX-1580

NOT GENERALLY AVAILABLE.

The CX-1580 is also based on a passive backplane design, which allows all modules to be inserted from the front. It has slots for 8 modules (including the CPU). The CPU must be installed in slot 5 in a single CPU configuration and slots 5 and 6 in a redundant configuration (see precaution above). Power (+5V DC, Ground) is supplied to the chassis from an external connector (customer furnished). The chassis does not support an AC or –48V DC power input. The CX-1580 is designed to be rack mounted. A typical front panel view of the CX-1580 is shown in Figure 1-5.

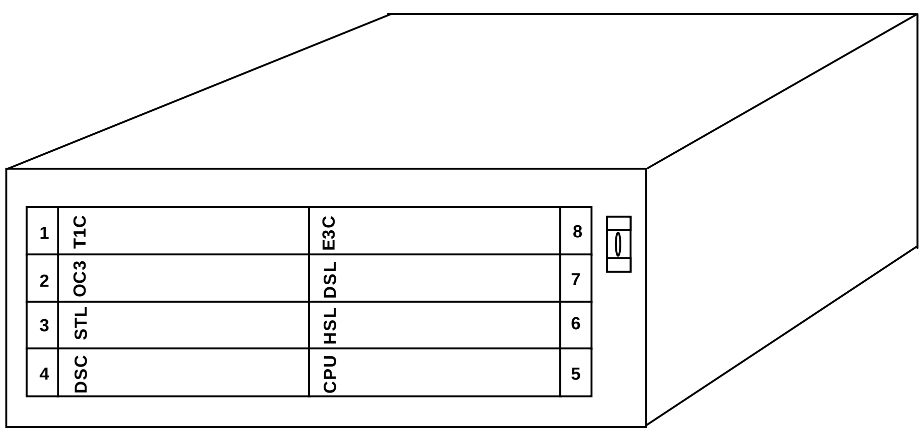


Figure 1-5. CX-1580 Cell Exchange System

Chassis Specifications	
Size:	Designed for vertical mounting: 12 inches high, 3.5 inches wide, 13 inches deep
Input Power:	+5.1 VDC (±5%), 14.0 amps

Power Distribution

Power distribution within the Cell Exchange systems is relatively simple. Standard AC power (90 to 230 VAC, 47 to 63 Hz) is received at the backplane of the chassis and transferred via the power connector interface to the Power Supply Module. The Power Supply Module converts the AC input to +5 VDC, which is then sent to a voltage regulator and the backplane bus.

DC power is very similar. Standard DC power (-38 to -60 VDC) is received at the backplane of the chassis and transferred via the power connector interface to the Power Supply Module. The DC/DC Converter Module converts the DC input to +5 VDC, which is then sent to a voltage regulator and the backplane bus.

NOTE: The CX-1580 does not include a power supply, therefore power distribution is limited to the +5 VDC and Ground supplied by an external source. (Not generally available.)

Indicators

All indicators are located on the front panel of each module. Indicators for the various modules are described in the appropriate subsections in Chapter 3, “Modules.”

CPU Module

The CPU Module is designed around a Motorola 68340 microprocessor, and is used to control, configure, collect statistics, and provide all general management functionality within the unit. The CPU module also provides master timing for the cell bus and drives the INTERNAL and REFERENCE OUT clock lines.

The CPU Module provides all configuration, control, and management functions for the Cell Exchange systems from a local craft interface, remote dial-up modem management feature, or a Simple Network Management Protocol (SNMP) interface. The CPU module controls all microprocessors/controllers on other Modules located in the same chassis, using the ATM bus message formatting structure. The CPU module (ATM bus) is also responsible for ATM Q.2931 signaling used in communications with LAN Emulation servers.

CPU Redundancy

In order to sustain network operation in the event of a CPU failure, a redundant pair of CPU Modules may be installed in the CX-1500 or CX-1580. When two CPU Modules are present, they are installed in slots 7 and 8 in the CX-1500, or slots 5 and 6 in the CX-1580.

Only one of the two CPUs actively controls the CX-1500 shelf operation at any given time. The CPU in control is referred to as the active CPU and the other is called the standby CPU. The active CPU can be distinguished from the standby by examining the ACTV LED (located on the front panel of the CPU Module) or by examining the alarm log entries from the craft port. The standby CPU’s primary responsibilities are to passively monitor shelf activity and be ready to assume the active role whenever the active CPU fails for any reason. A CPU switchover can be enabled, disabled, and manually initiated from the craft port on either CPU (See Chapter 4, Operation).

The first CPU to boot up will become the Active CPU, the second one will become the Standby. The Standby CPU will adjust its configuration database to match that of the Active CPU. If the Standby CPU resets, it will boot up and again become the Standby CPU, adjusting its configuration database to match that of the Active CPU.

If the Active CPU resets, the Standby CPU will immediately become Active. When the CPU that reset boots up, it will become the Standby CPU, adjusting its configuration database to match that of the Active CPU. An active CPU that fails will result in the same actions as a CPU that resets.

The following is a brief explanation of the roles of the Active CPU and the Stand-by CPU.

Active CPU Operation

The active CPU controls all shelf activity, including:

- Downloading the interface modules
- Sending "keep alive" messages to ensure that the interface modules are operating correctly
- Monitoring bus activity (such as keep alive responses from interface modules) to determine which modules are present and operating properly
- Directing interface modules to establish connections
- Processing configuration changes entered by the user
- Recording interface module related alarms such as module up/down and interface up/down events
- Processing statistics from interface modules
- Sending database updates to the standby CPU when necessary

Standby CPU Operation

The standby CPU assumes a more passive role and is responsible for:

- Monitoring bus activity (such as keep alive responses from interface modules) to determine which modules are present and operating properly
- Recording interface module related alarms such as module up/down and interface up/down events
- Processing statistics from interface modules
- Polling the active CPU for any database changes that have occurred (these are the only messages that are sent by the standby CPU, and these messages only go to the active CPU, i.e., the standby CPU never sends messages to interface modules)
- Detecting loss of bus communications

Following database updates from the active CPU, the standby CPU reinitializes itself. The standby CPU also reinitializes itself whenever it detects a loss of bus communications. Whenever the standby CPU reinitializes for any reason, CPU switchover is automatically enabled. If the CPU switchover was previously disabled by the user, it will automatically be re-enabled when either CPU is reinitialized.

Power Supply Module

The CX-1500 chassis may be equipped with either an AC or DC Power Supply. One or two Power Supply Modules of the same type may be installed depending upon the degree of reliability the user is striving for. One Power Supply Module handles the full power load required for the number of interface modules placed in the chassis. The Power Supply Modules feature a “solid state” switcher design. If two modules are installed, the modules are coupled to supply redundant power to the bus. The Power Supply Modules are designed to allow removal and replacement into a working unit without affecting active operational traffic (hot swap). (See Chapter 7 for installation/removal precautions.) Each Power Supply Module has its own power connector and cord.

The DC Power Supply requires a different back panel than the standard CX1500 chassis to accommodate the DC power connector. The DC Power Supply and AC Power Supply are physically the same form and fit, but they are not compatible.

PRECAUTION: ***The AC and DC Power Supply Modules are physically interchangeable. Care must be taken to ensure the correct one is installed or damage to the module may result. If a DC Power Supply Module is inadvertently plugged into an AC chassis, the internal fuse on the power supply will blow. If an AC module is plugged into a DC chassis, nothing will happen and there will be no indication of any activity.***

NOTE: *The only way to determine whether the CX1500 chassis is designed for the AC or DC Power Supply Module is to look at the rear panel. (See Figures 2-1 and 2-2.)*

The CX-1540 is equipped with a single AC Power Supply Module that is integrated with the chassis. The CX-1580 does not come equipped with a power supply.

Station Clock Module

The Station Clock (SCM) Module allows the user to input and propagate an external clock source into the CX-1500 to be used as the internal reference clock for the unit. The SCM requires a balanced electrical input signal. The clock rate may be selected at a rate from 8 kHz to 20 MHz in 8 kHz steps.

Interface Modules

The Interface Modules are part of a broad group of modules that have been developed for the Cell Exchange systems. Each Interface Module provides a specific service, as described in Chapter 3, “Modules.”

Timing

The following describes the various timing systems and their functions that are resident in the *Synchrony* Cell Exchange system. These timing systems are used specifically in ATM networks to support AAL1 (CBR) circuit emulation type traffic. There are four major timing systems in the Cell Exchange system. These are:

- System Timing
- Data Bus Timing
- Channel/Port Timing
- External Timing

System Timing

System Timing is the term that is used when *selecting* a “single” timing source to be used as the Reference Timing Source by the Cell Exchange system. Only one timing source may be selected at a time. The Cell Exchange systems have the capability to select a pre-determined timing source that can be used by the rest of the Channel/Port Modules as a reference clock source. As shown in Figure 1-6, the timing signal that may be chosen as the timing reference source is labeled REF/I (note that all of the REF/I lines are tri-stated for selection purposes which are microprocessor controlled). Located on the same Figure, the timing signal that may be used as the timing reference is labeled REF/O.

Data Bus Timing

A high-speed 25 MHz clock resident on the CPU module provides Data Bus timing. Its function is to transfer ATM Cell traffic to and from installed modules in the Cell Exchange system chassis.

Channel/Port Timing

Channel/Port Timing represents the various timing reference signals that may be selected on a particular interface module residing in the Cell Exchange system. Normally the reference signal dictates how the timing on that particular channel/port will operate. The following timing options are available to various interface modules, although not all options are used on all modules:

- Recovered Timing
- On Board Timing
- Reference Timing
- Internal Timing
- Adaptive Timing
- Send Timing
- Receive Timing

Recovered Timing

In digital networks, the high-speed network interface circuit connected to the service provider’s network is normally used as the “master” timing reference. This digital interface is referenced in multiple geographic locations throughout the service provider’s network to a reference source (i.e., Stratum 1), which provides the network with a highly reliable and stable timing source. This timing source can be used as a timing source for the Cell Exchange system.

During initial configurations, the user can choose this timing source on most of the interface modules by selecting the interface circuit (A-B-C-D) connected to the service provider, and setting it as the reference timing source.

Most modules have the capability to “recover” timing originating from the carrier circuit and phase-lock the “reference clock” to it to produce various timing rates required by the Cell Exchange system. If the circuit chosen to provide reference should fail, the Cell Exchange system will revert to the internal clock source as a secondary choice. All other modules may now use this timing as the timing reference.

On-Board Timing

On Board timing is the least stable of all timing sources and should only be used if no other timing source is available. On Board timing is provided as a source reference when testing the Cell Exchange system in a “back-to-back” mode. This timing source may be used by all the channel/ports on that particular module.

This timing source may also be selected as the “reference” timing source. Selecting this timing source as the reference is accomplished in the same manner as for external timing, from the Timing Configuration screen at the craft interface. Lower speed circuits may use this timing reference as a primary clocking source.

Reference Timing

Reference timing may be used on some modules to select the “reference” timing to be used to transfer data in and out of the selected interface on that module. (It is not applicable for E3C or DS3 modules).

Internal Timing

Internal Timing is the clock that is resident on the CPU module and is presented to all the modules as an alternative timing selection. Internal Timing is also used for the “fall-back” timing source in case the selected timing source fails. In this case, the “fall-back” clock would then take its place until it is restored.

Adaptive Timing

Adaptive Timing is used on the DSL, HSL, HSSL, UT3L, UE3L, and UTEL Modules. Adaptive Timing derives timing from the clock that was inserted at the “far end” of the circuit. In Adaptive Timing, the received cell data is buffered and continuously tracked. The tracking information is then processed by the on-board CPU and used to control a VCXO. The output of the VCXO is then used to shape the timing that is produced to clock the clear data out of the module to the terminal equipment.

NOTE: *When using any of the above clock sources as timing for a CBR-type emulation circuit, it is imperative that BOTH ends of the circuit are timed from the same source, and that they are **synchronous** with one another. If this is not done, transmit and receive timing will “slip” as the two clocks drift past one another.*

External Timing

External Timing may be inserted into the Cell Exchange system by using the Station Clock Module (SCM). External Timing is a source of timing derived from a customer who has a highly reliable and stable timing source (such as LORAN or GPS) being used as a Master Station Clock. The Master Station Clock timing signal can then be injected into a Cell Exchange system and be used as the master timing source for all modules. From the craft interface, the user can select the SCM module as the source by entering the Timing Configuration screen and choosing the appropriate command. Lower speed circuits may use this timing reference for a primary clocking source.

Figure 1-6 shows a block diagram of the timing system.

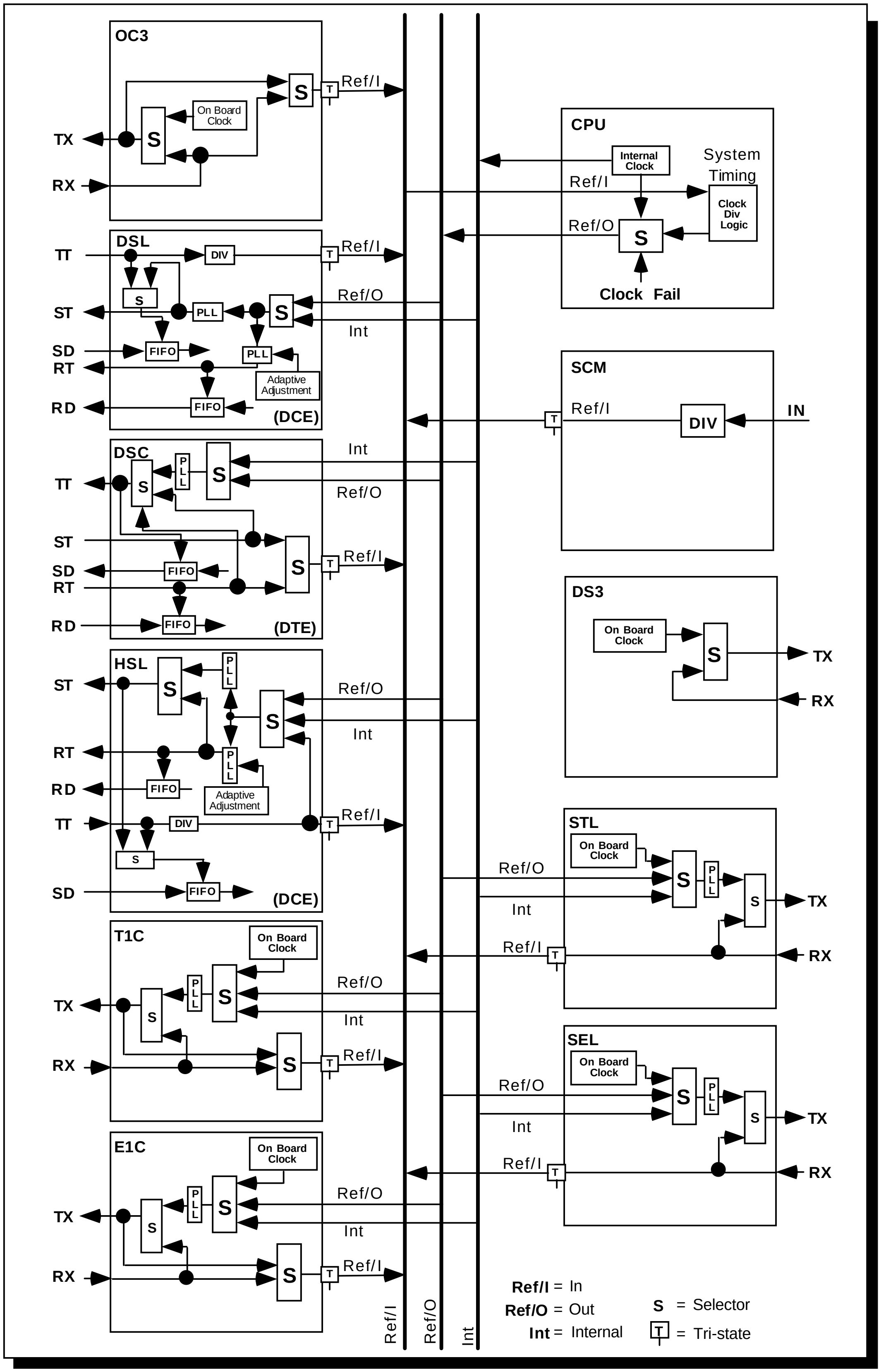


Figure 1-6. System Timing Diagram (Page 1 of 3)

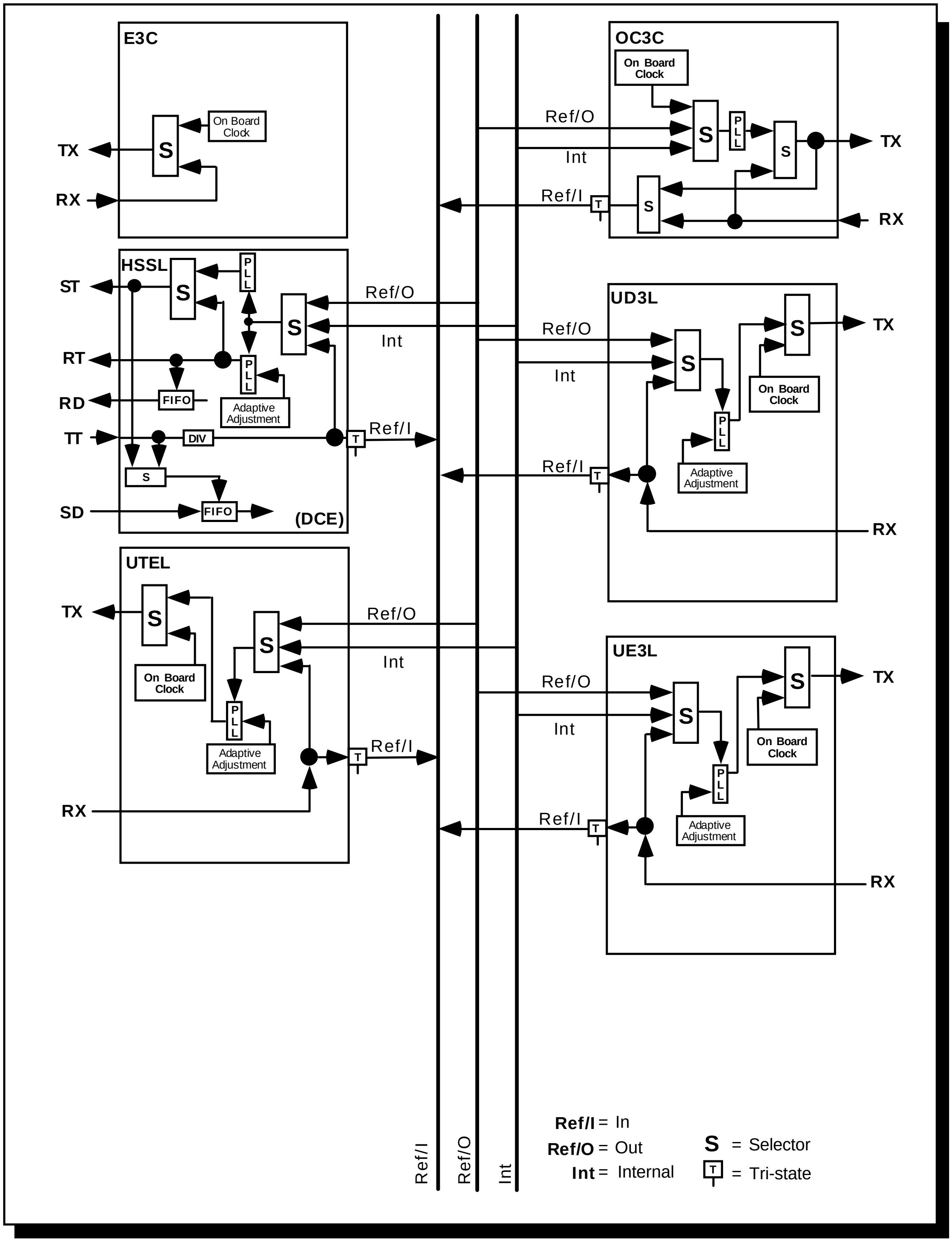


Figure 1-6. System Timing Diagram (Page 2 of 3)

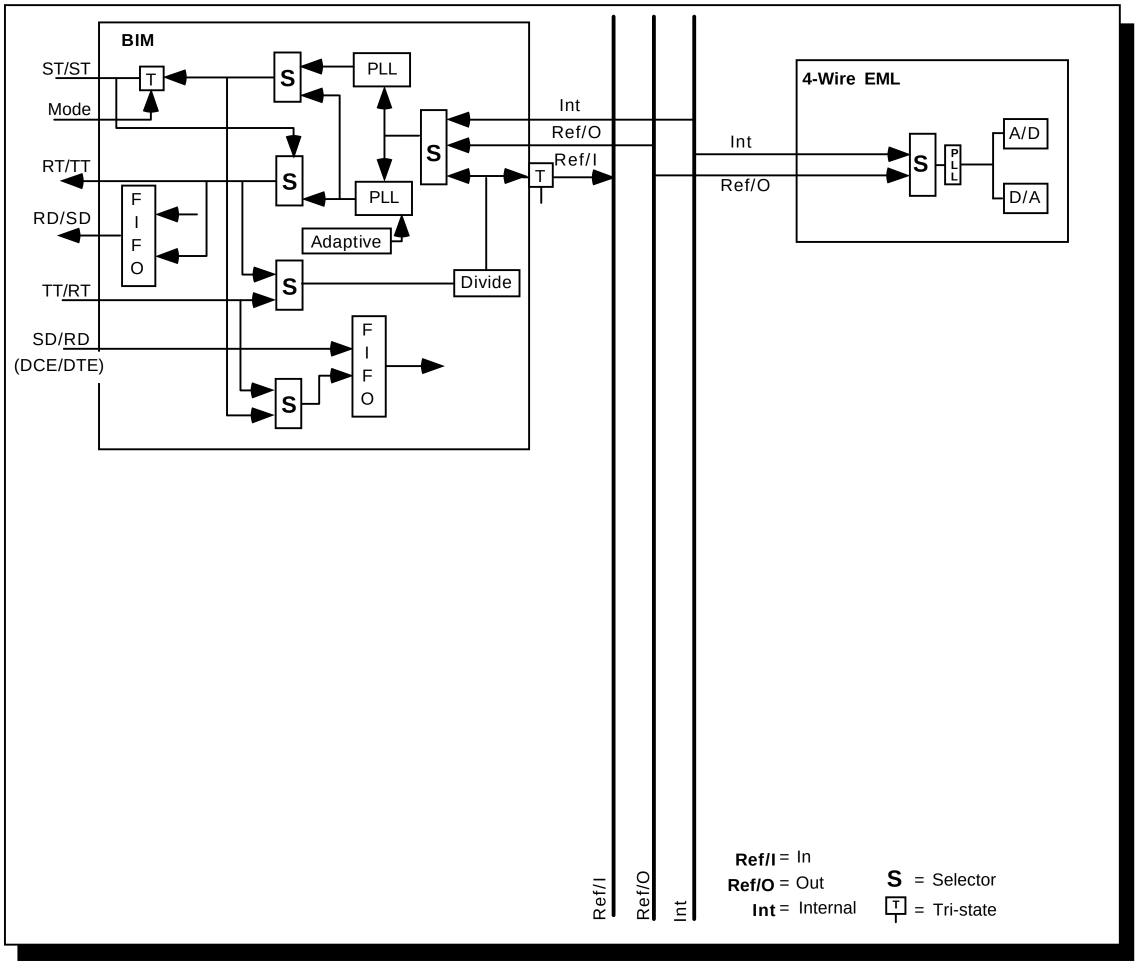


Figure 1-6. System Timing Diagram (Page 3 of 3)

NOTE: The HRIM and LSAL modules are asynchronous and do not require a timing reference.

System Cooling

System cooling is accommodated through normal ventilation. No special cooling is required under most environmental conditions when the unit is lightly populated (eight or less modules). Under severe operating conditions, such as extremely high ambient temperatures or high concentrations of dust, circulation aids, such as stacking fan units, may be required. A stacking fan arrangement is shown in Figure 1-7.

PRECAUTION: ***If more than half of the slots in the CX-1500 Cell Exchange system are populated, overheating may occur if ventilation fans are not installed.***

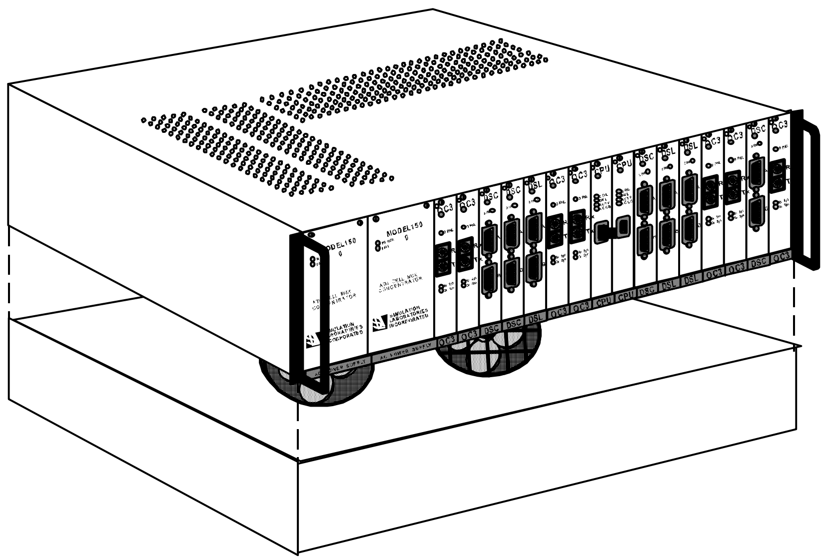


Figure 1-7. Cell Exchange with Stacking Fan Unit

Performance Characteristics

The physical, electrical, and environmental characteristics of the Cell Exchange system are shown in Tables 1-2 to 1-4.

Table 1-2. Physical, Electrical and Environmental Characteristics – CX-1500

Category	Standard Characteristics	Options
System Capacity	Case with backplane AC power supply CPU Module 15 empty slots	Up to 14 interface modules DC power supply Redundant power supply Redundant CPU module
Enclosure Size	5.25” high, 19” wide, and 13” deep	Same as standard
Chassis Weight	22 - 32 pounds, depending upon configuration	Same as standard
Clearance Requirements	1.75” above and below case required for ventilation	Same as standard
Power Input	90 - 230 VAC, 47 - 63 Hz, 2.0 amps	-38 to -60 VDC, 5.0 amps
Operating Environment	0° - 50° C Up to 85% relative humidity; non-condensing at 50° C	Same as standard

Table 1-3. Physical, Electrical and Environmental Characteristics – CX-1540

Category	Standard Characteristics	Options
System Capacity	Case with backplane AC power supply CPU Module 3 empty slots	Up to 3 interface modules
Enclosure Size	1.75” high, 19” wide, and 13” deep	Same as standard
Chassis Weight	8 - 11 pounds, depending upon configuration	Same as standard
Clearance Requirements	1.75” above case required for ventilation	Same as standard
Power Input	90 - 230 VAC, 47 - 63 Hz, 0.8 amps	None
Operating Environment	0° - 50° C Up to 85% relative humidity; non-condensing at 50° C	Same as standard

Table 1-4. Physical, Electrical and Environmental Characteristics – CX-1580

Category	Standard Characteristics	Options
System Capacity	Case with backplane CPU Module 7 empty slots	Up to 7 interface modules Redundant CPU module
Enclosure Size	12” high, 3.5” wide, and 13” deep	Same as standard
Chassis Weight	10-12 pounds, depending upon configuration	Same as standard
Clearance Requirements	1.75” above and below case required for ventilation	Same as standard
Power Input	+5.1 VDC (±5%), 14.0 amps	None
Operating Environment	0° - 50° C Up to 85% relative humidity; non-condensing at 50° C	Same as standard

Compatibility Requirements

This section covers interoperability with other systems, both ATM and non-ATM.

LINK Family

The CX family will inter-operate with products from the LINK family via the CX legacy cards using AAL1 to provide constant bit rate (CBR) cell streams for LINK traffic.

Synchrony ST

The CX family will inter-operate with products from the Synchrony ST family via the CX legacy cards using AAL1 to provide constant bit rate (CBR) cell streams for Synchrony ST traffic. The Synchrony can also interface with the CX via an OC3c UNI multi-mode link provided on the ATM ICP module in the ST.

IAN-150

The CX family will inter-operate with the IAN-150 via the CX legacy cards using AAL1 to provide constant bit rate (CBR) cell streams for IAN-150 traffic.

AD-10

The CX family will interoperate with the AD-10 via the CX legacy cards using AAL1 to provide constant bit rate (CBR) cell streams for AD-10 traffic.

Other Vendors' Equipment

Other vendors' systems connect with the CX via ATM interfaces or via legacy interfaces (as with TimePlex equipment). ATM interfaces are commonly used to connect to higher speed ATM switches or ATM services based on ATM switches. The CX is capable of supporting ATM traffic from any system that supports ATM Forum compliant interfaces that match the interface types supported on the CX. The CX-1500 has demonstrated interoperability with ATM switches from Fore and other vendors. For specific information, contact TimePlex.

Chapter 2

Installation

Site Preparation

Minimal site preparation is required for the Cell Exchange system. They are easily mounted into a standard 19-inch rack.

Equipment Installation

Unpacking

The Cell Exchange system is shipped in cartons with adequate packing material to protect them from damage due to shock and vibration. Upon receipt of either system, inspect the condition of the carton for obvious damage. After opening, inspect the equipment for signs of damage, and inventory the equipment against the enclosed packing list. Notify the carrier and *TimePlex* immediately if there is any damage or shortages.

Required Tools and Equipment

There are no special tools or equipment required for installation of the Cell Exchange system.

Chassis Installation Procedures

Installing a Cell Exchange system chassis into the rack is simply a matter of selecting a mounting position with adequate room and ventilation for the Cell Exchange. A Cell Exchange system should have at least one rack unit (1-3/4 inches) of space open above and below it to provide unrestricted airflow to the venting ports in the chassis.

Once the chassis is mounted on the tray (slides), push it back into the rack until the ears on each side of the front panel contact the rack. Secure the chassis to the rack with 4 screws.

Grounding Requirements

Once the chassis is installed, ground the installation by attaching a grounding strap (not supplied) between the common equipment rack ground and the grounding lug located on the backplane.

WARNING: ALWAYS ENSURE THAT THE CELL EXCHANGE SYSTEM IS PROPERLY GROUNDED BEFORE COMMENCING OPERATIONS. INJURY TO PERSONNEL AND DAMAGE TO THE EQUIPMENT COULD RESULT IF THIS IS NOT OBSERVED.

Power Connections

The Cell Exchange systems require AC or DC (CX-1500 only) input power. For AC, the range must be 90 - 230 VAC, 47 - 63 Hz. For DC, the range must be –38 to –60 VDC. Ensure that the available station power can meet these criteria.

WARNINGS: FOR DC INPUT, THE CHASSIS MUST BE CONNECTED TO AN ISOLATED SECONDARY CIRCUIT OR SOURCE.

SECURE THE POWER CABLE TO THE CONNECTOR ON THE REAR PANEL BEFORE CONNECTING THE CABLE TO THE POWER SOURCE. FAILURE TO COMPLY WITH THIS PROCEDURE MAY RESULT IN ELECTRICAL SHOCK.

PRECAUTIONS: Observe electrostatic discharge (ESD) precautions when handling any Cell Exchange system module. If ESD precautions are not taken, sensitive components may be permanently damaged.

Individual external power must be turned off to the chassis prior to removal/installation of the individual power supply. Severe damage to components may occur if power is not turned off.

To make a power connection, plug one end of a power cord into the system receptacle on the backplane and the other end into the power source receptacle. Figure 2-1 shows the AC module (receptacle) mounted on the rear of the CX-1500 chassis, Figure 2-2 shows the DC module, and Figure 2-3 shows the CX-1540.

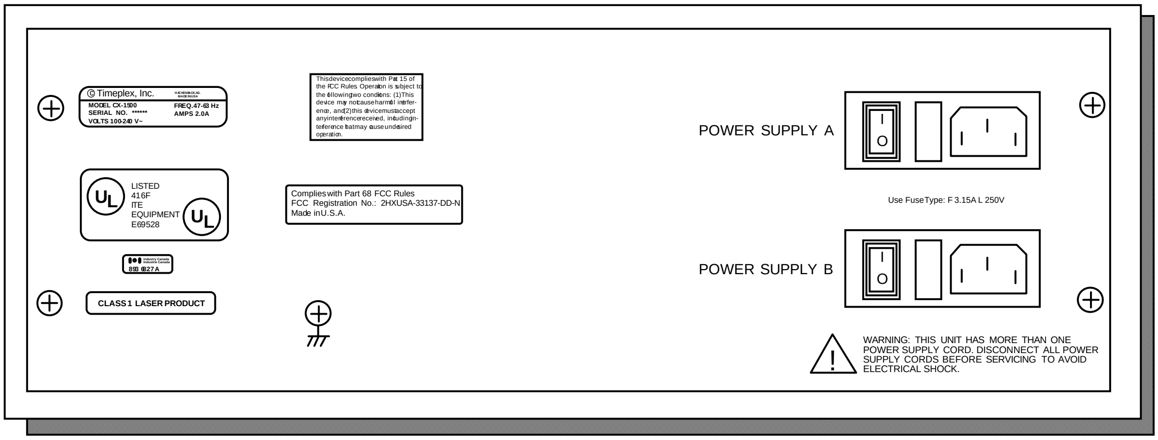


Figure 2-1. CX-1500 AC Power Connector Module (Rear Chassis)

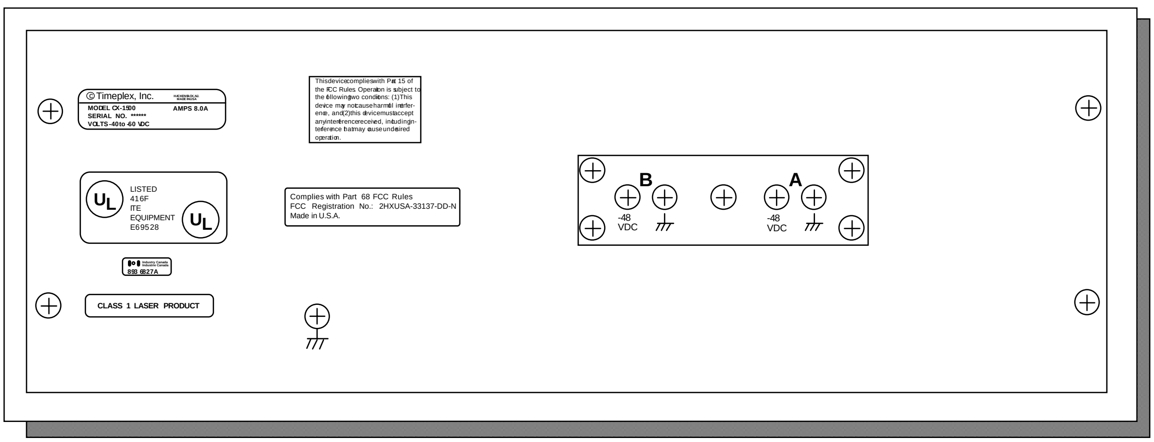


Figure 2-2. CX-1500 DC Power Connector Module (Rear Chassis)

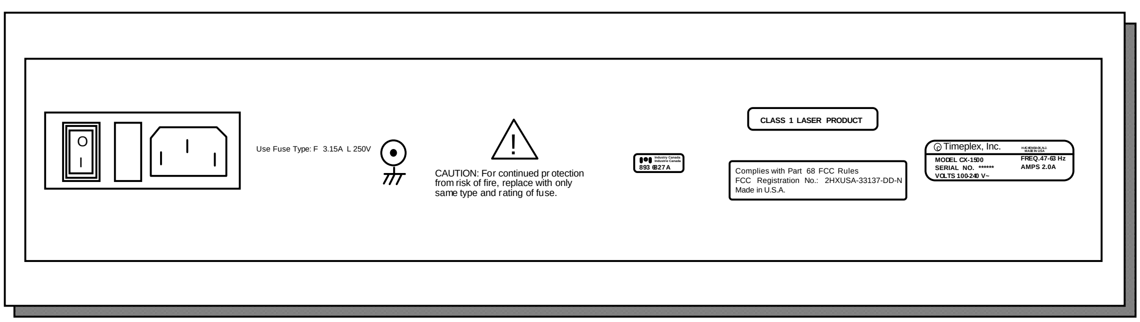


Figure 2-3. CX-1540 AC Power Connector Module (Rear Chassis)

Module Installation Procedures

The CX system is delivered with all user-specified modules installed. If additional modules are to be subsequently installed, follow these basic procedures:

1. Select an available slot to install the new module.

PRECAUTION: ***The CPU Module must be installed in slot 8 of Model CX-1500 for non-redundant operation, and in slots 7 and 8 for redundant operation.***

The CPU Module may be installed in any slot except slot 1 of Model CX-1540.

The CPU Module must be installed in slot 5 of the CX-1580 for non-redundant operation, and in slots 5 and 6 for redundant operation.

1. Loosen the two captive screws holding the blank front panel to the chassis.
2. Insert the module into the chassis. Use care to ensure that the DIN connector is correctly lined up and fully seated into the backplane.
3. Tighten the two screws that attach the module front panel to the chassis.

NOTE: *Never force the screws when starting them. If they become difficult to turn, back them off and start over.*

4. Attach required cable(s) to module connector(s)
5. Some modules may have fiber optic components; carefully observe the following:

PRECAUTION: ***Working with fiber optic cables can be hazardous to personnel and, if mishandled, can cause permanent damage to the cables.***

WARNING: ***THE FIBER-OPTIC CONNECTORS MAY EMIT LASER LIGHT THAT CAN INJURE YOUR EYES. NEVER LOOK INTO AN OPTICAL FIBER CONNECTOR OR CABLE.***

Software Installation

Diskette Installation

Installation instructions for the CPU software file are included in the readme.txt file on the first diskette. See the Release notes for details.

Software Upgrade Requirements

Software upgrade requires:

- IBM/compatible PC running Windows 95, Windows 98 or Windows NT
- Terminal emulation software: HyperTerminal located in Windows 95, Windows 98 or Windows NT Accessories
- At least 5MB of hard disk space

CX Release 4.0 supports the FTP feature, which allows users to remotely update software versions through an IP or LANE interface.

The FTP feature allows CX users to save and restore databases and upload new software from a remote location. The FTP feature requires use of an FTP Client application. Most simple off-the-shelf FTP Client applications will work hosted on a PC or Unix workstation.

However, not all off-the-shelf FTP Client applications can be used with the CX. The CX has difficulty keeping up with FTP clients that send the FTP Server multiple segments at a time. These sophisticated FTP Clients can be used only if configured to send one segment at a time.

The software upload feature requires use of both a telnet session and the FTP Client. Through the Software Ver Menu screen the user selects the name of the new software version. The CX will inform the user that it is erasing flash memory, and then that it is ready to accept software. Once the user sees the second prompt from the telnet screen the new software image can be sent to the CX via the FTP Client. The following ftp command, **FTP>put CPUROM.BIN**, sends the software image to the CX.

General Information

- Flash contains two versions of software: the one that is currently running and one 'other'.
- There is only one database version held in non-volatile RAM.
- Although either the online or standby CPU can receive a software download via FTP or Craft Station, it is recommended that only the online CPU be used for software download.
- Some PC-based FTP Clients display both the client and server's directory tree. These FTP Client applications cannot be used due to the fact that the CX does not have a disk system.

Redundant CPU Database Synchronization

The active CPU checksums blocks of its database. Any blocks that have a changed checksum are sent to the standby CPU, in messages that includes the database version.

The standby CPU updates its database, only if the database version identifier matches. If the database versions do not match, no update occurs.

Save and Restore

The Database Save and Restore operations are performed from the FTP client.

The FTP command, **FTP>get <filename>,** saves the CX's current database configuration into the file given as **<filename>.** Any filename can be used except CPUROM.HEX or CPUROM.BIN.

The FTP command, **FTP>put <filename>**, restores the CX database configuration with the contents on **<filename>**. Any filename can be used except CPUROM.HEX or CPUROM.BIN. Once the database restore operation is complete, the CX will reboot so that it can initialize itself with the new database configuration.

For step-by-step instructions on saving and restoring a database, see Chapter 4 of this manual.

Boot Failsafe

There is a failsafe during the reboot from a code swap. If after 8 seconds the boot code detects the CPU code execution has not occurred, or the CPU is not stable, the system will automatically revert to the old flash image (by executing a code swap). This will insure a stable, executing version of software. If the database has been converted forward, a download of the old configuration database and a nodal reboot will be required to bring the node back to its original state.

Procedures for Software Upgrade

Software upgrade procedures will vary depending upon the version of the old software being upgraded. The table below summarizes the upgrade method and file type for upgrading software versions 3.1.1 and subsequent. Refer to the Release Notes for upgrade procedures for versions prior to 3.1.1.

Table 2-1. Upgrade Path – Version 3.1.1 and Subsequent

From Version	To Version	Method Available	File Type
3.1.1	4.0	Craft Interface "send text file"	cpurom.hex
3.2	4.0	Craft Interface "send text file"	cpurom.hex
3.2	4.0	FTP	cpurom.hex
4.0	4.0 and higher	Craft Interface "Xmodem"	cpurom.bin
4.0	4.0 and higher	FTP	cpurom.bin

Single CPU Scenario

This section describes generically what happens during software upgrade in a single CPU CX node. See the detailed procedures for using the craft station, FTP or Xmodem for software upgrade.

STEP 1 – Log on using the Administrator password.

The NVRAM is pulled from the online CPU and stored as a file on the Craft Station PC in case the user needs to revert to an earlier version of software.

STEP 2 - Download the new software version to the CPU.
The new version of software is loaded into the section of flash for "other" software (non-executing).

***NOTE**:* *Only two images may be accommodated in flash at one time. If more than one software image exists in flash, one must be deleted before downloading new software. The download procedure will take approximately 15 to 45 minutes to complete depending on the CPU and operating system being used.*

STEP 3 - Execute a Code Swap.
This will transfer the "other" flash area into the online flash area. Meanwhile the older release software is transferred from the online flash area into the "other" flash area. A true swap occurs.

A separate section of NVRAM stores the Code Swap State. This state is updated at the start of Code Swap, after each block is swapped, and at the end of the Code Swap. If an event occurs during code swap which causes the CPU to stop executing, upon reboot the CPU will pick up the Code Swap process from where it left off. The Code Swap process cannot be interrupted until it has completed.

STEP 4 - Automatic Nodal Reset
Following the Code Swap, the CPU will automatically reboot. This will bring the CPU online executing the new software and bring all other modules online executing the new software. Updated configuration databases will be sent to all modules.

Redundant CPU Scenario

This section describes how software upgrade occurs for a pair of redundant CPUs in the CX node. At the start, the primary CPU is online and the other is in standby.

STEP 1 - Logon to the Craft Station using the Administrator password.

The NVRAM is pulled from the online CPU and stored as a file on the Craft Station PC in case the user needs to revert to an earlier version of software.

STEP 2 - Download the new software version to the online CPU.

The new version of software is loaded into the section of flash for "other" software (non-executing).

***NOTE**:* *Only two images may be accommodated in flash at one time. If more than one software image exists in flash, one must be deleted before downloading new software. The download procedure will take* *approximately 15 to 45 minutes to complete depending on the CPU and operating system being used.*

STEP 3 - Execute a Code Swap

This will transfer the “other” flash area into the online flash area. Meanwhile the older release software is transferred from the online flash area into the “other” flash area. A true swap occurs. A separate section of NVRAM stores the Code Swap State. This state is updated at the start of Code Swap, after each block is swapped, and at the end of the Code Swap. If an event occurs during code swap which causes the CPU to stop executing, upon reboot the CPU will pick up the Code Swap process from where it left off. The Code Swap process cannot be interrupted until it has completed.

STEP 3B - Automatic Nodal Reset

Following the Code Swap, the online CPU will automatically reboot. This causes a toggle to the standby CPU, making it the online CPU. The formerly online CPU is now the standby. The node does not reset.

The standby CPU has new software. The online CPU has old software.

STEP 4 - Download the new software version to the online CPU

The new version of software is loaded into the section of flash for “other” software (non-executing).

STEP 5 - Execute a Code Swap

This will transfer the “other” flash area into the online flash area. Meanwhile the older release software is transferred from the online flash area into the “other” flash area. A true swap occurs.

A separate section of NVRAM stores the Code Swap State. This state is updated at the start of Code Swap, after each block is swapped, and at the end of the Code Swap. If an event occurs during code swap which causes the CPU to stop executing, upon reboot the CPU will pick up the Code Swap process from where it left off. The Code Swap process cannot be interrupted until it has completed.

STEP 5B - Automatic Nodal Reset

Following the Code Swap, the online CPU will automatically reboot. This causes a toggle to the standby CPU. Now both CPUs have new software.

STEP 6 – Manual Node Reset

The user executes a node reset. Both CPUs reboot. All modules come online executing the new software version. All modules receive the updated configuration database. The CPU that was online will remain the online CPU following a manual reset.

Flow Diagrams

Table 2-2 illustrates the message flows for redundant CPU operation and SW upgrade. The "*" symbol indicates the current operating version of software loaded in I/O modules.

Table 2-2. Software Flow Diagrams

ACTION	Online CPU				Standby CPU			
	Online SW	Other SW	NVRAM	Online (Y/N)	Online SW	Other SW	NVRAM	Online (Y/N)
Start	3.2*	-	3.2*	Y	3.2	-	3.2	N
Load SW (Online CPU)	3.2	4.0	3.2	Y	3.2	3.1	3.2	N
Code Swap	4.0	3.2	3.2	N	3.2*	3.1	3.2*	Y
- DB Convert	4.0	3.2	4.0	N	3.2*	3.1	3.2*	Y
- CPU Toggle	4.0	3.2	4.0	N	3.2*	3.1	3.2*	Y
Load SW (New Online CPU)	4.0	3.2	4.0	N	3.2*	4.0	3.2*	Y
Code Swap	4.0*	3.2	4.0*	Y	4.0	3.2	3.2	N
- DB Convert	4.0*	3.2	4.0*	Y	4.0	3.2	4.0	N
- CPU Toggle	4.0*	3.2	4.0*	Y	4.0	3.2	4.0	N
Node Reset	4.0*	3.2	4.0*	Y	4.0	3.2	4.0	N

Loading New Software Using the Craft Interface

These procedures describe upgrading software from version 3.11 to 4.0. For upgrading versions prior to 3.1.1, see the Release Notes. To upgrade software using the craft interface:

1. Log in with the appropriate password (default is “admin”).

2. Select **Software Ver** from the **Configure** menu (Figure 2-4).

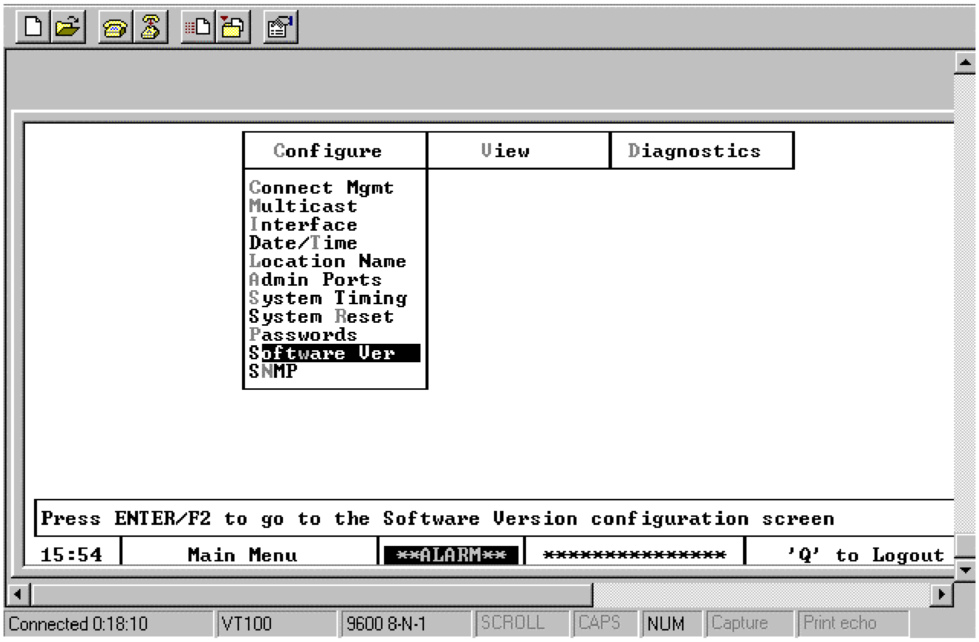


Figure 2-4. Configure Menu

3. When the window shown in Figure 2-5 appears, ensure that there is only one software image in Flash. If only one image appears (as shown) proceed to Step 5.

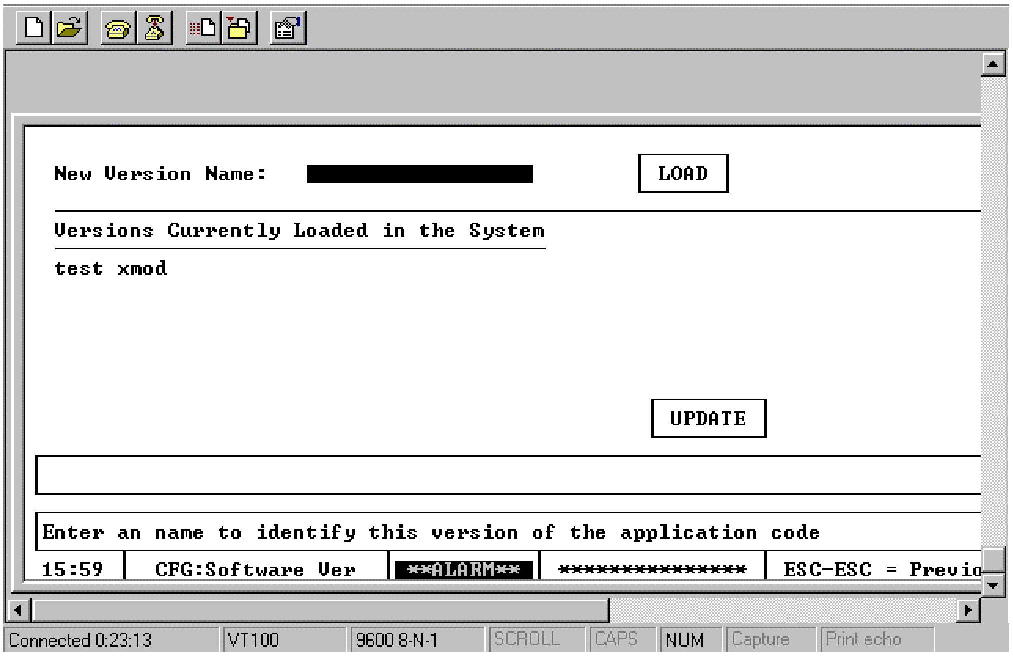


Figure 2-5. Software Version Window

4. To remove a “second” copy of an image in Flash, use the arrow key to highlight the last image listed. (The uppermost image is the current image being executed by the CPU.) Press the **F4** key. Use the arrow key to highlight the **UPDATE** button and press **<ENTER>**.

NOTE: This step is very important. If it is not performed, the second image remains in Flash. Since only two images can reside in Flash, any attempt to load a new image will fail.

5. Using the arrow key, highlight the **New Version Name:** field. Enter a descriptive name to indicate the version of the software loaded and/or operating in the Flash location. In the example pictured, the version loaded is *cpurom.hex*. The *.hex* extension indicates that this is a hexadecimal file, used by the craft interface.

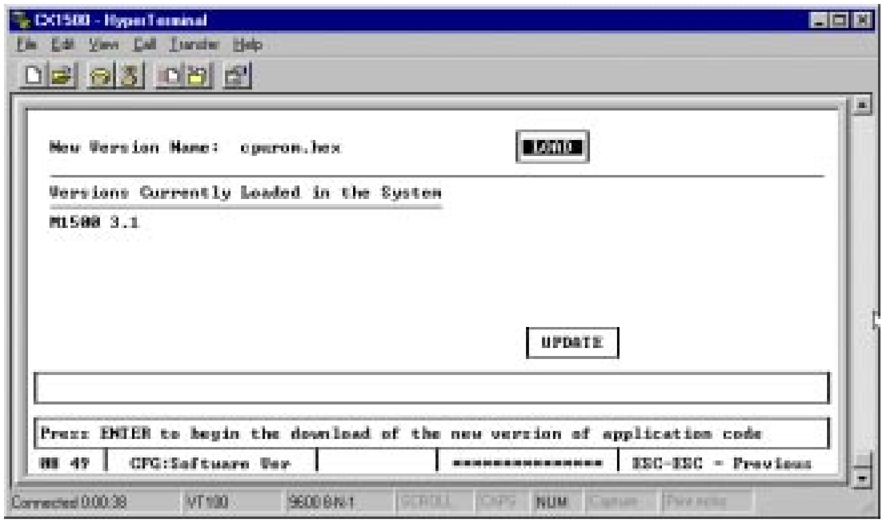


Figure 2-6. New Version Name

6. Press **<ENTER>**. The **LOAD** button should be highlighted. Press **<ENTER>** again. This will return to the main screen.

7. Carefully watch the lower task bar for two messages. The first message is, "Erasing Flash Memory...." shown in Figure 2-7. The second message is "Host is ready to download SW."

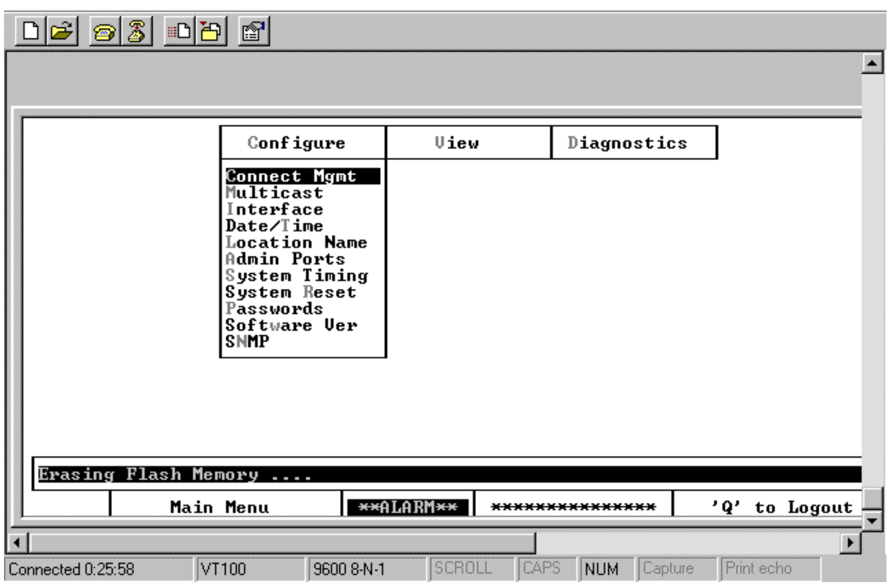


Figure 2-7. Flash Memory Message

8. From the menu bar of HyperTerminal, click on **Transfer** and **Send Text File**.

9. When the window shown in Figure 2-8 appears, select file name *CPUROM.HEX* and click on **Open**. The file transfer will take over 120 minutes to finish

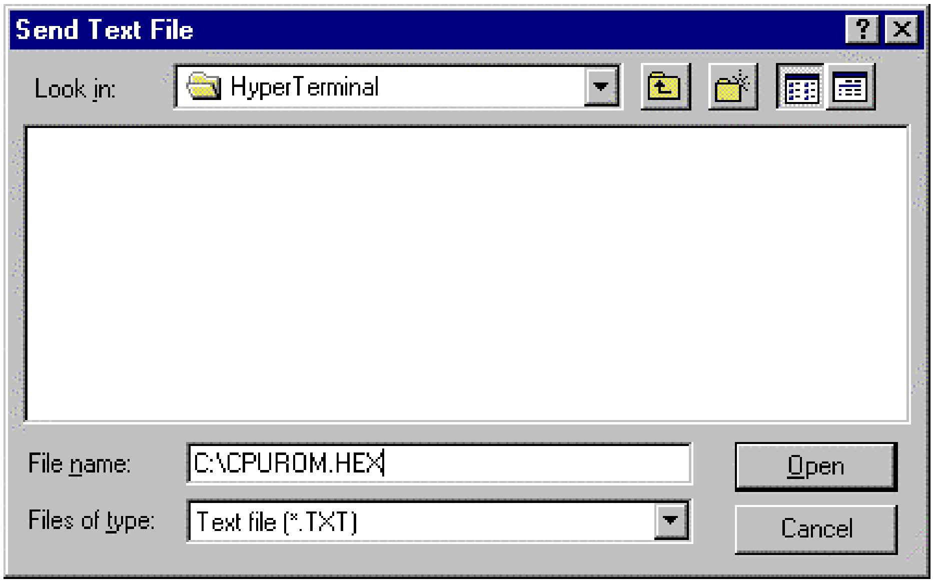


Figure 2-8. Send Text File Window

NOTE: *Load-in-progress indications include, the OPNL light on the CPU module flashes at a constant rate for the duration of the load, and the time stamp freezes (lower left corner of the main menu).*

10. When the load is complete, you will be returned to the Login screen. Log back in with the appropriate password. From the **Configure** menu, select **Software Ver**. Use the arrow key to highlight the second image listed in flash (Figure 2-9), which is the software just loaded. Verify the filename and press the **F2** key. This will begin a Code Swap to the new image.

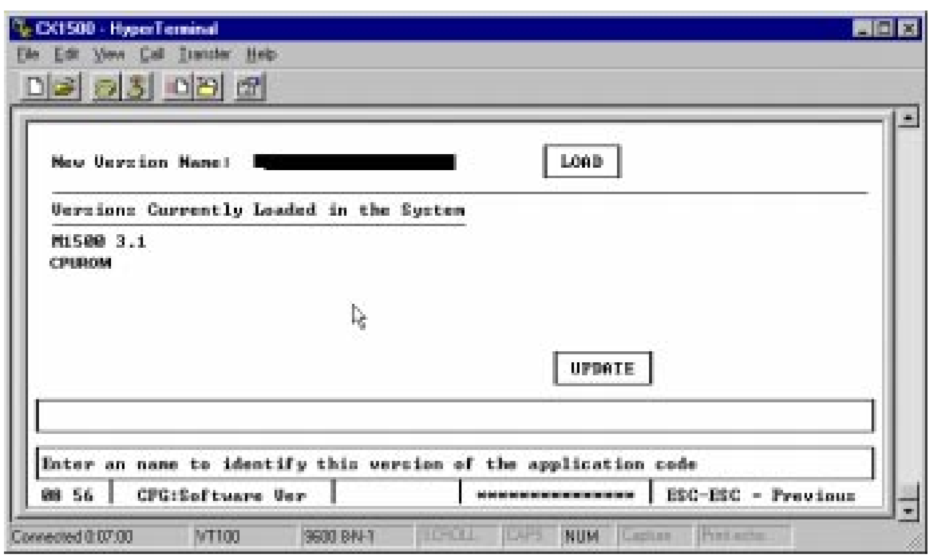


Figure 2-9. Loading New Image

Loading New Software Using FTP

These procedures describe upgrading software from version 3.2 and subsequent versions to 4.0. For upgrading versions prior to 3.2, see Table 2-1 and the Release Notes.

You can load new software versions to a remote CX device using FTP. The procedure is similar to the procedure used from a CRAFT port. This requires that your network be configured for management using either LANE or Classical IP.

You use a telnet window to set up the load procedure and a separate window with an FTP session to start the load.

To load a new software version to a remote CX device using FTP:

1. Open an MS-DOS window or xterm window as appropriate and path to the directory where the hex file for the new version resides on your PC or workstation (This file initially comes from a diskette, and must be decompressed before loading. Instructions for decompressing and installing software from a diskette are contained in the *readme.txt* file accompanying the software.).
2. Copy the hex file to the file name CPUROM.HEX for loading:

   cp cpu400.hex CPUROM.HEX

   -- or --

   copy cpu400.hex CPUROM.HEX
3. Start a telnet session with the CX and log into the Cell Exchange system as "admin."
4. Select **"Software Ver"** under the Configure menu.
5. Enter the name of the new version (supplied with the diskette).
6. Select **<LOAD>** and press **<ENTER>**. Observe that the Main Menu screen is repainted. The time of day display will freeze, which is an indication that the upload is in progress.
7. Prompts will appear indicating first that the host is "erasing FLASH memory" and then that it is ready to accept software.
8. When the host is ready to accept software, return to the window where CPUROM.HEX is in the current path, and start an FTP session:
   - From a DOS command prompt, enter:

     ftp *IPAddress* (IP address of the node being upgraded)
   - From an HP-UX command prompt, enter:

     ftp –B 1 *IPAddress* (This switch forces a single outstanding block of data.)
9. When prompted to log in, enter the level 3 password as the user name (default "admin") and press **<ENTER>** when prompted for a password.
10. Enter the command: put CPUROM.HEX

NOTES: UNIX is case sensitive. If you are performing this operation from an HP-UX workstation, the filename you use in the put command must *match the case of the file name you created from the command prompt.*

During the download, the OPNL light on the CPU will randomly light and extinguish.

The Telnet session will timeout after 300 seconds (5 minutes).

A direct connection through the craft interface will not terminate the FTP session. On a direct connection the clock will continue running, unlike an upload from the craft interface.

11. Once the load operation is complete, quit the FTP session:

    quit

    The completion of the load operation interrupts the current telnet session.

12. Start a new telnet session with the CX and log into the Cell Exchange system as "admin."
13. Select **“Software Ver”** and observe that the new version is displayed on the screen.
14. If the new version is to be used, move the cursor to select the new version.
15. Press the **<F2>** function key. After a short delay, the new version will load into the CPU and subsequently to all installed interface modules. Other versions of the software are selected and made active in the same manner.

Loading New Software Using Xmodem

These procedures describe upgrading software from version 4.0 to 4.0 and subsequent versions. For upgrading versions prior to 4.0, see Table 2-1 and the Release Notes. In Version 4.0, files may also be transferred using Xmodem. Xmodem is used to transfer binary files. To set up for Xmodem transfer:

1. Log in with the appropriate password (default is “admin”).

2. Select **Software Ver** from the **Configure** menu (Figure 2-10).

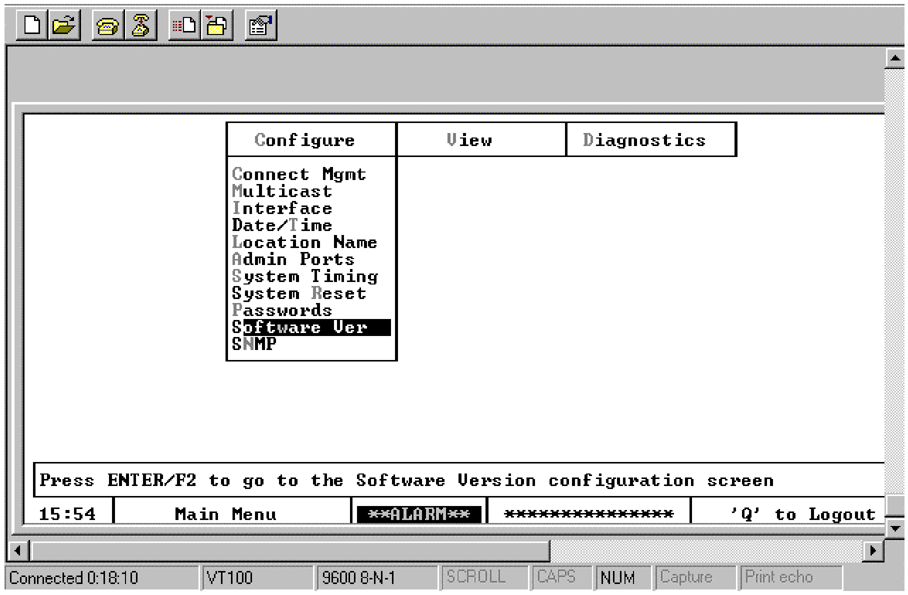


Figure 2-10. Configure Menu

3. When the window shown in Figure 2-11 appears, ensure that there is only one software image in Flash. If only one image appears (as shown) proceed to Step 5.

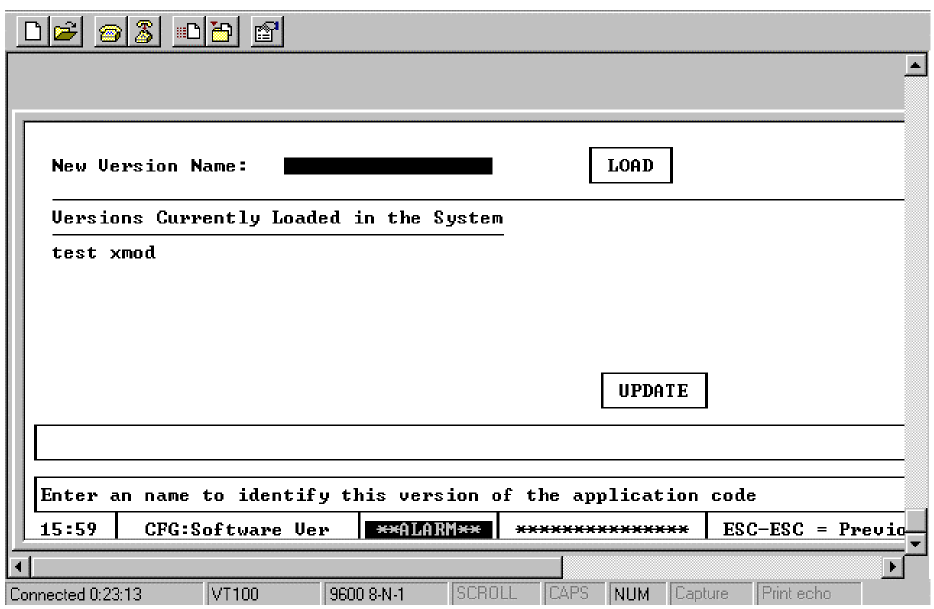


Figure 2-11. Software Version Window

4. To remove a “second” copy of an image in Flash, use the arrow key to highlight the last image listed. (The uppermost image is the current image being executed by the CPU.) Press the **F4** key. Use the arrow key to highlight the **UPDATE** button and press **<ENTER>**.

NOTE: This step is very important. If it is not performed, the second image remains in Flash. Since only two images can reside in Flash, any attempt to load a new image will fail.

5. Using the arrow key, highlight the **New Version Name:** field. Enter a descriptive name to indicate the version of the software loaded and/or operating in the Flash location. In the example pictured, the version loaded is *CPU400.bin*. The *.bin* extension indicates that this is a binary file, required for Xmodem.

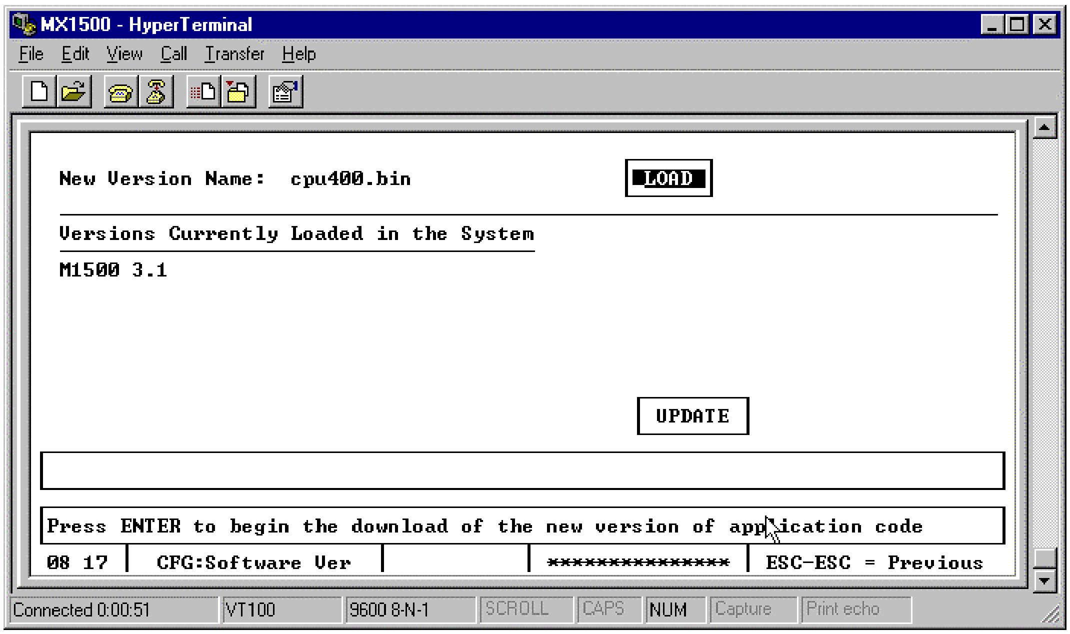


Figure 2-12. New Version Name

6. Press **<ENTER>**. The **LOAD** button should be highlighted. Press **<ENTER>** again. This will return to the main screen.

7. Carefully watch the lower task bar for two messages. The first message is, “Erasing Flash Memory....” shown in Figure 2-13. The second message (Figure 2-14) is very important. When it appears, press **<ENTER>**.

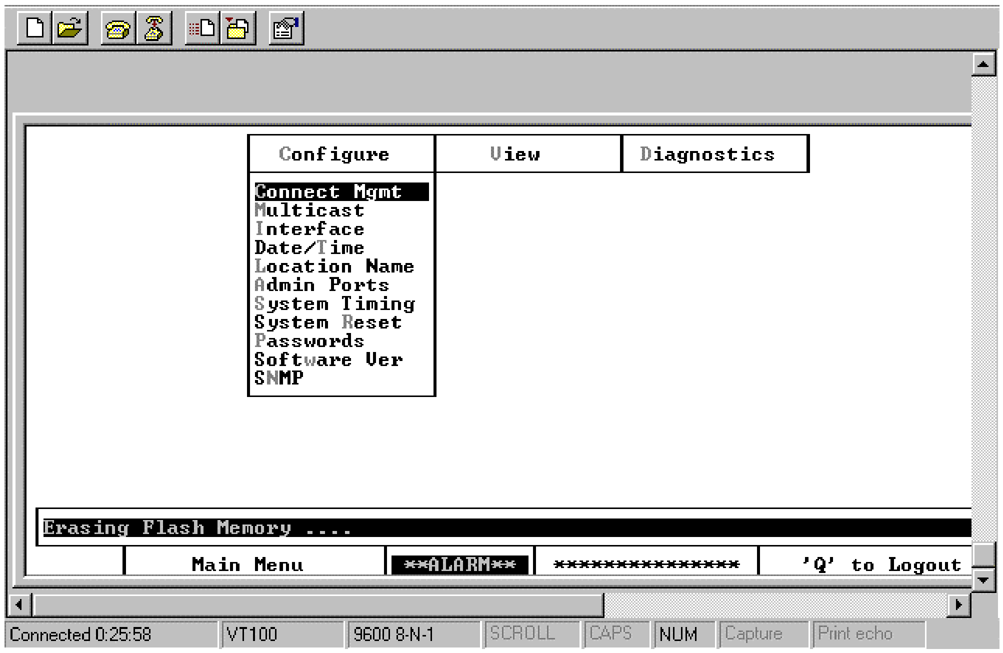


Figure 2-13. Flash Memory Message

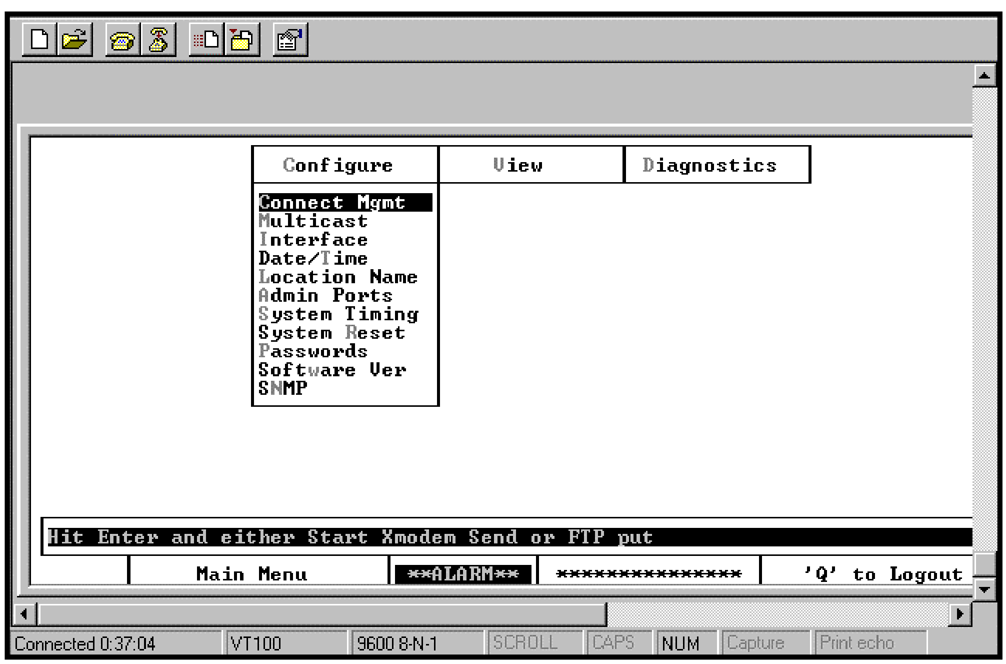


Figure 2-14. Start Xmodem Send Message

8. Set up for the Xmodem transfer. From the **Transfer** menu, select **Send File**.

9. When the window shown in Figure 2-15 appears, select **Xmodem** and enter the path/filename where the image *.bin* file is located. Click on the **Send** button.

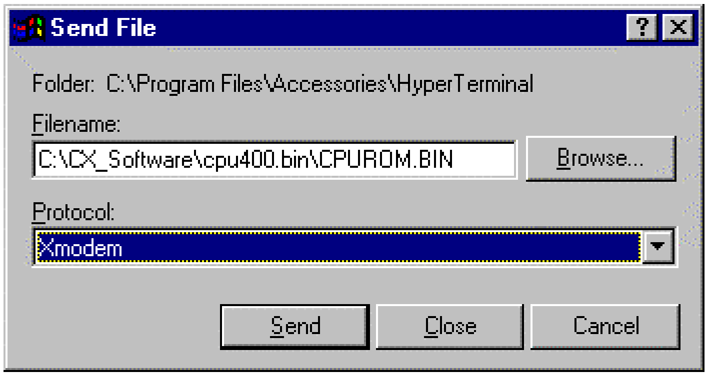


Figure 2-15. Xmodem Selection Window

NOTE: *After decompressing the software in accordance with the* readme.txt *accompanying the software, the file will be named,* CPUROM.BIN. *Do not rename this file or the load will fail.*

10. When the window shown in Figure 2-16 appears, monitor the progress of the image loading process. The load will take approximately 41 minutes.

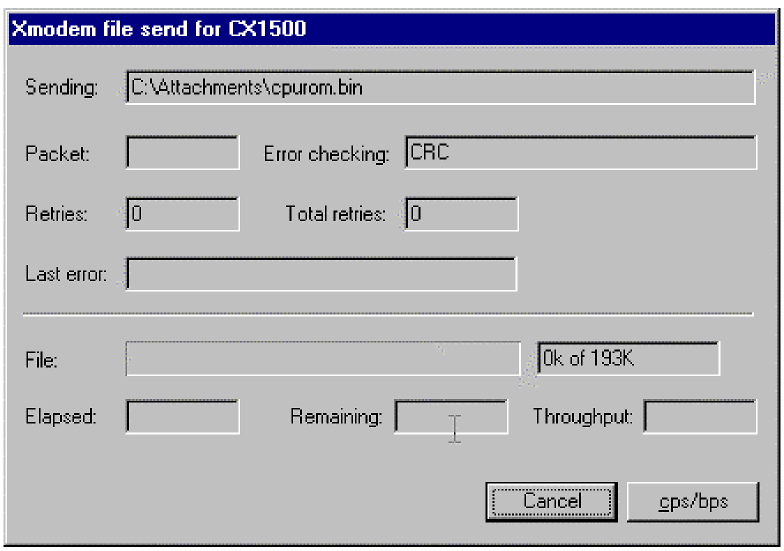


Figure 2-16. Software Load Indicator Window

11. Load-in-progress indications include, the OPNL light on the CPU module flashes at a constant rate for the duration of the load, and the time stamp (lower left corner of the main menu) disappears during the load.

PRECAUTION: ***Do not press any key on the keyboard while the load is in progress. Pressing a key will terminate the image transfer. If there is a screen saver active, use a mouse movement to redisplay the screen.***

*NOTE: If the file transfer stops before completion, select **Disconnect** from the **Call** menu, then **Connect** from the same menu. This will restart the file transfer.*

12. When the load is complete, you will be returned to the Login screen. Log back in with the appropriate password. From the **Configure** menu, select **Software Ver**. Use the arrow key to highlight the second image listed in flash (Figure 2-17), which is the software just loaded. Verify the filename and press the **F2** key. This will begin a Code Swap to the new image.

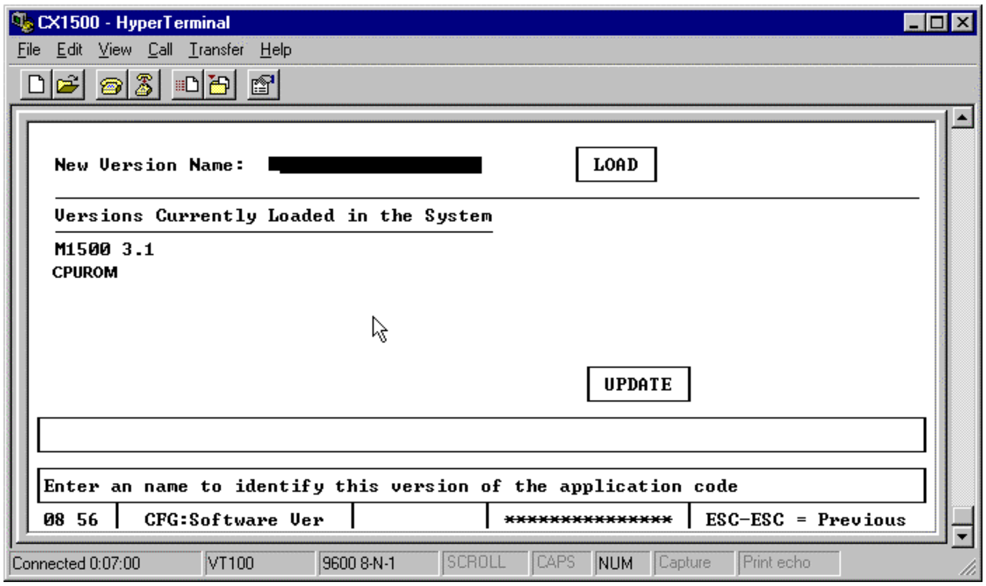


Figure 2-17. Loading New Image

Software Download Process Considerations

This section lists frequently asked questions regarding the software download process, and provides answers to these questions.

Incompatible Database

Prior to executing a "code swap" command, the CX will verify whether the current database is capable of being converted. If it is, the database will be converted. If it is not the database will be flushed.

Can the NVRAM Backup Be Forced?

No. The user must perform the backup prior to upgrading software.

What Happens if the DB Conversion is Interrupted?

The DB convert takes less than one second to execute. If the conversion is interrupted, the user is left with a corrupted DB. The DB will then have to be restored from backup, or flushed.

FTP Security

Any IP address can perform an FTP. Security is provided by using the "admin" user name and appropriate level 3 password prior to allowing the FTP session to continue.

NVRAM Format

What if an upgrade failed and the system software is swapped back? The scenario is old software with new database. Is the NVRAM structure such that the passwords still operate? Will the network management channel work to remote nodes? Answer: Reverse database conversion (new to old) is not supported. The new database will be flushed by the old software during conversion.

Code Swap Time

The code swap takes seconds to execute. The craft screen (time clock) freezes for the duration of the code swap. Once the swap is completed, the logon screen will reappear.

Alarm events are generated to indicate progress, success, and failures during a code swap. From a craft station or telnet the user can access the alarm logs to retrieve this information.

Software Versions

When the user receives a new version of software (initially distributed on a diskette), it is normally uploaded using terminal emulation software as described above in the craft interface procedures. Software loads may also be accomplished using FTP and Xmodem transfers as described above. Once uploaded, new software versions are activated by following these procedures.

1. Log into the Cell Exchange system and select **"Software Ver"** under the Configure menu as shown in Figure 2-18.

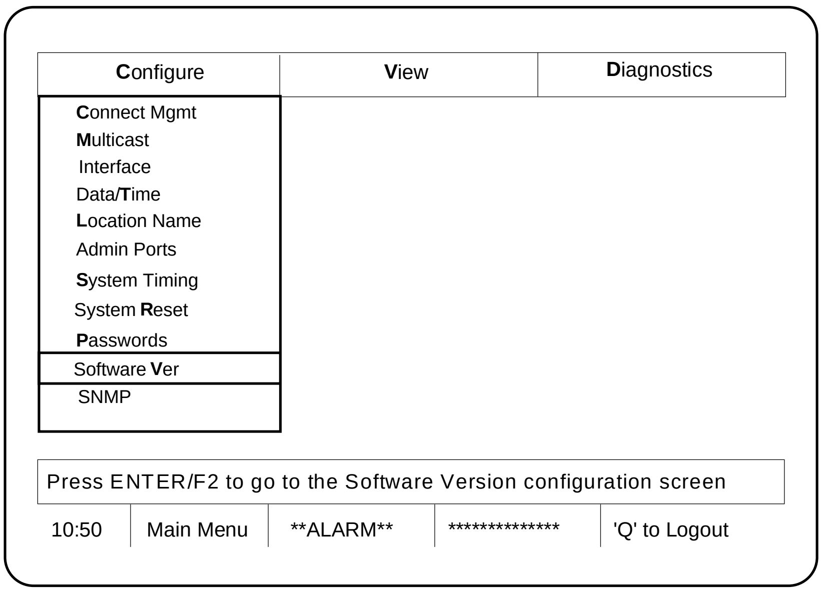


Figure 2-18. Software Version Command

This will bring up the screen shown in Figure 2-19.

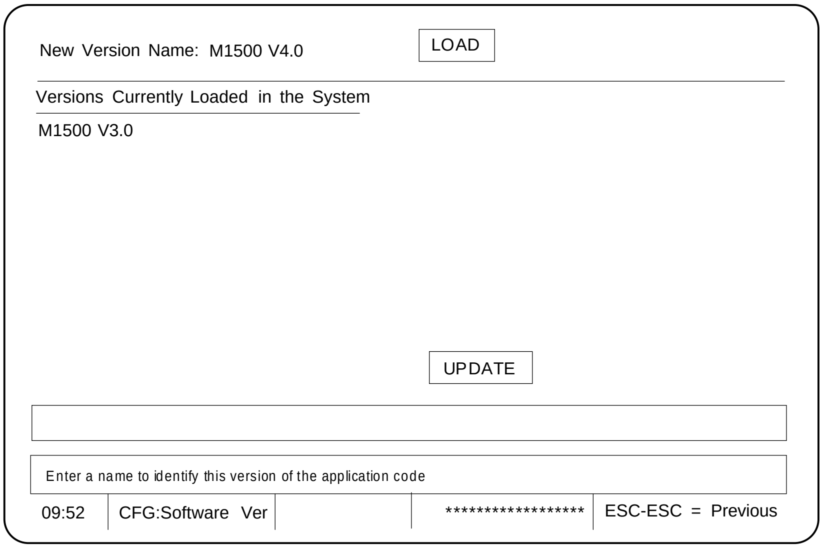


Figure 2-19. Software Version Selection Screen

2. Enter the name of the new version (supplied with the diskette) as shown in Figure 2-19.

3. Select **<LOAD>** and press **<ENTER>**. Observe that the Main Menu screen is repainted. The time of day display will freeze, which is an indication that the upload is in progress.

4. On the terminal emulation toolbar, click the “Transfer” function and select “Send Text File” on the drop-down menu.

5. When the dialog box appears, fill in the file name installed previously from the floppy diskette **(<filename>.hex or bin)** and click **OK**, or **Open**.

6. This will load the new software version. The process takes approximately 35 minutes to and hour and 45 minutes depending on the current software version loaded. After the upload is completed, the Main Menu is displayed again.

7. Select **“Software Ver”** and observe that the new version is displayed on the screen.

8. If the new version is to be used, move the cursor to select the new version.

9. Press the **<F2>** function key. After a short delay, the new version will load into the CPU and subsequently to all installed interface modules.

10. Other versions of the software are selected and made active in the same manner.

Chapter 3

Modules

This section provides a functional overview of installable Cell Exchange system modules.

Summary of Modules

Table 3-1 summarizes the functions performed by the various modules available for the Cell Exchange systems.

Table 3-1. Module Summary

Common Modules and Station Clock Module	
Component	**Function**
CPU Module (CPU)	• Configuration, control and management functions • Controls processors on other modules
AC Power Supply Module	• Converts AC input voltage to +5 VDC and +1.2 VDC output
DC Power Supply Module	• Converts DC input voltage to +5 VDC and +1.2 VDC output
Station Clock Module (SCM)	• Monitors the attached clock signal for activity • Accepts an external timing signal from a Master Station Clock
Cell Bearing Interface Modules	
Dual T1 Interface Module (T1C)	• Accepts T1 cell data • Places the cells on the ATM cell bus • Monitors physical interface • Collects module performance statistics
OC3 Cell Interface Module (OC3)	• Accepts OC3 ATM cell data • Places the cells on the ATM cell bus • Monitors physical interface • Collects module performance statistics

Table 3-1. Module Summary (Cont'd)

Cell Bearing Interface Modules (Cont'd)	
Component	**Function**
OC3C Interface Module (OC3C)	• Accepts OC3C ATM cell data • Places the cells on the ATM cell bus • Monitors physical interface • Collects module performance statistics • Software selectable between SONET and SDH • Improved clocking for network operations • Replacement for original OC3 module
Dual Synchronous Cell Interface Module (DSC)	• Accepts synchronous cell traffic and monitors for corrupted traffic • Sends resynchronization signal if corrupted traffic discovered • Places the cells on the ATM cell bus • Monitors physical interface • Collects module performance statistics
DS3 Cell Interface Module (DS3)	• Accepts DS3 cell data • Places the cells on the ATM cell bus • Monitors the physical interface • Collects module performance statistics
Dual E1 Cell Interface Module (E1C)	• Accepts E1 cell data • Places the cells on the ATM cell bus • Monitors physical interface • Collects module performance statistics
E3 Cell Interface Module (E3C)	• Accepts E3 cell data • Places the cells on the ATM cell bus • Monitors physical interface • Collects module performance statistics

Table 3-1. Module Summary (Cont'd)

Non-Cell Bearing Interface Modules	
Component	**Function**
Structured T1 Legacy Interface Module (STL)	• Accepts voice or data from T1 channel groups and passes it to/from ATM cell bearing equipment • Monitors the physical interface • Collects module performance statistics
Synchronous Legacy Interface Module (DSL)	• Accepts synchronous non-cell (legacy) traffic and converts the data to ATM CBR cells • Places the cells on the ATM cell bus • Monitors the physical interface • Collects module performance statistics
High Speed Synchronous Legacy Interface Module (HSL)	• Accepts synchronous non-cell (legacy) traffic and converts the data to ATM CBR cells • Places the cells on the ATM cell bus • Monitors the physical interface • Collects module performance statistics
High Speed Serial Legacy Interface Module (HSSI Interface) (HSSL)	• Accepts synchronous non-cell (legacy) traffic and converts the data to ATM CBR cells • Places the cells on the ATM cell bus • Monitors the physical interface • Collects module performance statistics
Hub Router Legacy Interface Module (HRIM)	• Allows IP/Ethernet traffic to be integrated into an ATM network • Provides 4 or 8 RJ-45 and 1 BNC physical connectors • As a hub, each physical connector shares a configurable portion of the aggregate bandwidth
Low Speed Asynchronous Legacy Interface Module (LSAL)	• Accepts asynchronous non-cell (legacy) traffic and converts the data to ATM AAL5 cells • Places the cells on the ATM cell bus • Monitors the physical interface • Collects module performance statistics • Optionally provides reliable transport

Table 3-1. Module Summary (Cont'd)

Non-Cell Bearing Interface Modules (Cont'd)	
Component	**Function**
Unstructured T1/E1 Legacy Interface Module (UTEL)	• Accepts synchronous non-cell (legacy) traffic and converts the data to ATM CBR cells • Places the cells on the ATM cell bus • Monitors the physical interface • Collects module performance statistics
Unstructured DS3/T3 Legacy Interface Module (UD3L)	• Accepts synchronous non-cell (legacy) traffic and converts the data to ATM CBR cells • Places the cells on the ATM cell bus • Monitors the physical interface • Collects module performance statistics
Unstructured E3 Legacy Interface Module (UE3L)	• Accepts synchronous non-cell (legacy) traffic and converts the data to ATM CBR cells • Places the cells on the ATM cell bus • Monitors the physical interface • Collects module performance statistics
Basic Interface Module	• Processes CBR data source and generates AAL1 cells • Provides support for one daughterboard • Cell rate error signal • Monitors the physical interface for alarms • Collects statistics on module performance
4-Wire EML Module	• Takes voice analog input and converts it to a 64 Kbps PCM signal • Translates the PCM signal to AAL1 cell format for transmission across the ATM network • Supports connections between E&M analog and T1 DS0 interfaces • Monitors the physical interface for alarms • Collects statistics on module performance

CPU Module

Overview

The CPU Module is designed around a Motorola 68340 microprocessor, and is used to control and configure the unit, collect statistics, and provide all general management functionality within the unit. The CPU module also provides master timing for the cell bus. A view of the front panel of the CPU Module is shown in Figure 3-1.

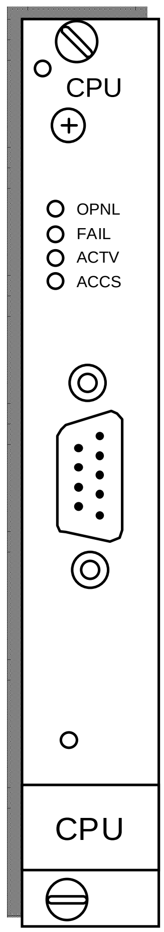


Figure 3-1. Front Panel of CPU Module (CPU)

The CPU Modules may be installed in a redundant configuration in the CX-1500 and CX-1580 to improve network reliability. The recommended slots for single and redundant configuration are shown below.

Chassis	Primary (Single CPU) Operation	Redundant CPU Operation
CX-1500	Slot 8	Slots 7 and 8
CX-1540	Slot 2, 3, or 4	None
CX-1580	Slot 5	Slots 5 and 6

The CPU Module provides all configuration, control, and management functions for the Cell Exchange system, either from a local craft interface, or by using the remote SNMP management feature. The CPU module controls all microprocessors/controllers on other modules located in the same chassis, using the ATM bus message format structure. The CPU module is also responsible for LANE ATM Q.2931 signaling between the Cell Exchange system and LAN Emulation Servers. A functional block diagram of the CPU Module is shown in Figure 3-2.

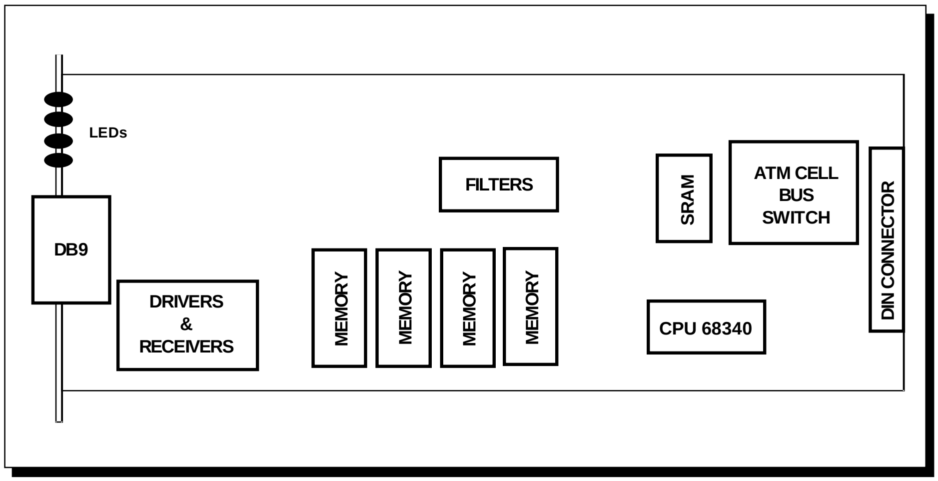


Figure 3-2. CPU Module Functional Block Diagram

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the CPU Module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Motorola 68340 microprocessor
- Battery-backed RAM
- Capacitor filtering, provided for control and noise suppression
- DB-9M connector to interface with an external VT100 type device for the craft interface

Unique Module Functionality Section

A DB-9 male connector installed on the front of the module is used for configuration and diagnostics on the Cell Exchange system. The drivers and receivers used for this interface are asynchronous and meet RS-232C interface standards. Four LEDs mounted on the front panel provide indications of the functioning of the module.

Specifications

Port Capacity:	One
Media:	Null modem
Connector:	DB-9, Male
Connection Capacity:	10,240 channels VPI/VCI Translation available, VPI 0 – 39, VCI 0 – 255 VPI-only Translation, VPI 40 – 255
Power:	≤ 7 watts

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during loading of a new operational code image.
LED	FAIL	Red	CPU card processor has entered a HALT condition. Normally a brief condition, the software watchdog should reset the card within one second, clearing the FAIL condition.
LED	ACTV	Green	On - Module is active Off - Module is standby
LED	ACCS	Yellow	Indicates that CPU module is being accessed from a user interface

Pinouts

Pinouts for the DB-9M (DTE) connector on the CPU module are as shown in Figure 3-3 and the accompanying table. The mating cable should use a Female DB-9 connector

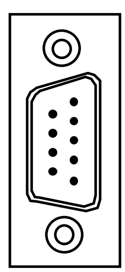


Figure 3-3. DB-9M Connector

Pin	Direction	Signal
1		N/C
2	←	RxD
3	→	TxD
4		N/C
5	—	Gnd

Pin	Direction	Signal
6		N/C
7	→	RTS
8	←	CTS
9		N/C

← To CPU Module

→ From CPU Module

AC Power Supply Module

CX-1500 Chassis

In the CX-1500 chassis, the power supply slots are located in the left-most part of the chassis. A single power supply module may be installed in either slot. The front panel of the AC power supply module for the CX-1500 is shown in Figure 3-4.

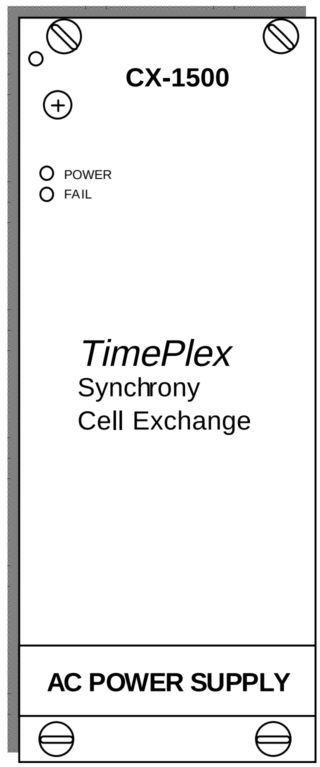


Figure 3-4. AC Power Supply Module (CX-1500)

One or two power supply modules may be installed. One Power Supply Module will handle the full power load required for the number of interface modules placed in the chassis, although a second module may be installed for enhanced reliability. The Power Supply Modules feature a “solid state” switcher design. If two modules are installed, the modules are coupled to supply redundant power to the bus. The Power Supply Modules are designed to allow removal and replacement into a working unit without affecting active operational traffic (hot swap). (See Chapter 7 for installation/removal precautions.) Each Power Supply Module has its own AC power connector and cord.

PRECAUTION: ***The AC and DC Power Supply Modules are physically interchangeable. Care must be taken to ensure the correct one is installed or damage to the module may result. If a DC Power Supply Module is inadvertently plugged into an AC chassis, the internal fuse on the power supply will***

blow. If an AC module is plugged into a DC chassis, nothing will happen and there will be no indication of any activity.

NOTE: *The only way to determine whether the CX1500 chassis is designed for the AC or DC Power Supply Module is to look at the rear panel.*

AC power distribution within the CX-1500 is relatively simple. Standard AC power is received at the backplane of the chassis and transferred via the power connector interface to the Power Supply Module. The Power Supply Module converts the AC input to +5 VDC for transistor-transistor logic (TTL) use, then sends it to a voltage regulator and the backplane bus. The voltage regulator reduces the +5 VDC input to a +1.2 VDC output for Gunning Transistor Logic (GTL) use. There are three signal components to the DC power output: +5 VDC (TTL), +1.2 VDC (GTL), and ground. A functional block diagram of the AC power supply module is shown in Figure 3-5.

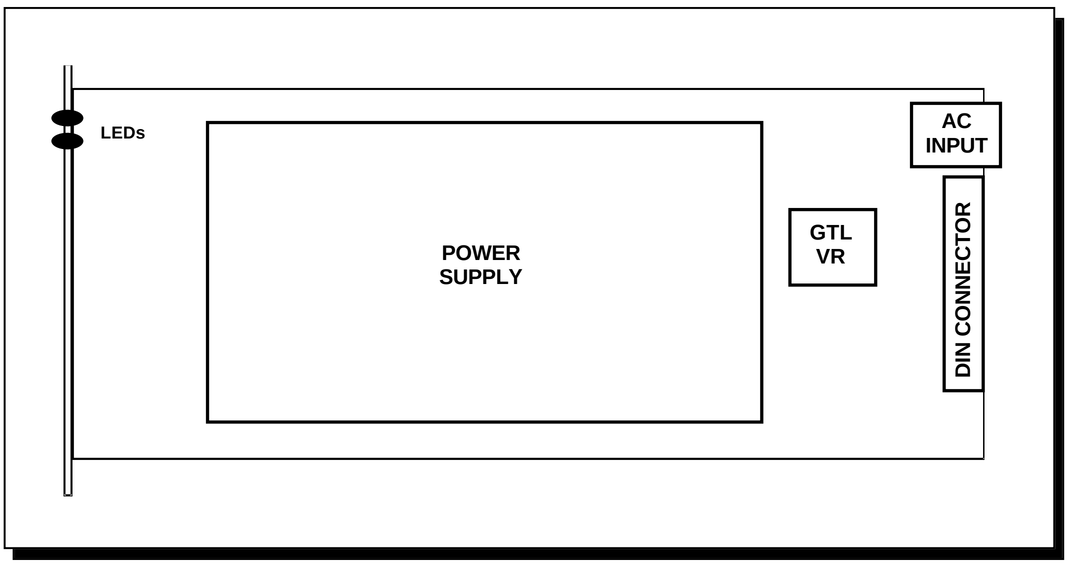


Figure 3-5. AC Power Supply Module Functional Block Diagram

Specifications

Input Voltage:	90 to 230 VAC
Input Frequency:	47 to 63 Hz
Input Current	2.0 amps (CX-1500) or 0.8 amps (CX-1540)
Output Voltages:	+5 VDC (TTL) +1.2 VDC (GTL)

Indicators

Type	Label	Color	Meaning
LED	POWER	Green	Indicates that +5V is being read at the bus
LED	FAIL	Red	Illuminates when the 5 volts generated by the power supply is below 4.75 volts or above 5.25 volts. Indicates that the power supply module has failed or no AC is present.

CX-1540 Chassis

In the Model 1540 chassis, the single AC power supply module is installed internally. The Power Supply Module will handle the full power load required for the number of interface modules placed in the chassis.

AC power distribution within the CX-1540 is relatively simple. Standard AC power is received at the backplane of the chassis and transferred via the power connector interface to the internal Power Supply. The Power Supply converts the AC input to +5 VDC for transistor-transistor logic (TTL) use, then sends it to a voltage regulator and the backplane bus. The voltage regulator reduces the +5 VDC input to a +1.2 VDC output for Gunning Transistor Logic (GTL) use. There are three signal components to the DC power output: +5 VDC (TTL), +1.2 VDC (GTL), and ground.

Specifications

Input Voltage:	90 to 230 VAC
Input Frequency:	47 to 63 Hz
Input Current	0.8 amps
Output Voltages:	+5 VDC (TTL) +1.2 VDC (GTL)

Indicators

Type	Label	Color	Meaning
LED	POWER	Green	Indicates that +5V is being read at the bus

DC Power Supply Module

The CX-1500D is equipped with a DC Power Supply Module. The power supply slots are located in the left-most part of the chassis. A single power supply module may be installed in either slot. The front panel of the DC power supply module is shown in Figure 3-6.

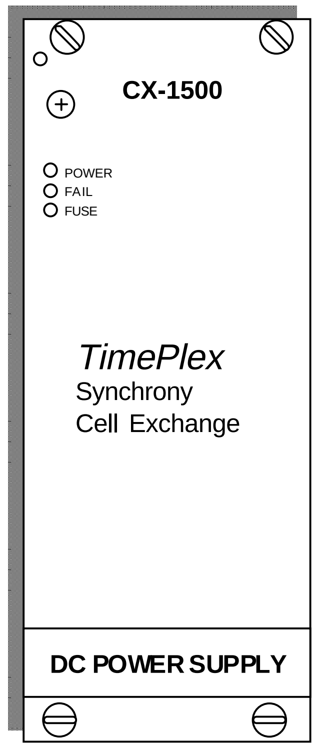


Figure 3-6. DC Power Supply Module (CX-1500D)

One or two power supply modules may be installed. One Power Supply Module will handle the full power load required for the number of interface modules placed in the chassis, although a second module may be installed for enhanced reliability. The Power Supply Modules feature a "solid state" switcher design. If two modules are installed, the modules are coupled to supply redundant power to the bus. The Power Supply Modules are designed to allow removal and replacement into a working unit without affecting active operational traffic (hot swap). (See Chapter 7 for installation/removal precautions.) The rear panel of the chassis provides separate connections for –48 VDC power sources, one connection per module.

DC power distribution within the CX-1500D is similar to AC power distribution. Standard DC power (-38 to -60 VDC) is received at the backplane of the chassis and transferred via the power connector interface to the DC/DC Converter. There is a separate power input to each power supply slot (A or B). The DC/DC Converter converts the –48 VDC input to +5 VDC for transistor-transistor logic (TTL) use, then sends it to a voltage regulator and the backplane bus. The voltage regulator reduces the +5 VDC input to a +1.2 VDC output for Gunning Transistor Logic (GTL) use. There are three signal components to the DC power output, +5 VDC (TTL), +1.2 VDC

(GTL), and ground. Filters are provided to reduce electromagnetic interference (EMI). A functional block diagram of the DC power supply module is shown in Figure 3-7.

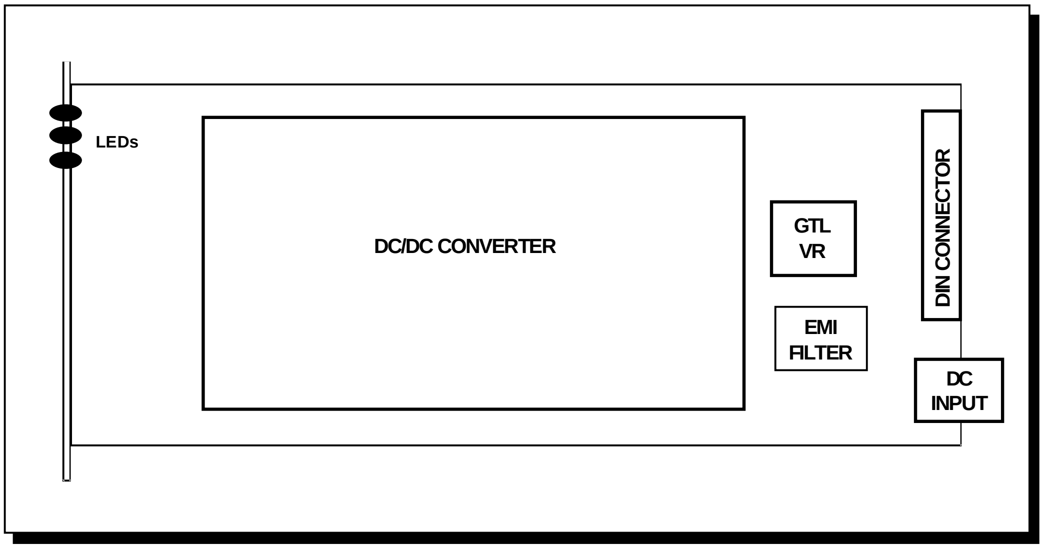


Figure 3-7. DC Power Supply Module Functional Block Diagram

Specifications

Input Voltage:	-38 to –60 VDC
Input Current:	5.0 amps per DC feed max.
Output Voltage:	+5 VDC, +1.2 VDC

Indicators

Type	Label	Color	Meaning
LED	POWER	Green	Indicates that +5V is being read at the bus
LED	FAIL	Red	Illuminates when the 5 volts generated by the power supply is below 4.75 volts or above 5.25 volts. Indicates that the power supply module has failed or no DC is present.
LED	FUSE	Red	Indicates that the fuse has blown.

Station Clock Module (SCM)

Overview

The Station Clock Module (SCM) allows the user to input and propagate an external clock source into the Cell Exchange to be used as the internal reference clock for the unit. The SCM requires a balanced electrical input signal. The clock rate may be selected at a rate from 8 kHz to 20 MHz in 8 kHz steps. The front panel of the SCM is shown in Figure 3-8.

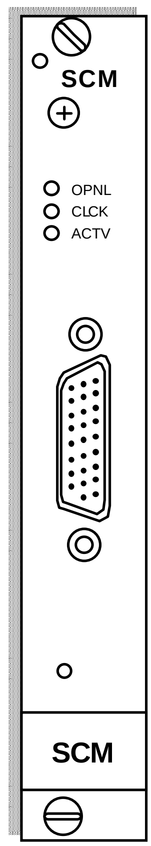


Figure 3-8. Station Clock Module (SCM)

The Station Clock Module performs the following primary functions:

- Accepts an external timing signal from a Master Station Clock
- Monitors the attached clock signal for activity

Specifications

Port Capacity:	One
Media:	Shielded Multi-twisted pair cable, low capacitance
Electrical:	EIA-530, DCE
Connector:	HDB-26, Female
Line Format:	Balanced
Clock Rates:	8 kHz - 20 MHz (in 8 kHz increments)
Power:	≤ 7 Watts

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download.
LED	CLCK	Green	External clock source is present at the interface connector
LED	ACTV	Green	SCM is selected as timing reference on timing screen

Pinouts

The high-speed DB-26 connector pinouts are shown in Figure 3-9 and the accompanying table.

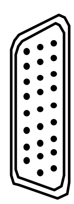


Figure 3-9. HDB-26F (DCE) Pin Location

Pin	Direction	Signal
1		FG
7		SG
13	←	TTA
21	←	TTB

← From Master Clock Source

All other pins are N/C (No Connection)

Dual T1 Cell Interface Module (T1C)

Overview

The Dual T1 Cell Interface Module is part of a broad group of standard interface modules designed for use in the ATM Cell Exchange systems. The Dual T1 Cell Interface Module is a compact sub-assembly that occupies one of the slots available in the Cell Exchange system. It can connect to other equipment as a DSX-1 interface or terminate a public T1 on its built-in T1 CSU. A front panel view of the Dual T1 Cell Interface Module is shown in Figure 3-10.

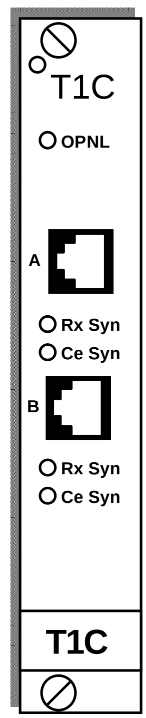


Figure 3-10. Dual T1 Cell Interface Module (T1C)

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the T1C module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Intel 80C31 microprocessor
- Capacitor filtering, provided for control and noise suppression
- RJ-45 connectors to interface with external devices

Unique Module Functionality Section

The Dual Cell Bearing T1 Module terminates two independent T1 facility interfaces through drivers and receivers. The submodule labeled Type Functions (AAL1) recovers clock, accesses the ATM cells within the T1 payload, and sends these cells to the switching fabric. In the transmit direction the process is reversed. ATM cells are taken off the switching fabric and mapped into the T1 framed payload, which is then formatted per ATM Forum specifications and clocked out on the T1 facility. A functional block diagram is shown in Figure 3-11.

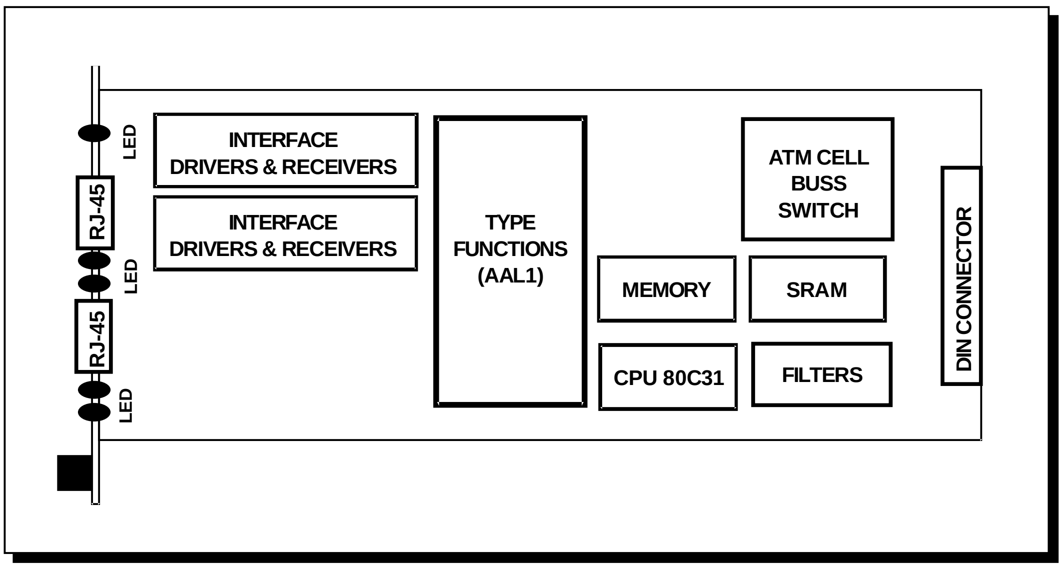


Figure 3-11. Dual T1 Cell Interface Module Functional Block Diagram

Jumper Settings

The jumper settings listed are factory set defaults. No user configuration is required.

Jumper	Pins
J2	2-3

Specifications

Port Capacity: Two

Interface: DSX-1 or CSU (Software configurable in the interface configuration window)

Media: Shielded, Twisted pair

Connector: RJ-45, Female (DCE)

Line Encoding: B8ZS, AMI

Data Format: ATM Cells

Timing: Recovered, External, Internal, On Board

Diagnostics: Facility and Terminal Loopback

Alarm: LOF, LOC, AIS

Alarm/Statistics: LCV, FER, CRC-6, OOF, HCS, Rx CELLS, Tx CELLS

Applicable Standards: ATM Forum DS1 UNI v3.1, af-phy-0016.0000, ANSI/Bellcore DSX-1, T1.102, T1.408, TR-TSY-000009, ITU-T G.703, G.804, AT&T 62411

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download.
LED	Rx Syn	Green	Receive Synchronization
LED	Ce Syn	Green	Cell Synchronization

Pinouts

Pinouts for the RJ-45 connectors are as shown in Figure 3-12 and the accompanying table.

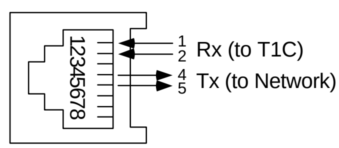


Figure 3-12. Pin Location

Pin	Direction	Signal
1	To T1C	Rx-R
2	To T1C	Rx-T

Pin	Direction	Signal
4	To Network	Tx-R
5	To Network	Tx-T

OC3 Cell Interface Module (OC3)

Overview

The OC3 Cell Interface Module is part of a broad group of standard Interface Modules that have been developed for the Cell Exchange system. The OC3 Cell Module allows the Cell Exchange system to interface with ATM switches, Engineering Workstations and ATM cell bearing transmission systems. The data rate is 155 Mbps.

The OC3 Cell Interface Module terminates an OC3 facility interface, recovers clock, accesses the ATM cells within the SONET payload, and provides these cells to the Cell Exchange system switching fabric.

A front panel view of the OC3 Cell Interface Module is shown in Figure 3-13.

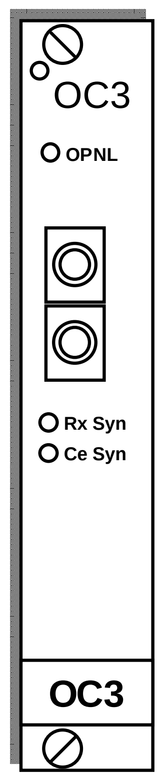


Figure 3-13. OC3 Cell Interface Module (OC3)

The module performs the following primary functions:

- Takes OC3 ATM cell data and uncouples the cells from the physical OC3 interface
- Takes the cells and places them onto the ATM Cell bus
- Monitors the physical interface for alarms
- Collects statistics on module performance.

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the OC3 module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Motorola 68340 microprocessor
- Capacitor filtering, provided for control and noise suppression
- ATM Physical Interface chip
- Optical interface device to interface with external devices

Unique Module Functionality Section

The OC3 Cell Module is a compact subassembly that provides the hardware necessary to terminate a OC3 facility interface, recover clock, access the ATM cells within the payload, and provide these cells to the Cell Exchange switching fabric. In the transmit direction the process is reversed. ATM cells are taken off the switching fabric and mapped into the payload, which is then properly formatted and clocked out on the OC3 facility. A functional block diagram of the OC3 Cell Interface Module is shown in Figure 3-14.

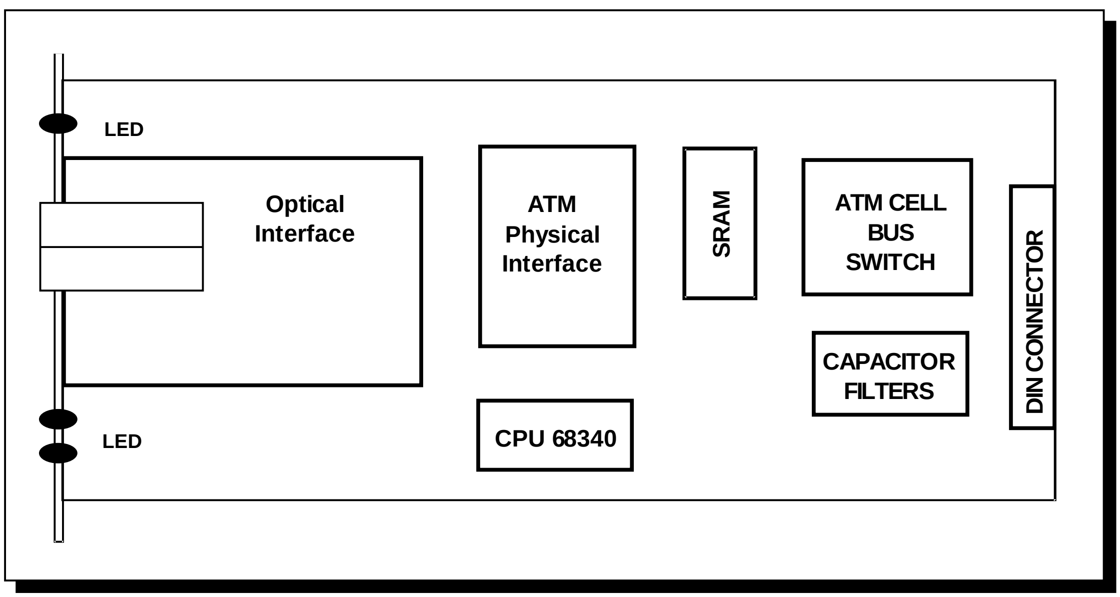


Figure 3-14. OC3 Cell Interface Module Functional Block Diagram

Two types of OC3 modules are available to allow the user to select various drive distances. The only differences are the fiber optic components, one being LED and the other MLM Laser.

Reach	Source	Fiber Type	Connector
Short (0-2 km)	LED	Multi-mode	SC-Duplex
Short/Intermediate (0-15 km)	MLM Laser	Single Mode	SC-Duplex

Specifications

Port Capacity: One

Media: Short Reach (Multimode) Fiber, Intermediate Reach (Single mode) Fiber

Connector: SC Duplex

Line Encoding: Non-Return to Zero (NRZ)

Framing: STS-3c/STM-1

Transmit Clock: Recovered Receive OC3 rate, On Board 155.52 MHz

Diagnostics: Facility Loopback, Terminal Loopback

Alarm Surveillance: Section, Line, and Path

Alarms/Statistics: LOS, LOF, LOP, FEBE, AIS, FERF, BIP, HCS

Maintenance Actions: SONET maintenance signaling generation RDI and AIS.

Applicable Standards: ATM Forum STS-c UNI v3.1, ANSI T1.105-1991, T1-231, T1E1.2/93-020, T1S1.5/92-029R3, ITU-T G.784, ITU-TS I.432, ITU-TS I.610, Bellcore TR-NWT-00112, TR-NWT-000253

Power: ≤ 7 Watts

Optical Transceiver Specifications

Optical Transmitter Specifications: Short reach, multimode, LED

Description	Min.	Typical	Max.	Units
Wavelength	1260	-	1360	nm
RMS Special Bandwidth ($\Delta\lambda$rms)	-	-	75	nm
Average Transmitted Power (Pt)	-20	-17	-14	dBm
Extinction Ratio (remin)	10	-	-	dB

Optical Receiver Specifications: Short reach, multimode, LED

Description	Min.	Typical	Max.	Units
Average Received Power (Pr)	-30	-	-14	dBm
Optical Path Power Penalty (Po)	-	-	1	dB

Optical Transmitter Specifications: Intermediate, single mode, MLM laser

Description	Min.	Typical	Max.	Units
Wavelength	1260	-	1360	nm
RMS Special Bandwidth ($\Delta\lambda$rms)	-	-	7.7	nm
Average Transmitted Power (Pt)	-15	-11	-8	dBm
Extinction Ratio (remin)	8.2	-	-	dB

Optical Receiver Specifications: Intermediate, single mode, MLM laser

Description	Min.	Typical	Max.	Units
Average Received Power (Pr)	-28	-	-8	dBm
Optical Path Power Penalty (Po)	-	-	1	dB

Laser Radiation Hazards

The OC3 interface module with the single mode MLM laser emits a laser beam onto a fiber optic connection. This is a Class 1 laser product complying with IEC 825-1 and FDA 21 CFR 1040.10/1040.11. Observe the warning and precaution listed below.

WARNING: ***THE FIBER-OPTIC CONNECTORS MAY EMIT LASER LIGHT THAT CAN INJURE YOUR EYES. NEVER LOOK INTO AN OPTICAL FIBER CONNECTOR OR CABLE.***

PRECAUTION: ***Working with fiber optic cables can be hazardous to personnel and, if mishandled, can cause injury to personnel or permanent damage to the cables.***

Jitter Specifications:

Jitter Frequency	Maximum Tolerated Jitter Amplitude (UI p-p)
500 Hz - 1.3 MHz	1.5
65 kHz - 1.3 MHz	0.15
Meets Bellcore's requirement from TR-NWT-000253.	

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download.
LED	Rx Syn	Green	Indicates that the module has achieved frame synchronization with the received OC3 when lit, loss of frame synchronization when extinguished
LED	Ce Syn	Green	Indicates that the module has achieved synchronization with the ATM cell HEC in the received OC3 payload when lit, loss of cell synchronization when extinguished

Pinouts

Pinouts for the SC connector are as shown in Figure 3-15.

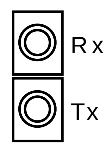


Figure 3-15. SC Duplex Connector

OC3C Cell Interface Module (OC3C)

Overview

The OC3C Cell Interface Module terminates an OC3C facility interface, recovers clock, accesses the ATM cells within the SONET payload, and provides these cells to the Cell Exchange system switching fabric. The OC3C module is available in either single or multimode configuration.

The OC3C Cell Interface Module is part of a broad group of standard Interface Modules that have been developed for the Cell Exchange system. The OC3C Cell Module allows the Cell Exchange system to interface with ATM switches, Engineering Workstations and ATM cell bearing transmission systems. The data rate is 155 Mbps. A front panel view of the OC3C Cell Interface Module is shown in Figure 3-16.

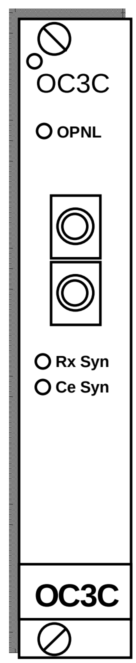


Figure 3-16. OC3C Cell Interface Module (OC3C)

The module performs the following primary functions:

- Takes OC3C ATM cell data and uncouples the cells from the physical OC3C interface
- Takes the cells and places them onto the ATM Cell bus
- Monitors the physical interface for alarms
- Collects statistics on module performance.

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the OC3C module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Motorola 68340 microprocessor
- Capacitor filtering, provided for control and noise suppression
- ATM Physical Interface chip
- Optical interface device to interface with external devices

Unique Module Functionality Section

The OC3C Cell Module is a compact subassembly that provides the hardware necessary to terminate a OC3C facility interface, recover clock, access the ATM cells within the SONET/SDH payload, and provide these cells to the switching fabric. In the transmit direction the process is reversed. ATM cells are taken off the switching fabric and mapped into the SONET/SDH payload, which is then properly formatted and clocked out on the OC3C facility. A functional block diagram of the OC3C Cell Interface Module is shown in Figure 3-17.

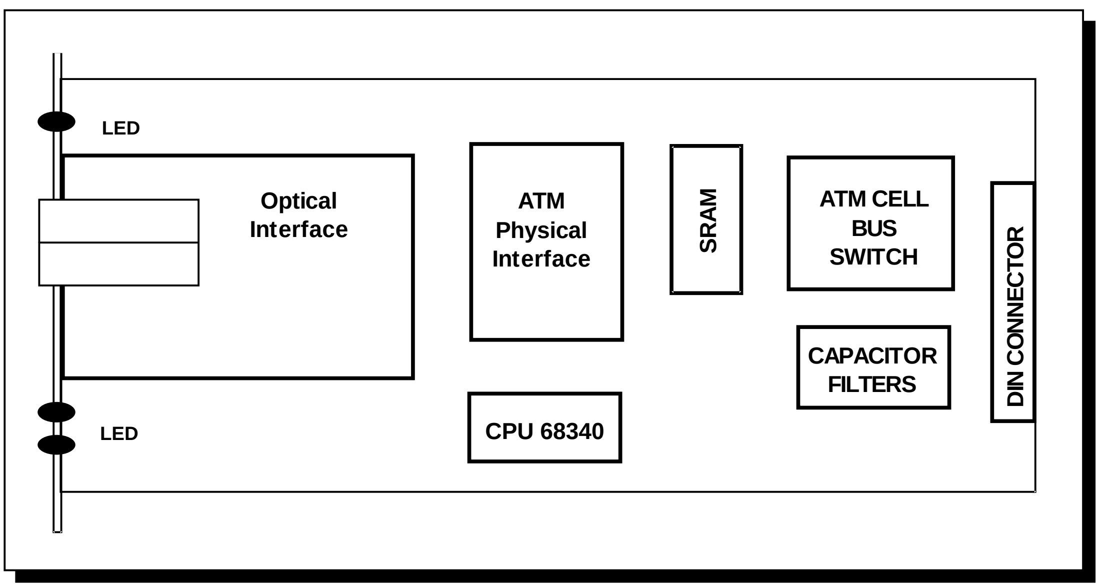


Figure 3-17. OC3C Cell Interface Module Functional Block Diagram

Three types of OC3C modules are available to allow the user to select various drive distances. The only differences are the fiber optic components, one being LED and the other two MLM lasers.

Reach	Source	Fiber Type	Connector
Short (0-2 km)	LED	Multi-mode	SC-Duplex
Short/Intermediate (0-15 km)	MLM Laser	Single Mode	SC-Duplex
Long (0-40 km)	MLM Laser	Single Mode	SC-Duplex

PRECAUTION: ***Do not connect one long reach interface directly with another OC3C card without 8-dB attenuation in between.***

Specifications

Port Capacity: One

Media: Short Haul (Multimode) Fiber, Intermediate/Long Haul (Single mode) Fiber

Connector: SC Duplex

Line Encoding: Non-Return to Zero (NRZ)

Framing: STS-3c/STM-1

Transmit Clock: Recovered Receive OC3C rate, Ref Clock, Internal, On Board 155.52 MHz

Diagnostics: Facility Loopback, Terminal Loopback

Alarm Surveillance: Section, Line, and Path

Alarms/Statistics: LOS, LOF, LOP, FEBE, AIS, FERF, BIP, HCS

Maintenance Actions: SONET maintenance signaling generation RDI and AIS.

Applicable Standards: ATM Forum STS-3c UNI v3.1, ITU-T I.432, ANSI T1E1.2/93-020, T1S1/92-158, ITU-T G.957, Bellcore TR-NWT-000253

Power: $\leq$ 7 Watts

Optical Transceiver Specifications

Optical Transmitter Specifications: Short reach, multimode, LED

Description	Min.	Typical	Max.	Units
Wavelength	1260	-	1360	nm
RMS Special Bandwidth ($\Delta\lambda$rms)	-	75	-	nm
Average Transmitted Power (Pt)	-19	-16	-14	dBm
Extinction Ratio (remin)	10	-	-	dB

Optical Receiver Specifications: Short reach, multimode, LED

Description	Min.	Typical	Max.	Units
Average Received Power (Pr)	-30	-	-14	dBm
Optical Path Power Penalty (Po)	1.5	3	-	dB

Optical Transmitter Specifications: Intermediate reach, single mode, MLM laser

Description	Min.	Typical	Max.	Units
Wavelength	1261	-	1360	nm
RMS Special Bandwidth ($\Delta\lambda$rms)	-	-	7.7	nm
Average Transmitted Power (Pt)	-15	-11	-8	dBm
Extinction Ratio (remin)	8.2	-	-	dB

Optical Receiver Specifications: Intermediate reach, single mode, MLM laser

Description	Min.	Typical	Max.	Units
Average Received Power (Pr)	-48	-37	-34	dBm
Optical Path Power Penalty (Po)	-	-	-	dB

Optical Transmitter Specifications: Long reach, single mode, MLM laser

Description	Min.	Typical	Max.	Units
Wavelength	1280	-	1335	nm
RMS Special Bandwidth ($\Delta\lambda$rms)	-	2.4	4	nm
Average Transmitted Power (Pt)	-5	-3	0	dBm
Extinction Ratio (remin)	10	--	-	dB

Optical Receiver Specifications: Long reach, single mode, MLM laser

Description	Min.	Typical	Max.	Units
Average Received Power (Pr)	-	-38	-34	dBm
Optical Path Power Penalty (Po)	1	1.5	3	dB

Laser Radiation Hazards

The OC3C interface module with the single mode MLM laser emits a laser beam onto a fiber optic connection. This is a Class 1 laser product complying with IEC 825-1 and FDA 21 CFR 1040.10/1040.11. Observe the warning and precaution listed below.

WARNING: THE FIBER-OPTIC CONNECTORS MAY EMIT LASER LIGHT THAT CAN INJURE YOUR EYES. NEVER LOOK INTO AN OPTICAL FIBER CONNECTOR OR CABLE.

PRECAUTION: Working with fiber optic cables can be hazardous to personnel and, if mishandled, can cause injury to personnel or permanent damage to the cables.

Jitter Specifications:

Jitter Frequency	Maximum Tolerated Jitter Amplitude (UI p-p)
500 Hz - 1.3 MHz	1.5
65 kHz - 1.3 MHz	0.15
Meets Bellcore's requirement from TR-NWT-000253.	

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download.
LED	Rx Syn	Green	Indicates that the module has achieved frame synchronization with the received OC3C when lit, loss of frame synchronization when extinguished
LED	Ce Syn	Green	Indicates that the module has achieved synchronization with the ATM cell HEC in the received OC3C payload when lit, loss of cell synchronization when extinguished

Pinouts

Pinouts for the SC connector are as shown in Figure 3-18.

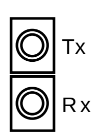


Figure 3-18. SC Duplex Connector

Dual Synchronous Cell Interface Module (DSC)

Overview

The Dual Synchronous Cell Interface Module is part of a broad group of standard Interface Modules that have been developed to be used with the ATM Cell Exchange systems. A front panel view of the Dual Synchronous Cell Interface Module is shown in Figure 3-19.

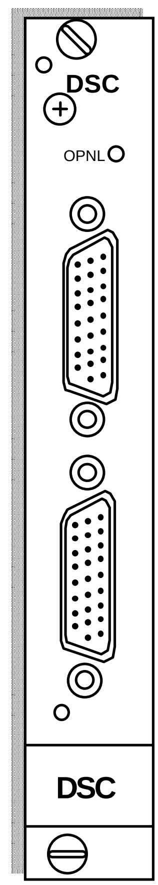


Figure 3-19. Dual Synchronous Cell Interface Module (DSC)

The Dual Synchronous Cell Interface Module is a compact subassembly designed to be used as a major system building block in the Cell Exchange system. The Dual Synchronous Cell Interface Module provides the necessary hardware to terminate two Synchronous interfaces, recover clock, access the ATM cells within the payload data stream, and provide these cells to the Cell Exchange switching fabric. In the transmit direction the process is reversed. ATM cells are taken off the switching fabric and mapped into the payload data stream, which is then properly formatted and clocked out on the synchronous facility. Figure 3-20 shows a functional block diagram of the Dual Synchronous Cell Interface Module.

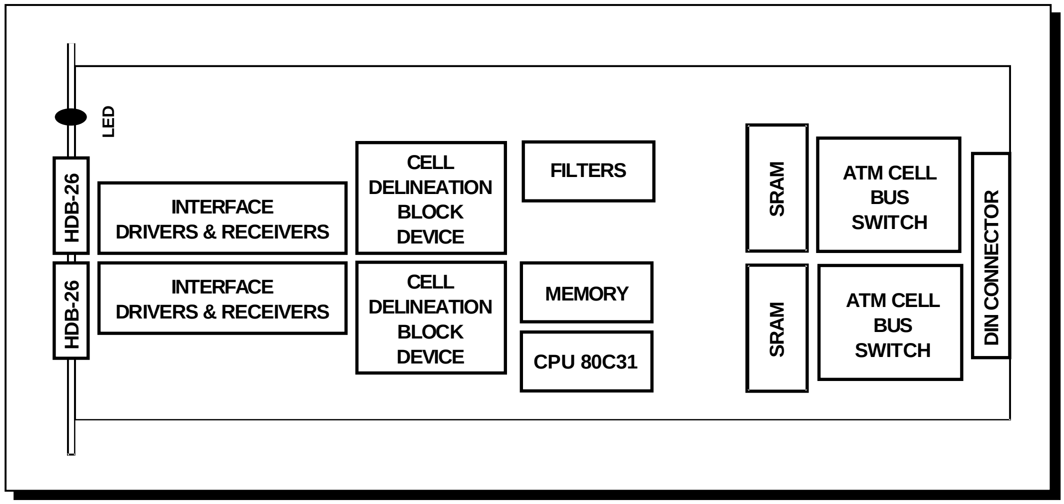


Figure 3-20. Dual Synchronous Cell Interface Module Functional Block Diagram

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the DSC module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Intel 80C31 microprocessor
- Capacitor filtering, provided for control and noise suppression

Unique Functionality Section

Unique Functionality of the Dual Synchronous Cell Interface Module includes:

- Module is equipped with two independent channels
- Connectors are High-Density DB-26 female type (DTE)
- Drivers and receivers conform to EIA - 530
- A Cell Delineation Block Device circuit provides Header Error Control (HEC) checks on the incoming cell synchronous data stream to provide a reset signal to the encryption device

Jumper Settings

The jumper settings listed are factory set defaults. No user configuration is required.

Jumper	Pins*
J1	2-3
J4	1-2
J5	1-2
J8	1-2
J9	1-2

** All other pins are open (not connected).*

Specifications

<u>Port Capacity</u>: Two

<u>Media</u>: Shielded Multi-twisted pair cable, low capacitance

<u>Electrical</u>: EIA - 530, which provides EIA-422 electrical interface; this is a DTE interface, connecting to DCE

<u>Connector</u>: HDB-26, Female

<u>Line Format</u>: Balanced

<u>Data Rates</u>: 16 Kbps-20 Mbps (in 8 Kbps increments)

***NOTE**: Maximum data rate is dependent on cable length. For exact data rate versus cable length formula, see EIA-422.*

***NOTE**: When operating the DSC at data rates up to 16Mbps, any timing option may be used. When operating at data rates above 16Mbps, timing must be sourced from the DCE device (ST). Sourcing from the DCE is the most common configuration.*

<u>Diagnostics</u>: Facility Loopback, Terminal Loopback

<u>Alarm – Surveillance</u>: HEC

<u>Crypto-Reset Signal</u>: Single-ended, EIA - 530 (activated on corrupted HEC)

<u>ATM Layer</u>: AAL 1, CBR

<u>Applicable Standards</u>: ITU-T I.432, af-phy.0043.000

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download.

Pinouts

Pinouts for the high-speed DB-26F connectors are as shown in Figure 3-21 and the accompanying table.

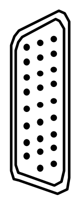


Figure 3-21. HDB-26F (DTE) Pin Location

Pin	Direction	Signal
1		FG
2	→	SDA
3	←	RDA
4	→	RSA
5	←	CSA
6	←	DMA
7		SG
8	←	RRA
9	→	LL
10	←	TM
11	→	SDB
12	←	RDB
13	→	TTA

Pin	Direction	Signal
14	←	CSB
15	←	STA
16	←	DMB
17	←	RTA
18	←	RRB
19	→	TRB
20	→	TRA
21	→	TTB
22	→	RSB
23	←	STB
24	→	RL
25	←	RTB
26	→	KGRST

← To DSC Module

→ To Network

DS3 Cell Interface Module (DS3)

Overview

The DS3 Cell Interface Module allows the Cell Exchange system to interface with ATM cell bearing communications equipment. A front panel view of the DS3 Cell Interface Module is shown in Figure 3-22.

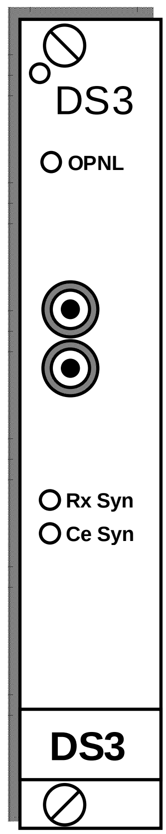


Figure 3-22. DS3 Cell Interface Module (DS3)

The DS3 Cell Interface Module performs the following primary functions:

- Takes the cells and places them onto the ATM cell bus
- Monitors the physical synchronous interface for alarms
- Collects statistics on module performance

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the DS3 module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Motorola 68340 microprocessor
- Capacitor filtering, provided for control and noise suppression

Unique Functionality Section

The DS3 Cell Interface Module includes the following unique functions:

- Module equipped with one complete DS3 channel
- Connectors are BNC type

A functional block diagram of the DS3 Cell Interface Module is shown in Figure 3-23.

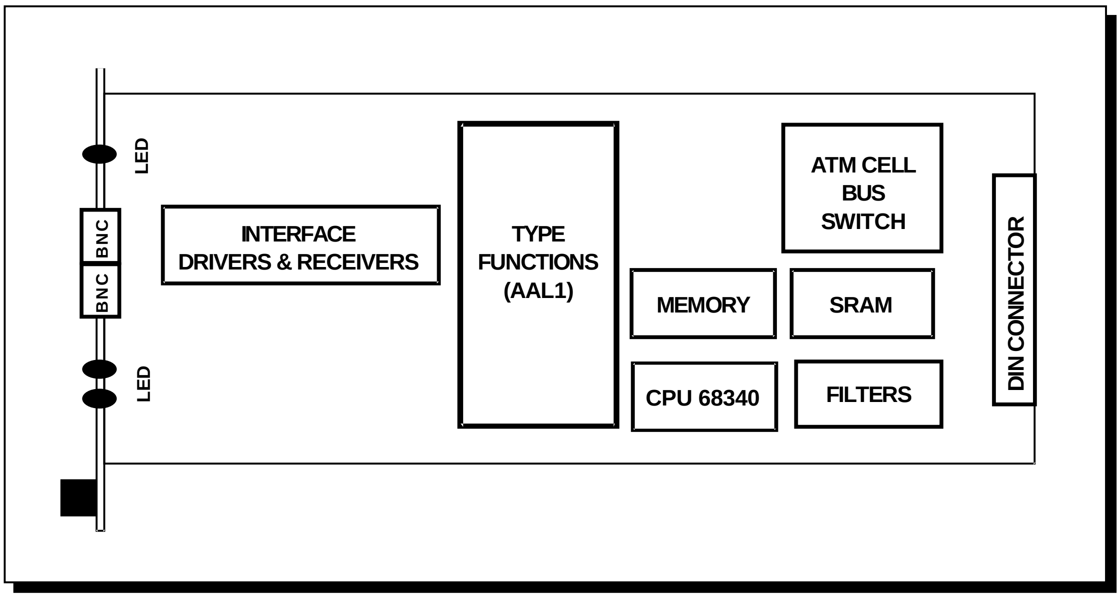


Figure 3-23. DS3 Cell Interface Module Functional Block Diagram

Specifications

Port Capacity: One

Media: Coaxial Cable

Connector: BNC Female

Data Rate: 44.736 Mbps

Signal Format: C-Bit Parity per ANSI T1.107a, M23 per ANSI T1.107

Transmit Clock: Recovered Receive DS3 rate, On-Board 44.736 MHz

Diagnostics: Signal Loopbacks, Self-Test

Alarm – Surveillance: LOS, LOF, LOC, AIS, Sync Fail, Hardware Fail, FERM, PLCP Path RAI, DS3 Path RFI

Alarm/Statistics: Physical Layer, Line Layer, DS3 Path Layer, PLCP Path Layer, and ATM Layer

Applicable Standards: ATM UNI v3.1, ANSI T1.107-1988, ANSI T1.107a-1990, ANSI T1.231-1993, ITU-TS Docs. I.432, I.610, G.703, G.804

Power: ≤ 7 Watts

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download.
LED	Rx Syn	Green	Indicates that the module has achieved frame synchronization with the received DS3 when lit, loss of frame synchronization when extinguished
LED	Ce Syn	Green	Indicates that the module has achieved synchronization with the ATM cell HEC in the received DS3 payload when lit, loss of cell synchronization when extinguished

Pinouts

Pinouts for the BNC connectors are as shown in Figure 3-24.

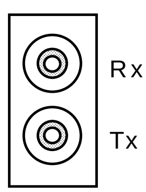


Figure 3-24. BNC Pin Location

E1 Cell Interface Module (E1C)

Overview

The E1 Cell Interface Module functions identically to the T1 Cell Interface Module except that it operates at 2.048 Mbps. The E1C Module has two E1 ports and is designed to connect other native ATM equipment operating with an E1 cell bearing interfaces into higher level ATM networks. The E1C Module terminates two independent E1 facility interfaces, recovers clock, accesses ATM cells within the E1 payload and sends these cells to the switching fabric. In the transmit direction it maps ATM cells into the E1 framed payload, formats the payload per ATM forum specifications and clocks it out on the E1 facility. A front panel view of the E1 Cell Interface Module is shown in Figure 3-25.

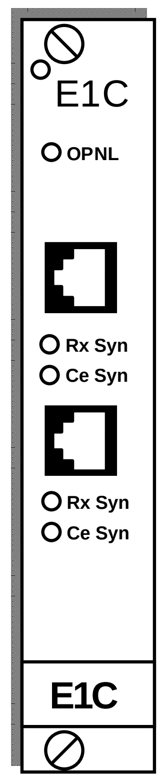


Figure 3-25. E1 Cell Interface Module (E1C)

The E1 Cell Interface Module performs the following primary functions:

- Takes the cells and places them onto the ATM cell bus
- Monitors the physical synchronous interface for alarms
- Collects statistics on module performance

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the E1C Module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Intel 80C31 microprocessor
- Capacitor filtering, provided for control and noise suppression

Unique Functionality Section

The E1 Cell Interface Module includes the following unique functions:

- Module equipped with two complete E1 channels
- Connectors are RJ-45 type

A functional block diagram of the E1 Cell Interface Module is shown in Figure 3-26.

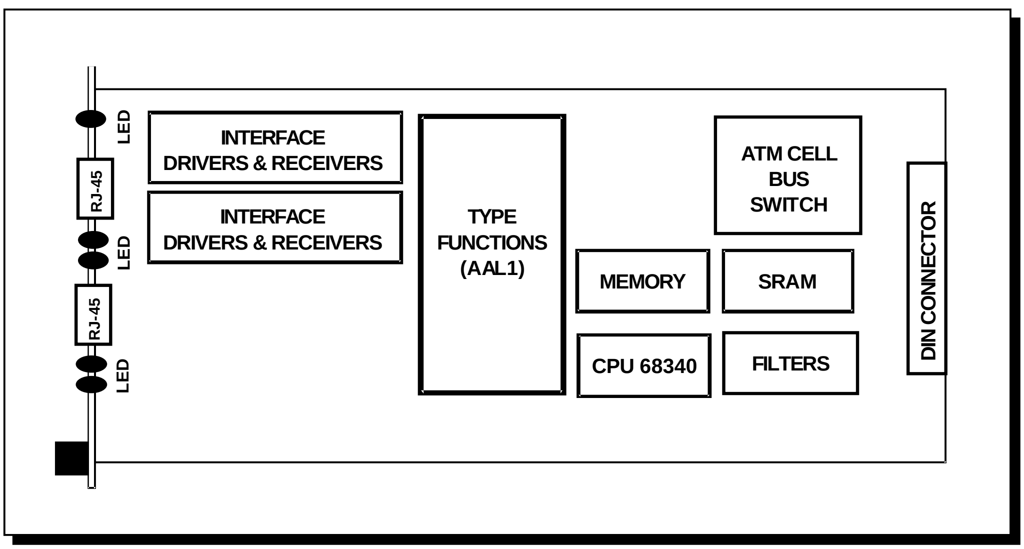


Figure 3-26. E1 Cell Interface Module Functional Block Diagram

Jumper Settings

The jumper settings listed are factory set defaults. No user configuration is required.

Jumper	Pins
J2	2-3

Specifications

Port Capacity: Two

Media: Shielded, Twisted

Connector: RJ-45, Female

Line Build Out: (75 Norm, 120 Norm, 75 P.R., 120 P.R., 75 HRL1, 75 HRL2, and 120 HRL)

Framing: CAS+CRC4 or CAS

Port Speed: 2.048 Mbps

Timing: Recovered, Internal, Reference, Onboard

Diagnostics: Signal Loopbacks, Self-Test

Power: ≤ 7 Watts

Applicable Standards: ITU G.703, G.804, af-vtoa-0078.000 Channel Emulation Service (CES) v2.0/1/97, ATM Forum E1 UNI v3.1, af_phy-0016.0000

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download.
LED	Rx Syn	Green	Indicates that the module has achieved frame synchronization with the received E1 when lit, loss of frame synchronization when extinguished
LED	Ce Syn	Green	Indicates that the module has achieved synchronization with the ATM cell HEC in the received E1 payload when lit, loss of cell synchronization when extinguished

Pinouts

Pinouts for the RJ-45 connector are shown in Figure 3-27 and the accompanying table.

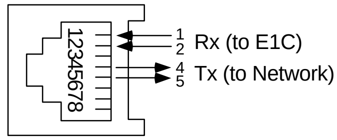


Figure 3-27. RJ-45 Pin Location

Pin	Direction	Signal
1	**To E1C**	**Rx-R**
2	**To E1C**	**Rx-T**

Pin	Direction	Signal
4	**To Network**	**Tx-R**
5	**To Network**	**Tx-T**

E3 Cell Interface Module (E3C)

Overview

The E3 Cell Interface Module allows the Cell Exchange to interface with ATM cell bearing communications equipment. The E3C Module performs the following primary functions: takes the cell from the E3C interface and places them onto the ATM cell bus; monitors the physical interface for alarms; and collects statistics on module performance. The E3C module terminates one E3 facility, recovers clock, accesses ATM cells within the payload and sends the cells to the bus. In the transmit direction it maps ATM cells into the payload, formats the payload and clocks it out on the E3 facility. A front panel view of the E3 Cell Interface Module is shown in Figure 3-28.

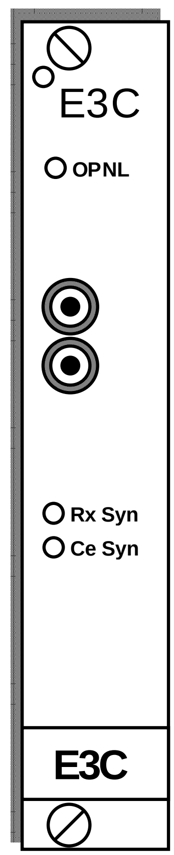


Figure 3-28. E3 Cell Interface Module (E3C)

The E3 Cell Interface Module performs the following primary functions:

- Takes the cells and places them onto the ATM cell bus
- Monitors the physical synchronous interface for alarms
- Collects statistics on module performance

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the E3C Module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Motorola 68340 microprocessor
- Capacitor filtering, provided for control and noise suppression

Unique Functionality Section

The E3 Cell Interface Module includes the following unique functions:

- Module equipped with one complete E3C channel
- Connectors are BNC type, one transmit and one receive

A functional block diagram of the E3 Cell Interface Module is shown in Figure 3-29.

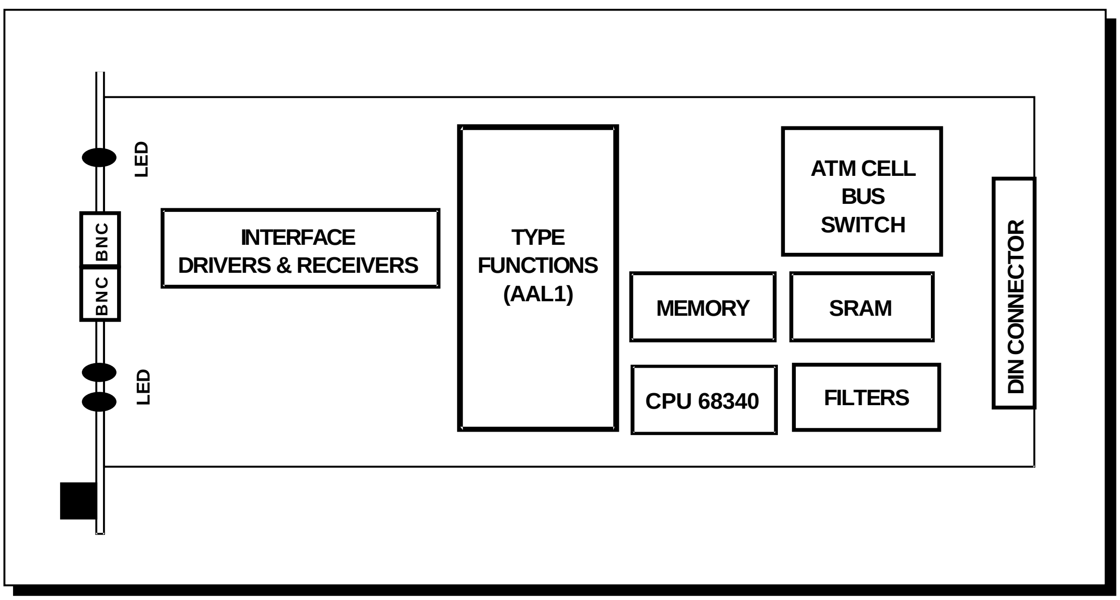


Figure 3-29. E3 Cell Interface Module Functional Block Diagram

Specifications

Port Capacity:	One
Media:	Coaxial Cable
Connector:	BNC Female
Framing:	CAS+CRC4 or CAS
Port Speed:	34.368 Mbps

Timing: Recovered, Onboard

Diagnostics: Signal Loopbacks, Self-Test

Alarm – Surveillance: LOS, LOF, LOC, AIS, Sync Fail, Hardware Fail, FERM, PLCP Path RAI, DS3 Path RFI

Alarm/Statistics: Physical Layer, Line Layer, DS3 Path Layer, PLCP Path Layer, and ATM Layer

Applicable Standards: ITU G.703, G.804, af-vtoa-0078.000 Channel Emulation Service (CES) v2.0/1/97, ATM Forum E3 UNI v3.1, af_phy-0016.0000

Power: ≤ 7 Watts

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download.
LED	Rx Syn	Green	Indicates that the module has achieved frame synchronization with the received E3 when lit, loss of frame synchronization when extinguished
LED	Ce Syn	Green	Indicates that the module has achieved synchronization with the ATM cell HEC in the received E3 payload when lit, loss of cell synchronization when extinguished

Pinouts

Pinouts for the BNC connectors are as shown in Figure 3-30.

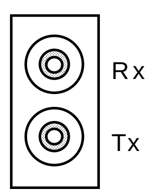


Figure 3-30. BNC Pin Location

Structured T1 Legacy Module (STL)

Overview

The Structured T1 Legacy (STL) Interface Module allows voice and data contained in T1 **channel groups** (one or more 64KHz DS0 channels) to be passed to and from ATM cell bearing equipment. The STL card supports either 4 or 8 T1 interfaces. Both ESF and SF framing formats are supported (T1 interface configuration is discussed in the following section). A front panel view of the Structured T1 Legacy Interface Modules is shown in Figure 3-31.

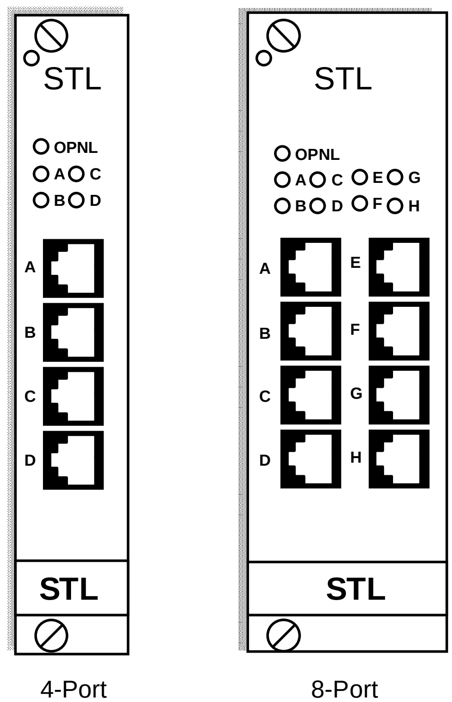
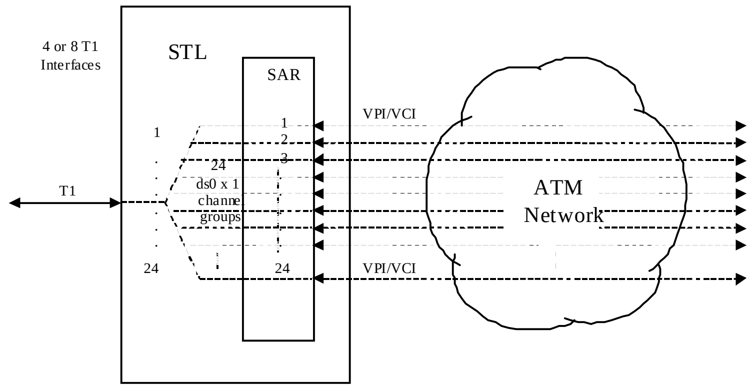


Figure 3-31. Structured T1 Legacy Interface Module (STL)

Channel groups are configured as either voice or data. For channels configured as data, the STL sets up “clear channel” (64KHz) connections. For voice connections, the STL enables in-band (“robbed bit”) signaling to pass through the network (Figure 3-32).

The user defines the various voice and data channel groupings via the STL interface configuration menu described in the configuration chapter. Each channel group consists of one or more channels. The channels can be either **c**ontiguous or non-contiguous.

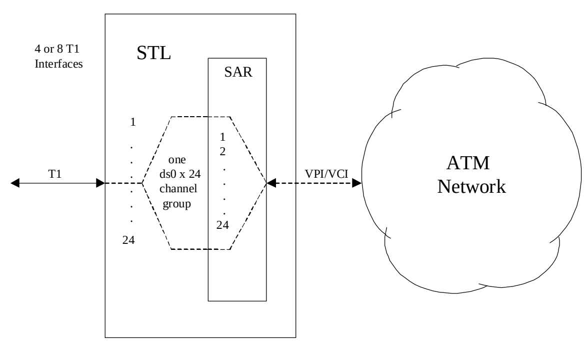


Each T1 channel mapped to different VPI/VCI pairs

Figure 3-32. T1 Mapping

STL connections are established via the connection management menu (See Configuring STL Connections in Chapter 5). The Cell Exchange system allows any channel group to be connected to:

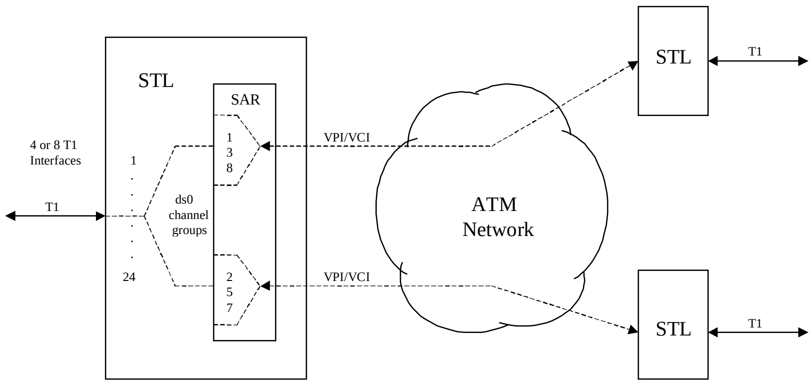
- Any VPI/VCI of any configured cell bearing interface
- Any “compatible” STL channel group, that is, any channel group that carries the same type of traffic (voice or data) and contains the same number of channels (Figure 3-33)



All 24 T1 channels mapped to one VPI/VCI pair

Figure 3-33. Channel Mapping

The STL utilizes an AAL1 Segmentation And Reassembly (SAR) processor to pass data to and from the ATM network. In Figure 3-34 below, two connections that have been established between a T1 interface and the ATM network. In this example, T1 channels 1, 3, and 8 are mapped to one VPI/VCI pair, and channels 2, 5, 7 are mapped to another VPI/VCI pair.



Two STL-to-VPI/VCI connections

Figure 3-34. STL to VPI/VCI Connections

For STL-to-STL connections, the actual channel numbers of each group may differ at each end as long as each group contains the same number of channels. The ordering of channels passed from the source channel group to the destination channel group is always preserved. In other words, the first channel of the destination receives the data from the first channel of the source; the second channel of the destination receives the data from the second channel of the source, and so on.

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the STL Interface Module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Motorola 68340 microprocessor
- Battery backed RAM
- Capacitor filtering, provided for control and noise suppression

Unique Functionality Section

The STL Interface Module includes the following unique functions:

- Module equipped with one complete independent synchronous channel
- Connectors RJ-45 female type
- High-speed AAL1 segmentation and reassembly function

A functional block diagram of the STL Interface Module is shown in Figure 3-35.

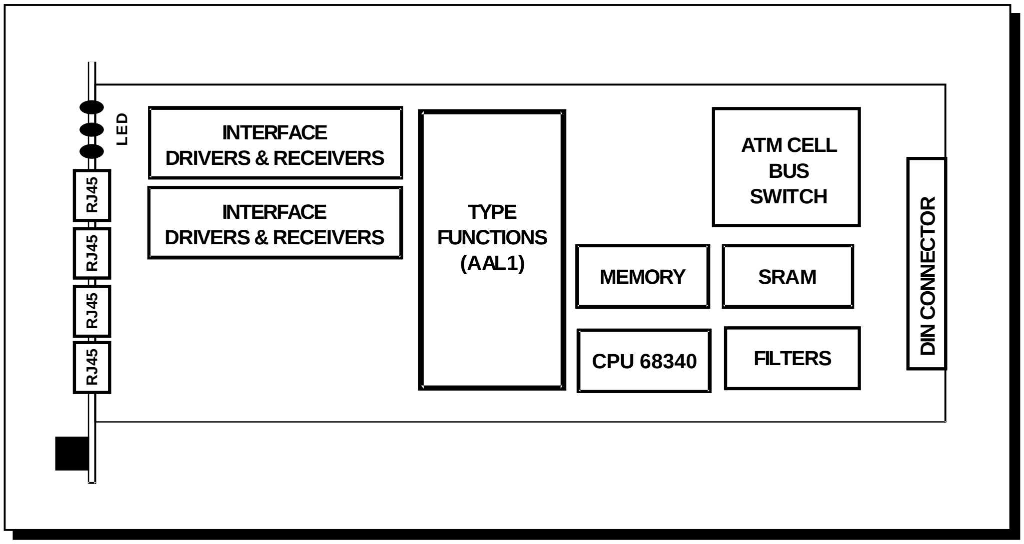


Figure 3-35. Structured T1 Legacy Interface Module Functional Block Diagram

STL Operation

Interface Loopback

Any STL interface can be looped back via the loopback option of the diagnostics menu. When loopback is enabled, the STL configures the interface for **remote loopback** (to connected equipment) as well as **framer loopback** (all T1 transmit data is looped back to the receiver).

STL to T1 Cell Bearing Connections

For connections between STL channel groups and a T1 cell bearing interface, the total number of T1 channels must not exceed 20 channels. This is due to overhead required by ATM. If more than 20 channels are connected to a T1 cell bearing interface, cells will be discarded. The result of attempting to connect more than 20 channels is a significant loss of signal quality across all channels.

Idle Channel Data Insertion

For channels configured as idle channels (not associated with any group), the STL inserts idle data according to the interface configuration settings.

When the idle channel conditioning is configured as “Data Idle,” the values inserted are:

- 0x7F (binary 01111111) if “Idle (UAC)” is selected as the trunk conditioning data code
- 0x1A (binary 00011010) if “MUX-OOS” is selected as the trunk conditioning data code

When the idle channel conditioning is configured as “Voice Idle” the idle values inserted are:

- 0xFF (all ones) if “Idle(0)/Busy(1)” is selected for trunk conditioning signaling
- 0x00 (all zeroes) if “Busy(1)/Idle(0)” is selected for trunk conditioning signaling

Trunk Conditioning Logic

Trunk conditioning attempts to minimize the impact that link failures can have on connected equipment by inserting data and signaling into each of the affected channels according to the currently configured trunk conditioning parameters. Figure 3-36 shows a typical case of trunk conditioning.

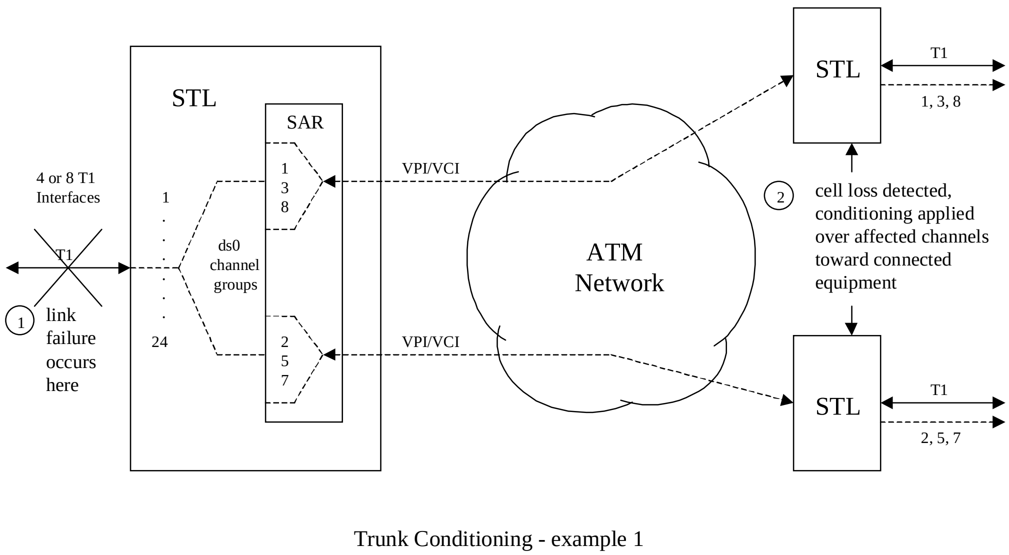


Figure 3-36. Trunk Conditioning

The STL initiates trunk conditioning whenever 1) connections are disabled or 2) received cell loss occurs for 3 seconds. Trunk conditioning is applied in the outbound direction (toward the connected equipment). Trunk conditioning is applied only on the affected channels.

For data channels, trunk conditioning simply inserts idle data into the affected channels.

For voice channels, idle data insertion is applied after trunk conditioning first toggles the signaling bits as follows:

- All zeroes (2.5 sec) followed by all ones (2.5 sec) when “Idle (0)/Busy (1)” is selected for trunk conditioning signaling. After one toggle cycle, idle data is inserted.
- All ones (2.5 sec) followed by all zeroes (2.5 sec) when “Busy (1)/Idle (0)” is selected for trunk conditioning signaling. After one toggle cycle, idle data is inserted.

The STL removes trunk conditioning following 9 seconds of error-free cell reception. Figure 3-37 shows another typical example of trunk conditioning.

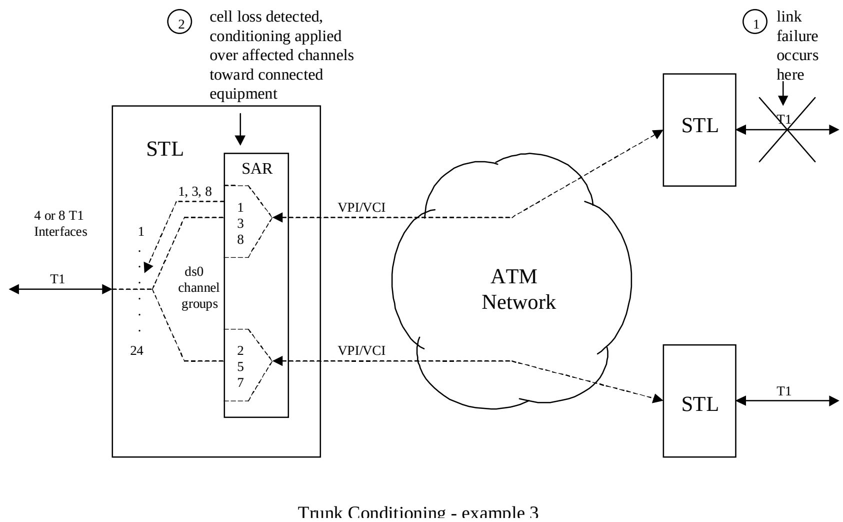


Figure 3-37. Another Example of Trunk Conditioning

T1 Signaling

As mentioned previously, the STL utilizes an AAL1 **Segmentation And Reassembly** (SAR) processor to pass the T1 data to and from the ATM network. For channel groups configured as voice, the STL directs the SAR to pass T1 signaling bits to and from the ATM network as well.

In the **inbound** direction (from a T1 interface into the ATM network), the SAR extracts signaling bits for each T1 channel and combines them with the user data into a single cell for transmission through the ATM network. In the **outbound** direction (from the ATM network to a T1 interface), the SAR extracts the signaling bits from these cells and inserts them into the correct T1 channels (see af-vtoa-0078.000, Channel Emulation Services for a description of signaling bits). This scheme allows signaling to be passed even if the T1 framing formats of the source and destination T1 interfaces differ.

ESF provides four signaling bits (A, B, C, and D bits) while SF provides only two (A and B bits). If a voice connection is configured between a channel group of a T1 ESF interface and a channel group of a T1 SF interface, signaling is affected as follows:

- ESF inbound signaling bits A and B are mapped to SF outbound bits A and B, respectively
- ESF inbound signaling bits C and D are lost since SF defines only two signaling bits
- SF inbound signaling bit A values are mapped to two outbound ESF signaling bits A and C
- SF inbound signaling bit B values are mapped to two outbound ESF signaling bits B and D

T1 Alarms

The STL sends a yellow alarm toward the connected equipment whenever a red alarm (loss of signal) is present for a period of 3 seconds. The STL removes the yellow alarm when a signal is present for at least 9 seconds.

Specifications

Port Capacity:	Four or Eight
Electrical:	DSX-1 or CSU
Media:	T1, Twisted Pair Cable
Connector:	RJ-45, Female (DCE)
Line Encoding:	AMI, B8ZS
Framing:	SF (D4), ESF
Timing:	On Board, Ref Clock, Recovered, Internal
Diagnostics:	Remote and Framer Loopback
Alarm - Surveillance:	LOF, LOS, BPV, AIS
Alarm/Statistics:	Physical Layer, Line Layer, T1 Path Layer, and ATM Layer
Applicable Standards:	ATM Forum DS1 UNI v3.1, af-vtoa-0078.000 Channel Emulation Service (CES) v2.0, 1/97, ANSI/Bellcore DSX-1, T1.102, T1.107, T1.408, T1.403-1989, TR-TSY-000009, ITU-T G.703, G.804, AT&T 62411
Power:	≤ 7 Watts

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download. Illuminated whenever the STL card is working properly and at least one T1 interface has been configured
LED (One per I/F)	A-D (4 port) A-H (8 port)	Green	STL has detected T1 frame synchronization on a configured interface. Extinguishes if channel dead or loss of frame (LOF) detected

Pinouts

All of the RJ-45 connectors on the STL 4 and 8 have the following pin-outs. Pins 1 and 2 are Transmit out to the terminal equipment (PBX in most cases.) Pins 4 and 5 are Receive in from the terminal equipment (PBX in most cases.) Pinouts for the RJ-45 connector are shown in Figure 3-38.

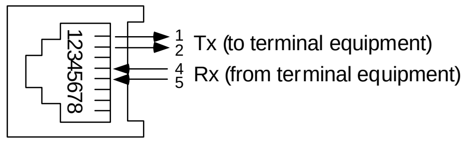


Figure 3-38. STL RJ-45 Pinouts

Pin	Direction	Signal
1	To TE	Tx-R
2	To TE	Tx-T

Pin	Direction	Signal
4	To STL	Rx-R
5	To STL	Rx-T

Dual Synchronous Legacy Interface Module (DSL)

Overview

The Dual Synchronous Legacy Interface Module (DSL) is the gateway for synchronous non-ATM traffic into the ATM network. The DSL module provides an EIA RS-530 interface, converts legacy traffic into ATM cells, and establishes circuit emulation over the ATM network in AAL1 unstructured mode. The DSL module supports data rates from 8 Kbps to 2.048 Mbps in 8 Kbps increments. Adaptive Clock Recovery timing allows the module to be highly tolerant of network timing ambiguities. A front panel view of the Dual Synchronous Legacy Interface Module is shown in Figure 3-39.

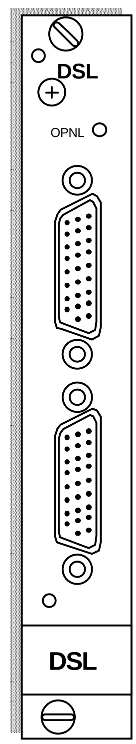


Figure 3-39. Dual Synchronous Legacy Interface Module (DSL)

The Dual Synchronous Legacy Interface Module performs the following primary functions:

- Takes synchronous non-cell bearing traffic (Legacy traffic) and converts the data stream to ATM CBR cells, adding the appropriate cell overhead
- Takes the cells and places them onto the ATM cell bus
- Monitors the physical synchronous interface for alarms
- Collects statistics on module performance

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the Dual Synchronous Legacy Interface Module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Intel 80C31 microprocessor
- Capacitor filtering, provided for control and noise suppression

Unique Functionality Section

- Module equipped with two complete independent synchronous channels
- Connectors are High Density DB-26 female type
- Configured as a DCE device using DB-26 (Female) high density connectors

A functional block diagram of the Dual Synchronous Legacy Interface Module is shown in Figure 3-40.

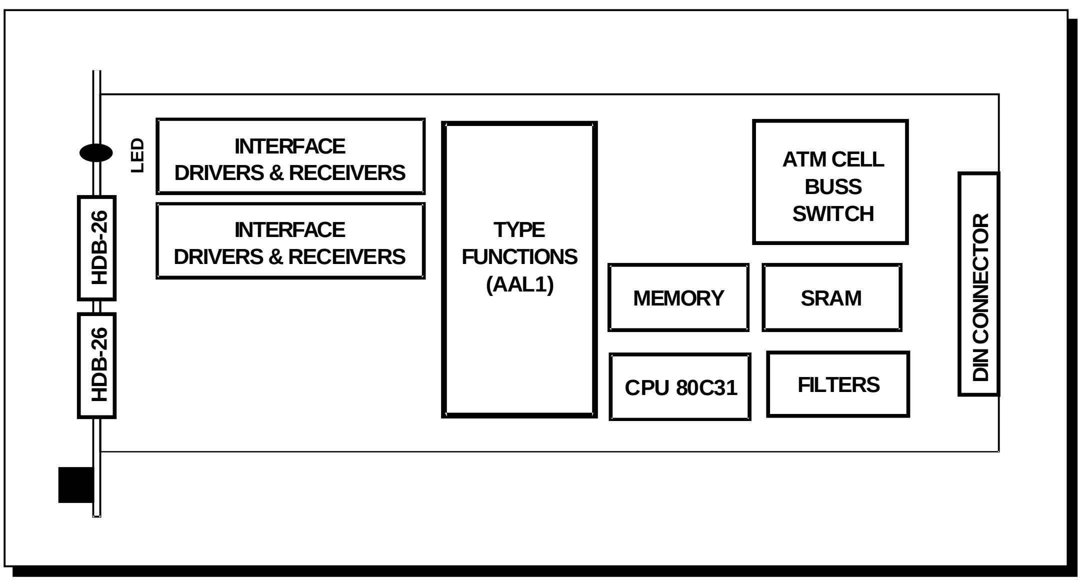


Figure 3-40. Dual Synchronous Legacy Interface Module (DSL) Functional Block Diagram

Jumper Settings

The jumper settings listed are factory set defaults. No user configuration is required.

Jumper	Pins*
J5	1-2
J3	2-3

** All other pins are open (not connected).*

Specifications

Port Capacity:	Two
Media:	Shielded Multi-twisted pair cable, low capacitance
Electrical:	EIA - 530, which provides EIA-422 electrical interface; this is a DCE interface, connecting to DTE
Connector:	HDB-26, Female
Line Format:	Balanced
Data Format:	Serial Synchronous
Data Rates:	16 Kbps-2.048 Mbps (in 8 Kbps increments)
Timing:	Internal, Ref Clock
Diagnostics:	Facility Loopback, Terminal Loopback
Alarm – Surveillance:	HEC
Applicable Standards:	ITU-T I.432, af-phy.0043.000

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download.

Pinouts

Pinouts for the high-speed DB-26 connectors are as shown in Figure 3-41 and the accompanying table.

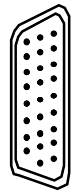


Figure 3-41. HDB-26F (DCE) Pin Location

Pin	Direction	Signal
1		FG
2	←	SDA
3	→	RDA
4	←	RSA
5	→	CSA
6	→	DMA
7		SG
8	→	RRA
9	←	LL
10	→	TM
11	←	SDB
12	→	RDB
13	←	TTA

Pin	Direction	Signal
14	→	CSB
15	→	STA
16	→	DMB
17	→	RTA
18	→	RRB
19	←	TRB
20	←	TRA
21	←	TTB
22	←	RSB
23	→	STB
24	←	RL
25	→	RTB
26		N/A

← To DSL Module

→ To Terminal

High-Speed Synchronous Legacy Interface Module (HSL)

Overview

The High Speed Synchronous Legacy Interface Module (HSL) allows the Cell Exchange to interface with non-ATM cell bearing equipment at speeds up to 20 Mbps. The synchronous channels operate in steps of 8 Kbps. A front panel view of the High Speed Synchronous Legacy Interface Module is shown in Figure 3-42.

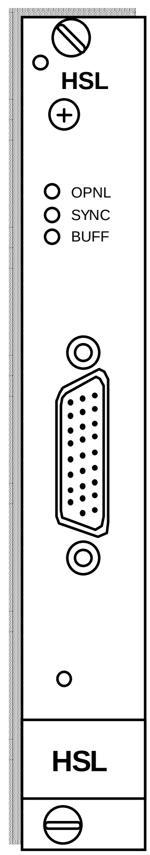


Figure 3-42. High Speed Synchronous Legacy Interface Module (HSL)

The High Speed Synchronous Legacy Interface Module performs the following primary functions:

- Takes synchronous non-cell bearing traffic (Legacy traffic) and converts the data stream to ATM CBR cells, adding the appropriate cell overhead
- Takes the cells and places them onto the ATM cell bus
- Monitors the physical synchronous interface for alarms
- Collects statistics on module performance

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the High Speed Synchronous Legacy Interface Module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Intel 80C31 microprocessor
- Capacitor filtering, provided for control and noise suppression

Unique Functionality Section

Unique functionality of the High Speed Legacy Interface Module includes:

- Module equipped with one complete independent synchronous channel
- Connector is a High Density DB-26 female type
- Configured as a DCE device using a DB-26 (Female) high density connector

A functional block diagram of the Synchronous Legacy Interface Module is shown in Figure 3-43.

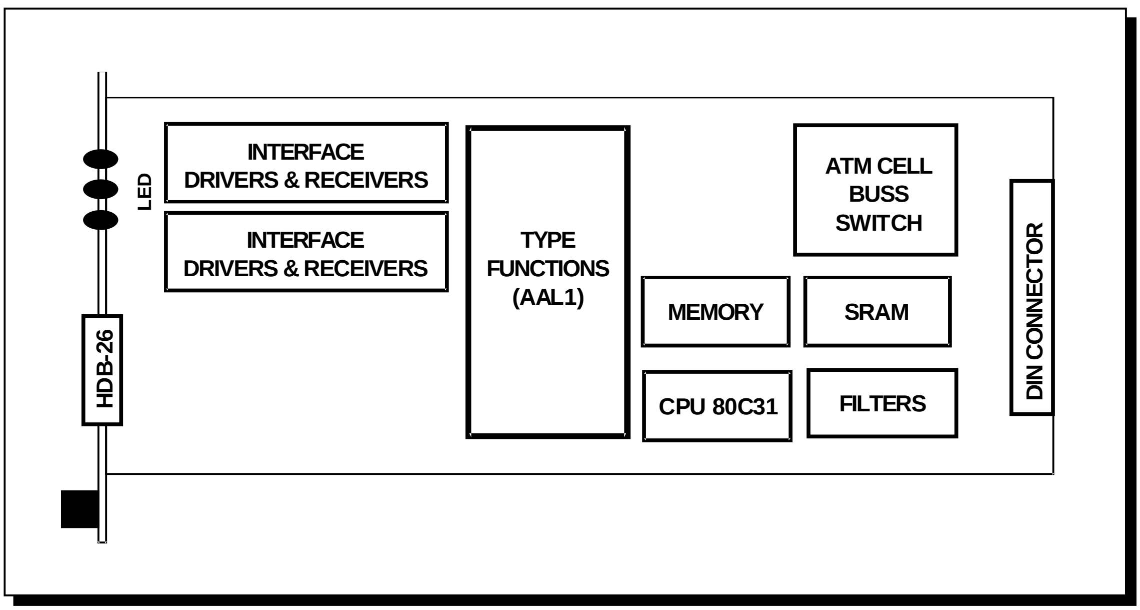


Figure 3-43. High Speed Synchronous Legacy Interface Module Functional Block Diagram

Jumper Settings

The jumper settings listed are factory set defaults. No user configuration is required.

Jumper	Pins
J3	1-2

** All other pins are open (not connected).*

Specifications

Port Capacity: One

Media: Shielded Multi-twisted pair cable, low capacitance

Electrical: EIA - 530, which provides EIA-422 electrical interface; this is a DCE interface, connecting to DTE

Connector: HDB-26, Female

Line Format: Balanced

Data Format: Serial Synchronous

Data Rates: 128 Kbps - 20 Mbps (in 8 Kbps increments)

NOTE: Maximum data rate is dependent on cable length. For estimated data rates versus cable lengths, see the description in EIA-422.

Timing: Internal, External, Ref Clock

Diagnostics: Facility Loopback, Terminal Loopback

Alarm – Surveillance: HEC

Applicable Standards: ITU-T I.432, af-phy.0043.000

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download.
LED	SYNC	Red	Off (normal) indicates synchronization with source; On indicates synchronization lost (i.e. not receiving cells)
LED	BUFF	Red	Off (normal); On indicates data output buffer is completely full or completely empty due to a mismatch in data rates between the HSL and the far end source, or due to loss of cells.

Pinouts

Pinouts for the high density DB-26 connector are shown in Figure 3-44 and the accompanying table.

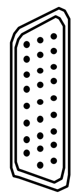


Figure 3-44. HDB-26F (DCE) Pin Location

Pin	Direction	Signal
1		FG
2	←	SDA
3	→	RDA
4	←	RSA
5	→	CSA
6	→	DMA
7		SG
8	→	RRA
9	←	LL
10	→	TM
11	←	SDB
12	→	RDB
13	←	TTA

Pin	Direction	Signal
14	→	CSB
15	→	STA
16	→	DMB
17	→	RTA
18	→	RRB
19	←	TRB
20	←	TRA
21	←	TTB
22	←	RSB
23	→	STB
24	←	RL
25	→	RTB
26		N/A

← To HSL Module

→ To Terminal

High-Speed Serial Interface Legacy Module (HSSL)

Overview

The High Speed Serial Interface Legacy Module (HSSL) allows the Cell Exchange to interface with non-ATM cell bearing equipment at speeds up to and including 52 Mbps. The synchronous channels operate in steps of 8 Kbps. A front panel view of the High Speed Synchronous Legacy Interface Module is shown in Figure 3-45.

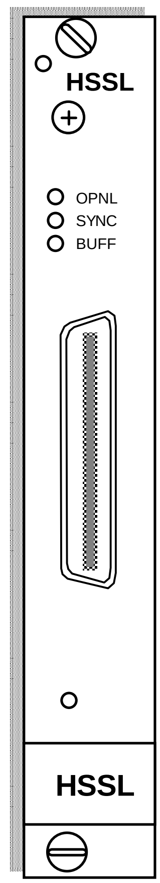


Figure 3-45. High Speed Serial Interface Legacy Module (HSSL)

The High Speed Synchronous Legacy Interface Module performs the following primary functions:

- Takes synchronous non-cell bearing traffic (Legacy traffic) and converts the data stream to ATM CBR cells, adding the appropriate cell overhead
- Takes the cells and places them onto the ATM cell bus
- Monitors the physical synchronous interface for alarms
- Collects statistics on module performance

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the High Speed Synchronous Legacy Interface Module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Intel 80C31 microprocessor
- Capacitor filtering, provided for control and noise suppression

Unique Functionality Section

Unique functionality of the High Speed Legacy Interface Module includes:

- Module equipped with one complete independent synchronous channel
- Connector is a HSSI type
- Configured as a DCE device using a HSSI connector
- High-speed AAL1 segmentation and reassembly function process data speeds up to and including 52 Mbps at the user interface (CBR type)

A functional block diagram of the High Speed Synchronous Legacy Interface Module is shown in Figure 3-46.

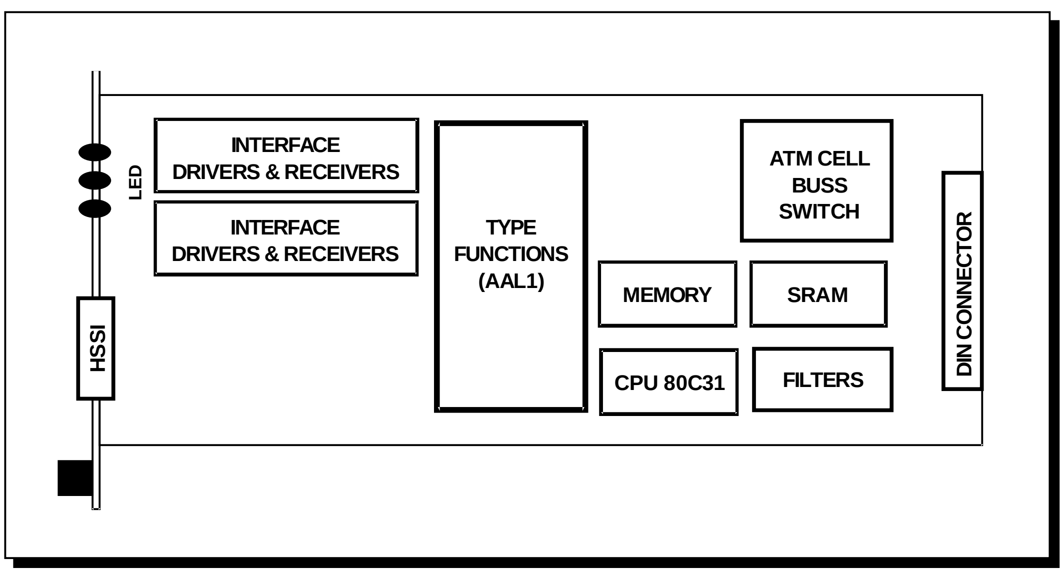


Figure 3-46. High Speed Synchronous Legacy Interface Module Functional Block Diagram

Jumper Settings

The jumper settings listed are factory set defaults. No user configuration is required.

Jumper	Pins
J3	1-2

Specifications

Port Capacity: One

Media: Shielded Multi-twisted pair cable, low capacitance

Electrical: EIA - 530, which provides EIA-422 electrical interface; this is a DCE interface, connecting to DTE

Connector: HSSI

Line Format: Balanced

Data Format: Serial Synchronous

Data Rates: 128 Kbps - 52 Mbps (in 8 Kbps increments)

NOTE: Maximum data rate is dependent on cable length. For estimated data rates versus cable lengths, see the description in EIA-422.

Timing: Ref Clock, External, Internal

Diagnostics: Facility Loopback, Terminal Loopback

Alarm – Surveillance: HEC

Applicable Standards: ITU-T I.432, af-phy.0043.000

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download.
LED	SYNC	Red	Off (normal) indicates synchronization with source; On indicates synchronization lost
LED	BUFF	Red	Off (normal); On indicates clock synthesis buffer completely full or completely empty

Pinouts

Pinouts for the high speed HSSI connector are shown in Figure 3-47 and the accompanying table.

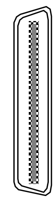


Figure 3-47. HSSL Pin Location

Pin	Direction	Signal	Pin	Direction	Signal
1		GND	26		GND
2	→	RTA	27	→	RTA
3	→	CAA	28	→	CAB
4	→	RDA	29	→	RDA
5			30		
6	→	STA	31	→	STB
7		GND	32		GND
8	←	TAA	33	←	TAB
9	←	TTA	34	←	TTB
10	←	LAA	35	←	LAB
11	←	SDA	36	←	SDB
12	←	LBA	37	←	LBB
13		GND	38		GND
14			39		
15			40		
16			41		
17			42		
18			43		
19		GND	44		GND
20			45		
21			46		
22			47		
23			48		
24			49		
25		GND	50		GND

← To HSSL Module   → To Terminal

Hub Router Legacy Interface Module (HRIM)

Overview

The Hub Router Legacy Interface Module (HRIM) is a legacy module that allows IP/Ethernet traffic to be integrated into an ATM network. The HRIM is configured for an IP address on the LAN/Ethernet side and an IP address on the ATM WAN side. The HRIM Module has four or eight RJ-45 connectors and one BNC connector forming an Ethernet hub. Each of the RJ-45 connected systems is on the same LAN segment. One 10Base2 and 4 or 8 10BaseT connectors share an aggregate 10BaseT hub. A front panel view of the HRIM Module is shown in Figure 3-48.

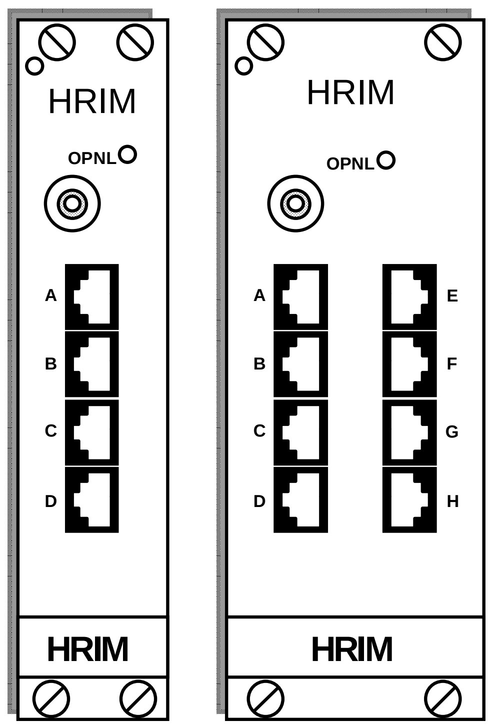


Figure 3-48. Hub Router Legacy Interface Module (HRIM)

Specifications

Ports:	Four 10BT, One 10B2 or Eight 10BT, One 10B2
Media:	Twisted Pair, Coax
Connector:	RJ-45 Female, BNC
Virtual Connections:	32 IP hosts or subnets mapped to 32 ATM channels
Status & Statistics:	Standard status and statistics provided
Diagnostics:	Network/Physical Loopback

Alarm Surveillance: ILMI, SNMP Agent

Applicable Standards: IEEE 802.3, RFC 1577

Routed Protocol: TCP/IP

Power: ≤ 7 Watts

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download.

Pinouts

Pinouts for the BNC are shown in Figure 3-49. Pinouts for the RJ-45 connectors are shown in Figure 3-50 and its accompanying table.

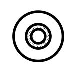


Figure 3-49. BNC Pin Location

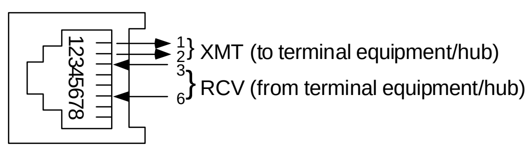


Figure 3-50. RJ-45 Pinouts

Pin	Direction	Signal
1	To TE/Hub	UXMTB
2	To TE/Hub	UXMTA

Pin	Direction	Signal
3	To HRIM	URCVB
6	To HRIM	URCVA

Low Speed Asynchronous Legacy Interface Module (LSAL)

Overview

The Low Speed Asynchronous Legacy Interface Module (LSAL) is an asynchronous interface module that allows for the transmission of up to eight (8) low-speed asynchronous data channels over an ATM network using AAL-5 type PVCs. Channels are individually addressable by assigning a VPI/VCI to each channel.

The LSAL Module allows users to transport asynchronous traffic, point-to-point, through an ATM network, provides the capability to control lead mapping (RTS-CTS), and provides reliable transport. An Automatic Repeat Request (ARQ) feature has been incorporated into the LSAL module to provide for retransmission of cells dropped due to a timeout or indication of non-receipt (negative acknowledgement) by the receiving entity. The LSAL Module does not provide statistical multiplexing or any form of terminal-server type functionality. A front panel view of the LSAL Module is shown in Figure 3-51.

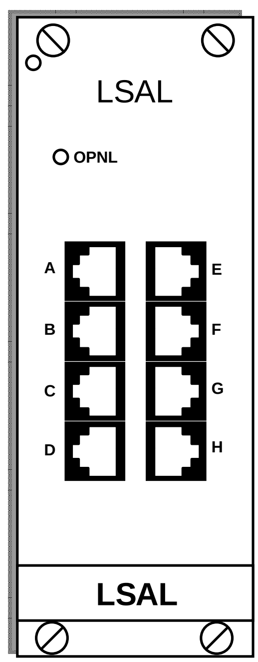


Figure 3-51. Low Speed Asynchronous Legacy Interface Module (LSAL)

Specifications

Ports: Eight Asynchronous

Media: Shielded

Electrical: EIA-561

Connector: RJ-45, Female

Virtual Connections: Eight individual AAL-5 type connections

Line Format: Single Ended, Asynchronous

Port Speed: 75 bps - 38.4 Kbps

NOTE: *Sum of all port speeds must not exceed 153.6 Kbps.*

Timing: Internal Timing Reference

Control Lead Mapping: RTS-CTS

Port Settings: Data, Stop, Parity, and control lead mapping

Status & Statistics: Standard status and statistics provided

Diagnostics: Facility and Terminal Loopback

Alarm Surveillance: None

Applicable Standards: ATM/AAL5 type VBR

Power: ≤ 7 Watts

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	On Steady - Indicates that at least one port is configured and operational On Blinking - Downloading program Off - No power to module, no port configured, or CPU failed

Pinouts

Pinouts for the RJ-45 connectors are shown in Figure 3-52 and the accompanying table.

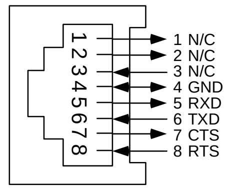


Figure 3-52. LSAL RJ-45 Pinouts

Pin	Direction	Signal
1		N/C
2		N/C
3		N/C
4	↔	GND

Pin	Direction	Signal
5	→	RXD
6	←	TXD
7	→	CTS
8	←	RTS

Unstructured T1/E1 Legacy Interface Module (UTEL)

Overview

The Unstructured T1/E1 Legacy (UTEL) Interface Module is the gateway for synchronous non-ATM T1 or E1 traffic into the ATM network. The UTEL Module provides either a T1 (1.544 Mbps) or E1 (2.048 Mbps) interface channel per module. The module may be configured as either a T1 or E1 by a strap selection (jumper setting) on the module.

The UTEL Module converts legacy traffic into ATM cells. The Module does not require any particular framing format; the entire 1.544/2.048 Mbit/s data rate is carried as cell payload. Data entering the module is "unstructured," meaning that NO framing format is used. The data is strictly clear-channel (non-channelized). In other words the entire "payload" is used for data transport. Legacy data is placed in AAL1 or CBR type format, given a VPI/VCI address and transmitted over the ATM network. This module is non-channelized and is intended to be used in a point-to-point configuration. A front panel view of the UTEL Module is shown in Figure 3-53.

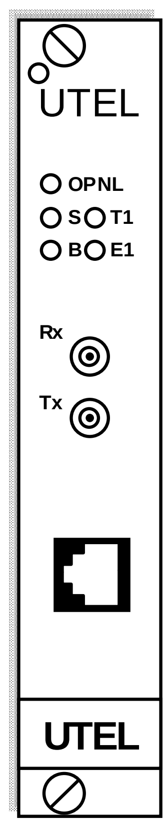


Figure 3-53. Unstructured T1/E1 Legacy Interface Module (UTEL)

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the UTEL Interface Module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Motorola 68340 microprocessor
- Capacitor filtering, provided for control and noise suppression

Unique Functionality Section

The UTEL Interface Module includes the following unique functions:

- Module equipped with one complete independent synchronous channel
- Connectors are two BNC (Tx, Rx) (E1) and one RJ-45 (E1 or T1)
- High-speed AAL1 segmentation and reassembly function

A functional block diagram of the UEL Interface Module is shown in Figure 3-54.

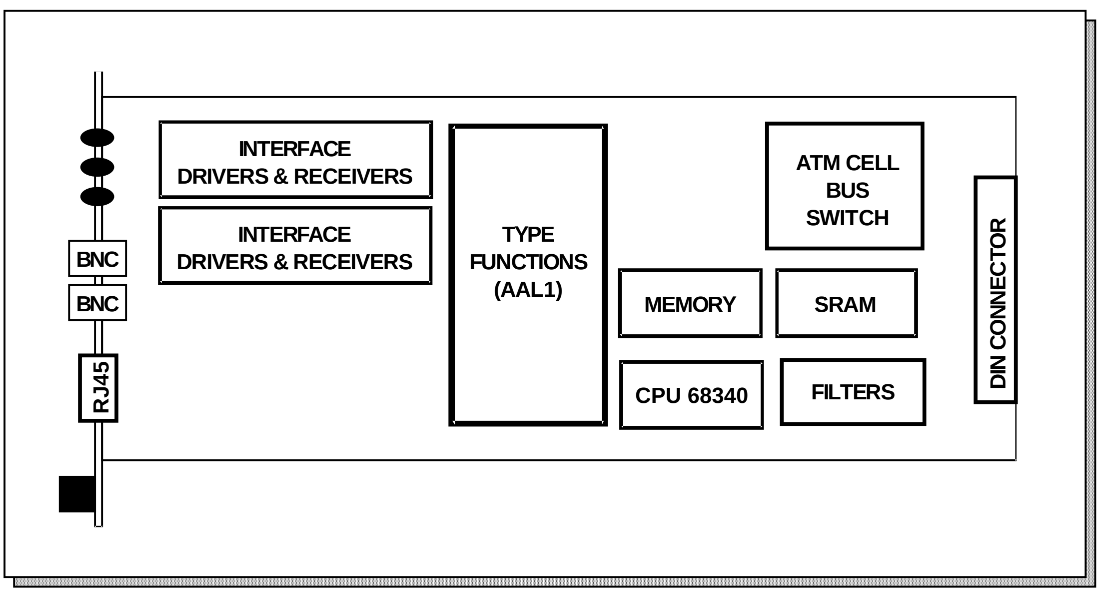


Figure 3-54. Unstructured T1/E1 Legacy Interface Module Functional Block Diagram

Jumper Settings

The jumper settings listed are factory set defaults. No user configuration is required.

Jumper	Pins
J3	1-2

The following settings are user configurable for the noted card types:

E1 75 Ohms:

Jumper	Pins
J5	1-2
J8	1-2
J11	1-2
J15	1-2
J17	1-2*

* For shield to be grounded

E1 120 Ohms:

Jumper	Pins
J6	1-2
J9	1-2
J12	1-2
J15	None

T1:

Jumper	Pins
J7	1-2
J10	1-2
J13	1-2
J15	None

Specifications

<u>Port Capacity</u>: One

<u>Electrical</u>: T1, E1 @ 120 ohms, E1 @ 75 ohms

<u>Port Speed</u>: T1 - 1.544 Mbps, E1 - 2.048 Mbps

<u>Media</u>: Shielded Multi-twisted pair (low capacitance) or Co-axial cable

<u>Connector</u>: RJ-45 - Female (DCE), BNC (TX-RX)

<u>Line Coding</u>: T1-AMI or B8ZS, E1- HDB3 or AMI

<u>Line Format</u>: Unframed

<u>Data Format</u>: Serial

<u>Timing</u>: Internal, External, Ref. Clock, On Board

<u>Status & Statistics</u>: Standard status and statistics provided

<u>Diagnostics</u>: Facility Loopback, Terminal Loopback (Bi-directional)

<u>Virtual Connections</u>: One VPI/VCI

<u>Applicable Standards</u>: ITU G.703, ETSI DTRBR/BT-02036, AAL1, CBR Unstructured Mode

<u>Power</u>: ≤ 7 watts

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download. Off - No power to module, UTEL failed, CPU failed
LED	S	Red	When the S (SYNC) LED is ON, it indicates that synchronization with the source has been lost. OFF is the Normal indication.
LED	B	Red	When the B (Buffer) LED is ON, it indicates that the clock synthesis buffer is completely full or completely empty. OFF is the Normal indication.
LED	T1	Green	When the T1 LED is ON, it indicates that the T1 Mode of operation has been selected.
LED	E1	Green	When the E1 LED is ON, it indicates that the E1 120 ohm or E1 75-ohm mode of operation has been selected.

Pinouts

Pinouts for the BNC connectors are as shown in Figure 3-55.

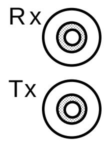


Figure 3-55. BNC Pin Location

The RJ-45 connector on the UTEL Module has the following pinouts. Pins 1 and 2 are Transmit out to the terminal equipment (PBX in most cases.) Pins 4 and 5 are Receive in from the terminal equipment (PBX in most cases.) Pinouts for the RJ-45 connector are shown in Figure 3-56.

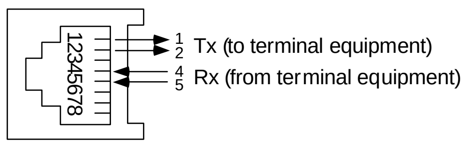


Figure 3-56. RJ-45 Pinouts

Pin	Direction	Signal
1	To TE	Tx-R
2	To TE	Tx-T

Pin	Direction	Signal
4	To UTEL	Rx-R
5	To UTEL	Rx-T

Unstructured DS3/T3 Legacy Interface Module (UD3L)

Overview

The Unstructured DS3/T3 Legacy (UD3L) Interface Module is the gateway for synchronous non-ATM DS3/T3 traffic into the ATM network. The UD3L Module provides a DS3/T3 (unframed 44.736 Mbps) interface channel per module.

The UD3L Module converts legacy traffic into ATM cells. The Module does not require any particular framing format; the entire 44.736 Mbit/s data rate is carried as cell payload. Data entering the module is "unstructured," meaning that NO framing format is used. The data is strictly clear-channel (non-channelized). In other words the entire “payload” is used for data transport. Legacy data is placed in AAL1, CBR type format, given a VPI/VCI address and transmitted over the ATM network. This module is non-channelized and is intended to be used in a point-to-point configuration. A front panel view of the UD3L Module is shown in Figure 3-57.

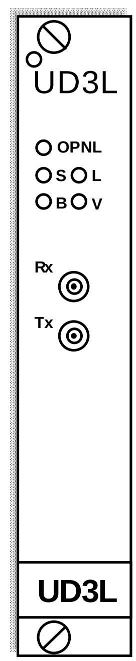


Figure 3-57. Unstructured DS3/T3 Legacy Interface Module (UD3L)

The UD3L Legacy Interface Module performs the following primary functions:

- Takes non-cell bearing traffic (Legacy traffic) and converts the data stream to ATM CBR cells, adding the appropriate cell overhead
- Takes the cells and places them onto the ATM cell bus
- Monitors the physical interface for alarms
- Collects statistics on module performance

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the UD3L Interface Module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Motorola 68340 microprocessor
- Capacitor filtering, provided for control and noise suppression

Unique Functionality Section

The UD3L Interface Module includes the following unique functions:

- Module equipped with one complete independent synchronous channel
- Connectors are two BNC (Tx, Rx)
- High-speed AAL1 segmentation and reassembly function

A functional block diagram of the UD3L Interface Module is shown in Figure 3-58.

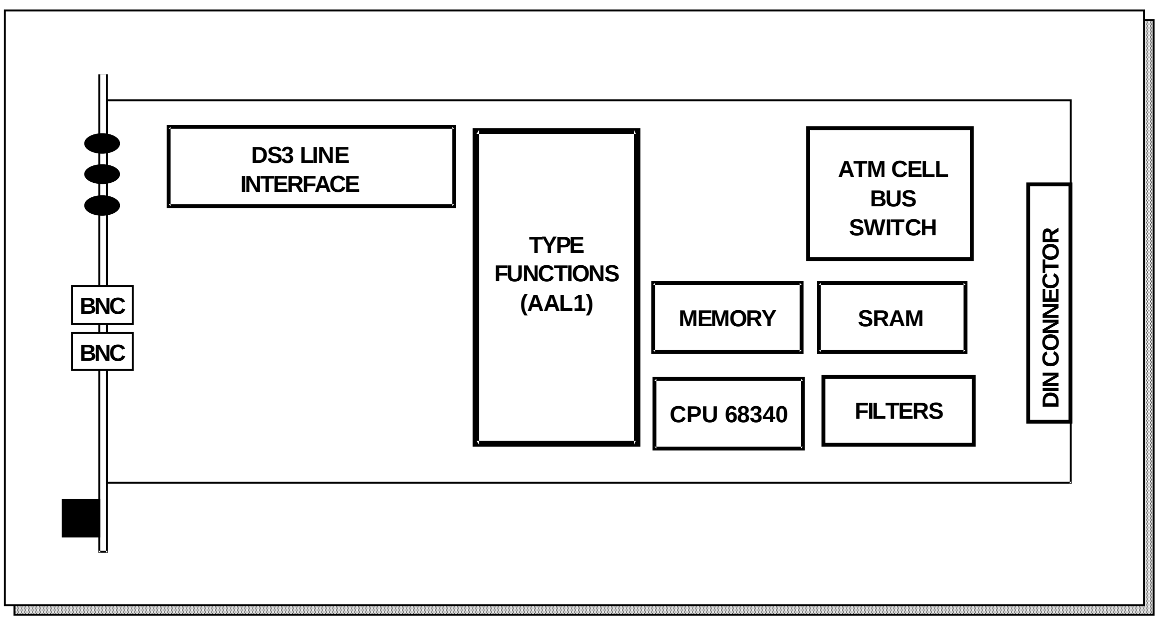


Figure 3-58. Unstructured DS3/T3 Legacy Interface Module Functional Block Diagram

Jumper Settings

The jumper settings listed are factory set defaults. No user configuration is required.

Jumper	Pins
J1	2-3
J3	1-2
J10	1-2

Specifications

Port Capacity:	One
Electrical:	ANSI T1.404, Bellcore TR-NWT-000499, ACCUNET T45, G.703.
Port Speed:	DS3/T3 – 44.736 Mbps
Media:	Unbalanced, 75-Ohm Co-axial cable
Connector:	BNC (Female)
Line Coding:	AMI or B3ZS
Line Format:	Unbalanced bi-polar
Data Format:	Serial
Timing:	Internal, Reference, Recovered, On Board
Status & Statistics:	Standard status and statistics provided
Diagnostics:	Facility Loopback, Terminal Loopback (Bi-directional)
Applicable Standards:	ANSI T1.109, ANSI T1.107
Power:	≤ 7 watts

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download. Off - No power to module, UD3L failed, CPU failed
LED	S	Red	When the S (SYNC) LED is ON, it indicates that synchronization with the source has been lost. OFF is the Normal indication.
LED	B	Red	When the B (Buffer) LED is ON, it indicates that the clock synthesis buffer is completely full or completely empty. OFF is the Normal indication.
LED	L	Red	Indicates loss of signal to the module.
LED	V	Red	Indicates Bi-polar Violation

Pinouts

Pinouts for the BNC connectors are as shown in Figure 3-59.

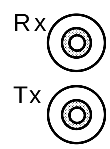


Figure 3-59. BNC Pin Location

Unstructured E3 Legacy Interface Module (UE3L)

Overview

The Unstructured E3 Legacy (UE3L) Interface Module is the gateway for synchronous non-ATM E3 traffic into the ATM network. The UE3L Module provides an E3 (34.368 Mbps) interface channel per module.

The UE3L Module converts legacy traffic into ATM cells. The Module does not require any particular framing format; the entire 1.544/2.048 Mbit/s data rate is carried as cell payload. Data entering the module is "unstructured," meaning that NO framing format is used. The data is strictly clear-channel (non-channelized). In other words the entire “payload” is used for data transport. Legacy data is placed in AAL1, CBR type format, given a VPI/VCI address and transmitted over the ATM network. This module is non-channelized and is intended to be used in a point-to-point configuration. A front panel view of the UE3L Module is shown in Figure 3-60.

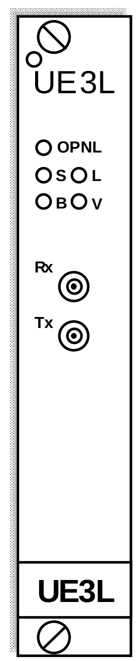


Figure 3-60. Unstructured E3 Legacy Interface Module (UE3L)

The UE3L Legacy Interface Module performs the following primary functions:

- Takes non-cell bearing traffic (Legacy traffic) and converts the data stream to ATM CBR cells, adding the appropriate cell overhead
- Takes the cells and places them onto the ATM cell bus
- Monitors the physical interface for alarms
- Collects statistics on module performance

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the UE3L Interface Module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Motorola 68340 microprocessor
- Capacitor filtering, provided for control and noise suppression

Unique Functionality Section

The UE3L Interface Module includes the following unique functions:

- Module equipped with one complete independent synchronous channel
- Connectors are two BNC (Tx, Rx)
- High-speed AAL1 segmentation and reassembly function

A functional block diagram of the UE3L Interface Module is shown in Figure 3-61.

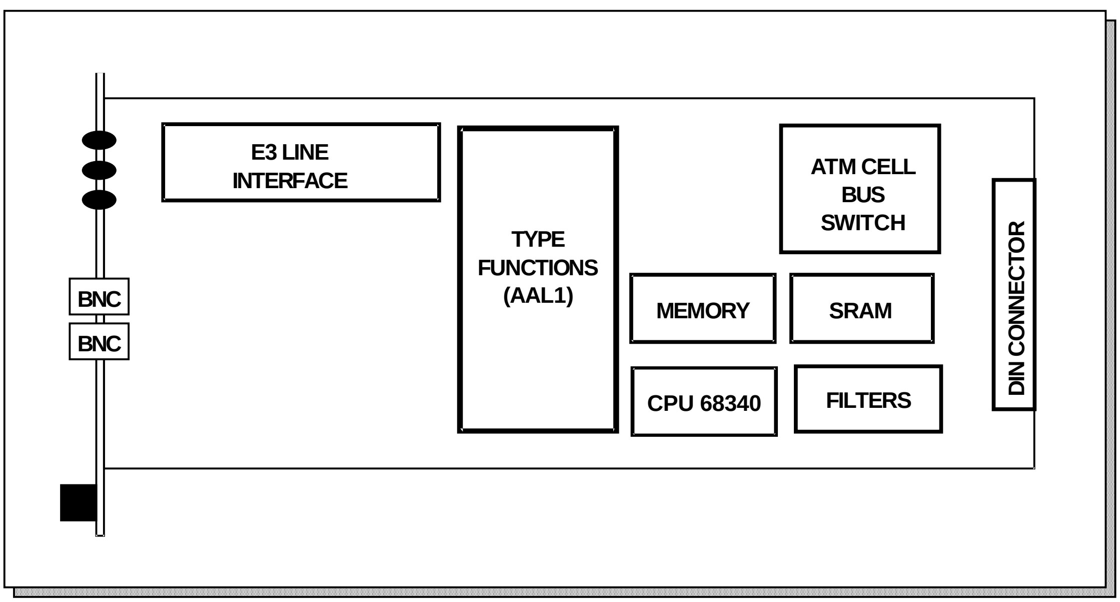


Figure 3-61. Unstructured E3 Legacy Interface Module Functional Block Diagram

Jumper Settings

The jumper settings listed are factory set defaults. No user configuration is required.

Jumper	Pins
J2	Open
J4	Open

Specifications

Port Capacity: One

Electrical: ANSI T1.404, Bellcore TR-NWT-000499, ACCUNET T45, G.703.

Port Speed: 34.368 Mbps

Media: Unbalanced, 75-Ohm Co-axial cable

Connector: BNC (Female)

Line Coding: HDB3 or AMI

Line Format: Unbalanced bi-polar

Data Format: ATM Cells

Timing: Reference, Recovered

Status & Statistics: Standard status and statistics provided

Diagnostics: Facility Loopback, Terminal Loopback (Bi-directional)

Applicable Standards: ANSI T1.109, ANSI T1.107

Power: ≤ 7 watts

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download. Off - No power to module, UE3L failed, CPU failed
LED	S	Red	When the S (SYNC) LED is ON, it indicates that synchronization with the source has been lost. OFF is the Normal indication.
LED	B	Red	When the B (Buffer) LED is ON, it indicates that the clock synthesis buffer is completely full or completely empty. OFF is the Normal indication.
LED	L	Red	Indicates loss of signal to the module.
LED	V	Red	Indicates Code Violation (UE3L)

Pinouts

Pinouts for the BNC connectors are as shown in Figure 3-62.

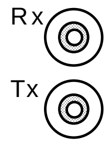


Figure 3-62. BNC Pin Location

Basic Interface Module (BIM)

Overview

NOT GENERALLY AVAILABLE

The Basic Interface Module (BIM) provides an ATM gateway for additional legacy interface functionality. The BIM provides a general platform for accommodating two DCE/DTE type interfaces into the CX system. The BIM module is only available for selected applications.

The BIM is comprised of a motherboard and a daughterboard (customer furnished). The BIM motherboard provides AAL1 processing and interfacing onto the ATM cell bus backplane. The daughterboard provides the external interfaces (i.e., DTE/DCE, connector, electrical signal definition, etc.) A front panel view of the Basic Interface Module is shown in Figure 3-63.

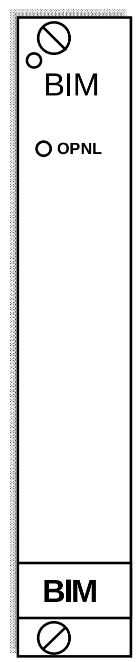


Figure 3-63. Basic Interface Module (BIM)

The Basic Interface Module performs the following primary functions:

- Processes CBR data source and generates AAL1 cells
- Provides support for a daughterboard providing two physical interfaces
- Cell rate error signal
- Monitors the physical interface for alarms ("daughtercard available" indication that is interpreted as an interface up/down for both interface ports)
- Collects statistics on module performance

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the Basic Interface Module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Motorola 80C31 microprocessor
- Capacitor filtering, provided for control and noise suppression

Unique Functionality Section

The Basic Interface Module includes the following unique functions:

- Module supports two complete independent synchronous channels
- High-speed AAL1 segmentation and reassembly function

A functional block diagram of the Basic Interface Module is shown in Figure 3-64.

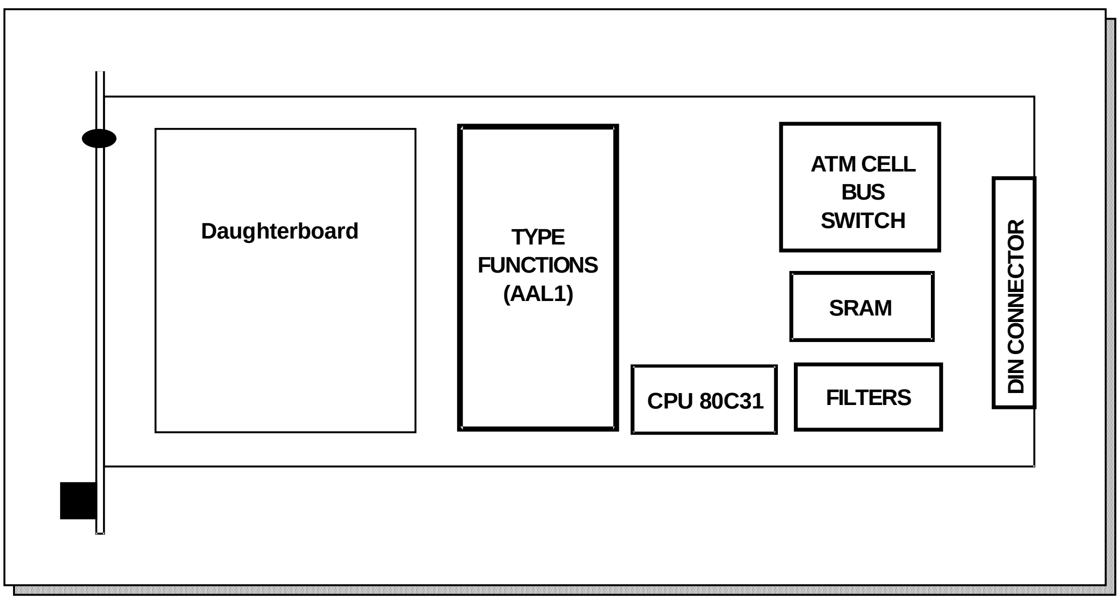


Figure 3-64. Basic Interface Module Functional Block Diagram

Jumper Settings

The jumper settings listed are factory set defaults. No user configuration is required.

Jumper	Pins
P7	1-2

Specifications

Port Capacity: Supports two synchronous channels

Electrical: Provided by daughterboard

Port Speed: Programmable at 9.6, 12.8, 19.2, 25.6 or 38.4 Kbps and n*8 Kbps with a range from 8 Kbps to 4.096 Mbps

Connector: Provided by daughterboard

Data Format: ATM Cells

Timing: Reference, Internal, External

Status & Statistics: Standard status and statistics provided

Diagnostics: Terminal Loopback (Bi-directional)

Power: ≤ 7 watts

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download. Off - No power to module, BIM failed, CPU failed

4-wire Analog Interface Module (EML)

Overview

The 4-wire Analog Interface Module allows the user to connect 4-wire E&M interfaces to co-located lines, data lines through modems, and switched voice lines for small capacity applications. The CX itself does not support call-by-call switching of voice circuits, but will pass supervisory and addressing information end to end.

Note: *The EML does not provide any echo control. External solutions may be required in some applications.*

The 4-wire Analog Interface Module will support 2 voice channels. The module is intended for use in a point-to-point environment using an ATM network to provide WAN transport. A front panel view of the 4-Wire EML Module is shown in Figure 3-65.

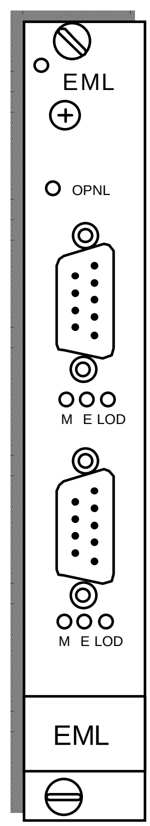


Figure 3-65. 4-wire Analog Interface Module (EML)

The 4-wire Analog Interface Module performs the following primary functions:

- Takes voice analog input and converts it to a 64 Kbps PCM signal
- Translates the PCM signal to AAL1 cell format for transmission across the ATM network
- Supports connections between E&M analog and T1/E1 DS0 interfaces

- Monitors the physical interface for Hook Status
- Collects statistics on module performance

Cell Bus-Microprocessor-Power Section

The Cell Bus-Microprocessor-Power section of the 4-wire Analog Interface Module consists of the following:

- ATM Cell Bus Switching Logic IC (ATM Cell Bus Switch), along with a RAM IC, provides connectivity to the backplane board
- 96-Pin DIN connector, used to connect onto the ATM Cell Bus
- Motorola 68340 microprocessor
- Capacitor filtering, provided for control and noise suppression

Unique Functionality Section

The 4-Wire EML Interface Module includes the following unique functions:

- Supports two 4-wire analog voice channels
- Each voice channel configured as Type 1, 2, or 5 E&M
- Connector is DB-9, female
- High-speed AAL1 segmentation and reassembly function

A functional block diagram of the EML Interface Module is shown in Figure 3-66.

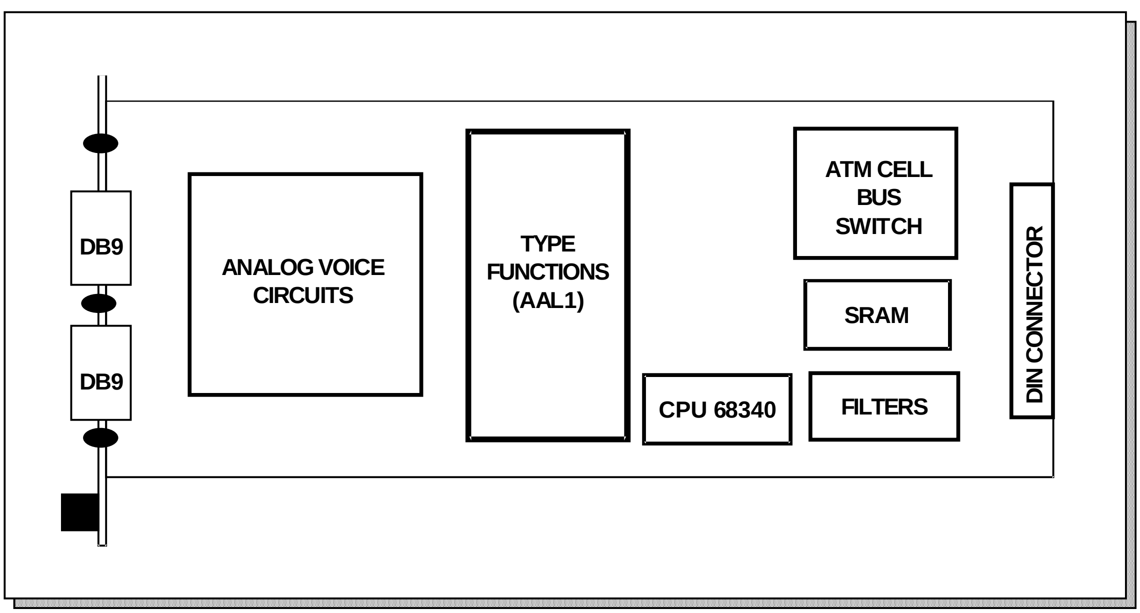


Figure 3-66. 4-wire Analog Interface Module Functional Block Diagram

Jumper Settings

No jumper settings are required on the 4-Wire EML Module.

Specifications

Port Capacity: Two

Connector: DB-9 (Female)

Timing: Internal, Ref Clock

Status & Statistics: Standard status and statistics provided

Diagnostics: Terminal Loopback (Bi-directional)

Applicable Standards: ITU G.712 – G.714

Power: ≤ 7.5 watts

Indicators

Type	Label	Color	Meaning
LED	OPNL	Green	Illuminates when operational code begins running after the boot process is complete. Blinks during operational code download. Off - No power to module, EML failed, CPU failed
LED	M	Green	Illuminates when the “M” lead is in active mode (off hook).
LED	E	Green	Illuminates when the “E” lead is in active mode (off hook).
LED	LOD	Red	Loss Of Data (Controlled by Software) Illuminates when a connection has been lost. During normal operation if a user removes the cable connected to the EML, it does not necessarily illuminate the LED. The LED will illuminate for a short time when the connection is reestablished and the EML is receiving valid cells from the bus.

Pinouts

Pinouts for the DB-9 connectors are as shown in Figure 3-67 and the accompanying table.

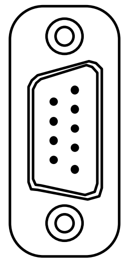


Figure 3-67. DB-9 Pin Location

Pin	Signal
1	N/C
2	T1
3	R1
4	E
5	R

Pin	Signal
6	T
7	SG
8	M
9	SB

Chapter 4

Operation

Initial Startup

On startup, the Cell Exchange will run through a short set of diagnostics, check for range errors in the current system configuration settings, and install the current system configuration (or the default configuration if range errors were detected).

Local Management Station

The Cell Exchange can be configured via a local VT100 emulation device (PC) connected via a null modem cable (see Appendix B for a description of the null modem cable). Plug one end of the null modem cable into the PC serial port and the other into the port on the front of the active CPU Module as shown in Figure 4-1.

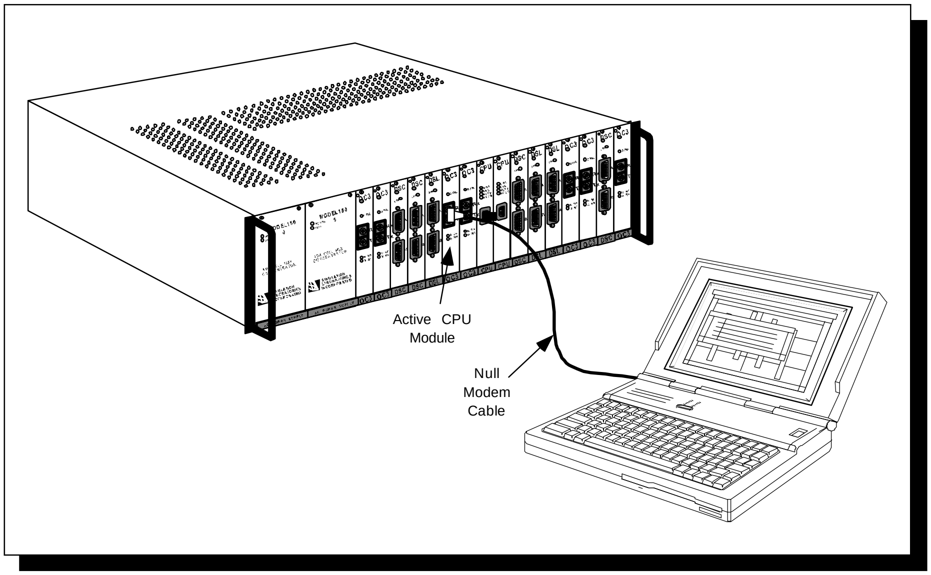


Figure 4-1. Local Cell Exchange—VT100 Connection

It is important that the emulation package used is VT100 compatible, such as ProComm or Windows terminal emulation software. The configuration environment makes use of attributes that are not always correctly emulated by non-compatible packages. The Cell Exchange will not be affected by missing reverse video in the display, but it can be tiring for the operator. Setup instructions for two terminal emulation packages – Windows Terminal and Windows Hyper Terminal are described in the following paragraphs.

Windows Hyper Terminal Software

If using the Hyper Terminal application, open the program (**Program Files/Accessories/ Hyper Terminal**). When the **New Connection** window opens, name it and select an icon (if desired), then click **OK**. On the next (**Phone Number**) screen, in the **Connect using:** box select **Direct to Com 1** (or 2); click **OK**. When the **COM 1 Properties** window opens, choose the following settings:

- Bits per second = 9600
- Data Bits = 8
- Parity = None
- Stop Bits = 1
- Flow Control = Xon/Xoff

Click **OK**. When the Hyper Terminal window opens, select **View/Font**. In that window, choose the following:

- Font = Terminal
- Font Style = Regular
- Size = 10
- Script = OEM/DOS

The management system application runs within the Cell Exchange, using the terminal keyboard for input and the terminal screen for display. Pull down menus provide an easy to use environment. Simply open the connection from the terminal screen and the window shown in Figure 4-2 will appear.

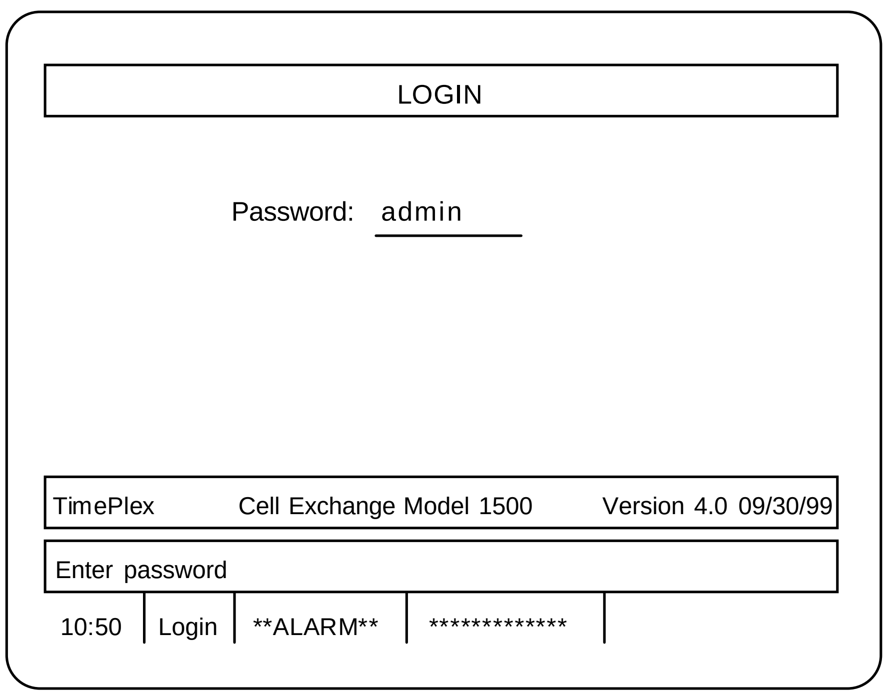


Figure 4-2. Typical Logon Screen

Initial Logon

To access the Cell Exchange for configuration or software setup, the operator must first complete the logon procedures. The management system requires operators to logon with a password for the level of access desired. There is one password assigned to each access level. Passwords are assigned and controlled by the local system administrator.

To logon:

- Power up the Local Management Station.
- Once the LMS has completed its internal startup procedures, call up the logon screen. If the logon screen is not displayed, or only partially displayed, refresh the screen by pressing **<ENTER>** at the password entry prompt or removing and reinserting the null modem cable. Once the logon screen has repainted, the normal logon process can continue.
- Follow the prompts on the screen.
- The default password is “admin.”

NOTE: *Once logged on, it is strongly recommended that the password be changed as described in the section entitled,* "Changing Passwords.”

Logon Access Levels

Since various personnel will use the Cell Exchange, the management system allows three different levels of access. The following paragraphs describe the levels and the degree of access associated with each level.

Level 1 – Maintenance User - Able to login to view status and alarm conditions.

Level 2 – Management User - Able to login to modify the configuration of the system in addition to maintenance user functions.

Level 3 – System Administrator - Able to login to set or change passwords in addition to all management and maintenance user functions.

Changing Passwords

Occasionally the system administrator or other authorized person may have to change passwords, due to the departure of personnel, compromise of the existing passwords, or some other reason. To change a password, select the Passwords command from the Configure menu. This will bring up the screen shown in Figure 4-3. Default passwords for each access level are shown (passwords are not case sensitive).

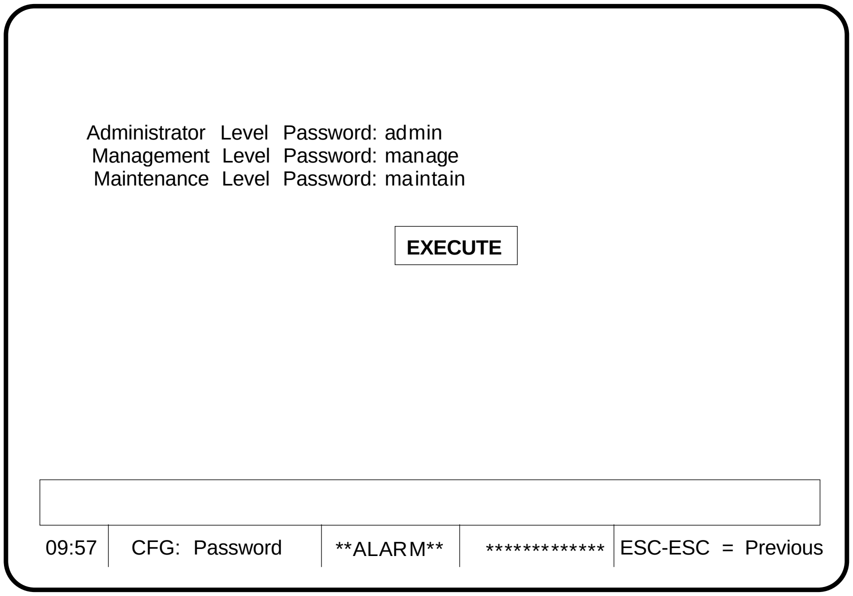


Figure 4-3. Password Menu

***NOTE**: Only the administrator level can change passwords*

1. Highlight the password to be changed.
2. Make the change.
3. Select execute.

Menu Operation

Once logged on, the operator is automatically presented with the Main menu screen shown in Figure 4-4. The Cell Exchange management system uses this menu-driven user interface for both operations and maintenance. The screen is divided into four sections: menu name, menu-specific selections, prompt line, and status line.

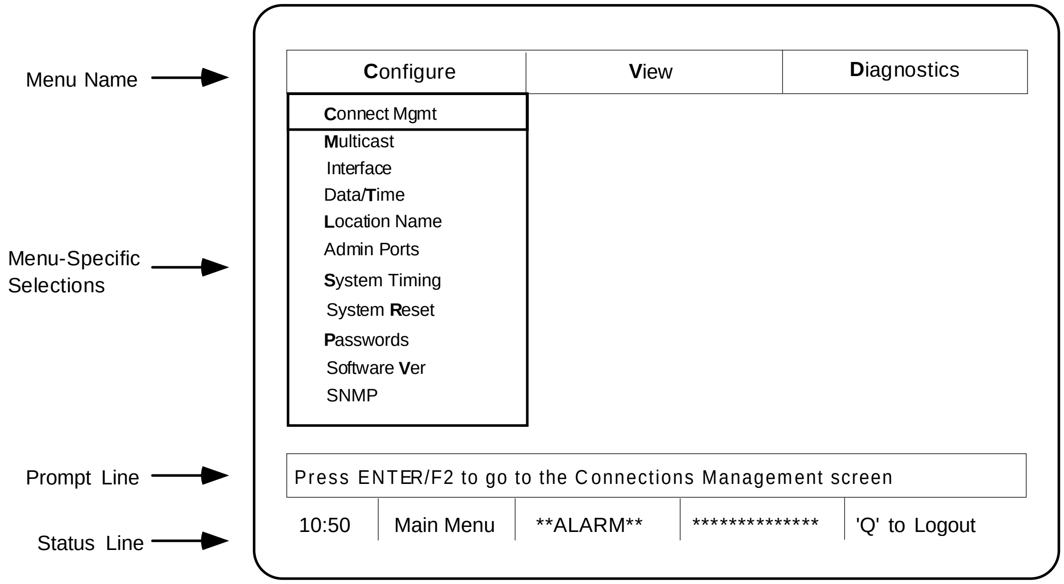


Figure 4-4. Main Menu Screen

The menu name section is self-explanatory. The menu-specific section provides information or command selections relative to the menu that has been selected.

The prompt line is a user help function, containing information about the commands available for selection and the outcome of the selection. A prompt message will appear to show the user what information should be entered, or which key should be pressed, depending on the location of the cursor or the command selected.

The prompt line will also display alarm messages. When an alarm condition occurs or goes away, a brief message will be displayed. If multiple alarms occur, they will be queued and each message will be displayed for a very short time. When the last alarm message has timed out, the prompt line will revert to the help function.

The status line displays the current local time, the screen or menu name, alarm status, location name, and menu escape instructions where:

- Time is displayed in 24-hour clock format (i.e., 2:30 PM is displayed as 14:30).
- The screen/menu name area gives an indication of the path taken from the Main menu to the currently displayed screen. A colon is used to separate each element of the path.
- The alarm status area tells the user if any alarms currently exist. If an alarm exists, the string “**ALARM**” will be displayed. If no alarm exists, this area will be blank.
- The location name area displays the user-assigned location name for each system.

- The menu escape area displays the command required to exit the current screen. At the Main menu, the string “Q to Logout” is displayed. At any other menu or screen, the string “ESC-ESC = Previous” is displayed.

Menu Selection

Within the Menu screen, the operator can move between menus by using the arrow keys or by “quick key.” To use the arrows, simply press one of the left or right arrow keys. The menu selection will move left or right, and the new selection will be highlighted by displaying the menu name in reverse video and opening its command selections (drop down menu). If the current menu is the left-most menu and the left arrow is pressed, the display will “wrap” to the right-most selection. The reverse is also true.

To use the “quick key” approach, press the key of the highlighted letter in each menu name.

Command Operation

From the Menu screen, the operator must perform the following steps to execute a command:

1. Select the desired menu as the current menu.
2. Use the arrow key or “quick key” to select the desired command. Once a command is selected, it will be displayed in reverse video.
3. Select the command for execution by pressing **<ENTER>** or **<F2>** as shown on the prompt line. The Command screen will now be displayed.

Moving around between commands is very similar to the menus, using the up and down arrow keys or a “quick key.” Using the arrow keys works exactly the same as for the menus, including the capability to wrap from top to bottom or vice versa. To use the “quick key,” press the key of the highlighted character in the command name.

Command Parameter Entry

Once a command is selected for execution, the operator will be prompted for all parameters associated with that command. For each required parameter, an entry area will be provided along with a prompt on the prompt line explaining the type of data required. As each parameter field is displayed, a default is provided. To select the default parameter, press the **<ENTER>** key before pressing any other key. Whenever possible, parameter selections will be made by toggle selections using the space key. This provides the operator with a consistent, user-friendly interface, and helps to limit out of range parameters. If numeric or ASCII text is required, the prompt line will show the valid range or number of ASCII characters allowed.

Regardless of the type of parameter, the entry process is ended by pressing the **<ENTER>** key. As each parameter is entered, validation checks are performed. If the entry is invalid, an error indication will be displayed on the status line. When the operator acknowledges the error by pressing the **<ENTER>** key, he/she will be prompted to enter a valid response before advancing to the next field. After a valid parameter has been entered, it will remain on the screen (if possible) until all parameters have been entered.

Keystroke Correction

To correct keystroke errors during command parameter entry, use the backspace key to erase the error, then reenter the correct information.

Abort Command Key

The command parameter entry process can be ended at any time by pressing the **<ESC>** key twice (**<ESC><ESC>**). This action will cancel command execution and return to the Menu screen.

Command Response

Commands executed by the Cell Exchange generally fall into two categories: commands that perform some process and commands that return status information. Commands that perform a process will usually return a completion code. This code is mapped into a completion status string that will be displayed on the status line. If an error is encountered during execution, the completion status string will be displayed in reverse video on the status line. If the command is executed successfully, the status string will be displayed in normal video.

Commands returning status information will only display a status string on the status line if an error occurred during execution. If execution is successful, the retrieved status information will be displayed in the command parameter window.

Main Menu

Menus are provided for Configure, View, and Diagnostics. Figure 4-5 shows the Main Menu with all submenus displayed for reference.

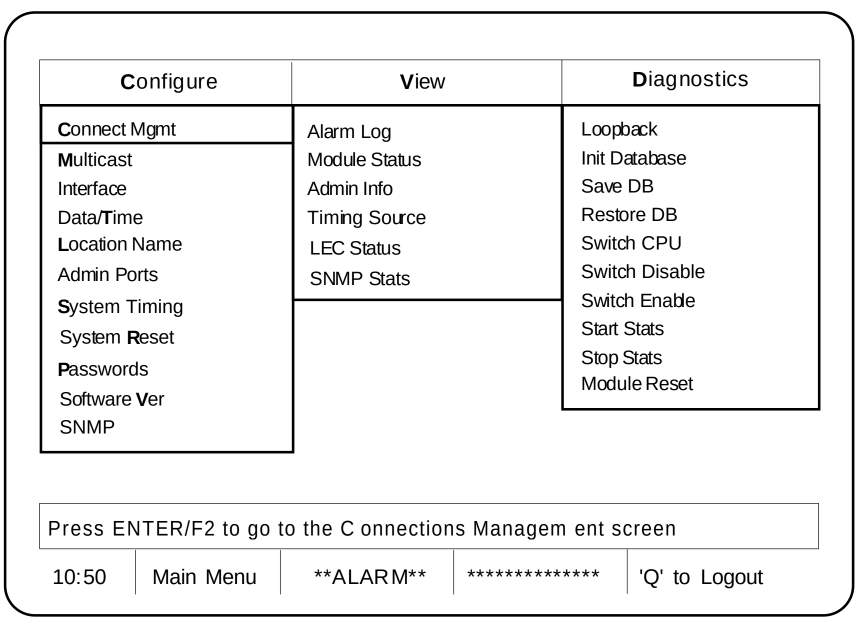


Figure 4-5. Main Menu Screen

Configure Menu

The Configure menu allows the operator to specify and update configuration parameters, and to set or display certain administrative information. This menu also allows the system administrator to assign or change passwords and access levels. Submenus include:

Connection Management - This menu is described in the section entitled, "Configuring Interface Connections."

Multicast – This menu is described in the section entitled, "Multicast Feature."

Interface - This menu is described in the section entitled, "Configuring Physical Interfaces."

Date/Time - The Date/Time menu provides a means for setting or modifying the system parameters for date and time. When selected, the screen shown in Figure 4-6 will be displayed:

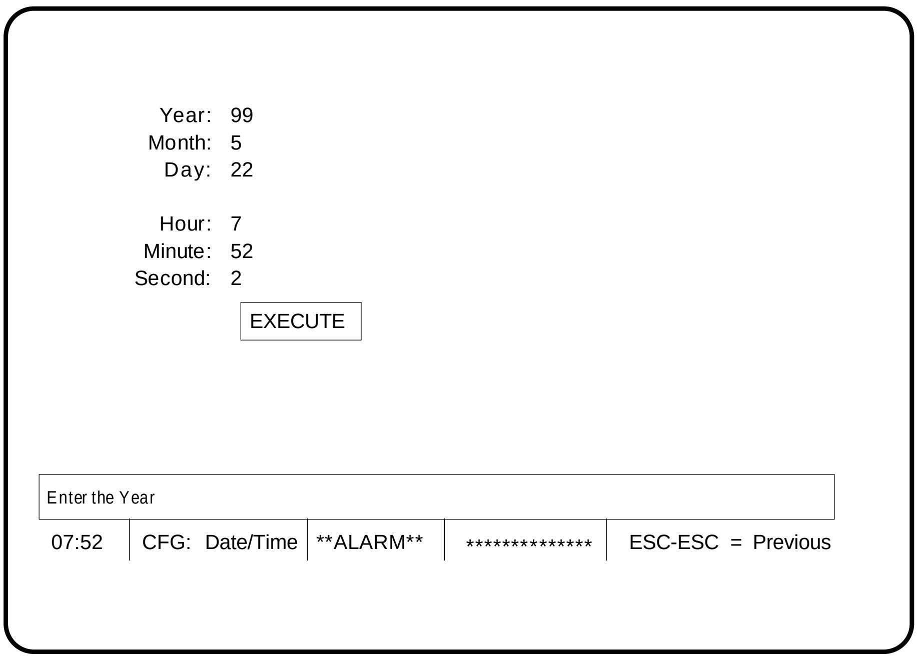


Figure 4-6. Date/Time Window from Configure Menu

Location Name - This menu is described in the section entitled, "Setting Location Name."

Admin Ports - This menu item is not yet implemented.

System Timing - This menu is described in the section entitled, "Setting System Timing."

System Reset - The System Reset menu provides a means to reboot the Cell Exchange system. Selecting this menu item will bring up the window shown in Figure 4-7.

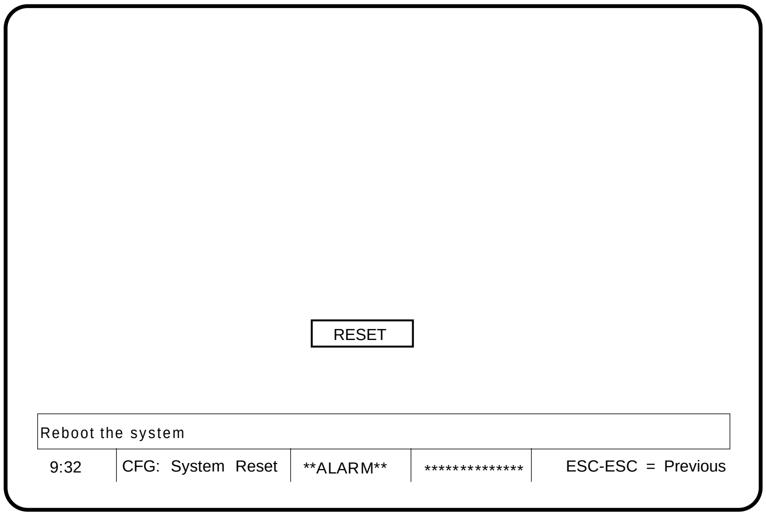


Figure 4-7. System Reset Window from Configure Menu

<u>Passwords</u> - This menu is described in the section entitled, "Changing Passwords."

<u>Software Ver</u> - This menu is described in the section entitled, "Software Versions."

<u>SNMP</u> - This menu is described in the section entitled, "Network Management/Simple Network Management Protocol."

View Menu

The View menu allows the operator to display system parameters. Submenus include:

<u>Alarm Log</u> - This menu provides a description of the alarms and provides a timestamp. When this menu item is selected, a screen similar to Figure 4-8 is displayed. A complete listing of alarms is shown in Chapter 6.

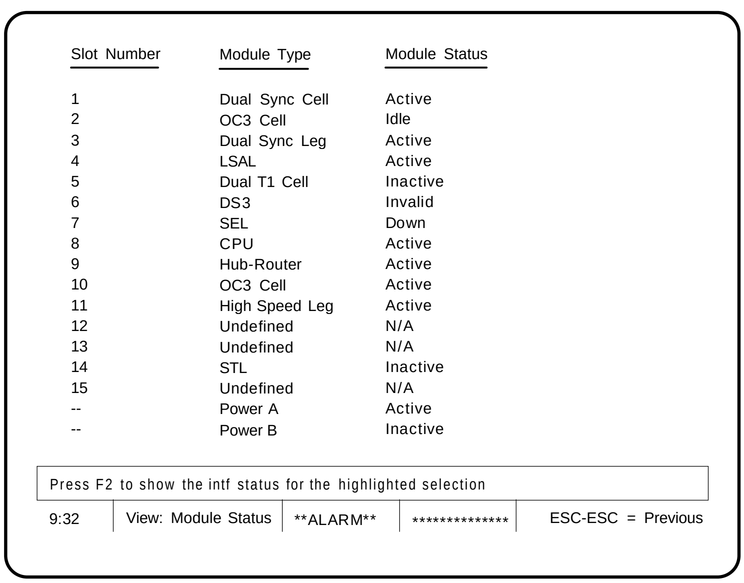


Figure 4-8. Alarm Log Window from View Menu

Module Status - This menu provides a top-level view of what modules are installed in the Cell Exchange system and defines their status. When you select this menu item, the screen shown in Figure 4-9 is displayed.

Slot Number	Module Type	Module Status
1	Dual Sync Cell	Active
2	OC3 Cell	Idle
3	Dual Sync Leg	Active
4	LSAL	Active
5	Dual T1 Cell	Inactive
6	DS3	Invalid
7	SEL	Down
8	CPU	Active
9	Hub-Router	Active
10	OC3 Cell	Active
11	High Speed Leg	Active
12	Undefined	N/A
13	Undefined	N/A
14	STL	Inactive
15	Undefined	N/A
--	Power A	Active
--	Power B	Inactive

Press F2 to show the intf status for the highlighted selection

9:32	View: Module Status	**ALARM**	**************	ESC-ESC = Previous

Figure 4-9. Module Status Window from View Menu

Entries in this window include:

Entry (Column)	Meaning
Undefined (Module Type)	No card in slot or interface not configured
N/A (Module Status)	No card in slot or interface not configured
Invalid (Module Status)	Mismatch between the card installed and the interface configuration for the slot
Active (Module Status)	For redundant modules (CPU, Power Supply) indicates the on-line module; for interface cards indicates the card is up and has a connection
Inactive (Module Status)	For redundant modules (CPU, Power Supply) indicates the standby module
Idle (Module Status)	Indicates the interface card is up but does not have a connection

The Module Status menu and associated windows are further described in the section entitled, “Module Statistics.”

Admin Info - This menu provides a summary of administrative information that has been previously entered in other screens. Selecting this menu item brings up the window shown in Figure 4-10.

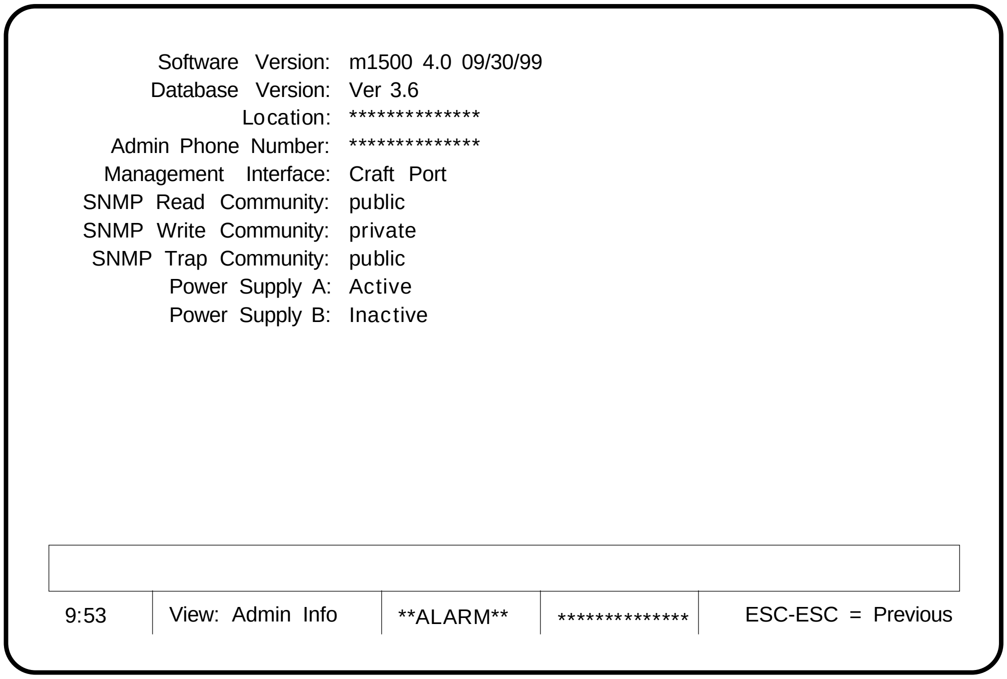


Figure 4-10. Admin Info Window from View Menu

The entries on this screen include:

Software Version	The version of the software that is currently in use by the CX device
Database Version	The version of the database currently installed
Location	Optional entry for the physical location of the switch
Admin Phone Number	Optional entry for the contact phone number
Management Interface	Interface being used to connect to the CX-1500/CX-1540
SNMP Read Community	Access level for "reading" the network
SNMP Write Community	Access level for writing to the network
SNMP Trap Community	Access level for receiving traps from the network
Power Supply A and B	Status of installed power supplies

Timing Source - This menu provides information on the source of the timing that is presently being used. Selecting this menu item brings up the window shown in Figure 4-11.

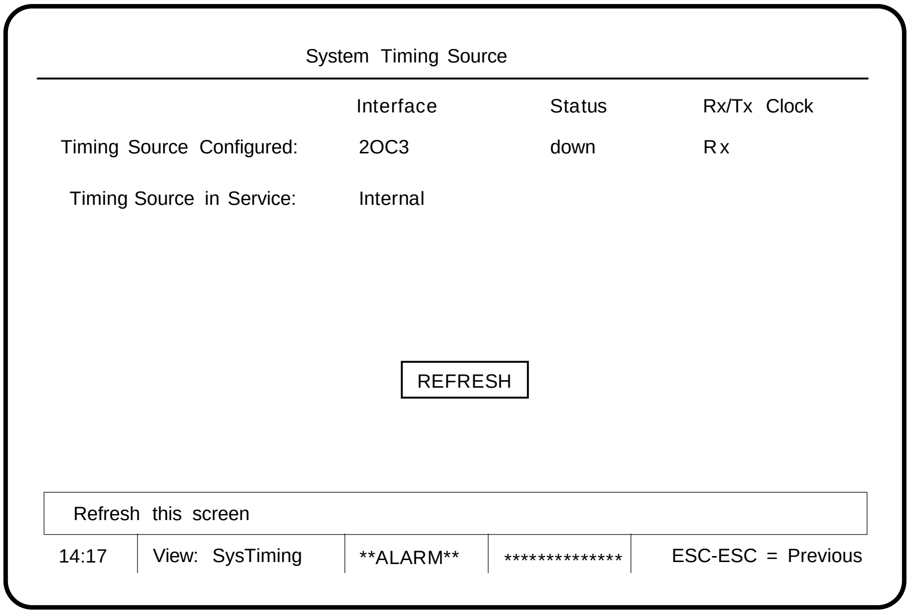


Figure 4-11. Timing Source Window from View Menu

<u>LEC Status</u> - This menu provides information on LAN Emulation Client (LEC) status. The LEC Status window displays the statistics accumulated by the LANE client in the CPU. Selecting this menu item brings up the window shown in Figure 4-12.

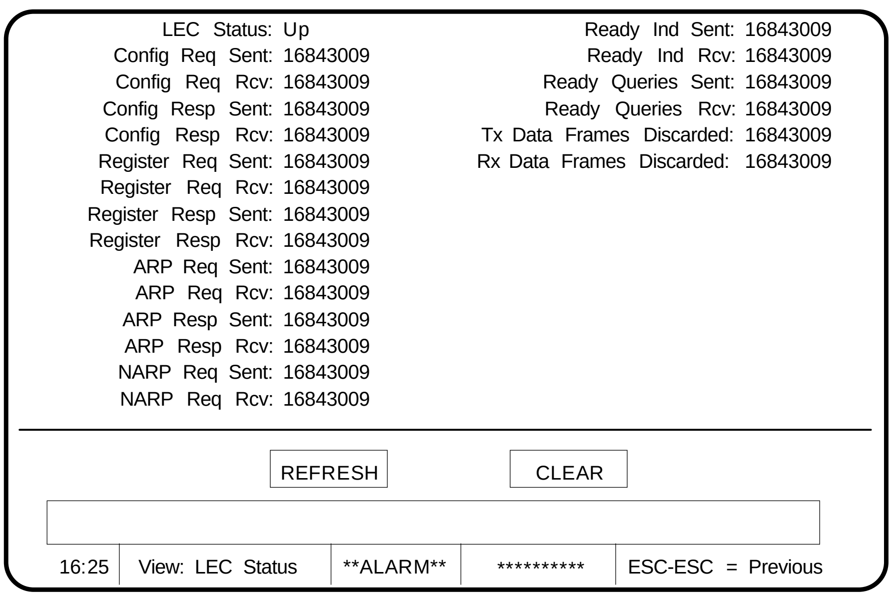


Figure 4-12. LEC Status Window from View Menu

To clear the statistics use the arrow key(s) to highlight the **CLEAR** button and press the **<ENTER>** key. This action resets all the SNMP statistics to zero. To refresh the screen use the arrow key(s) to highlight the **REFRESH** button and press the **<ENTER>** key - this will display the current accumulated values.

SNMP Stats - This menu allows the user to view statistical information collected from the network management system. Selecting this menu item brings up the window shown in Figure 4-13.

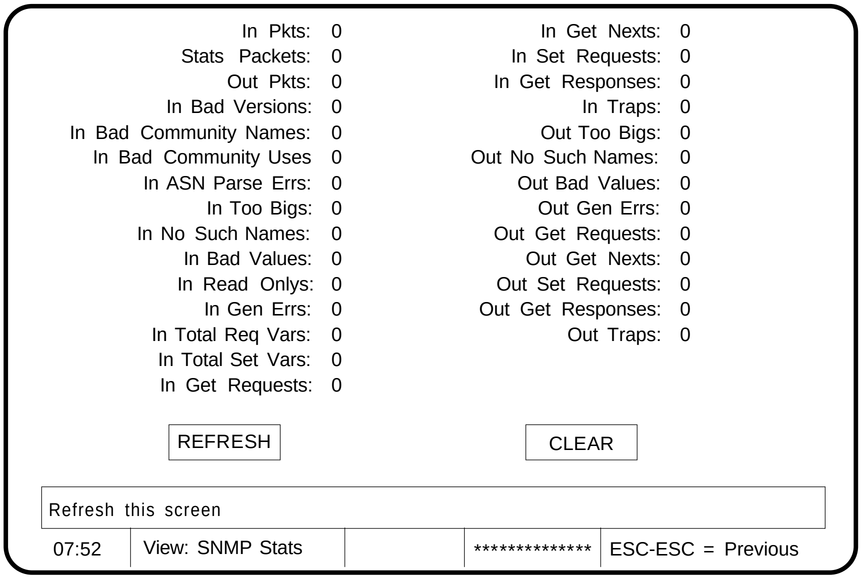


Figure 4-13. SNMP Stats Window from View Menu

To clear the statistics use the arrow key(s) to highlight the **CLEAR** button and press the **<ENTER>** key. This action resets all the SNMP statistics to zero. To refresh the screen use the arrow key(s) to highlight the **REFRESH** button and press the **<ENTER>** key - this will display the current accumulated values.

Diagnostics Menu

The Diagnostics menu allows the operator to access Cell Exchange diagnostic routines and database functions.

Loopback: - This menu is described in Chapter 6, under the section entitled, “User-initiated Tests.”

Init Database - This menu provides the user with a means to clear the contents of the current database. Selecting this menu item brings up the screen shown in Figure 4-14.

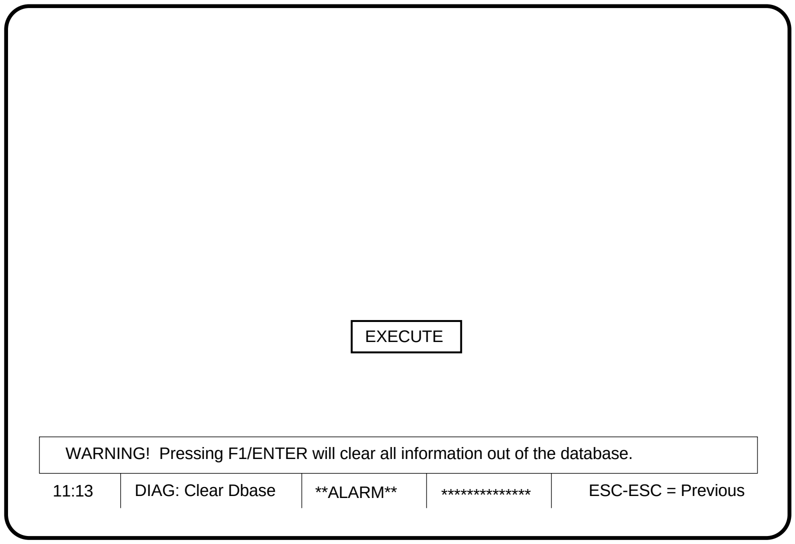


Figure 4-14. Initialize Database Window from Diagnostics Menu

<u>Save DB</u> - This menu allows the user to save the contents of the current database to a new file on the local management station.

NOTE: *The Save DB and Restore DB functions can only be executed in Hyper Terminal. See the section on "Windows Hyper Terminal Software" for information on setting up a Hyper Terminal connection. See the section on "Telnet Support" for information on remote access to these menus.*

Selecting this menu item brings up the window shown in Figure 4-15.

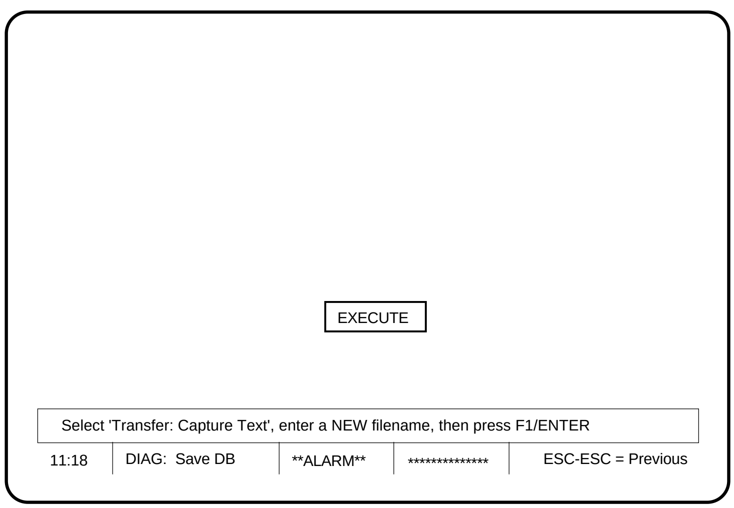


Figure 4-15. Save Database Window from Diagnostics menu

From the Hyper Terminal menu, select **Transfer**, then **Capture Text**. Hyper Terminal will prompt for the name of the file in which the text will be stored.

NOTE: ***It is very important to enter a NEW filename*** *each time the database is saved. If an old filename is used, the capture text operation will append the text to the file instead of overwriting its contents, and subsequent database restore operations will fail.*

Once the new filename is entered, click **Start** and hit the **<ENTER>** key or **F1** to send the contents of the database to the local management station. When the transfer is complete, the screen is cleared and the following prompt is displayed in the prompt line.

```
Select Transfer: Capture text: Stop then press ESC-ESC to
exit
```

After the **Capture Text** is stopped, the save operation is complete and pressing **ESC-ESC** returns to the Main Menu.

<u>Restore DB</u> **-** This menu allows the user to restore the database from a previously saved file. Selecting this menu item brings up the screen shown in Figure 4-16.

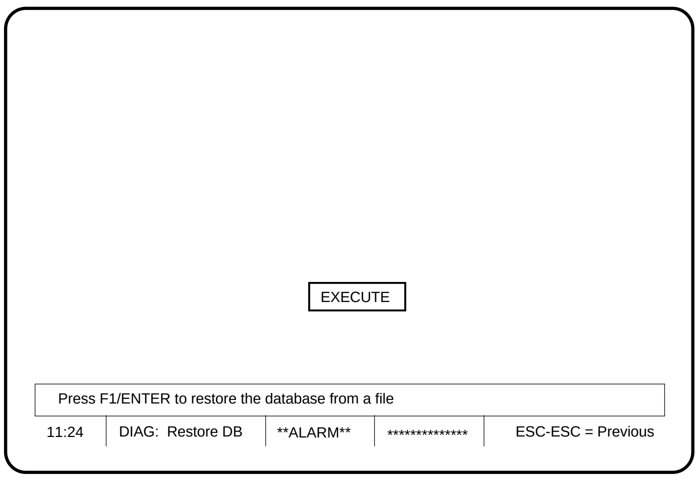


Figure 4-16. Restore Database Window from Diagnostics Menu

Pressing the **<F1>** or **<ENTER>** key will begin the operation. The prompt line will change to:

```
Select Transfer: Send Text File, enter the file name, and
click Open
```

Select the **Transfer/Send Text File** (ASCII) in the HyperTerminal window and the restore operation will begin.

*NOTE: The **Send File** menu option, which uses FTP, cannot be used for the Database Restore function. FTP is not used by the CX in the Restore Database function.*

Database restoration may take up to 2 minutes, depending on the contents of the file. During this operation, no feedback is provided to the user.

When the transfer is completed, the Cell Exchange will be rebooted to ensure that any needed database conversion will be performed.

If an error is detected during the Database Restore operation, the database will be completely cleared. Errors can arise from any of the following conditions:

- Checksum error (each database file contains a checksum over the data).
- Invalid database file format detected.
- Database version not supported.

Switch CPU - This menu item allows the user to force a changeover of CPUs when redundant CPU Modules are installed.

Switch Disable - This menu item disables automatic CPU switchover capability when redundant CPU Modules are installed.

NOTE: If new configuration data is loaded onto the active CPU, this will automatically reset to the "Enable" mode.

Switch Enable - This menu item enables automatic CPU switchover capability when redundant CPU Modules are installed.

Start Stats - Selecting this menu item will start or resume the collection of statistics.

Stop Stats - This menu item stops the collection of statistics.

Module reset - This menu item allows the user to reset a selected module that was defined in the CX-1500/1540 via the configure/interface menu item. . The Interface Name field is a tumbler field. Select the module to be reset by pressing the **<SPACE>** bar until the desired module name appears. To cancel this command, press the **<ESC>** key. Selecting this menu item brings up the window shown in Figure 4-17. The Interface Name field is a tumbler field. Pressing the **<SPACE>** bar will move through the installed modules.

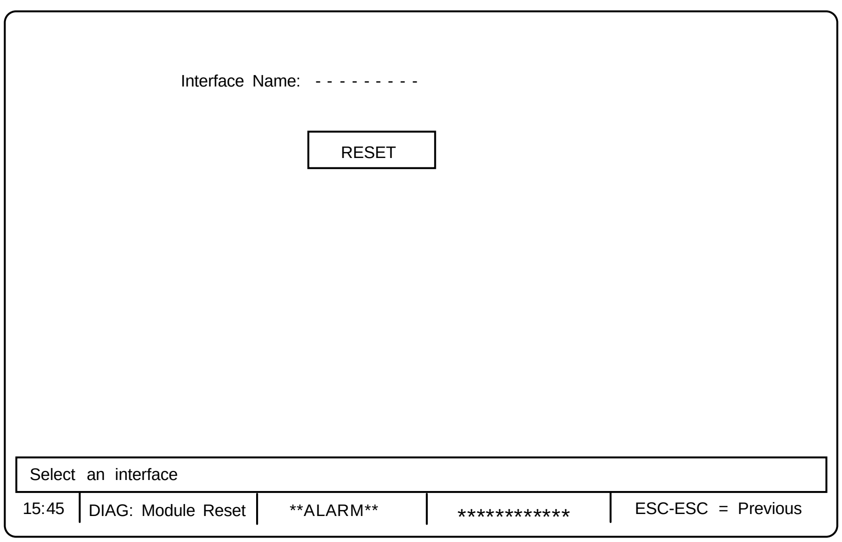


Figure 4-17. Module Reset Window from Diagnostics Menu

Network Management

The Cell Exchange software provides the capability to review the configuration information and addressing for the Cell Exchange system on which it is installed. The management system software will also determine the specific model of Cell Exchange by identifying the position of the CPU module (i.e., if the CPU module located in a slot numbered above 4, it is a CX-1500 or CX-1580; if the slot is 4 or less, it is a CX-1540). Selecting **Configure**/**SNMP** will bring up the window shown in Figure 4-18.

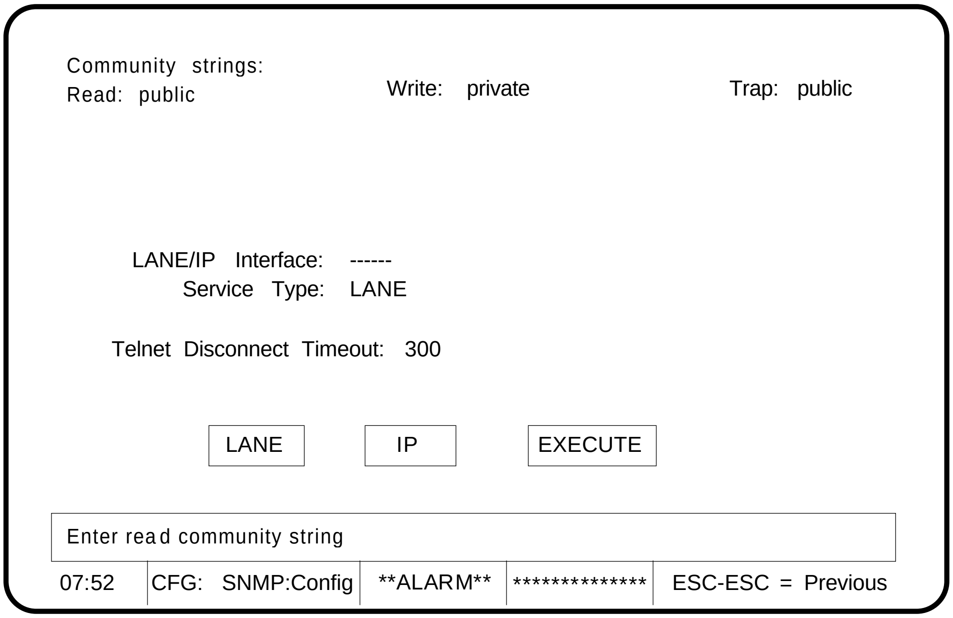


Figure 4-18. SNMP Window

The entries on this screen include:

Read Community String	Access level for "reading" the network. Must match craft display. Default is "public."
Write Community String	Access level for writing to the network. Must Match craft display. Default is "private."
Trap Community String	Access level for receiving traps from the network. Must match craft display. Default is "public."
LANE/IP Interface	Tumbler field to select the SNMP interface for LANE or IP access. Only one type of service can be selected (LANE or IP).
Service Type	Toggle field to select the type of service – LANE or IP.
Telnet Disconnect Timeout	Edit field for entering a timer value in seconds (60-999)

NOTE: This window has one or more secondary windows associated with it. Care must be taken that the configuration shown in the "primary" window is the one desired. Moving to the secondary window automatically accepts or "executes" the configuration displayed in the primary window.

LANE Operation

The following is a short list of features that the LANE NMS Operation provides:

- Allows Operations the capabilities so that a remote management system can operate and maintain the ATM network.
- Allows OA&M functions for SVCs provided in accordance with sections 13, 14, and 15 of Bellcore GR-1248-CORE, Issue 3
- Provides sufficient ATM operational capabilities so that an electronically bonded remote Management System can operate and maintain the CX-1500's
- Supports the following network management standards for interface to management systems:

  * Simple Network Management Protocol (SNMP) v2.0, RFC1577

  * Interim Local Management Interface (ILMI) v4.0, af-ilmi-0065.000

  * MIBs as an integral part of the CX-1500 specifications

  * LANE, Emulation (LEC)(version 1.0, 2.0)

  * UNI Signaling (UNI 3.1)
- Supports LANE over a single ATM interface.
- Management of the CX-1500 is directly interoperable with, and manageable by ATM Network Management Systems, (system based on HP OpenView)

To configure for LANE operation, select the appropriate interface (Figure 4-19) and service type. Enter a timeout value. Using the arrow keys, select the **<LANE>** button, then press **<ENTER>**. This will bring up the window shown in Figure 4-19.

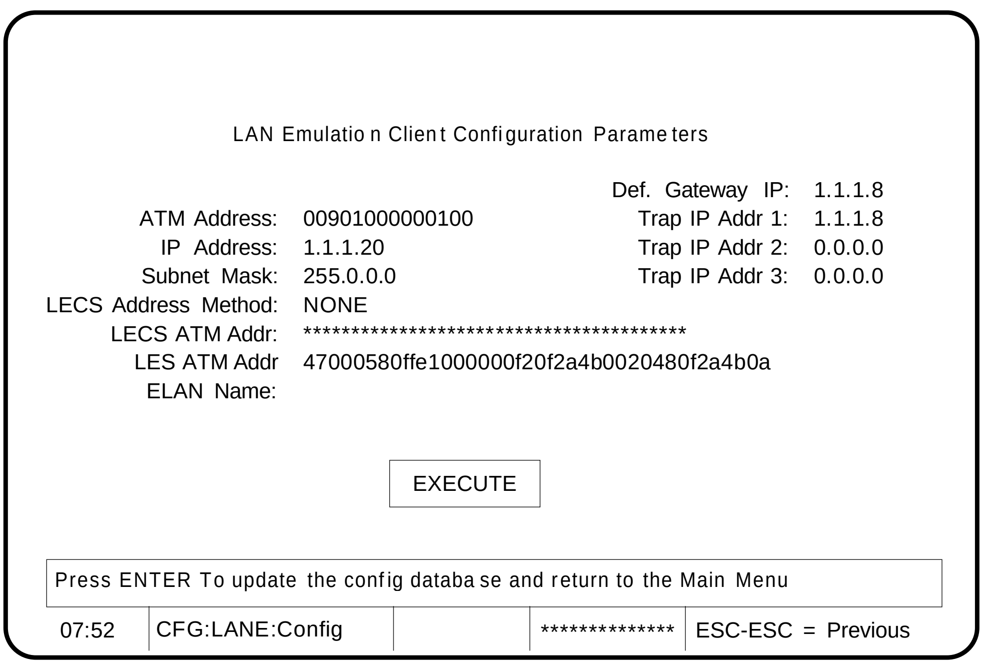


Figure 4-19. LANE Configuration

All fields except the LECS Address Method are edit fields. Use the arrow keys to move around the screen. Enter information using the keyboard. The LECS Address Method field is a tumbler field.

Use the space bar to toggle through the allowable entries. Parameters that define a LANE Client are:

- ATM Address (Edit field)
- IP Address (Edit field)
- Subnet Mask (Edit field)
- LECS Address Method: (NONE, AUTO, ILMI, PROG)
- LECS ATM Addr (Edit field)
- LES ATM Addr (Edit field)
- ELAN Name (Edit field)

IP Operation

NOTE: *For IP, an HRIM module is required.*

To configure for IP operation, select the appropriate interface (Figure 4-19) and service type. Enter a timeout value. Using the arrow keys, select the **<IP>** button, then press **<ENTER>**. This will bring up the window shown in Figure 4-20.

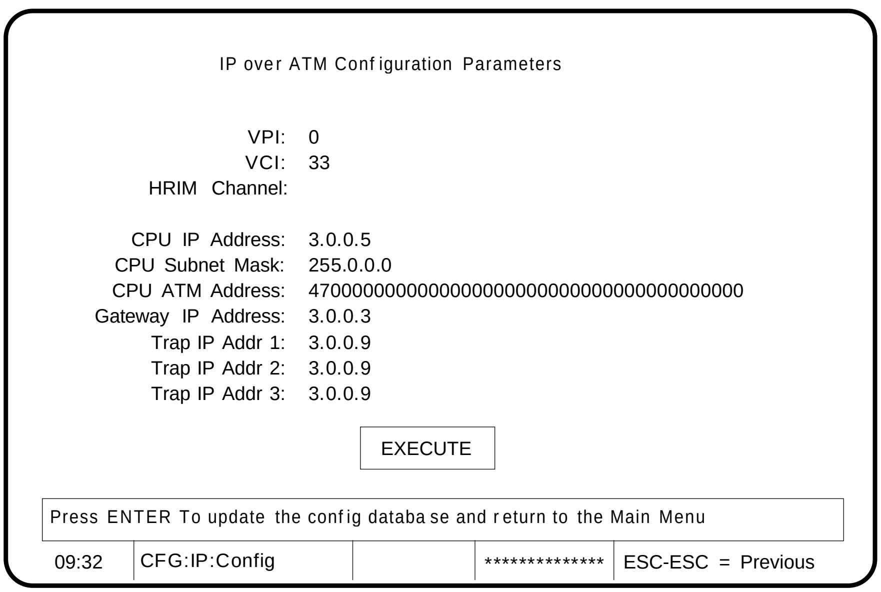


Figure 4-20. IP Configuration

All fields are edit fields. Use the arrow keys to move around the screen. Enter information using the keyboard. Parameters that define an IP configuration are:

- VPI (Edit field)
- VCI (Edit field)
- HRIM Channel (Tumbler field, pressing the **<SPACE>** bar will show the configured channels)

- CPU IP Address (Edit field)
- CPU Subnet Mask (Edit field)
- CPU ATM Address (Edit field)
- Gateway IP Address (Edit field)
- Trap IP Addr 1 (Edit field)
- Trap IP Addr 2 (Edit field)
- Trap IP Addr 3 (Edit field)

For information on configuring local and remote nodes using IP, see also Chapter 5, Configuring for IP Operation.

For information on configuring a network consisting of one or more Cell Exchange nodes, refer to the *Synchrony* Cell Exchange Management Application User's Guide (MC17358).

Setting the MAC Address of the CPU

Each CPU can be uniquely identified by its MAC Address - a 12-digit numeric identifier. The first 6 digits are the TIMEPLEX/CX company ID. The next 6 digits are the CPU's serial number (located on the CPU board).

On initialization of the database, this value is:

009010000001

To change this value go the login screen, then remove and re-insert the cable from the CPU's serial port or type a 'Q'. Enter 'MACMAN' as the password and press **<ENTER>**. On the next screen, enter the new MAC address, use the arrow keys to move to the **EXECUTE** button, and press **<ENTER>**.

NOTE: The MAC address MUST BE unique when operating with LANE since it becomes part of the CX-1500/1540 unique ATM address in an ATM network using LANE. If two or more CPUs on different nodes have the same MAC address the first CPU to establish connectivity with the LAN Emulation Server becomes an active LANE client. All others (with the same MAC address) will cause the CPU to constantly reboot.

Telnet Support

CX software provides the capability to launch a TELNET session directly to any CX node. The TELNET protocol is used to log in to the remote CX and monitor or control the unit as if locally connected. TELNET sessions may be established locally or remotely. TELNET can be launched from one of three interfaces:

- Craft Interface (Telnet to a remote node)

- LANE (Telnet from NMS station)
- HRIM IP Connection (Telnet from NMS station)

TELNET has session security. This is identical to the user login and three levels of security supported by the Craft Station interface. There can only be one TELNET session active to a CX node.

From the NMS workstation, TELNET is invoked by selecting the Node Icon from the HPOV map then using the HP OpenView menu:

MISC >> ***Terminal Connect*** >> ***TELNET*** *(xterm)*

-or-

MISC >> ***Terminal Connect*** >> ***TELNET*** *(cmdtool)*

Function Key mapping for different terminal types is provided using an external utility *Map_F1_F4key*. The function key mapping is active for the current Unix user session. Upon logout or reboot the function key mapping is lost. The utility *Map_F1_F4key* should be placed in the *.cshrc* file so that it will be invoked automatically on user login.

Local Session

The procedures to establish a local TELNET session (a locally connected PC and HRIM and CPU on same chassis as shown in Figure 4-21) are described below:

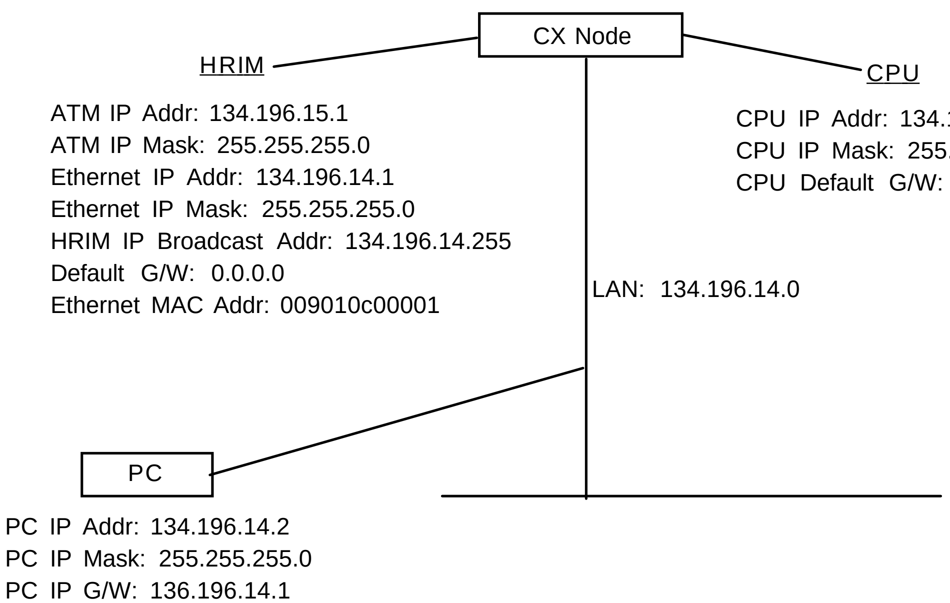


Figure 4-21. Locally Connected TELNET Session

1. Select the **Interface** command from the **Configure** menu. This will bring up the screen shown in Figure 4-22.

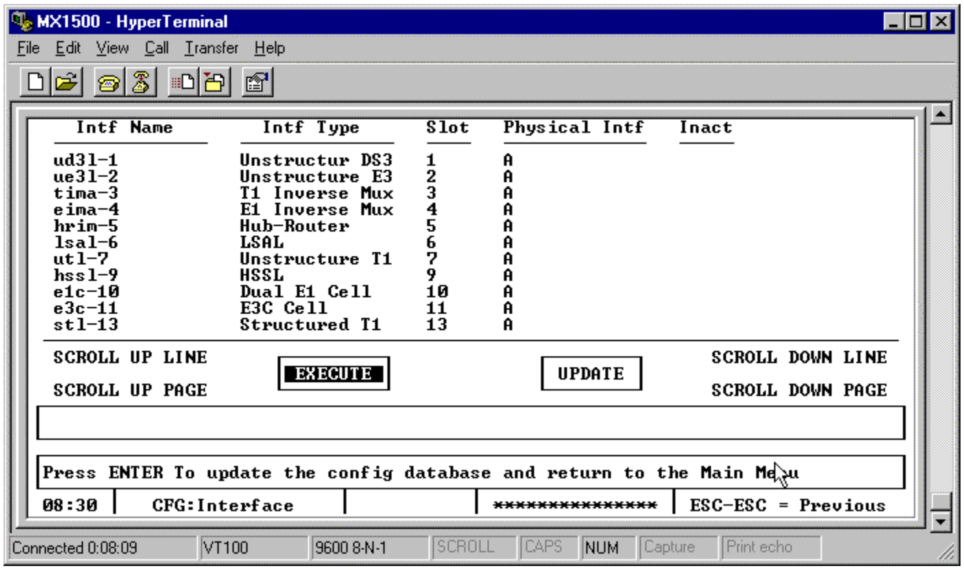


Figure 4-22. Interface Configuration Window

2. Using the **ARROW** keys, select the HRIM module. Press **F2** to go to the configuration screen (Figure 4-23).

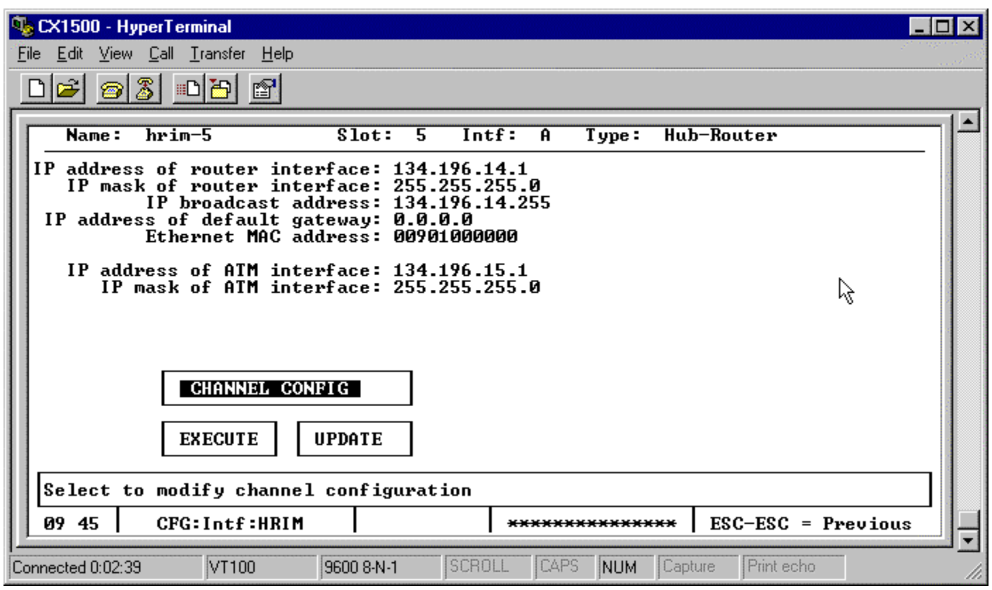


Figure 4-23. HRIM Configuration Window

3. Using the **ARROW** keys, move to the **CHANNEL CONFIG** button and press **<ENTER>**. This will bring up the window shown in Figure 4-24.

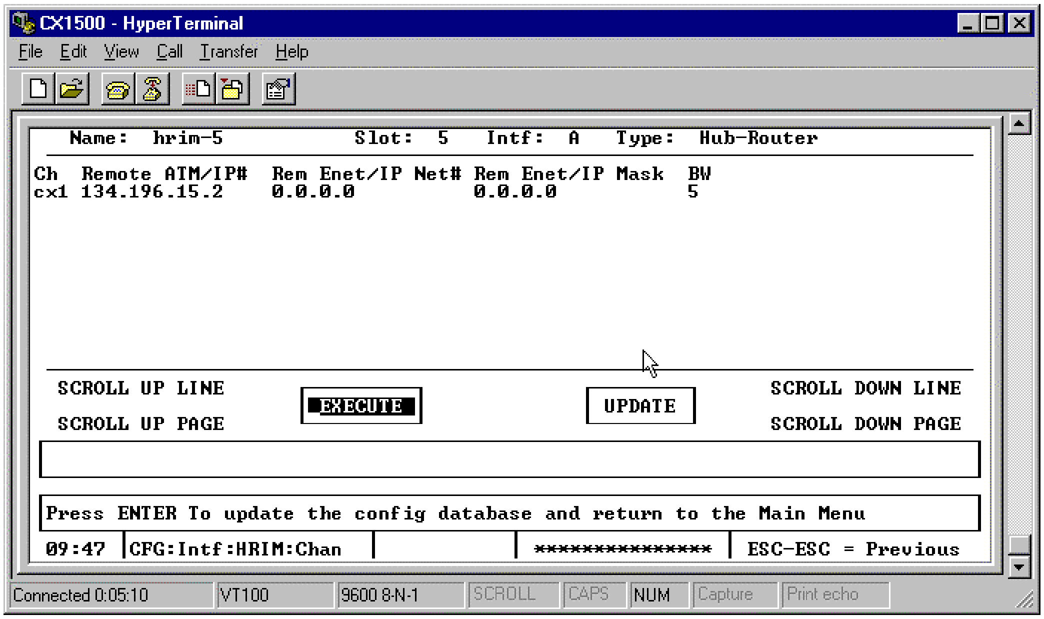


Figure 4-24. HRIM Channel Configuration Window

4. Use the **ARROW** keys to move the cursor into the channel configuration field. Press **F3** to add a new record. Enter the identification and address information for the local CPU.

5. When finished, move to the **EXECUTE** button, to update the database and return to the main menu, or **UPDATE**, to update the database and remain in this window.

6. Press **<ENTER>** to execute the selected command.

7. Return to the main menu and select **SNMP** from the **Configure** menu. The screen shown in Figure 4-25 will appear.

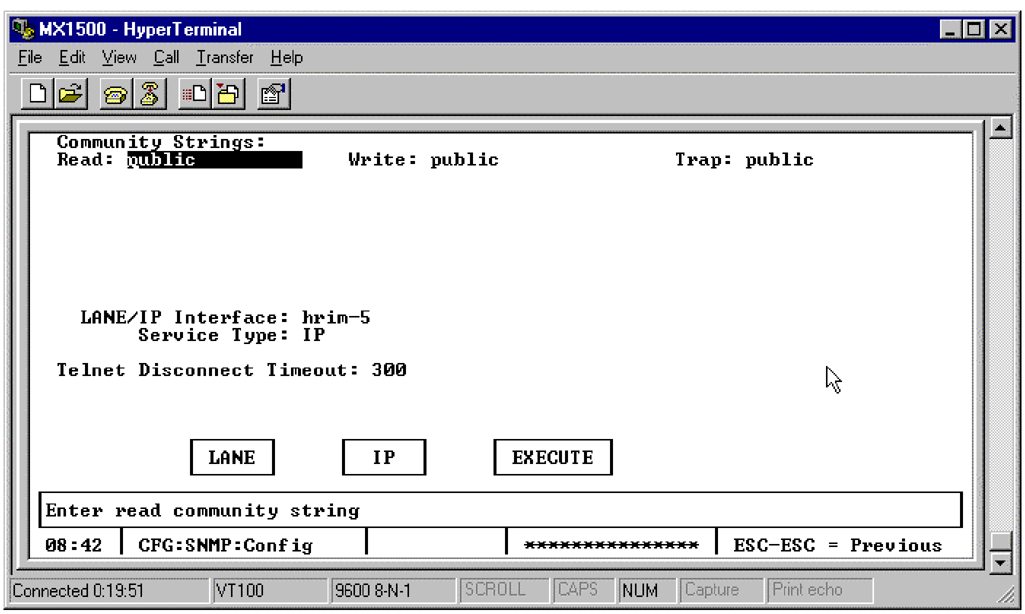


Figure 4-25. SNMP Configuration Window

8. Use the **ARROW** keys to move to the **LANE/IP Interface** field.
9. With the **<SPACE>** bar, toggle through the interfaces until the HRIM appears.
10. Move to the **Service Type** field and toggle to **IP**.
11. Move to the **Telnet Disconnect Timeout** and enter a timer expiration in seconds (60 to 999).
12. Move to the **IP** button and press **<ENTER>**. This will bring up the screen shown in Figure 4-26.

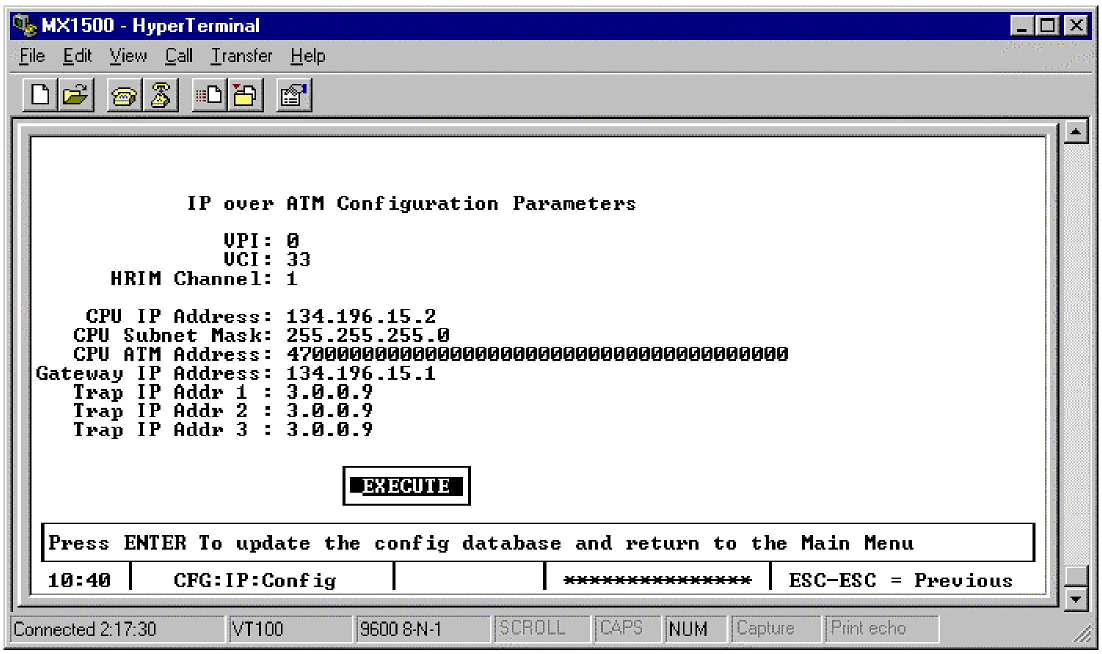


Figure 4-26. IP over ATM Configuration Window

13. The **VPI** and **VCI** fields will show the default values 0 and 33, respectively.

NOTE: When the CPU and HRIM are co-located, modification of these values will not be recognized. The system will revert to the default values.

14. Move to the **HRIM Channel** and toggle to the channel previously configured (Figure 4-22).
15. Assign the **CPU IP Address**, **Subnet Mask**, and **Gateway IP Address**.
16. If using an SNMP management station, assign appropriate **Trap IP Address**(es).
17. Move to the **EXECUTE** button and press **<ENTER>** to update the database and return to the main menu.

Remote Session

The procedures to establish a remote TELNET session (a locally connected PC and HRIM and CPU on same chassis as shown in Figure 4-27) are described below:

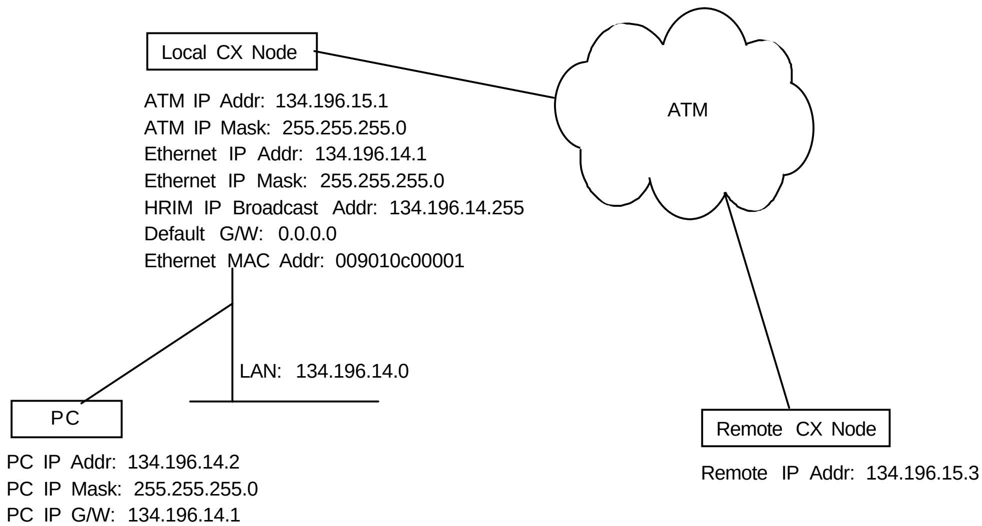


Figure 4-27. Remotely Connected TELNET Session

1. Select the **Interface** command from the **Configure** menu. This will bring up the screen shown previously in Figure 4-21.
2. Using the **ARROW** keys, select the HRIM module. Press **F2** to go to the configuration screen (Figure 4-28).

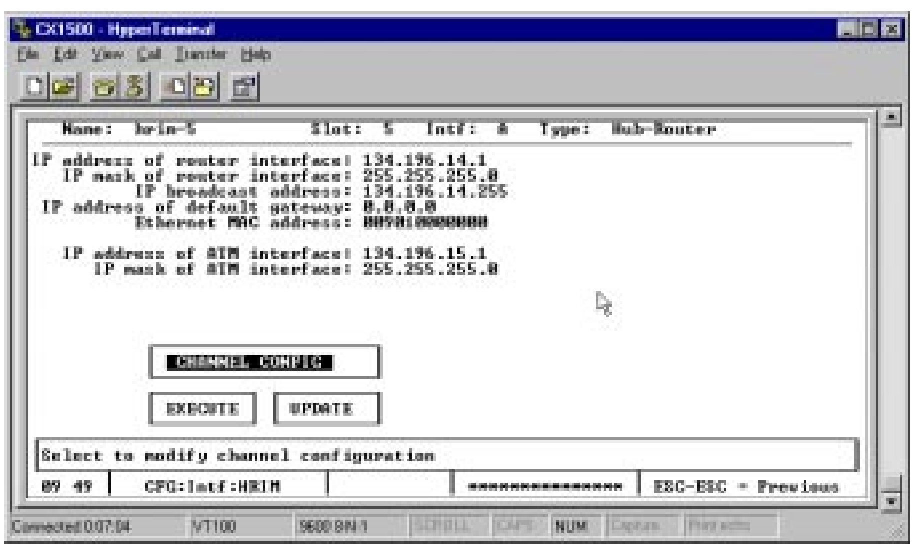


Figure 4-28. HRIM Configuration Window

3. Using the **ARROW** keys, move to the **CHANNEL CONFIG** button and press **<ENTER>**. This will bring up the window shown in Figure 4-29.

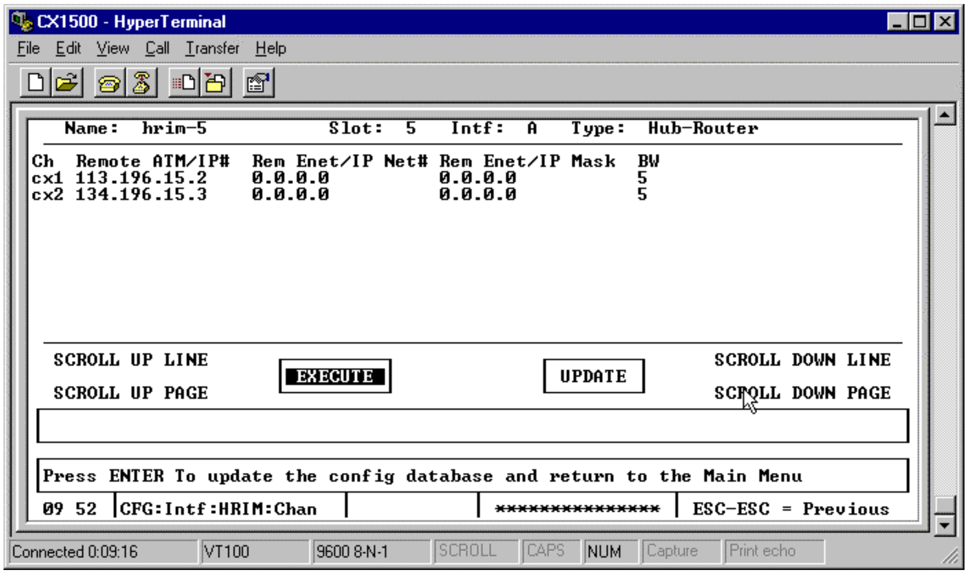


Figure 4-29. HRIM Channel Configuration Window

4. Use the **ARROW** keys to move the cursor into the channel configuration field. Press **F3** to add a new record. Enter the identification and address information for the remote CPU.

5. When finished, move to the **EXECUTE** button, to update the database and return to the main menu, or **UPDATE**, to update the database and remain in this window.

6. Press **<ENTER>** to execute the selected command.

7. Select **Connection Mgmt** from the **Configure** menu. When the window appears, move to select the HRIM card and press **F2**. The window shown in Figure 4-30 will appear.

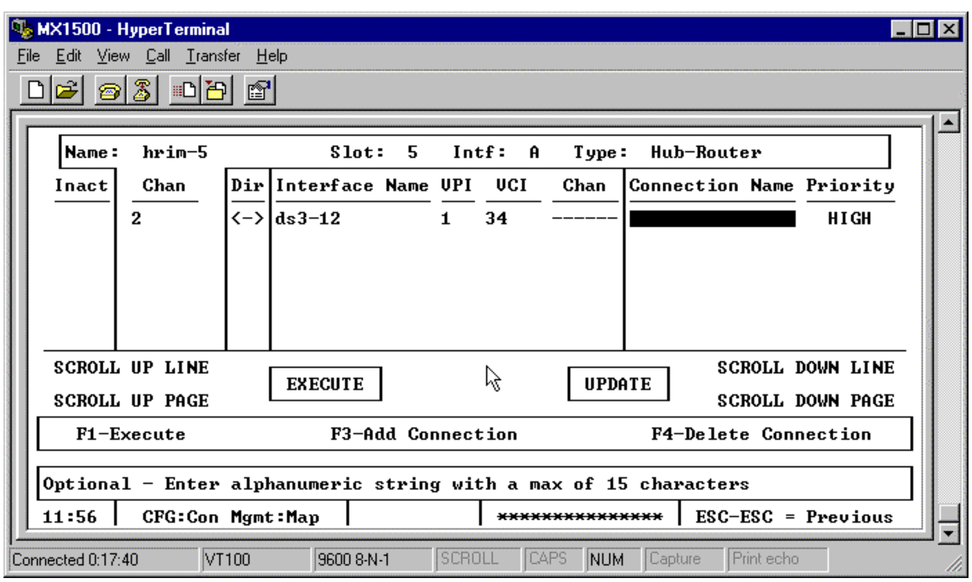


Figure 4-30. Connection Management Window

8. Use the **ARROW** keys to move into the connection mapping area. Move to **Chan** and toggle until **2** appears. In a similar fashion, set the **Dir** and **Interface** fields. Enter the **VPI** and **VCI** values for incoming ATM access to the CPU.

9. Move to **EXECUTE** and press **<ENTER>** to update the database and return to the main menu.

From the remote node, execute the following steps:

1. Return to the main menu and select **SNMP** from the **Configure** menu. The screen shown in Figure 4-31 will appear.

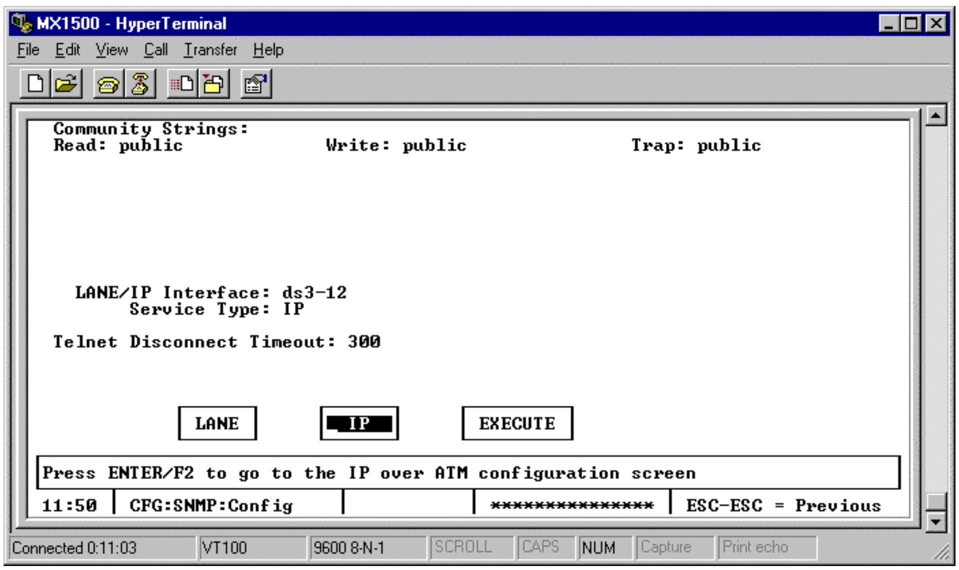


Figure 4-31. SNMP Configuration Window

2. Use the **ARROW** keys to move to the **LANE/IP Interface** field.

3. With the **<SPACE>** bar, toggle through the interfaces to select the remote CPU interface (in this case via a DS3 cell VPI/VCI connection across the ATM cloud).

4. Move to the **Service Type** field and toggle to **IP**.

5. Move to the **Telnet Disconnect Timeout** and enter a timer expiration in seconds (60 to 999).

6. Move to the **IP** button and press **<ENTER>**. This will bring up the screen shown in Figure 4-32.

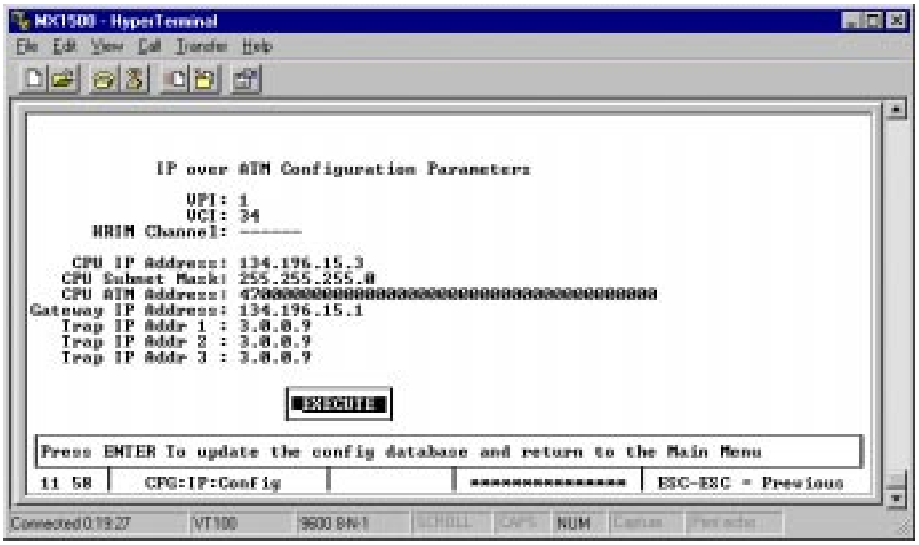


Figure 4-32. IP over ATM Configuration Window

7. Move to the **VPI** and **VCI** fields and configure them for the incoming ATM access to the CPU.
8. Move to the **HRIM Channel** and toggle to the channel previously configured (Figure 4-31).
9. The **CPU IP Address** should reflect the remote CPU and the **Gateway IP Address** should show the local HRIM address.
10. Move to the **EXECUTE** button and press **<ENTER>** to update the database and return to the main menu.

FTP Support

The user can establish an FTP session onto any CX node in the network by initiating an FTP session to the CPU IP address within the node. At the password prompt, the user must enter the Administrator level password on the craft interface in order to establish an FTP session. An incorrect password entry will result in termination of the FTP session.

From the FTP session a user may GET the NVRAM file, PUT an NVRAM file, or PUT a software flash image. The file name for the software flash image is “cpurom.hex.” The status of file transmissions is monitored by the FTP session itself. No SNMP support is available in CX to configure, monitor or control the FTP session.

The procedure for software upgrade using FTP or Craft interface is described in Chapter 2.

Saving a Database Using FTP

You can save (back up) the configuration database that resides on the CPU of a CX-1500 or CX-1540 device remotely, using FTP. The following instructions assume you are using Windows 95, Windows NT, or an HP-UX workstation.

To save a CX database to a file using FTP:

1. Open an MS-DOS window or xterm window as appropriate and path to the directory where you want the backed up file to reside on your PC.
2. Start an FTP session:
   - From a DOS command prompt, enter: ftp *IPAddress* (of the CX node being accessed)
   - From an HP-UX command prompt, enter: ftp –B 1 *IPAddress*
3. When prompted to log in, enter the level 3 password as the user name (default “admin”) and press **<ENTER>** when prompted for a password.
4. Enter the command: get *filename*

   where *filename* is the name of the file you are saving the database to. This can be any name except CPUROM.HEX or CPUROM.BIN.
5. Once the save operation is complete, quit the FTP session by entering: quit

Restoring a Database Using FTP

You can restore the database from a previously saved file for a remote CX device, using FTP. To restore a database to a CX device using FTP:

1. Open an MS-DOS window or xterm window as appropriate and path to the directory where you want the backed up file to reside on your PC.
2. Start an FTP session:
   - From a DOS command prompt, enter: ftp *IPAddress*
   - From an HP-UX command prompt, enter: ftp –B 1 *IPAddress*
3. When prompted to log in, enter the level 3 password for the user name (default “admin”) and press **<ENTER>** when prompted for a password.
4. Enter the command: put *filename*

   where *filename* is the name of the file you restoring. This can be any name except CPUROM.HEX or CPUROM.BIN.
5. Once the restore operation is complete, quit the FTP session by entering: quit

Alarms

Alarm messages are displayed on the prompt line. When an alarm condition occurs or clears, a brief message appears, lasting about 5 seconds. At the same time, the string “**ALARM**” appears in the status line. This string will remain until all alarms are cleared. If multiple alarms occur simultaneously, the alarms will be queued up, and each alarm message will only be displayed for about 1/2 second. The last message in the queue will be displayed for the full 5 seconds, assuming no new alarms occur. When the last alarm message has been displayed and has timed out, the prompt line will revert to its user help display.

An alarm message has priority over other prompt line messages. Therefore, if an alarm message is being displayed, and the user moves the cursor, the alarm message will remain for the full 5 seconds before displaying the help prompt for the new cursor position. See Chapter 6 for a list of alarm codes.

Module Statistics

The Cell Exchange system collects and displays performance statistics for each of its installed modules. To view the statistics for a given interface module, select **Module Status** from the **View** menu. The window shown in Figure 4-33 will appear.

Slot Number	Module Type	Module Status
1	Dual Sync Cell	Active
2	OC3 Cell	Idle
3	Dual Sync Leg	Active
4	LSAL	Active
5	Dual T1 Cell	Inactive
6	DS3	Invalid
7	SEL	Down
8	CPU	Active
9	Hub-Router	Active
10	OC3 Cell	Active
11	High Speed Leg	Active
12	Undefined	N/A
13	Undefined	N/A
14	STL	Inactive
15	Undefined	N/A
--	Power A	Active
--	Power B	Inactive

Press F2 to show the intf status for the highlighted selection

9:32	View: Module Status	**ALARM**	**************	ESC-ESC = Previous

Figure 4-33. Module Status Window

This window provides a top-level view of the hardware installed in the chassis. Information is available for each slot, including module type and module status. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This action will bring up a logical interface screen like that shown in Figure 4-34.

Intf Name	Intf Type	Slot	Physical Intf	Inact	Intf Status
Walkersville	Dual T1 Cell	5	A		Up

SCROLL UP LINE | SCROLL DOWN LINE

SCROLL UP PAGE | SCROLL DOWN PAGE

Press F2 to go to the specific interface screen

09:52	View: Intf Status	**ALARM**	******************	ESC-ESC = Previous

Figure 4-34. Logical Interface Status Window

The logical interface status window displays status information for each logical interface defined for a specific module. In addition to configuration information (name, type, slot, physical interface, active), the status of the interface is shown. This represents a snapshot of the current state of the interface – up or down. Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**. The screen shown in Figure 4-35 will appear.

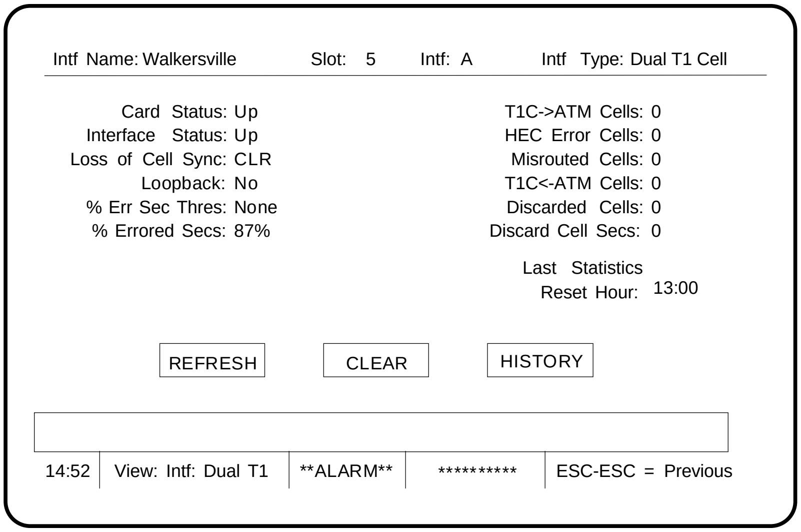


Figure 4-35. Specific Interface Window

The specific interface screen contains information that is tailored to the interface. The sample above represents a T1 Cell interface module. Entries for this screen are described in each module section.

CPU Module (CPU)

To view the statistics for the CPU Module, select **Module Status** from the **View** menu. The window that appears provides a top-level view of the hardware installed in the chassis. More information can be obtained for the CPU module by highlighting the module and pressing **<F2>**. This action will bring up the specific interface screen shown in Figure 4-36.

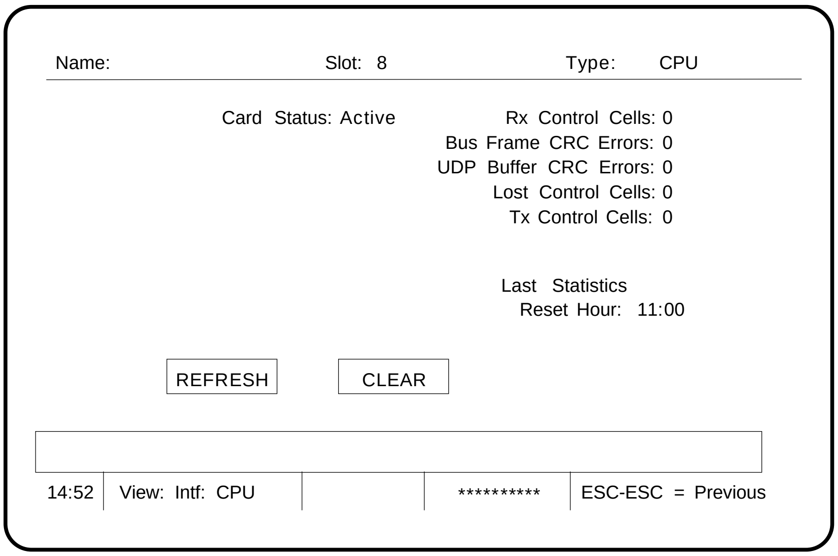


Figure 4-36. Logical Interface Status Window—CPU

Entries for this window include:

<u>Card Status</u>: Active (normal) indicates that the card is up and, in a redundant configuration, that it is the active CPU.

<u>Rx Control Cells</u>: Indicates the number of control cells received from interface cards.

<u>Bus Frame CRC Errors</u>: Indicates the number of CRC errors received from the bus.

<u>UDP Buffer CRC Errors</u>: Indicates the of data packet CRC errors received.

<u>Lost Control Cells</u>: Indicates the number of instances that a control cell was generated but not received.

<u>Tx Control Cells</u>: Indicates the number of control cells transmitted to interface cards.

Station Clock Module (SCM)

To view the statistics for the Station Clock Module (SCM), select **Module Status** from the **View** menu.

The window that appears provides a top-level view of the hardware installed in the chassis. More information can be obtained for the SCM by highlighting the module and pressing **<F2>**. This action will bring up the specific interface screen shown in Figure 4-37.

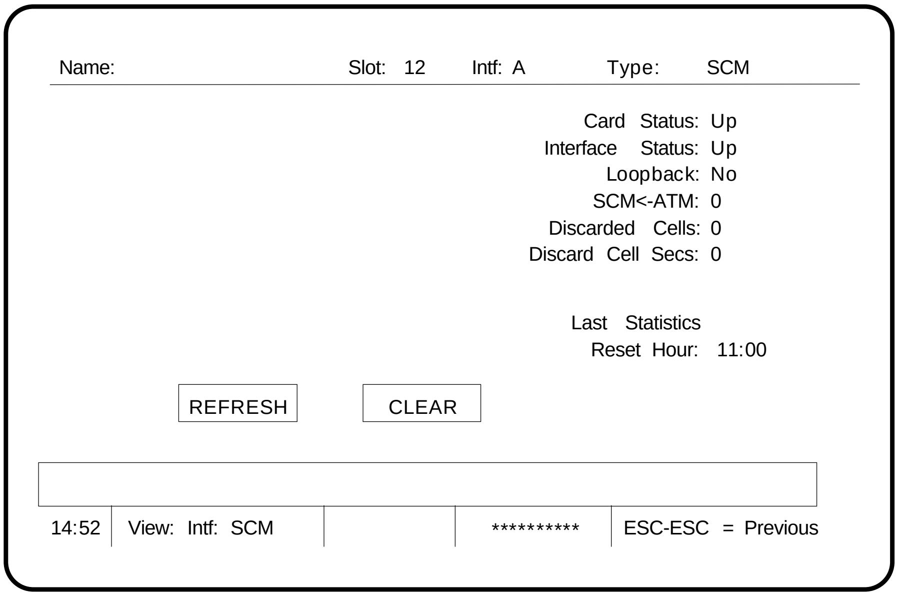


Figure 4-37. Logical Interface Status Window—SCM

Entries for this window include:

Card Status: Up (normal) indicates that the card has been recognized by the CPU and a software download has been successfully executed.

Interface Status: Indication of whether a valid T1 signal is being received at the interface.

Loopback: User selectable from the configuration screen.

SCM<-ATM: Number of cells from the network to the interface.

Discarded Cells: Number of cells discarded due to FIFO overflow.

Discard Cell Secs: Number of seconds in which cells were discarded.

Dual T1 Cell Interface Module (T1C)

To view the statistics for the Dual T1 Cell Interface Module, select **Module Status** from the **View** menu. The window that appears provides a top-level view of the hardware installed in the chassis. Information is available for each slot, including module type and module status. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This action will bring up the logical interface screen shown in Figure 4-38).

Intf Name	Intf Type	Slot:	Physical Intf	Inact	Intf Status
Walkersville	Dual T1 Cell	5	A		Up

SCROLL UP LINE　　SCROLL DOWN LINE

SCROLL UP PAGE　　SCROLL DOWN PAGE

Press ENTER/F2 to go to the interface statistics screen

15:17	View: Intf: Dual T1	**ALARM**	**********	ESC-ESC = Previous

Figure 4-38. Logical Interface Status Window—Dual T1 Cell

The logical interface status window displays status information for each logical interface defined for a specific module. In addition to configuration information (name, type, slot, physical interface, active), the status of the interface is shown. This represents a snapshot of the current state of the interface – up or down. Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**. The screen shown in Figure 4-39 will appear. This screen contains information that is tailored to the interface.

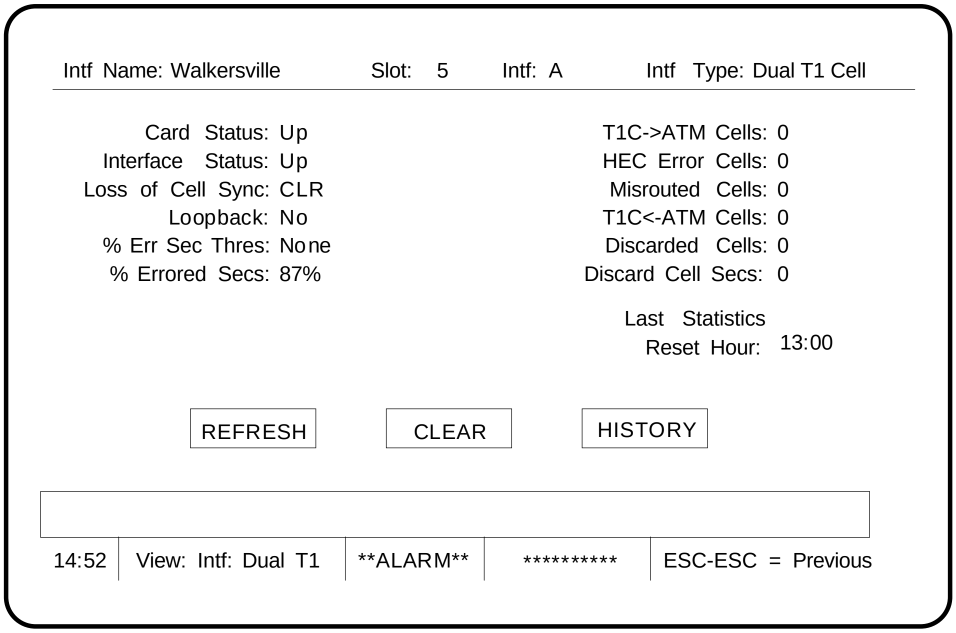


Figure 4-39. Specific Interface Window—Dual T1 Cell

Entries for this window include:

Card Status: Up (normal) indicates that the card has been recognized by the CPU and a software download has been successfully executed.

Interface Status: Indication of whether a valid T1 signal is being received at the interface.

Loss of Cell Sync: Indication of whether the interface is in synchronization with cells (CLR/ALM).

Loopback: User selectable from the configuration screen.

% Err Sec Thres: User selectable from the configuration screen; indicates the Bit Error Rate alarm threshold.

% Errored Secs: Indicates the percentage of seconds that the BER exceeds the alarm threshold.

T1C->ATM: Number of cells passed from the interface to the network.

HEC Error Cells: Number of cells with header errors.

Misrouted Cells: Number of cells that do not match any VPI/VCI configuration.

T1C<-ATM: Number of cells from the network to the interface.

Discarded Cells: Number of cells discarded due to FIFO overflow.

Discard Cell Secs: Number of seconds in which cells were discarded.

To view module activity for the past 8 hours, select the **<HISTORY>** button and press **<ENTER>**. This will bring up the screen shown in Figure 4-40.

Intf Name: Walkersville   Slot: 5   Intf: A   Intf Type: Dual T1 Cell

Period	T1C->ATM	T1C<-ATM
01:00 - 02:00	910	910
02:00 - 03:00	908	908
03:00 - 04:00	912	912
04:00 - 05:00	912	912
05:00 - 06:00	910	910
06:00 - 07:00	912	912
07:00 - 08:00	908	908
08:00 - 09:00	910	910

Note: Above statistics show total number of cells in each hour interval including cells lost due to uncorrectable header errors and non-matching VPI/VCI (misrouted), but excluding cells lost due to congestion.

14:52	View: History: Dual T1		**********	ESC-ESC = Previous

Figure 4-40. Interface Statistics Window—Dual T1 Cell

The column on the left shows the period in which the measurement was taken. The other two columns show the number of cells passed in each direction through the interface.

OC3 Cell Interface Module (OC3)

To view the statistics for the OC3 Cell Interface Module, select **Module Status** from the **View** menu. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38).

Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-41. This screen contains information that is tailored to the interface.

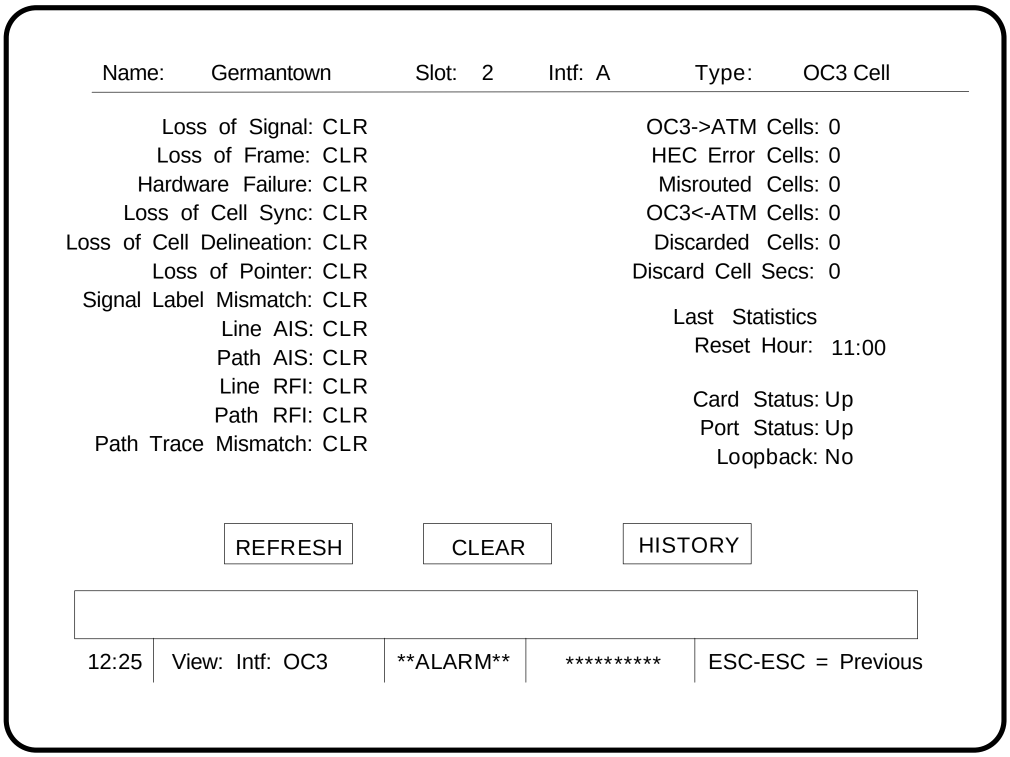


Figure 4-41. Specific Interface Window—OC3 Cell

Entries for this window include:

Loss of Signal: Indicates presence or absence of a valid optical signal at the interface.

Loss of Frame: Presence or absence of a SONET frame.

Hardware Failure: Self-explanatory.

Loss of Cell Sync: Indication of whether the interface is in synchronization with cells.

Loss of Cell Delineation: Indication of whether the interface is in synchronization with cells on the bus side.

Loss of Pointer: Presence or absence of a valid STS-3c pointer.

Signal Label Mismatch: Presence or absence of a valid path signal label.

Line AIS: Presence or absence of an Alarm Indication Signal at the interface.

Path AIS: Presence or absence of a valid STS-3c pointer from the network side.

Line RFI: Presence or absence of a Remote Failure Indication at the interface.

Path RFI: Presence or absence of an RFI from the network side.

Path Trace Mismatch: Indicates whether the Path Trace text matches the actual path trace reported.

O3C->ATM: Number of cells passed from the interface to the network.

HEC Error Cells: Number of cells with header errors.

Misrouted Cells: Number of cells that do not match any VPI/VCI configuration.

O3C<-ATM: Number of cells from the network to the interface.

Discarded Cells: Number of cells discarded due to FIFO overflow.

Discard Cell Secs: Number of seconds in which cells were discarded.

Card Status: Up (normal) indicates that the card has been recognized by the CPU and a software download has been successfully executed.

Port Status: Indication of whether a valid signal is being received at the interface.

Selecting the **<HISTORY>** button provides statistics for this module similar to those shown in Figure 4-40.

OC3c Cell Interface Module (OC3C)

To view the statistics for the OC3c Cell Interface Module, select **Module Status** from the **View** menu. The window that appears provides a top-level view of the hardware installed in the chassis. Information is available for each slot, including module type and module status. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38).

Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-42. This screen contains information that is tailored to the interface.

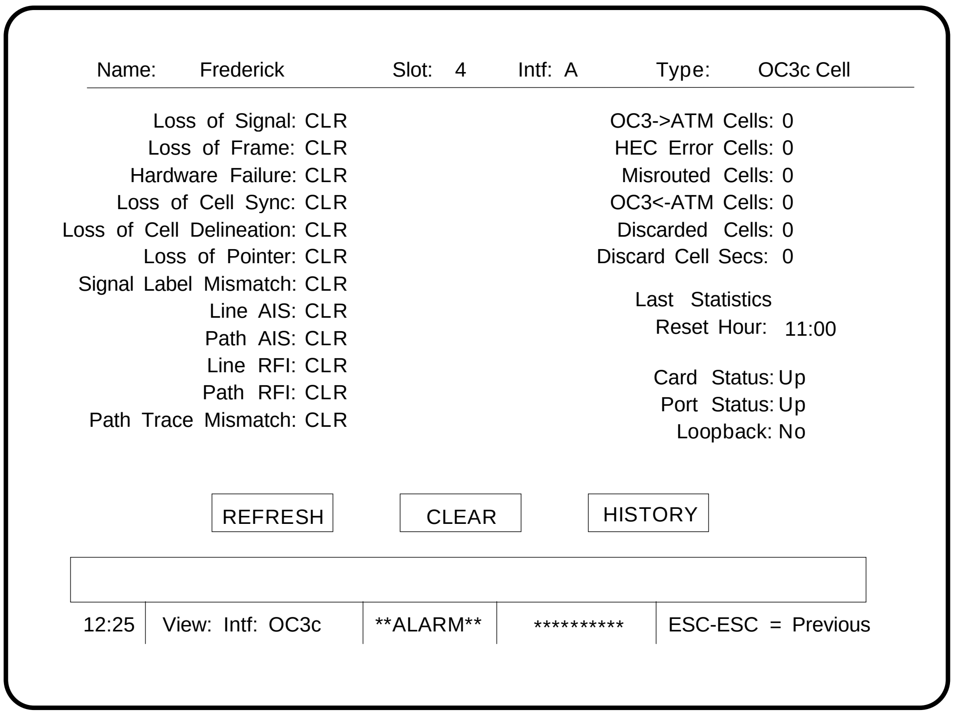


Figure 4-42. Specific Interface Window—OC3c Cell

The entries in this window are the same as the OC3.

Selecting the **<HISTORY>** button provides statistics for this module similar to those shown in Figure 4-40.

Dual Synchronous Cell Interface Module (DSC)

To view the statistics for the Dual Synchronous Cell Interface Module, select **Module Status** from the **View** menu. The window that appears provides a top-level view of the hardware installed in the chassis. Information is available for each slot, including module type and module status. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38).

Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-43. This screen contains information that is tailored to the interface.

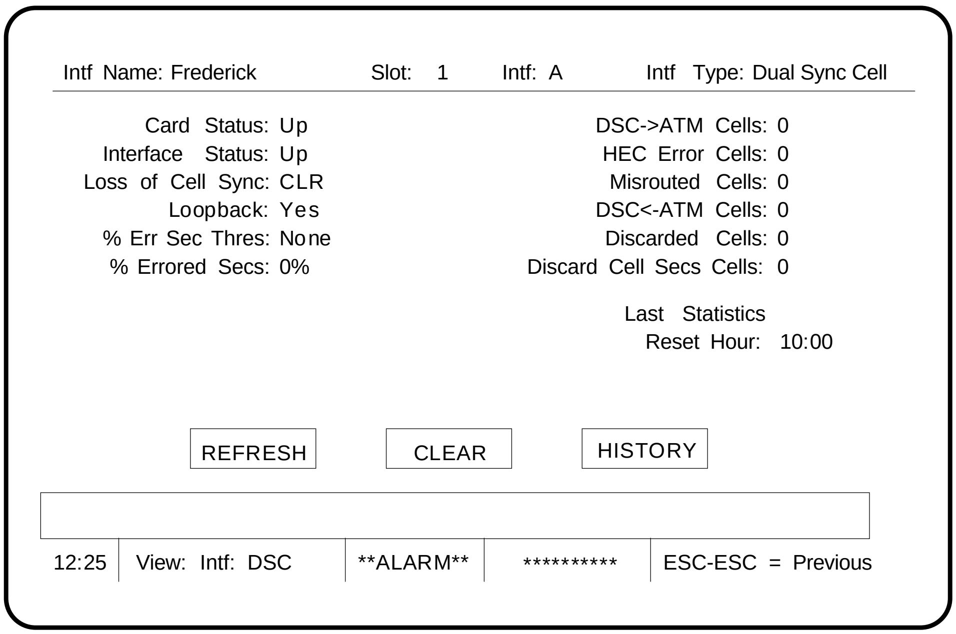


Figure 4-43. Specific Interface Window—Dual Sync Cell

The entries in this window are the same as the T1C.

Selecting the **<HISTORY>** button provides statistics for this module similar to those shown in Figure 4-40.

DS3 Cell Interface Module (DS3)

To view the statistics for the DS3 Cell Interface Module, select **Module Status** from the **View** menu. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38). Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-44. This screen contains information that is tailored to the interface.

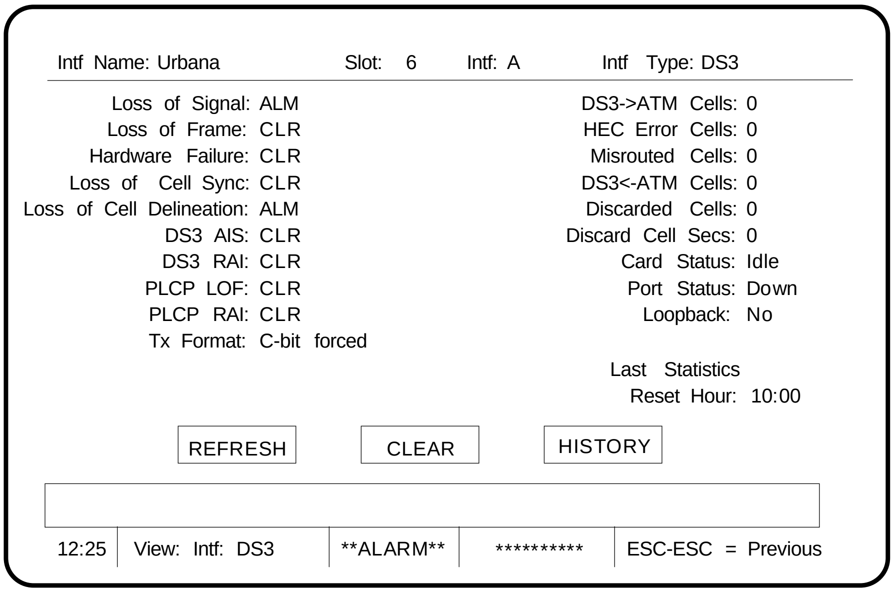


Figure 4-44. Specific Interface Window—DS3

Entries in this window include:

Loss of Signal: Indicates presence or absence of a valid DS3 signal at the interface.

Loss of Frame: Presence or absence of a DS3 frame.

Hardware Failure: Self-explanatory.

Loss of Cell Sync: Indication of whether the interface is in synchronization with cells.

Loss of Cell Delineation: Indication of whether the interface is in synchronization with cells on the bus side.

DS3 AIS: Presence or absence of an Alarm Indication Signal at the interface.

DS3 RAI: Presence or absence of a Remote Alarm Indication from the far end equipment.

PLCP LOF: Presence or absence of a PLCP frame.

PLCP RAI: Presence or absence of an RAI from the far end equipment.

Tx Format: User selectable at the configuration screen for transmit framing.

The remaining entries are the same as previously defined.

Selecting the **<HISTORY>** button provides statistics for this module similar to those shown in Figure 4-40.

E1 Cell Interface Module (E1C)

To view the statistics for the E1 Cell Interface Module, select **Module Status** from the **View** menu. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38).

Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-45. This screen contains information that is tailored to the interface.

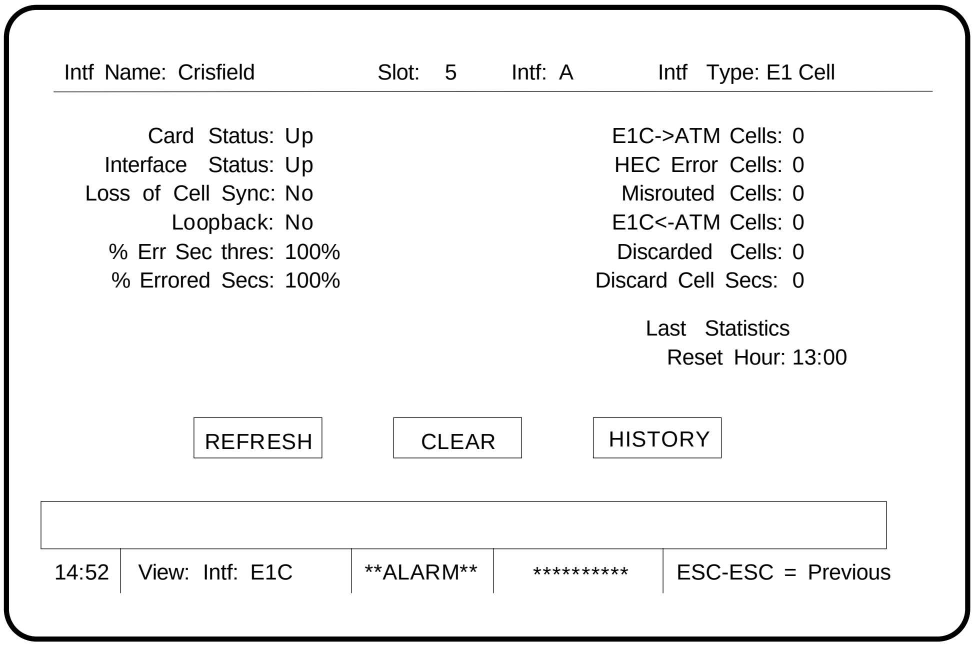


Figure 4-45. Specific Interface Window—E1C

The entries in this window are the same as the T1C.

Selecting the **<HISTORY>** button provides statistics for this module similar to those shown in Figure 4-40.

E3 Cell Interface Module (E3C)

To view the statistics for the E3 Cell Interface Module, select **Module Status** from the **View** menu. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38). Information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-46.

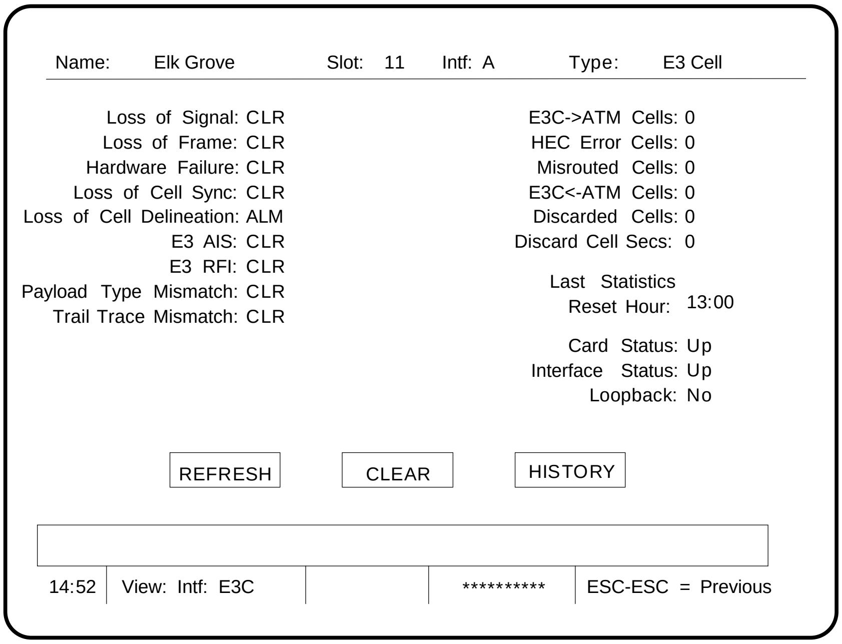


Figure 4-46. Specific Interface Window—E3C

Entries in this window include:

Loss of Signal: Indicates presence or absence of a valid E3 signal at the interface.

Loss of Frame: Presence or absence of an E3 frame.

Hardware Failure: Self-explanatory.

Loss of Cell Sync: Indication of whether the interface is in synchronization with cells.

Loss of Cell Delineation: Indication of whether the interface is in synchronization with cells on the bus side.

E3 AIS: Presence or absence of an Alarm Indication Signal at the interface.

E3 RAI: Presence or absence of a Remote Alarm Indication from the far end equipment.

Payload Type Mismatch: Presence or absence of the expected payload type.

Trail Trace Mismatch: Indicates whether the Path Trace text matches the actual path trace reported.

The remaining entries are as previously defined.

Selecting the **<HISTORY>** button provides statistics for this module similar to those shown in Figure 4-40.

Structured T1 Legacy Module (STL)

To view the statistics for the Structured T1 Legacy Module (STL), select **Module Status** from the **View** menu. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38). Information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-47.

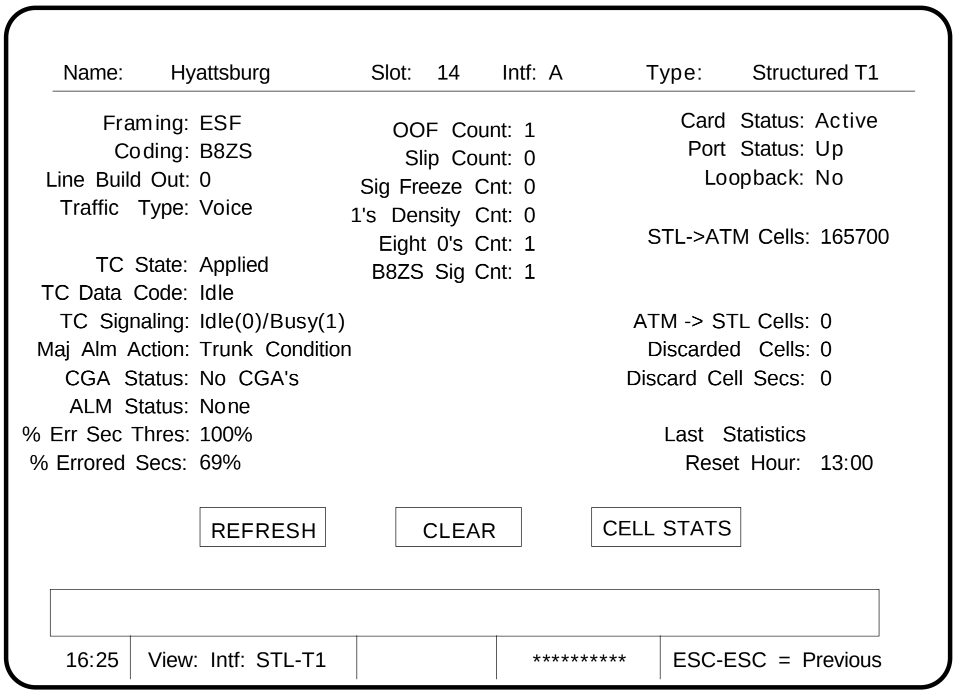


Figure 4-47. Specific Interface Window—Structured T1

Entries in this window include:

<u>Framing</u>: Reflects the user selection from the configuration window.

<u>Coding</u>: Reflects the user selection from the configuration window.

<u>Line Build Out</u>: Reflects the user selection from the configuration window.

<u>Traffic Type</u>: Indicates the type of traffic received.

<u>TC State</u>: Indicates whether Trunk Conditioning is being applied.

<u>TC Data Code</u>: Reflects the user selection from the configuration window.

<u>TC Signaling</u>: Reflects the user selection from the configuration window.

<u>Maj Alarm Action</u>: Indicates whether alarm action is set to “No Action” or “Trunk Condition.”

<u>CGA Status</u>: Presence or absence of a Carrier Group Alarm.

<u>ALM Status</u>: Presence or absence of alarms.

<u>% Err Sec Thres</u>: User selectable from the configuration screen; indicates the Bit Error Rate alarm threshold.

% Errored Secs: Indicates the percentage of seconds that the BER exceeds the alarm threshold.

OOF Count: Number of instances when there is no valid T1 framing.

Slip Count: Number of instances when the framing has slipped.

Sig Freeze Cnt: Number of instances of signal freeze.

1's Density Cnt: Number of instances when "1" appears in less than three bits out of twenty-four.

Eight 0's Cnt: Number of instances when eight "0's" appear (only valid when B8ZS coding selected).

B8ZS Sig Cnt: Number of instances B8ZS signal received when B8ZS coding is NOT selected.

The remaining entries are the same as previously defined.

Selecting the **<CELL STATS>** button provides statistics for this module as shown in Figure 4-48.

Name: Hyattsburg Slot: 14 Intf: A Type: Structured T1

Ch	Conn	TxC	RxC	Ch	Conn	TxC	RxC	Ch	Conn	TxC	RxC
1	D1	4659	4658	2	D1	0	0	3	D2	4658	4658
4	D2	0	0	5	I	0	0	6	I	0	0
7	I	0	0	8	I	0	0	9	I	0	0
10	I	0	0	11	I	0	0	12	I	0	0
13	I	0	0	14	I	0	0	15	I	0	0
16	I	0	0	17	I	0	0	18	I	0	0
19	I	0	0	20	I	0	0	21	I	0	0
22	I	0	0	23	I	0	0	24	I	0	0

REFRESH CLEAR

16:28 | View: Intf: STL-CELL | | ********** | ESC-ESC = Previous

Figure 4-48. Interface Statistics Window – Structured T1

For each configured Channel, a connection identifier and the number of cells transmitted and received is displayed under the corresponding headings.

Dual Synchronous Legacy Interface Module (DSL)

To view the statistics for the Dual Synchronous Legacy Interface Module (DSL), select **Module Status** from the **View** menu. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38).

Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-49. This screen contains information that is tailored to the interface.

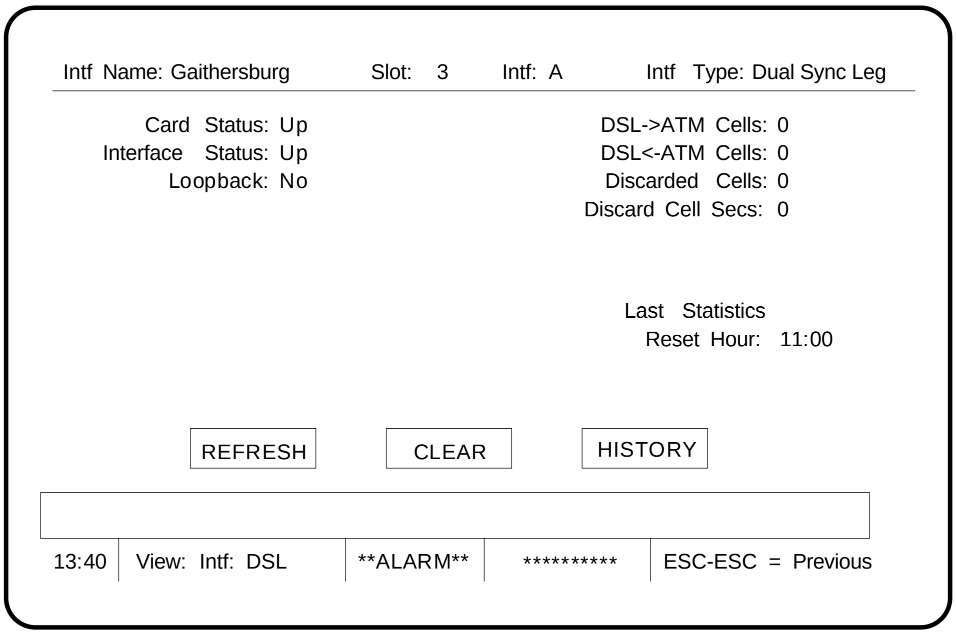


Figure 4-49. Specific Interface Window—Dual Sync Leg

The entries for this window are the same as previously described.

Selecting the **<HISTORY>** button provides statistics for this module similar to those shown in Figure 4-40.

High-Speed Synchronous Legacy Interface Module (HSL)

To view the statistics for the High-Speed Synchronous Legacy Interface Module (HSL), select **Module Status** from the **View** menu. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38).

Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-50. This screen contains information that is tailored to the interface.

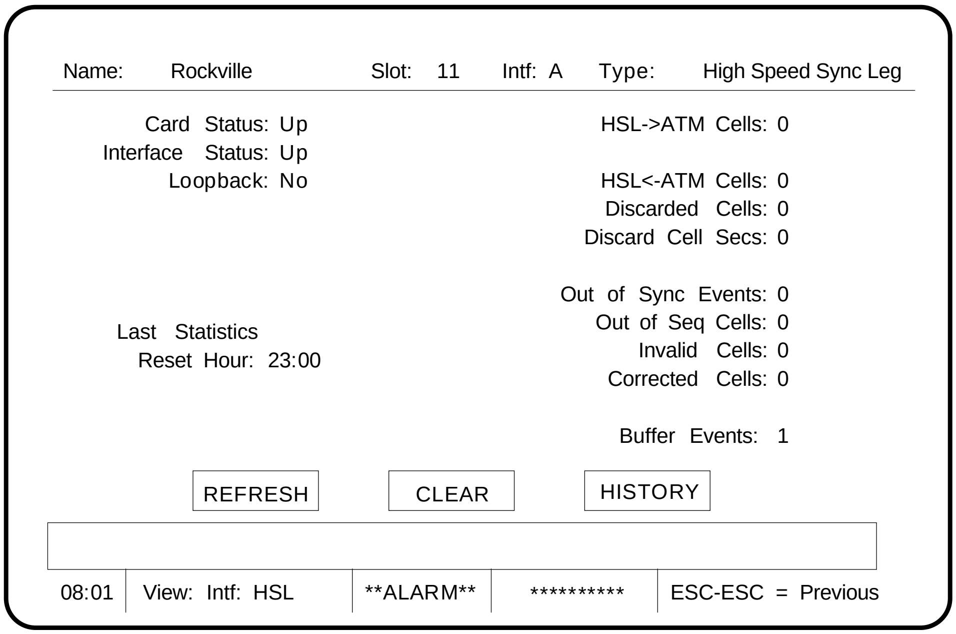


Figure 4-50. Specific Interface Window—High-Speed Sync Leg

Out of Sync Events: Number of instances when invalid cells were received.

Out of Seq Cells: Number of cells received where the internal sequence was out of order.

Invalid Cells: Number of cells received containing uncorrectable errors.

Corrected Cells: Number of errored cells that were corrected.

Buffer Events: Number of instances of buffer overrun/underrun.

The remaining entries are as previously described.

Selecting the **<HISTORY>** button provides statistics for this module similar to those shown in Figure 4-40.

High-Speed Serial Interface Legacy Module (HSSL)

To view the statistics for the High-Speed Serial Interface Legacy Module (HSSI Interface) (HSSL), select **Module Status** from the **View** menu. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38).

Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-51. This screen contains information that is tailored to the interface.

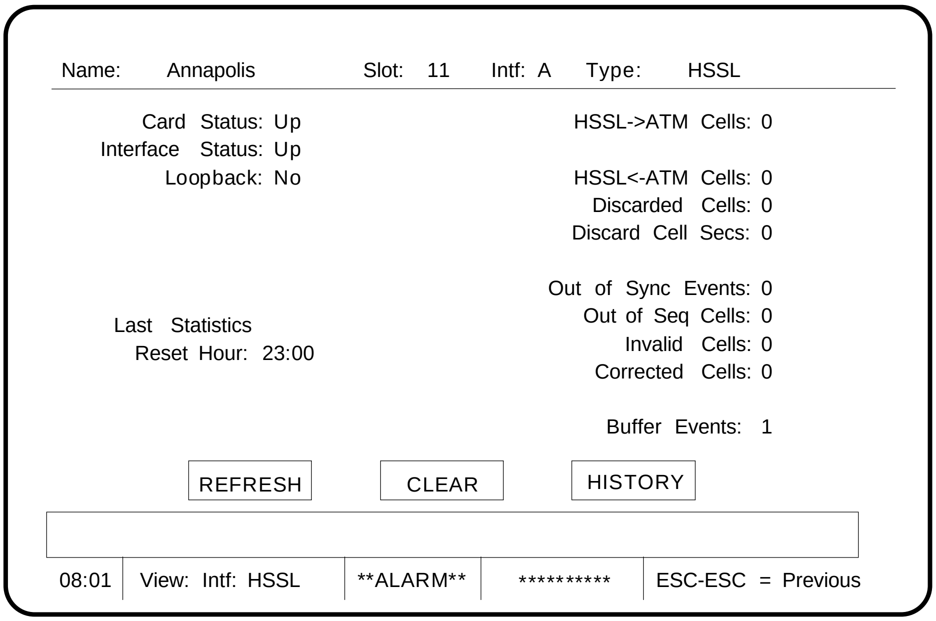


Figure 4-51. Specific Interface Window—High-Speed Serial Interface Legacy (HSSL)

The entries for this window are the same as the HSL.

Selecting the **<HISTORY>** button provides statistics for this module similar to those shown in Figure 4-40.

Hub Router Interface Module (HRIM)

To view the statistics for the Hub Router Interface Module (HRIM), select **Module Status** from the **View** menu. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38).

Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-52. This screen contains information that is tailored to the interface.

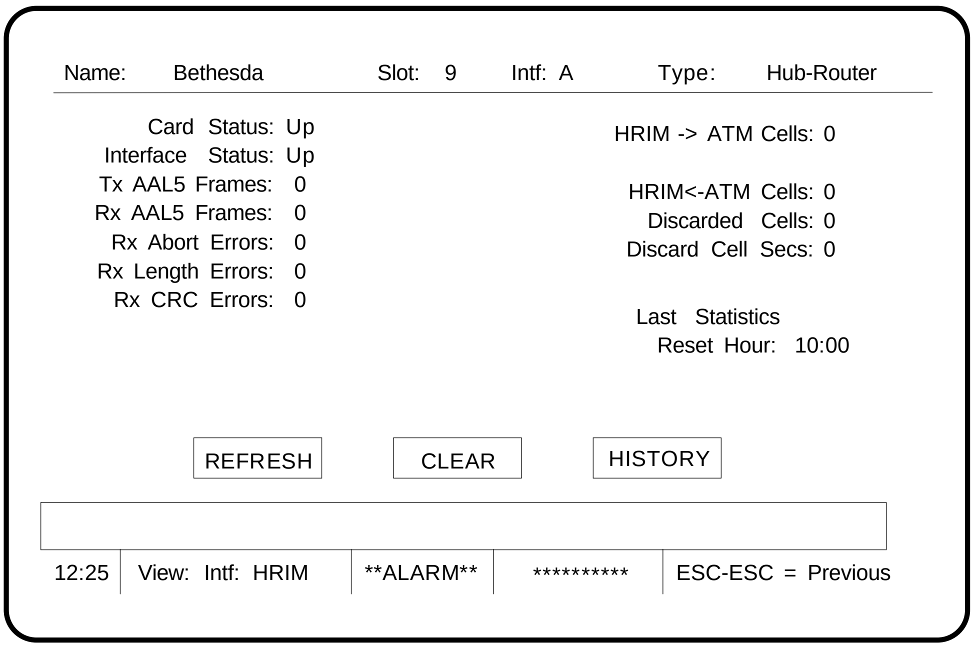


Figure 4-52. Specific Interface Window—HRIM

Tx AAL5 Frames: Number of AAL5 frames transmitted.

Tx AAL5 Frames: Number of AAL5 frames received.

Rx Abort Errors: Number of aborted frames received.

Rx Length Errors: Number of times there is a mismatch between the declared packet length and the actual packet length received.

Rx CRC Errors: Number of instances when the Cyclic Redundancy Check does not match.

The remaining entries are as previously described.

Selecting the **<HISTORY>** button provides statistics for this module similar to those shown in Figure 4-40.

Low Speed Asynchronous Legacy Interface Module (LSAL)

To view the statistics for the Low Speed Asynchronous Legacy Interface Module (LSAL), select **Module Status** from the **View** menu. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38).

Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-53. This screen contains information that is tailored to the interface.

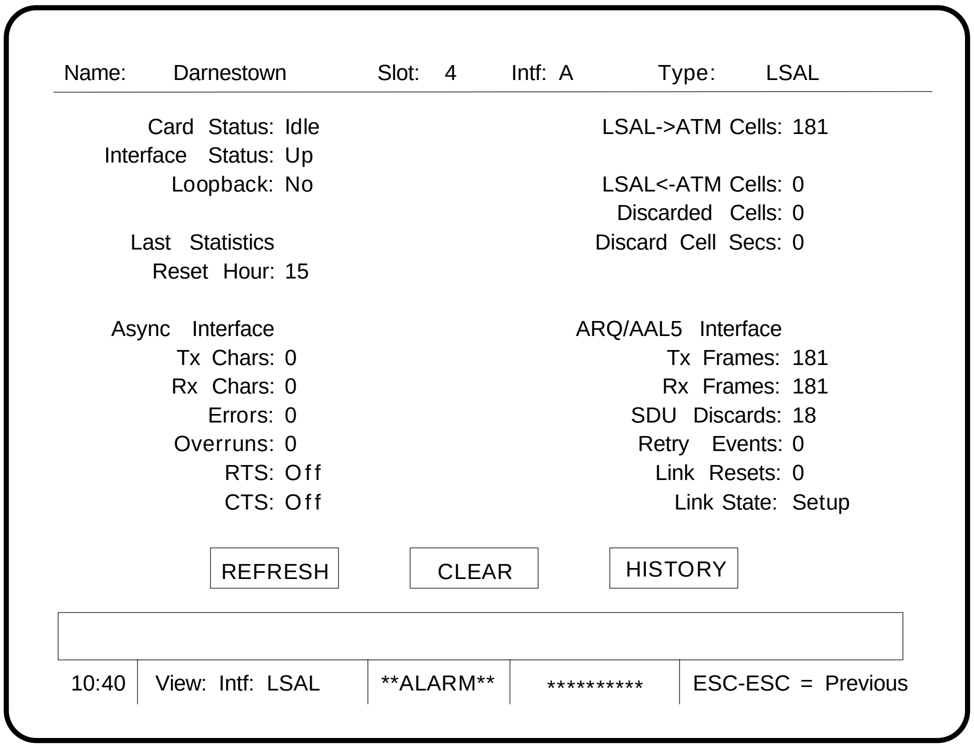


Figure 4-53. Specific Interface Window—LSAL

Tx Chars: Number of asynchronous characters transmitted.

Rx Chars: Number of asynchronous characters received.

Errors: Number of errors detected.

Overruns: Number of buffer overruns.

RTS: Status of control signaling.

CTS: Status of control signaling.

Tx Frames: Number of AAL5 frames transmitted.

Rx Frames: Number of AAL5 frames received.

SDU Discards: Number of SDU discards due to buffer overrun.

Retry Events: Number of attempts to retransmit SDU.

Link Resets: Number of times the ARQ link is reinitialized.

Link State: Indicates the current state of the ARQ link. “Setup” indicates the link is initializing. “Open” indicates the link is established. “Retry” indicates the link is reinitializing. “Closed” indicates ARQ is off.

The remaining entries are the same as previously described.

Selecting the **<HISTORY>** button provides statistics for this module similar to those shown in Figure 4-40.

Unstructured T1 Legacy Interface Module (UTL)

To view the statistics for the Unstructured T1 Legacy Interface Module (UTL), select **Module Status** from the **View** menu. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38).

Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-54. This screen contains information that is tailored to the interface.

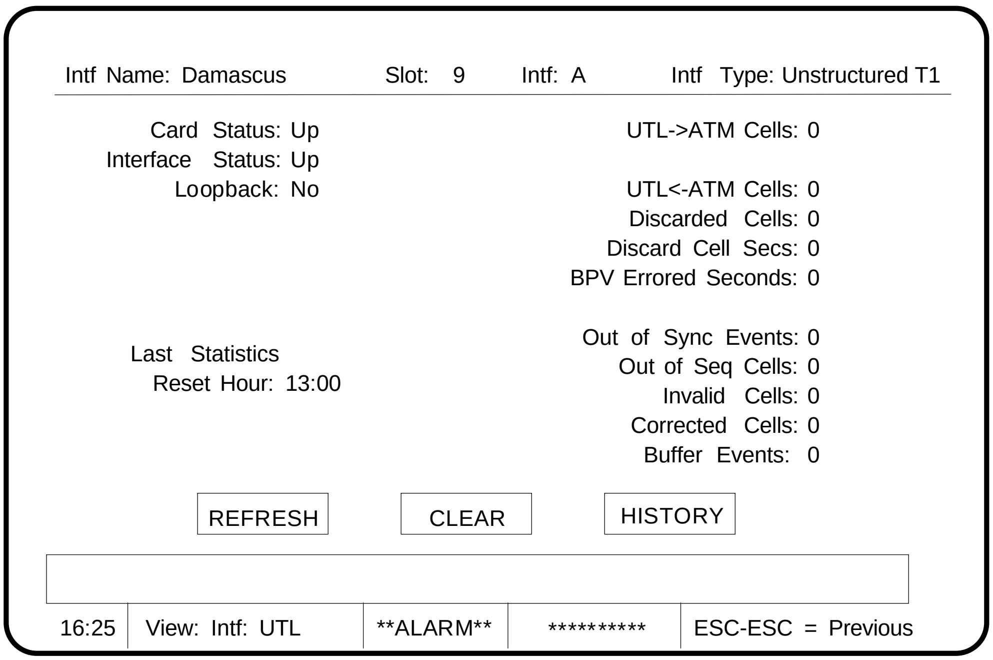


Figure 4-54. Specific Interface Window—UTL

<u>BPV Errored Seconds</u>: Number of seconds when a Bi-Polar Violation occurred.

The remaining entries are the same as previously described.

Selecting the **<HISTORY>** button provides statistics for this module similar to those shown in Figure 4-40.

Unstructured E1 Legacy Interface Module (UEL)

To view the statistics for the Unstructured E1 Legacy Interface Module (UEL), select **Module Status** from the **View** menu. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38).

Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-55. This screen contains information that is tailored to the interface.

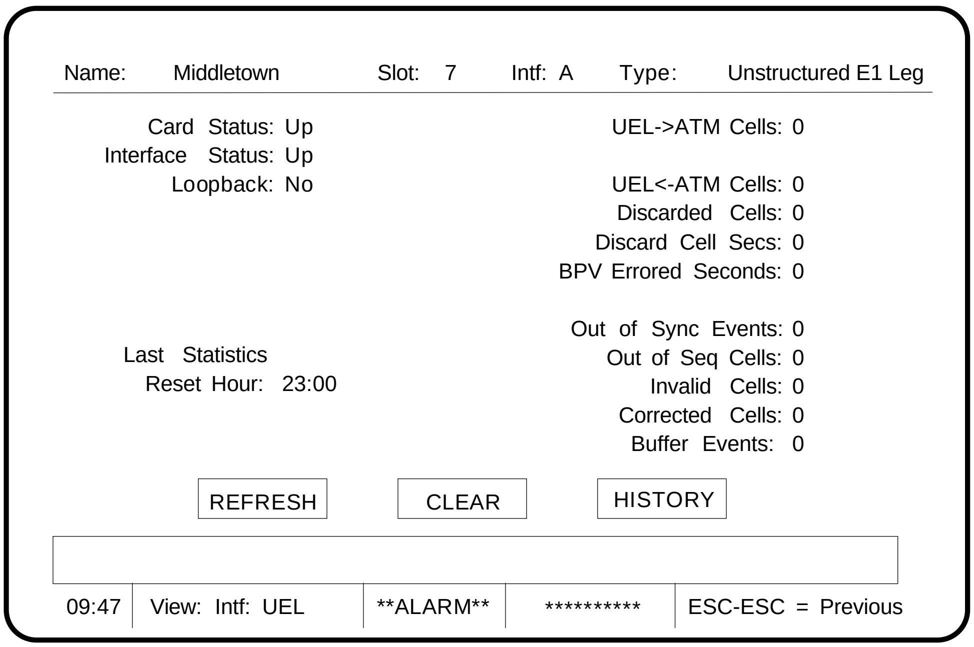


Figure 4-55. Specific Interface Window—UEL

Entries in this window are the same as the UTL.

Selecting the **<HISTORY>** button provides statistics for this module similar to those shown in Figure 4-40.

Unstructured DS3/T3 Legacy Interface Module (UD3L)

To view the statistics for the Unstructured DS3/T3 Legacy Interface Module (UD3L), select **Module Status** from the **View** menu. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38).

Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-56.

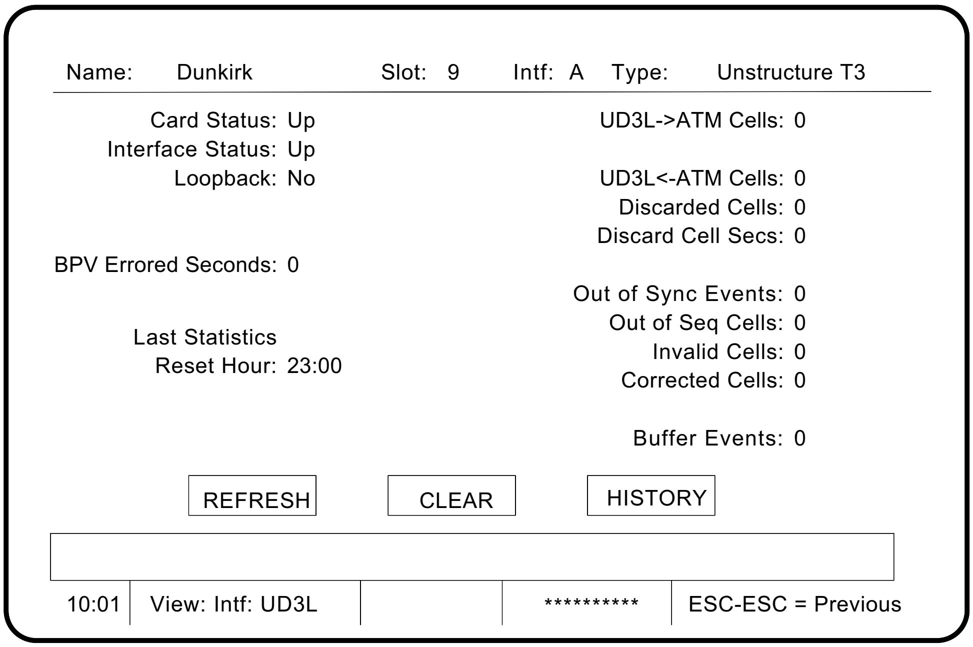


Figure 4-56. Specific Interface Window—UD3L

The entries for this window are the same as previously described.

Selecting the **<HISTORY>** button provides statistics for this module similar to those shown in Figure 4-40.

Unstructured E3 Legacy Interface Module (UE3L)

To view the statistics for the Unstructured E3 Legacy Interface Module (UE3L), select **Module Status** from the **View** menu. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38).

Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-57.

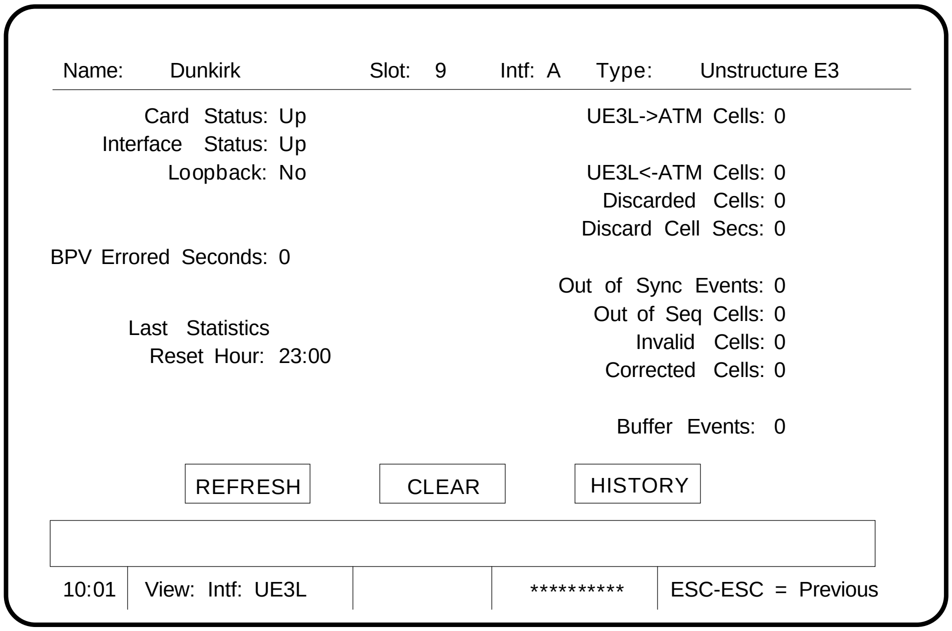


Figure 4-57. Specific Interface Window—UE3L

These entries are the same as the UD3L.

Selecting the **<HISTORY>** button provides statistics for this module similar to those shown in Figure 4-40.

Basic Interface Module (BIM)

To view the statistics for the Basic Interface Module (BIM), select **Module Status** from the **View** menu. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38).

Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-58.

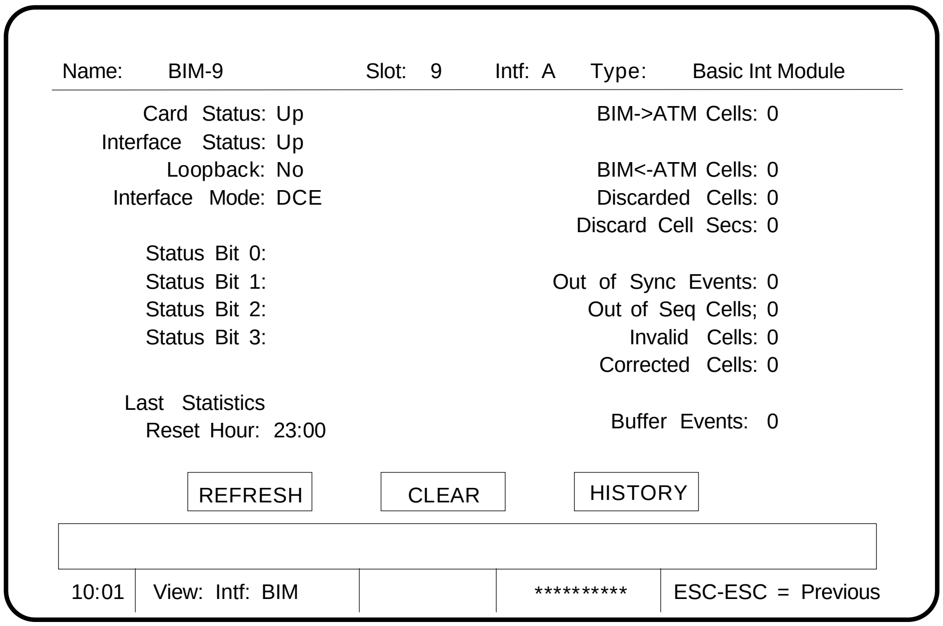


Figure 4-58. Specific Interface Window—BIM

Interface Mode: Reflects the configuration of the daughter card (DCE/DTE).

Status Bit 0-3: Reports signals from the daughter card.

All other entries are the same as previously described.

Selecting the **<HISTORY>** button provides statistics for this module similar to those shown in Figure 4-40.

4-wire Analog Interface Module (EML)

To view the statistics for the 4-wire Analog Interface Module (EML), select **Module Status** from the **View** menu. More information can be obtained for a particular module by highlighting the module and pressing **<F2>**. This will bring up the logical interface screen for this module (similar to Figure 4-38). Additional information for each logical interface can be obtained by highlighting the interface and pressing **<F2>**, which will bring up the screen shown in Figure 4-59.

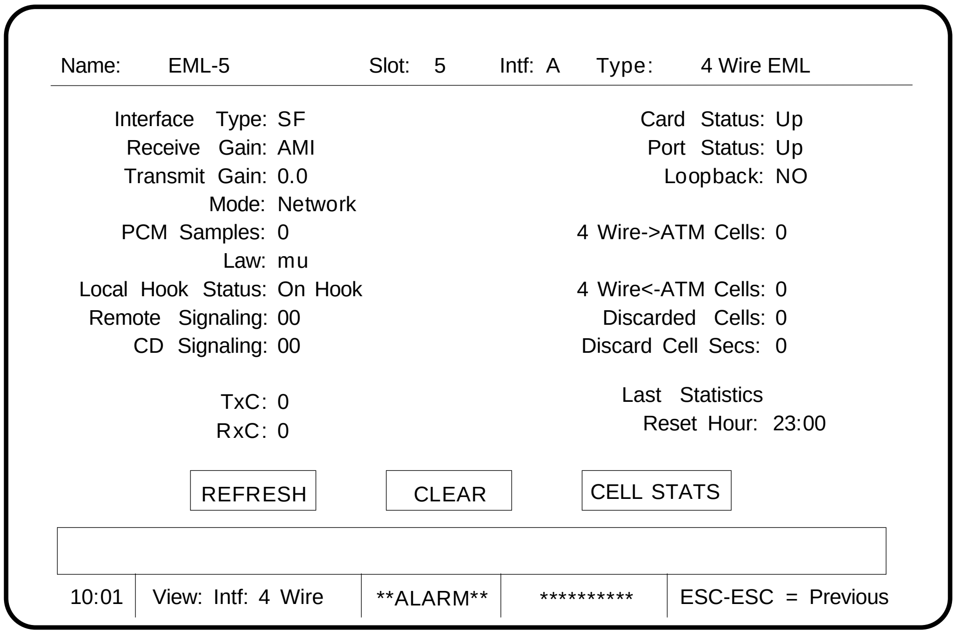


Figure 4-59. Specific Interface Window—4-Wire EML

Interface Type: Reflects user selection from the configuration window.

Receive Gain: Reflects user selection from the configuration window.

Transmit Gain: Reflects user selection from the configuration window.

Mode: Reflects user selection from the configuration window.

PCM Samples: Number of samples of Pulse Code Modulation in each ATM cell.

Law: Reflects user selection from the configuration window.

Local Hook Status: Reflects status of the local circuit.

Remote Signaling: Indicates the signaling from the far end (00, 01, 10, 11).

CD Signaling: Indicates far end ABCD signaling state.

TxC: Number of cells transmitted.

RxC: Number of cells received.

All other entries are the same as previously described.

Selecting the **<CELL STATS>** button provides statistics for this module similar to those shown in Figure 4-48.

Configuration

The configuration parameters for the Cell Exchange systems are stored on each module in battery-backed memory. This means that the configuration will remain unchanged even if power is removed from the unit. When power is restored, all configuration parameters previously set still reside in memory and the system will return to that configuration.

Initial configuration is normally accomplished in four steps:

1. Set location name.
2. Configure physical interfaces.
3. Select system timing source.
4. Configure connections.

These steps are further explained in the following paragraphs.

Setting Location Name

To set the location name, select the appropriate command from the **Configure** menu, Figure 5-1.

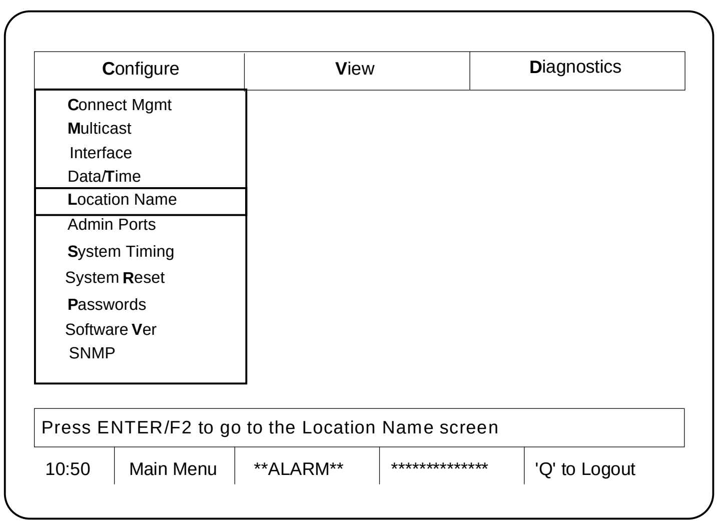


Figure 5-1. Configure Menu – Location Name

This action will bring up the screen shown in Figure 5-2.

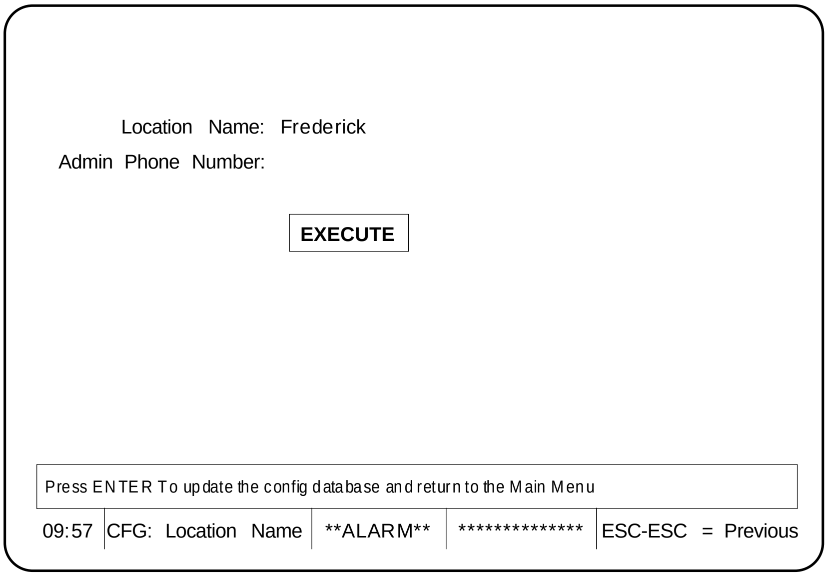


Figure 5-2. Location Name Screen

Using the **<TAB>** or **<ARROW>** keys, move to the Location Name field and enter the location. If desired, move to the Admin Phone Number field and enter the phone number of the point of contact for that location. When done, move to the **<EXECUTE>** button and press **<ENTER>** to save the entries and return to the main menu.

Configuring Physical Interfaces

To configure the interfaces for the Cell Exchange system, select the **Interface** command from the **Configure** menu, Figure 5-3.

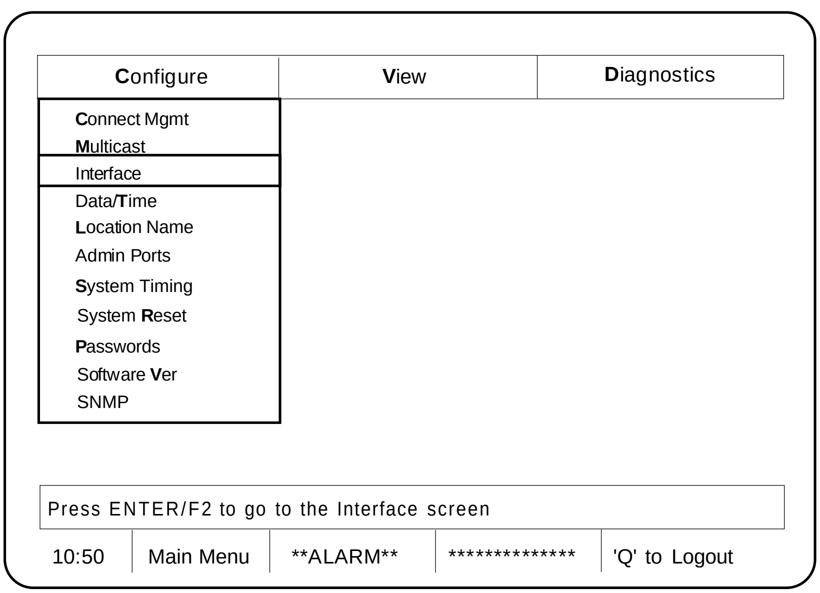


Figure 5-3. Configure Menu – Interface

This will bring up the screen shown in Figure 5-4.

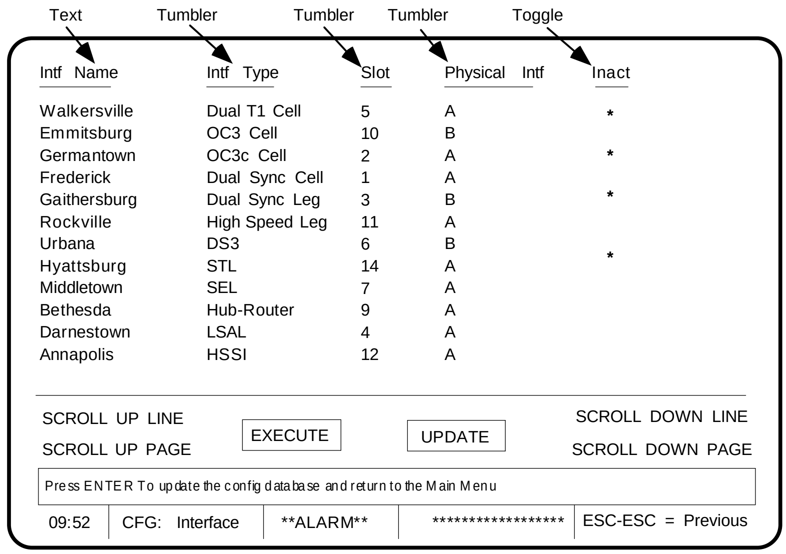


Figure 5-4. Interface Menu

A tumbler field contains three or more possible selections. A toggle field is normally an "on/off" field, providing a choice between two alternative selections. In both kinds of fields, the **<SPACE>** bar allows movement through the available choices.

For initial configuration, this screen will be blank; each interface will need to be entered. See Figure 5-5.

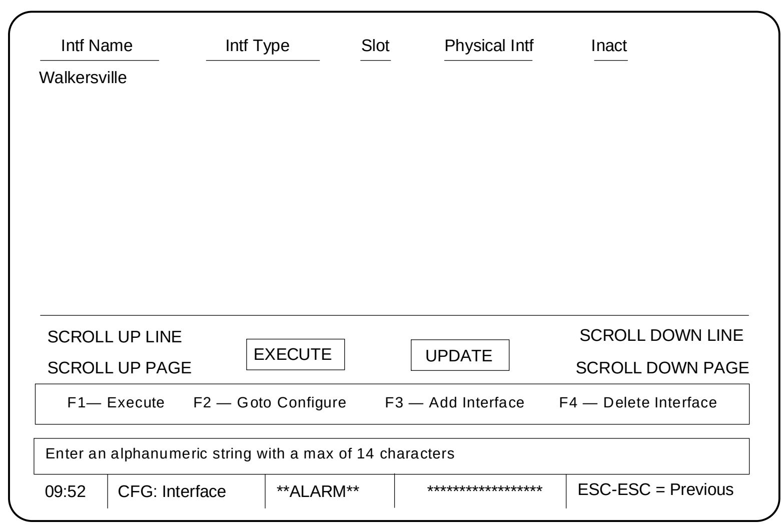


Figure 5-5. Entering Interface Information

NOTE: *For all menus, selecting the* ***<UPDATE>*** *button and pressing* ***<ENTER>*** *will update the active configuration and remain in the submenu. Selecting* ***<EXECUTE>*** *and pressing* ***<ENTER>*** *will update the configuration information and return to the main menu.*

To configure a specific interface, perform the following:

1. Using the up <**ARROW**> key, move the cursor to the Intf Name field, press **<F3>** to add an interface, and enter the name of the interface. The interface name can be up to 14 characters in length and is used as the interface reference name throughout the management system.

2. **Tab** to the Intf Type field and select the type of interface module installed. This is a tumbler field; pressing the **<SPACE>** bar will move through the choices available.

3. **Tab** to the Slot field and select the physical slot in which the module is installed. This is a tumbler field; pressing the **<SPACE>** bar will move through the slot numbers sequentially.

4. **Tab** to the Physical Intf field and, using the **<SPACE>** bar, toggle to the interface port for this connection.

5. **Tab** to the Inact field and, using the **<SPACE>** bar, toggle to select active or inactive status for this interface. Active status is blank, inactive status is marked with an asterisk (*).

6. Press **<F1>** to enter the interface information. After a short delay, the OPNL LED on the front of the affected module should illuminate, indicating that the module has successfully received configuration information from the CPU and has booted up.

NOTE: If configuring from a remote location, check the alarm log to ensure that the module has been configured successfully and is online.

7. Enter as many interfaces as needed by using the **<F3>** key to add interfaces.

8. To enter configuration details for the interface, press **<F2>**. This will bring up the screen shown in Figure 5-6.

NOTE: *The information required on each screen will differ depending upon the type of interface module selected.*

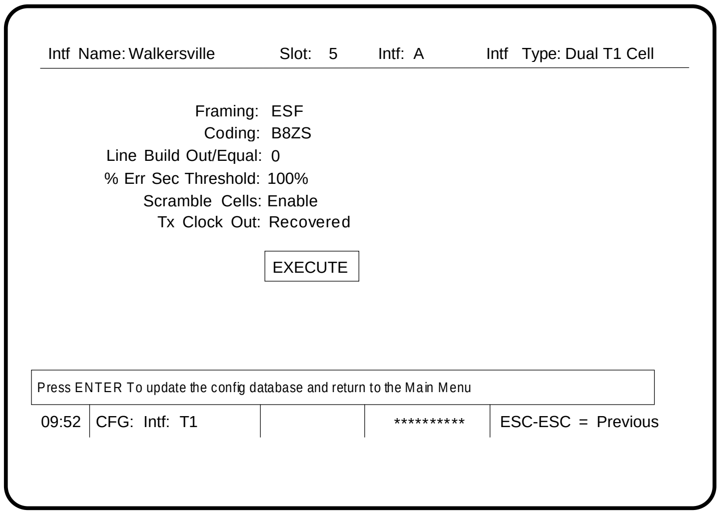


Figure 5-6. Detailed Interface Configuration (Dual T1 Cell Interface)

9. Enter appropriate information. (This screen shows the information required for a T1 cell interface).

   a. Using the **<TAB>** or **<ARROW>** key, move to the **Framing** field. This is a tumbler field; press the **<SPACE>** bar to move through the available choices.

   b. Using the **<TAB>** or **<ARROW>** key, move to the **Coding** field. This is also a tumbler field; press the **<SPACE>** bar to move through the selections.

   c. Using the **<TAB>** or **<ARROW>** key, move to the **Line Build Out/Equal** field, and toggle through the available choices.

   d. Using the **<TAB>** or **<ARROW>** key, move to the **% Err Sec Threshold** field and select the appropriate percentage. This is a tumbler field. When an error rate in excess of the threshold occurs, it is considered a "Major Alarm."

   e. Using the **<TAB>** or **<ARROW>** key, move to the **Scramble Cells** field and select the ATM cell scrambler. This is a two-position toggle field: Enable or Disable.

   f. Using the **<TAB>** or **<ARROW>** key, move to the **Tx Clock Out** field. This is a tumbler field, press the **<SPACE>** bar to move through the selections.

   g. To enter all the selected parameters on the screen, move to the **<EXECUTE>** block and press **<ENTER >**. This will enter the parameters in the database and return to the Main Menu.

10. To delete an interface (Figure 5-5), move the cursor to the appropriate line and press **<F4>**. Deleting an interface will delete the interface parameter settings. VPI/VCI connection settings associated with the deleted interfaces will also be deleted.

11. When all entries are complete, move to the **<UPDATE>** button and press **<ENTER>** to update the active configuration information, or use the **<EXECUTE>** button to update and return to the Main Menu. Changes take effect immediately upon execution.

Transmit Clock Configuration

For most modules, one of the possible transmit clock sources must be selected in the interface configuration menu:

- Recovered
- Internal
- Ref Clock
- On Board

Recovered means the transmit clock is derived from the received signal.

Internal means the transmit clock is supplied by the main CPU board.

Ref Clock means the transmit clock is supplied by the currently configured reference clock source, see "Setting System Timing."

On Board means the transmit clock is supplied by the module's on board clock source.

Setting System Timing

To select the timing reference for the Cell Exchange systems, select the **System Timing** command from the Main Menu. This will bring up the screen shown in Figure 5-7.

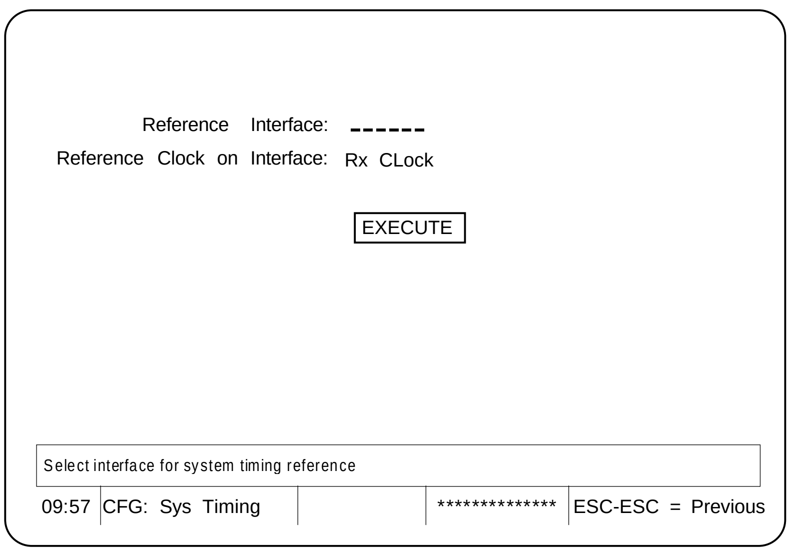


Figure 5-7. System Timing Window

1. Move the cursor to the **Reference Interface** field. This is a tumbler field. Pressing the **<SPACE>** bar will move between the available selections.

NOTE: The entry "--------" indicates that the REFERENCE OUT is by the CPU and is the same as INTERNAL.

2. Tab to **Reference Clock on Interface** field. This is also a tumbler field. Pressing the **<SPACE>** bar will move between selections (Rx Clock, TX Clock).
3. When done, tab or arrow to the **<EXECUTE>** button and press **<ENTER>** to save and execute the system timing references.

Network Clocking

When configuring the Cell Exchange to handle synchronous legacy traffic special attention needs to be paid to timing. The OC3, E3C and DS3 modules ***cannot*** accept timing from the system timing on the node. As a result, the Cell Exchange cannot propagate timing across the network. This will limit some of the applications for which the product can be configured.

NOTE: *The OC3C module* can *accept system timing.*

NOTE: *The way the Cell Exchange handles timing must be understood before designing a network. Please refer to the timing section in Chapter 1 for the full clocking descriptions.*

Synchrony ST-1000 and LINK/2 may be connected through the CX using the UTEL module. The UTEL module allows timing to propagate from one end of the network to the other, keeping the *Synchrony ST-1000* and LINK/2 in synchronization.

Configuring Interface Connections

The final step in the configuration process is to set up the connections for each interface. Select the **Connect Mgmt** command from the **Configure** menu. This will bring up the screen shown in Figure 5-8.

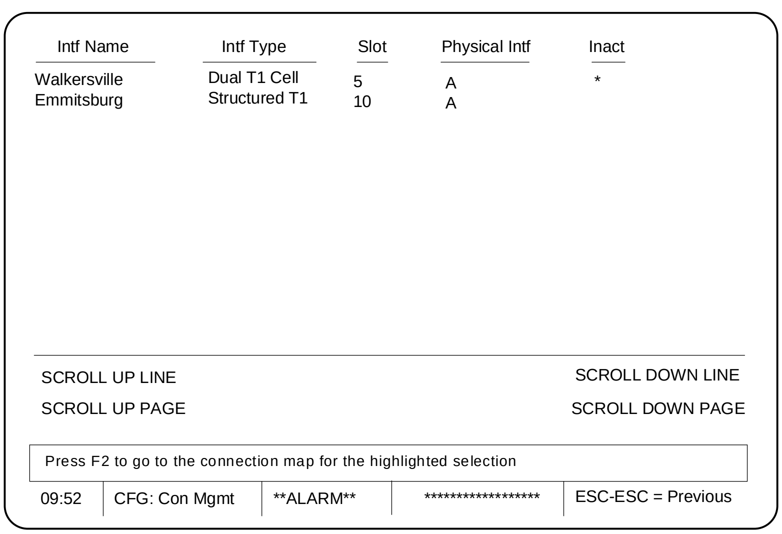


Figure 5-8. Connection Management Window

To configure the connections, move the cursor to highlight one of the interfaces. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface (Figure 5-9).

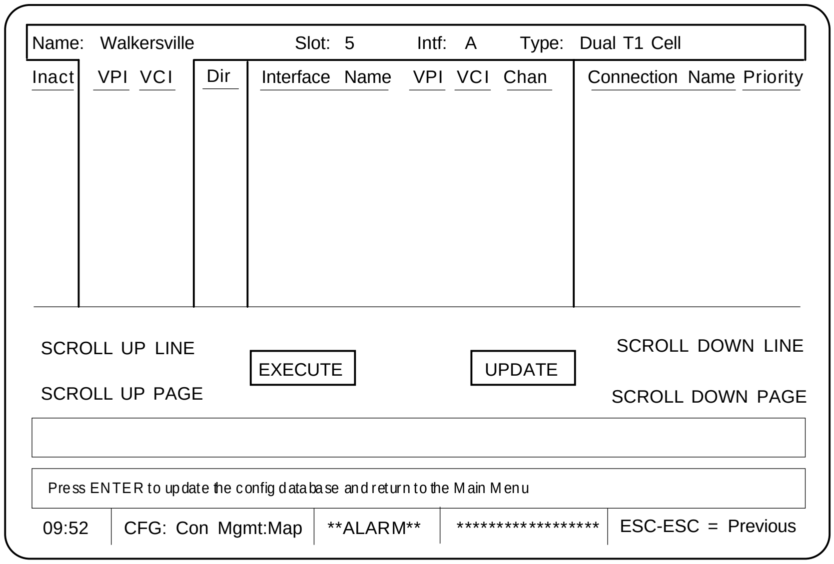


Figure 5-9. Configuration Management Mapping Menu

This screen shows the connection mapping for the selected interface (Dual T1 Cell Interface). Moving the cursor to the affected line enters connection data for each interface.

1. Position cursor in the **Inact** field. This is a toggle field, press the **<SPACE>** bar to toggle between active (blank) or inactive (*) modes.
2. **Tab** to the **VPI** field for the input interface and enter the appropriate value. VPI values are in the range 0-255.
3. **Tab** to the **VCI** field and enter a value. If the VPI value is 0-39, the VCI may be 0-255, or the special character "*" indicating a VPI only translation. In the latter case, the VCI is passed through unchanged. If the VPI value is greater than 39, the VCI passes the VPI without translation.
4. **Tab** to the **Direction** field and select the connection's traffic direction. This is a tumbler field, press the **<SPACE>** bar to move between the three possible directions: to, from, or bi-directional.
5. **Tab** to the **Interface Name** field and select the connection's interface. This is a tumbler field, press the **<SPACE>** bar to move through the available entries.
6. **Tab** to the **VPI** field for the output interface and enter the VPI then to the **VCI** field and enter the VCI in the same manner as described in paragraph 3.
7. **Tab** to the **Connection Name** field. A unique connection name of up to 14 characters may be entered if desired.
8. **Tab** to the **Priority** field and select the queuing priority for the destination interface. This is a tumbler field, pressing the **<SPACE>** bar will move between the selections: high, medium, or low priority for each VPI/VCI. The queuing priority setting may be used to minimize cell delay variation of CBR traffic, or to prioritize traffic on "over subscribed" circuits.

   As traffic enters the Cell Exchange, each cell is assigned a priority based on the setting selected for the VPI/VCI. Any type traffic (CBR, VBR, or ABR) may be assigned any priority. Although normally CBR traffic would be assigned high priority, other types of traffic could be set to higher priority and CBR to lower, as desired. As traffic exits the CELL EXCHANGE, it does so via the assigned priority queue for that traffic. Queuing takes place on the output port.

9. When done, press **<F1>** to update the configuration. Configuration changes take place immediately upon execution.
10. Press **<F3>** to add more connections or **<F4>** to delete.
11. When done with all connections for this interface, highlight the **<EXECUTE>** button and press **<ENTER>** to update the configuration database and return to the Main Menu, or highlight the **<UPDATE>** button and press **<ENTER>** to update the database and remain in this screen.

*NOTE 1: Pressing the escape key twice (**<ESC><ESC>**) will exit the screen without saving any changes. The configuration will revert to the data last saved through **<EXECUTE>** or **<UPDATE>**.*

NOTE 2: Traffic originating on a structured legacy port type should terminate on another structured legacy port. The same holds true for unstructured legacy ports; they should terminate on another unstructured legacy port. The only exception is that a single structured DS0 may be terminated on an unstructured legacy port provided that the structured legacy port is configured in "basic" mode.

Station Clock Module (SCM)

Configuring Interfaces

To configure a new SCM interface, follow the steps described in “Configuring Physical Interfaces” to enter the name, the interface type (Station Clock Module), the slot, and the physical interface. Press **<F2>** to enter the interface configuration menu. Figure 5-10 shows the configuration menu.

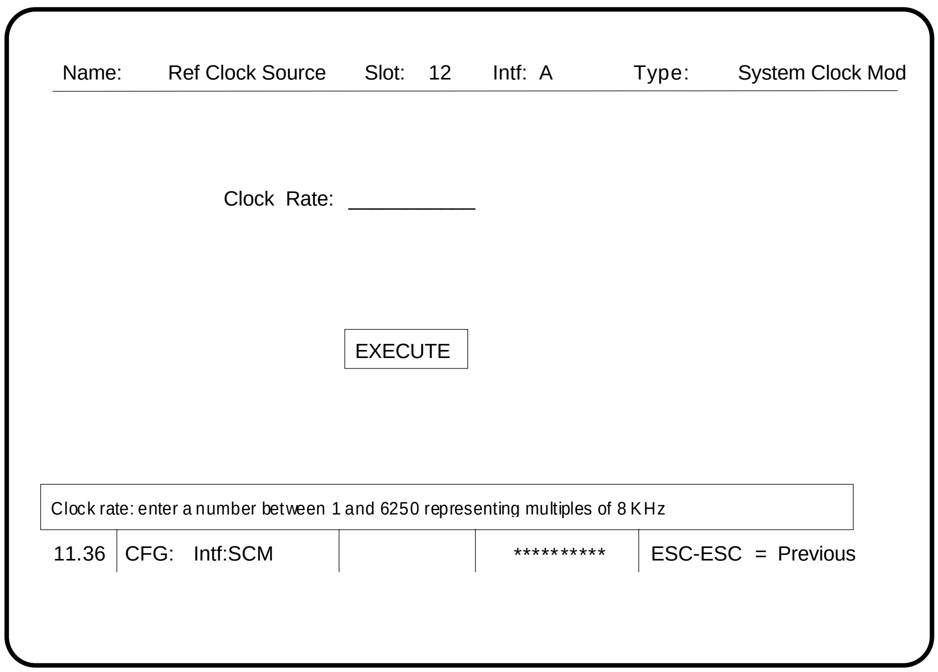


Figure 5-10. Interface Configuration Window—Station Clock Module

To configure the Station Clock Module:

1. Enter the desired clock rate in the **Clock Rate** field. This will be a number between 1 and 6250 representing a multiple of 8 kHz.

2. Using the Up/Down arrows, move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu.

Dual T1 Cell Interface Module (T1C)

Configuring Interfaces

To configure a new T1 interface, follow the steps described in "Configuring Physical Interfaces" to enter the name, the interface type (Dual T1 Cell), the slot, the physical interface and the active status. Press **<F2>** to enter the interface configuration menu. Figure 5-11 shows the configuration menu with all fields set to the default values.

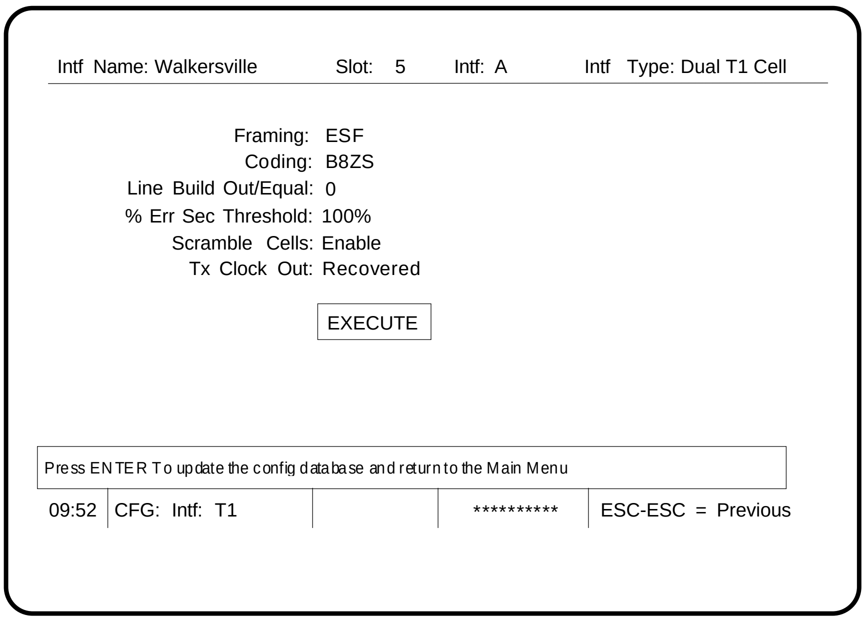


Figure 5-11. Interface Configuration Window – Dual T1 Cell

The arrow keys are used to move between the different fields. Beginning from the Framing field, the down arrow key can be used to move the cursor through each field in the following order (the space bar is used to move through the possible selections, which are given below in parentheses starting with the default):

- Framing (ESF, SF)
- Coding (B8ZS, AMI)
- Line Build Out/Equal (0, -7.5, -15.0, -22.5, 133-266, 266-399, 399-533, 533-655)

NOTE: Selecting a dB value (-7.5, -15.0, -22.5) configures the interface for CSU; selecting a distance value configures the interface for DSX-1. The "0" value may represent either dB or distance. When representing distance, it means 0-133 feet.

- % Err Sec Threshold (100%, 10%, 25%, 50%, 75%)
- Scramble Cells (Enable, Disable)
- Tx Clock Out (Recovered, Ref Clock, Internal, On Board)

When done, move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu.

Configuring Connections

T1C connections are configured via the Connection Management menus. Figure 5-12 shows the connection management window.

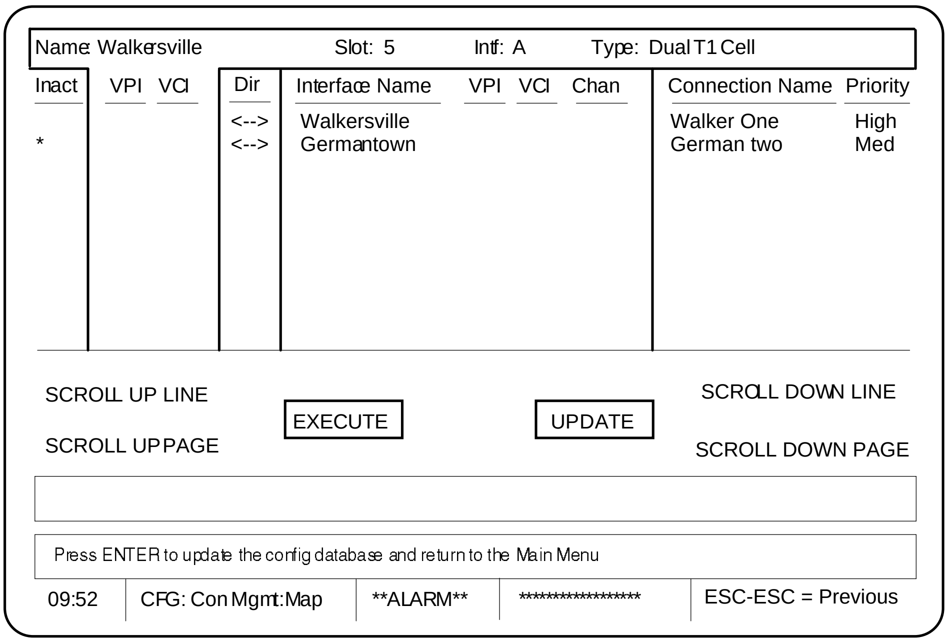


Figure 5-12. Connection Management Window

Configuring connections to and from T1 interfaces is very similar to configuring other connections (see "Configuring Interface Connections").

1. Select the **Connect Mgmt** command from the **Configure** menu.

2. To configure the connections, move the cursor to highlight one of the interfaces.

3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.

4. Use the Up/Down arrow key to move to the **Inact** field.

5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in "Configuring Interface Connections" to add new connections.

6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

OC3/OC3C Cell Interface Module (OC3/OC3C)

Configuring Interfaces

To configure a new interface, follow the steps described in “Configuring Physical Interfaces.” Enter the name, the interface type, the slot, the physical interface and the active status. Press **<F2>** to enter the configuration menu. The same window is used to configure the OC3 and OC3C interface modules. Figure 5-13 shows the OC3/OC3C Cell configuration menu with all fields set to the default values.

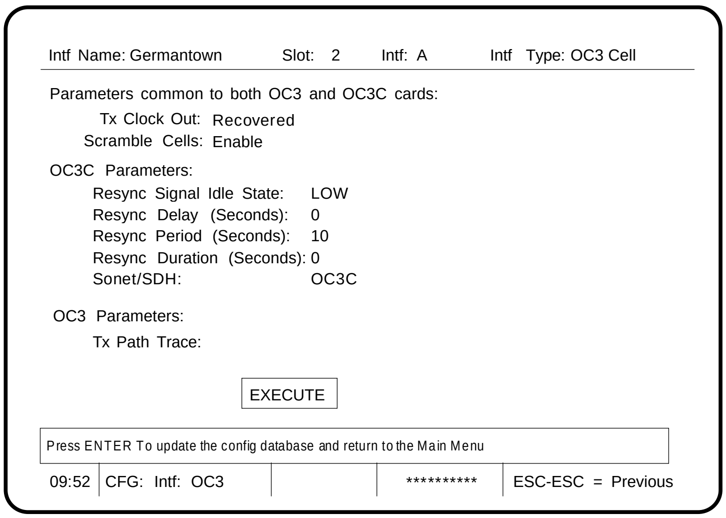


Figure 5-13. Interface Configuration Window – OC3 Cell

To configure this interface, position the cursor on the **Tx Clock Out** field by using the up and down arrow keys. Then configure the interface for the desired clock, using the space bar to move through the selections. The arrow keys are used to move between the different fields. Beginning with the TX Clock Out field, the down arrow key can be used to move the cursor through each field in the following order:

Parameters common to both OC3 and OC3C cards:

- Tx Clock Out (Recovered, Ref Clock [OC3C only], Internal [OC3C only], On Board)
- Scramble Cells (Enable, Disable)

OC3C Parameters:

- Sonet/SDH (OC3C, STM1)

NOTE: The following parameters are currently not available to the user.

- Resync Signal Idle State (LOW, HIGH). The “Resync” parameters control the operation of a resynchronization signal to a crypto device.
- Resync Delay (Seconds) (edit field)
- Resync Period (Seconds) (edit field)

- Resync Duration (Seconds) (edit field)

OC3 Parameters:

- Tx Path Trace (Text string of up to 15 characters placed in the transmit path and used for checking connectivity)

When done, move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu.

Configuring Connections

Connections are configured via the Connection Management menus. Figure 5-14 shows the connection management mapping window.

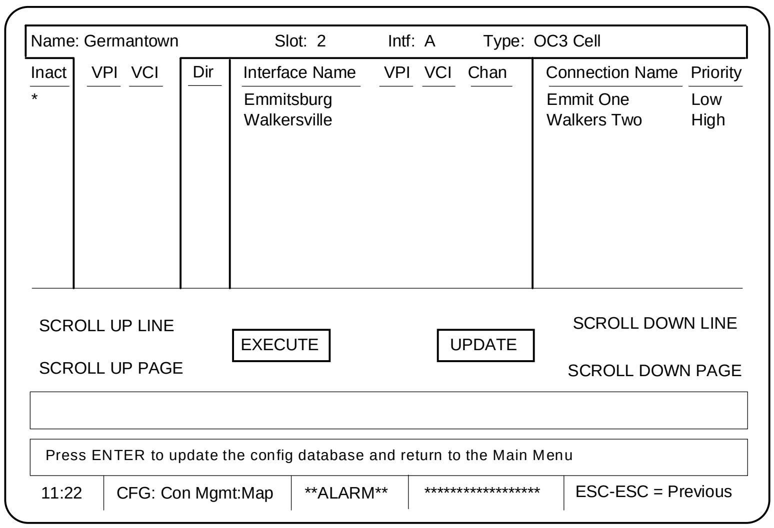


Figure 5-14. Configuration Management Mapping Window – OC3 Cell

Configuring connections to and from OC3/OC3C interfaces is very similar to configuring other connections (see “Configuring Interface Connections”).

1. Select the **Connect Mgmt** command from the **Configure** menu.

2. To configure the connections, move the cursor to highlight one of the interfaces.

3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.

4. Use the Up/Down arrow key to move to the **Inact** field.

5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in “Configuring Interface Connections” to add new connections.

6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

Dual Synchronous Cell Interface Module (DSC)

Configuring Interfaces

To configure a new interface, follow the steps described in “Configuring Physical Interfaces.” Enter the name, the interface type (Dual Sync Cell), the slot, the physical interface (A or B) and the active status. Press **<F2>** to enter the configuration menu. Figure 5-15 shows the Synchronous Cell configuration menu with all fields set to the default values.

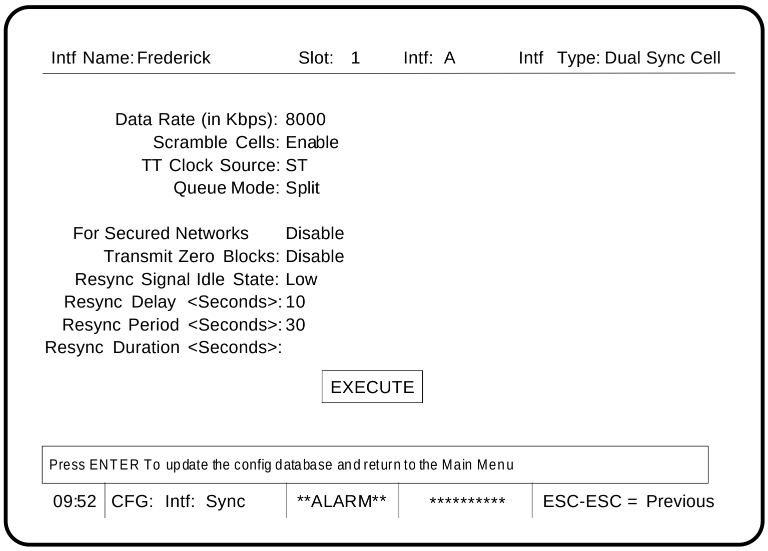


Figure 5-15. Interface Configuration Window – Dual Sync Cell

To configure this interface, position the cursor on the Data Rate field by using the up and down arrow keys. The arrow keys are used to move between the different fields. Beginning with the Data Rate field, use the down arrow key to move the cursor through each field. Enter text using the keyboard. The space bar is used to move through the possible selections in tumbler fields (given below in parentheses, starting with the default):

- Data Rate (in Kbps) (Text string, 16 – 20,000 kbps in 8kbps intervals)
- Scramble Cells (Enable, Disable)
- TT Clock Source (ST, RT, Ref Clock, Internal)
- Queue Mode (Split, Single)

For Secured Networks:

- Transmit Zero Blocks (Disable, Enable)
- Resync Signal Idle State (Low, High)
- Resync Delay <Seconds> (Text string)
- Resync Period <Seconds> (Text string)
- Resync Duration <Seconds> (Text string)

When done, move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu.

Configuring Connections

Connections are configured via the Connection Management menus. Figure 5-16 shows the configuration management mapping window for the DSC.

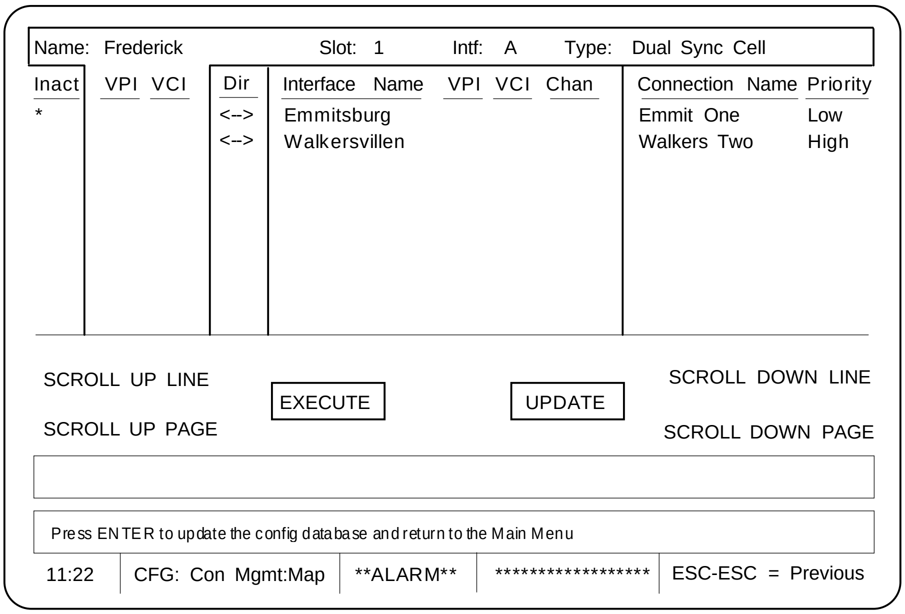


Figure 5-16. Configuration Management Mapping Window – Dual Sync Cell

Configuring connections to and from DSC interfaces is very similar to configuring other connections (see “Configuring Interface Connections”).

1. Select the **Connect Mgmt** command from the **Configure** menu.
2. To configure the connections, move the cursor to highlight one of the interfaces.
3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.
4. Use the Up/Down arrow key to move to the **Inact** field.
5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in “Configuring Interface Connections” to add new connections.
6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

A "Queue Mode" selection on the Dual Sync Cell card allows the normal Split Queue mode of operation to be changed to Single Queue mode. Split Queue operation permits prioritization of cell traffic into High, Medium and Low priorities, settable on the Connection Map screens. The lengths of the queues in split queue mode are as follows:

High priority	57 cells
Medium priority	32 cells
Low priority	32 cells

In single queue mode, all cells pass through a single 123-cell queue. When operating in this mode, connection prioritization is disabled.

In most applications, the default, split queue operation, is the preferred mode since this supports the prioritized queues. There are, however, certain applications where the 57-cell High priority queue is not large enough to handle traffic involving large bursts of cells. In these applications, single queue mode will accommodate larger bursts at the expense of disabling the traffic prioritization for that particular interface.

NOTE: This queuing (single queue or split queue) only occurs in the outbound direction (ATM backplane to EIA-530).

DS3 Cell Interface Module (DS3)

Configuring Interfaces

To configure a new interface, follow the steps described in “Configuring Physical Interfaces.” Enter the name, the interface type (DS3), the slot, the physical interface (A) and the status indicator. Press **<F2>** to enter the configuration menu. Figure 5-17 shows the DS3 configuration menu with all fields set to the default values.

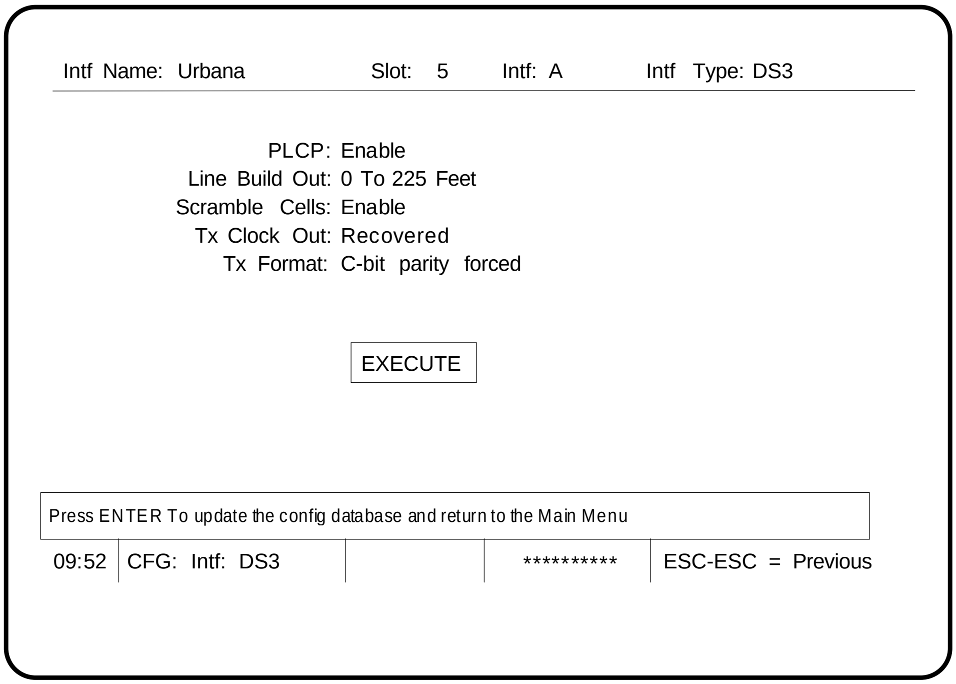


Figure 5-17. Interface Configuration Window – DS3

To configure this interface, position the cursor on the PLCP field by using the up and down arrow keys. The arrow keys are used to move between the different fields. Beginning with the PLCP (Physical Layer Convergence Protocol) field, use the down arrow key to move the cursor through each field. The space bar is used to move through the possible selections (given below in parentheses, starting with the default):

- PLCP (Enable, Disable)
- Line Build Out (0 To 225 Feet, 225 To 450 Feet)
- Scramble Cells (Enable, Disable)
- Tx Clock Out (Recovered, On Board)
- Tx Format (C-bit parity forced, C-bit parity preferred, M23 Forced)

When done, move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu.

Configuring Connections

Connections are configured via the Connection Management menus. Figure 5-18 shows the configuration management mapping window for the DS3.

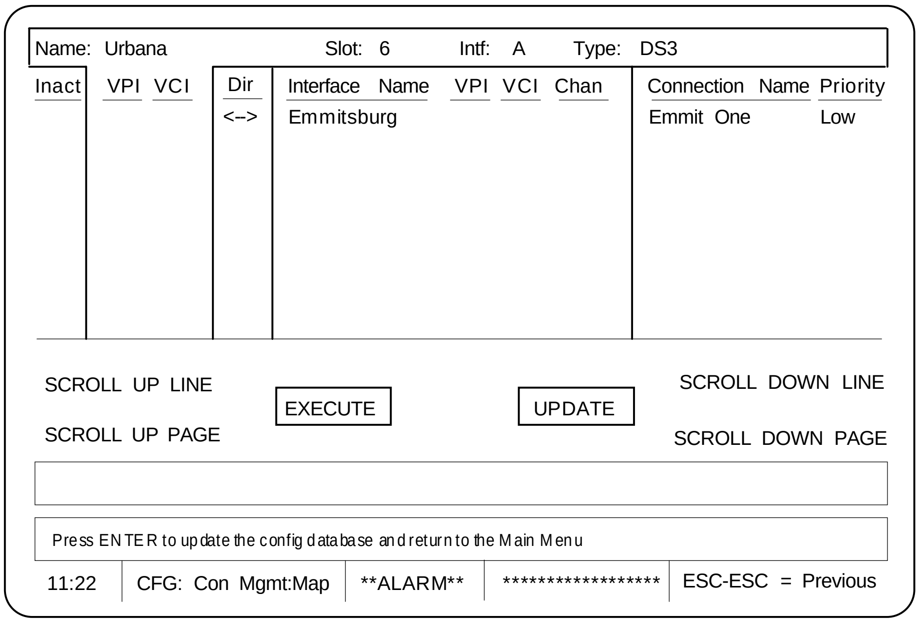


Figure 5-18. Configuration Management Mapping Window – DS3

Configuring connections to and from DS3 interfaces is very similar to configuring other connections (see “Configuring Interface Connections”).

1. Select the **Connect Mgmt** command from the **Configure** menu.
2. To configure the connections, move the cursor to highlight one of the interfaces.
3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.
4. Use the Up/Down arrow key to move to the **Inact** field.
5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in “Configuring Interface Connections” to add new connections.
6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

E1 Cell Interface Module (E1C)

Configuring Interfaces

To configure a new E1C interface, follow the steps described in “Configuring Physical Interfaces.” Enter the name, the interface type (E1C), the slot, the physical interface (A) and the status indicator. Press **<F2>** to enter the configuration menu. Figure 5-19 shows the E1C configuration menu with all fields set to the default values.

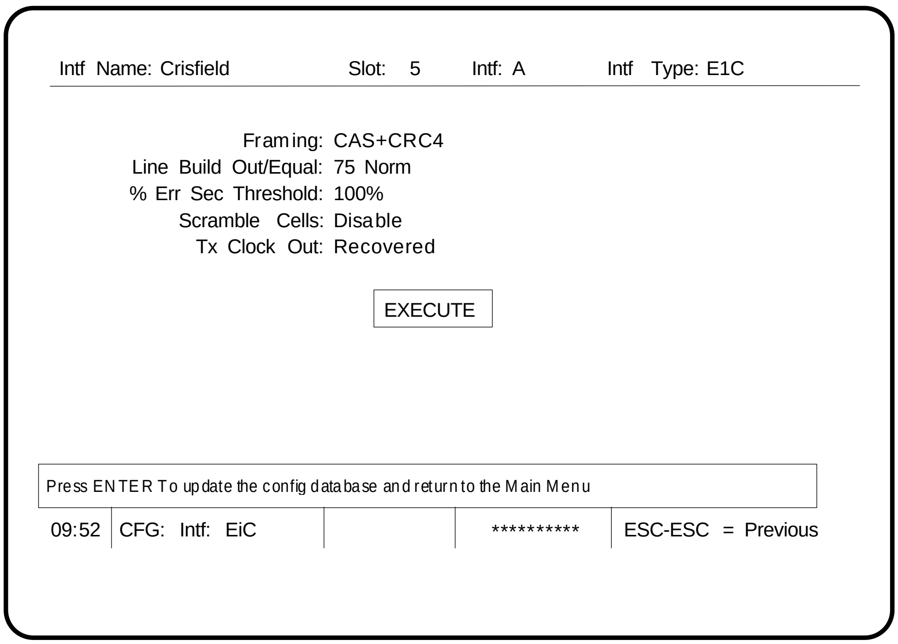


Figure 5-19. Interface Configuration Window – E1C

To configure this interface, position the cursor on the Framing field by using the up and down arrow keys. The arrow keys are used to move between the different fields. Use the down arrow key to move the cursor through each field. The space bar is used to move through the possible selections (given below in parentheses, starting with the default):

- Framing (CAS+CRC4, CAS)
- Line Build Out/Equal (75 Norm, 120 Norm, 75 P.R., 120 P.R., 75 HRL1, 75 HRL2, 120 HRL)
- % Err Sec Threshold (100%, 10%, 25%, 50%, 75%)
- Scramble Cells (Disable, Enable)
- Tx Clock Out (Recovered, Ref Clock, Internal, On Board)

When done, move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu.

Configuring Connections

Connections are configured via the Connection Management menus, see “Configuring Interface Connections.” Configuring connections to and from synchronous cell interfaces is very similar to configuring other connections. Figure 5-20 shows the configuration management mapping window for the E1C.

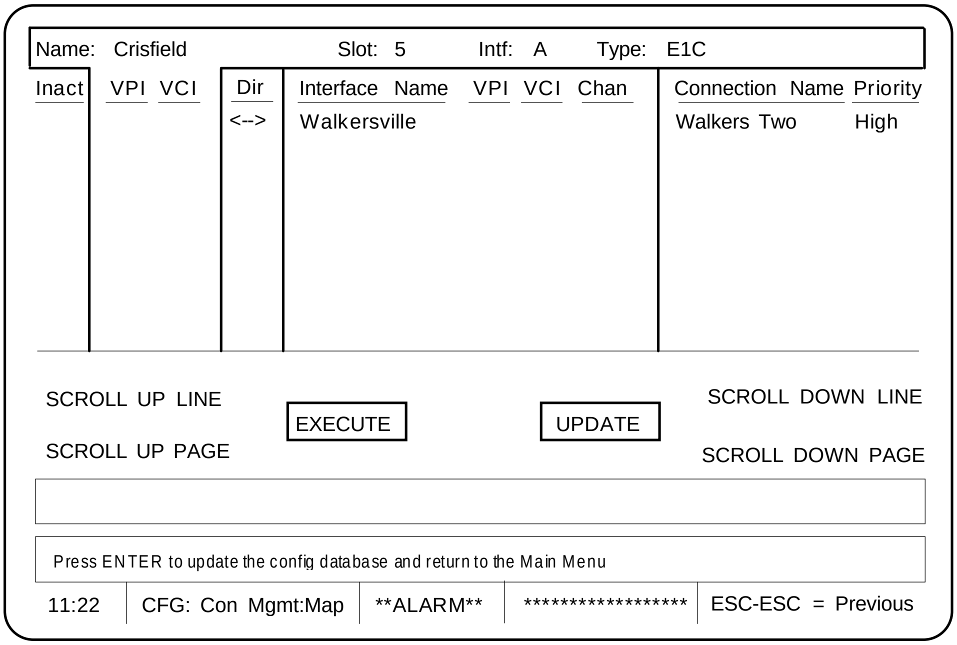


Figure 5-20. Configuration Management Mapping Window – E1C

Configuring connections to and from E1C interfaces is very similar to configuring other connections (see “Configuring Interface Connections”).

1. Select the **Connect Mgmt** command from the **Configure** menu.
2. To configure the connections, move the cursor to highlight one of the interfaces.
3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.
4. Use the Up/Down arrow key to move to the **Inact** field.
5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in “Configuring Interface Connections” to add new connections.
6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

E3C Cell Interface Module (E3C)

Configuring Interfaces

To configure a new E3C interface, follow the steps described in “Configuring Physical Interfaces.” Enter the name, the interface type (E3C), the slot, the physical interface (A) and the status indication. Press **<F2>** to enter the configuration menu. Figure 5-21 shows the E3C configuration menu with all fields set to the default values.

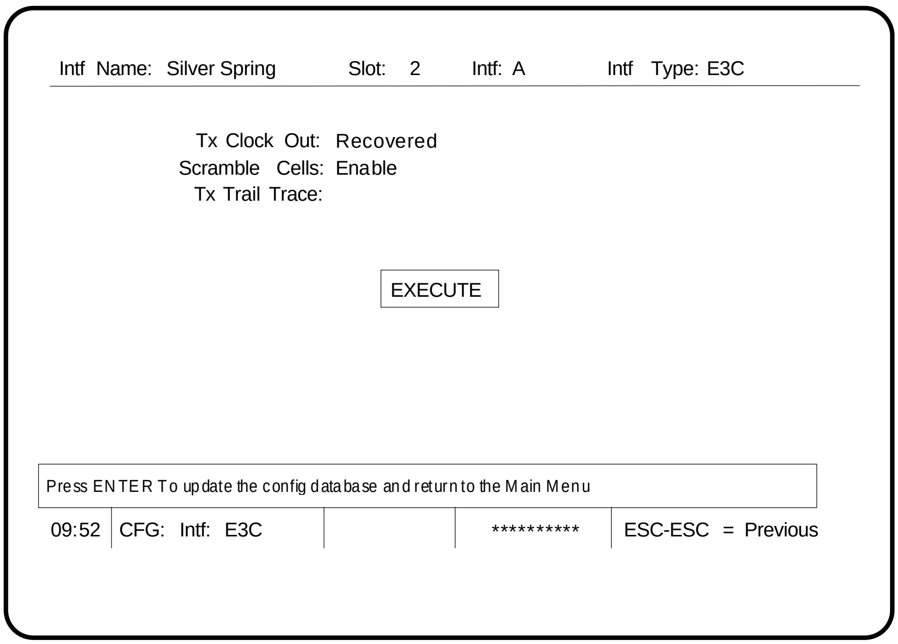


Figure 5-21. Interface Configuration Window – E3C

To configure this interface, position the cursor on the Tx Clock Out field by using the up and down arrow keys. The arrow keys are used to move between the different fields. Beginning with the Tx Clock Out field, use the down arrow key to move the cursor through each field. Enter text using the keyboard. The space bar is used to move through the possible selections in tumbler fields (given below in parentheses, starting with the default):

- Tx Clock Out (Recovered, On Board)
- Scramble Cells (Enable, Disable)
- Tx Trail Trace (Text string of up to 15 characters placed in the transmit path and used for checking connectivity)

When done, move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu.

Configuring Connections

Connections are configured via the Connection Management menus. Figure 5-22 shows the configuration management mapping window for the E3C.

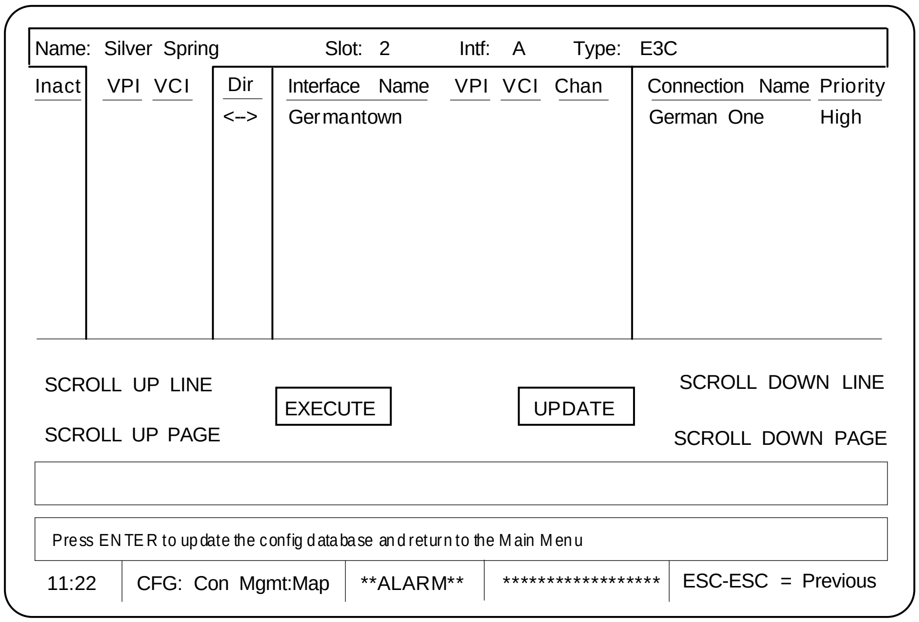


Figure 5-22. Configuration Management Mapping Window – E3C

Configuring connections to and from E3C interfaces is very similar to configuring other connections (see “Configuring Interface Connections”).

1. Select the **Connect Mgmt** command from the **Configure** menu.
2. To configure the connections, move the cursor to highlight one of the interfaces.
3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.
4. Use the Up/Down arrow key to move to the **Inact** field.
5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in “Configuring Interface Connections” to add new connections.
6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

Structured T1 Legacy Module (STL)

Configuring STL Interfaces

To configure a new STL interface, follow the steps described in “Configuring Physical Interfaces.” Enter the name, the interface type (Structured T1), the slot, and the physical interface (A-H). Press **<F2>** to enter the configuration menu. Figure 5-23 shows the STL configuration menu with all fields set to the default values. In the example, the user is configuring interface A of the STL Module in slot 14.

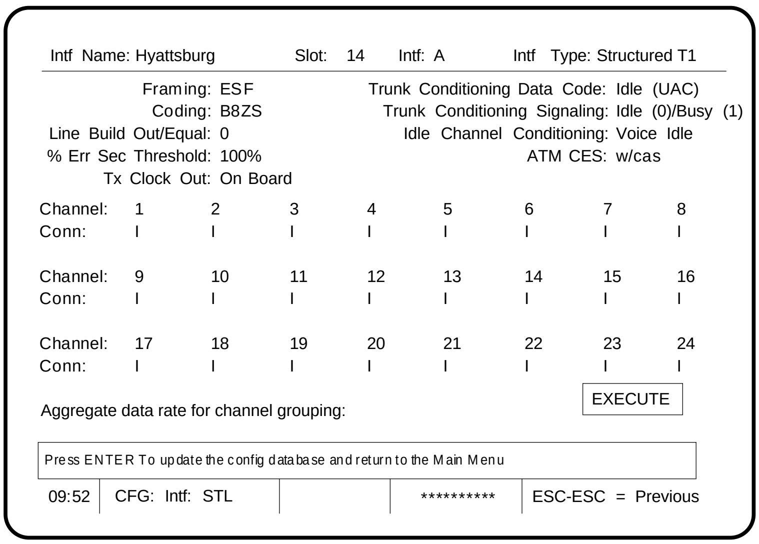


Figure 5-23. Interface Configuration Window – Structured T1

The arrow keys are used to move between the different fields. Beginning from the Framing field, the down arrow key can be used to move the cursor through each field in the following order (the space bar is used to move through the possible selections, which are given below in parentheses starting with the default):

- Framing (ESF or SF)
- Coding (B8ZS or AMI)
- Line Build Out/Equal (0, -7.5, -15.0, -22.5, 133-266, 266-399, 399-533, 533-655)
- % Err Sec Threshold (100%, 10%, 25%, 50%, 75%)
- Tx Clock Out (On Board, Recovered, Ref Clock, Internal)
- Trunk Conditioning Data Code (Idle (UAC) or MUX-OOS)
- Trunk Conditioning Signaling (Idle (0)/Busy (1) or Busy (1)/Idle (0))
- Idle Channel Conditioning (Voice Idle or Data Idle)
- ATM CES (w/cas, basic)

When done, move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu.

Configuring Channel Groups

The STL interface configuration menu provides a channel assignment (data entry) field for each of the 24 T1 channels. Whenever the cursor is positioned in one of the channel assignment fields, the user is prompted as follows:

```
Channel assignment: Valid choices: I (idle), D1-D24 (data), V1-
                                V24 (voice)
```

To configure a channel group, choose a unique channel group ID and enter it into each of the channel assignment fields of the group. Channel group IDs for data channels (64 kHz clear channel) always begin with "D" and channel group IDs for voice channels (signaling enabled) begin with "V." Only one ID can be assigned to a particular channel. An **idle channel** (a channel that does not belong to a group) is configured by entering an "I" in the channel assignment field. As shown in Figure 5-27, all channels are initially idle when a new interface is configured. The channels comprising a group may be contiguous or noncontiguous.

***NOTE**:* *All channels established in the local management screens are referenced by the names assigned by the system operator.* **The operator should exercise caution** *when assigning logical channel names and making entrees on the configuration screens. When changes are made on a management screen, they are implemented on the system database and will immediately affect the channels where the change or name assignments are made. These changes can be implemented on active channels, so any changes should be made intentionally by the system operator.*

Configuring STL Connections

STL connections are configured via the Connection Management menus, see "Configuring Interfaces." Configuring connections to and from STL interfaces is very similar to configuring other connections. For STL connections, however, the user selects one of the channel groups instead of entering a VPI/VCI pair.

1. Select the **Connect Mgmt** command from the **Configure** menu.
2. To configure the connections, move the cursor to highlight one of the interfaces.
3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.
4. Use the Up/Down arrow key to move to the **Inact** field.
5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in "Configuring Interface Connections" to add new connections.

6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

STL to Cell Bearing Interface Connections

An STL-to-Cell-Bearing connection configuration is illustrated in Figure 5-24, below. Here, a bi-directional connection is about to be enabled between a STL interface (channel group V14) and a cell-bearing interface such as an OC3 (VPI 2 and VCI 12). The channel group selection “V14/3” means that the channel group ID is V14 and is comprised of 3 channels. To select the desired channel group, the user positions the cursor in the channel group selection column (under the “Chan” column) and presses the space bar to move through the configured channel groups. In this example, the name associated with the connection is “German PBX200.”

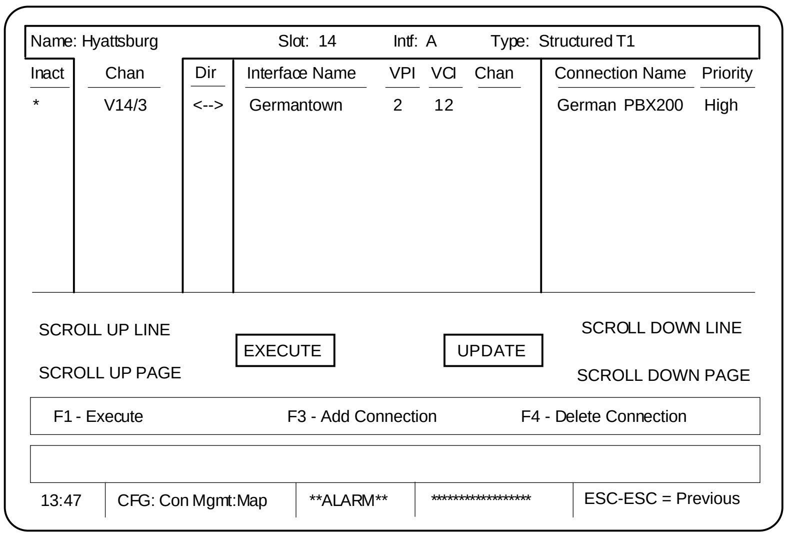


Figure 5-24. Connection Management Mapping Window – STL to Cell Bearing

STL to STL Connections

An STL-to-STL connection configuration is shown in Figure 5-25. Here a connection is configured between channel group D1 on one STL card and channel group D5 on another. Note that both of the channel groups must contain the same number of (but not necessarily the same) channels.

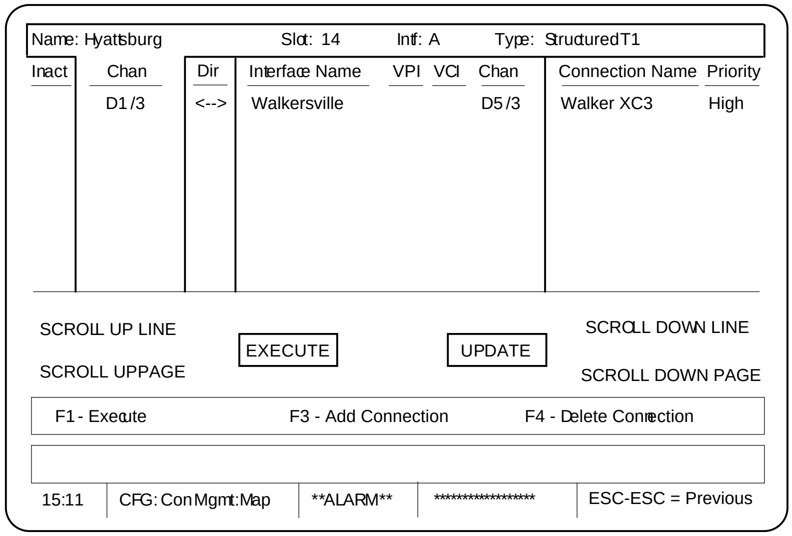


Figure 5-25. Connection Management Mapping Window – STL to STL

Dual Synchronous Legacy Interface Module (DSL)

Configuring Interfaces

To configure a new interface, follow the steps described in “Configuring Physical Interfaces” to enter the name, the interface type, the slot, the physical interface (A or B) and the status indication. Press **<F2>** to enter the interface configuration menu. Figure 5-26 shows the interface configuration menu with all fields set to the default values.

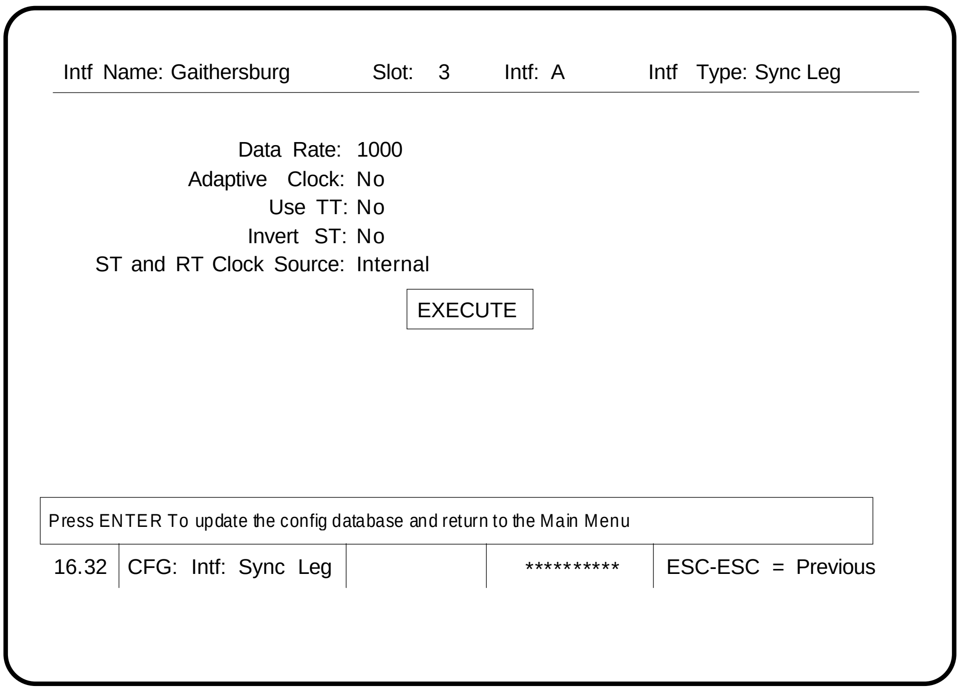


Figure 5-26. Interface Configuration Window – DSL

The arrow keys are used to move between the different fields. Beginning at the Data Rate field, the down arrow key can be used to move the cursor through each field in order. Enter text using the keyboard. The space bar is used to move through the possible selections in tumbler fields (given below in parentheses starting with the default):

- Data Rate (edit field)
- Adaptive Clock (No, Yes)
- Use TT (No, Yes)
- Invert ST (No, Yes)
- ST and RT Clock Source (Internal, Ref Clock)

When done, move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu.

Configuring Connections

Connections are configured via the Connection Management menus. Figure 5-27 shows the configuration map for the Dual Synchronous Legacy interface.

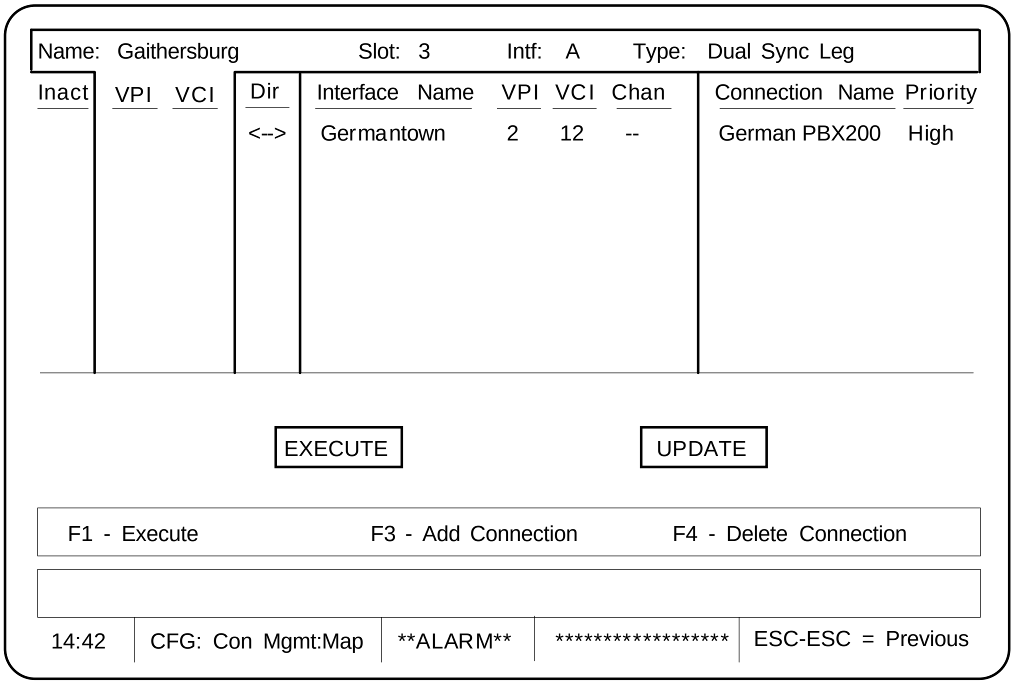


Figure 5-27. Connection Management Mapping Window – DSL

Configuring connections to and from DSL interfaces is very similar to configuring other connections (see “Configuring Interface Connections”).

1. Select the **Connect Mgmt** command from the **Configure** menu.
2. To configure the connections, move the cursor to highlight one of the interfaces.
3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.
4. Use the Up/Down arrow key to move to the **Inact** field.
5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in “Configuring Interface Connections” to add new connections.
6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

High-Speed Synchronous Legacy Interface Module (HSL)

Configuring Interfaces

To configure a new interface, follow the steps described in “Configuring Physical Interfaces” to enter the name, the interface type, the slot, and the physical interface. Press **<F2>** to enter the interface configuration menu. Figure 5-28 shows the interface configuration menu with all fields set to the default values.

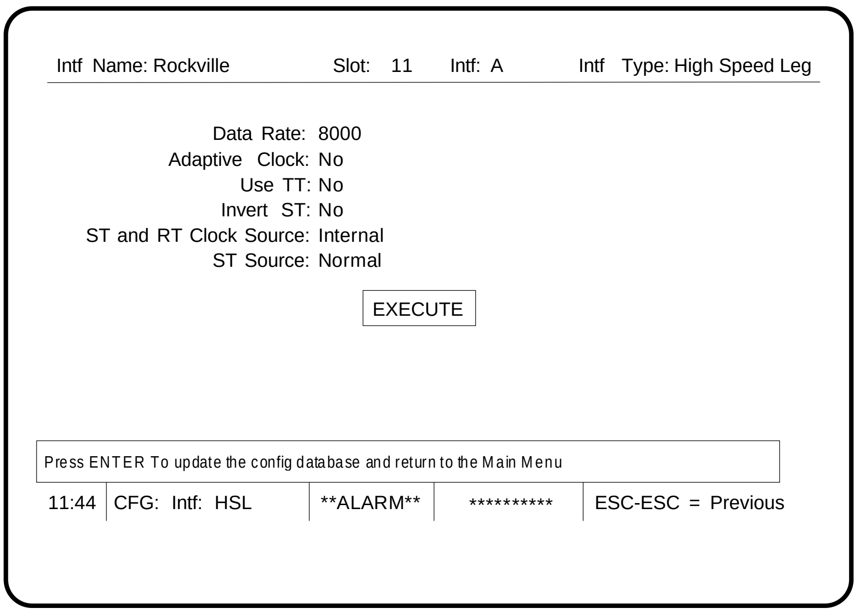


Figure 5-28. Interface Configuration Window – High-Speed Leg

The arrow keys are used to move between the different fields. Beginning at the Data Rate field, the down arrow key can be used to move the cursor through each field in order. Enter text using the keyboard. The space bar is used to move through the possible selections in tumbler fields (given below in parentheses starting with the default):

- Data Rate (edit field)
- Adaptive Clock (No, Yes)
- Use TT (No, Yes)
- Invert ST (No, Yes)
- ST and RT Clock Source (Internal, Ref Clock, External)
- ST Source (Normal, From RT)

When done, move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu.

Configuring Connections

Connections are configured via the Connection Management menus. Figure 5-29 shows the configuration map for a High Speed Synchronous Legacy interface.

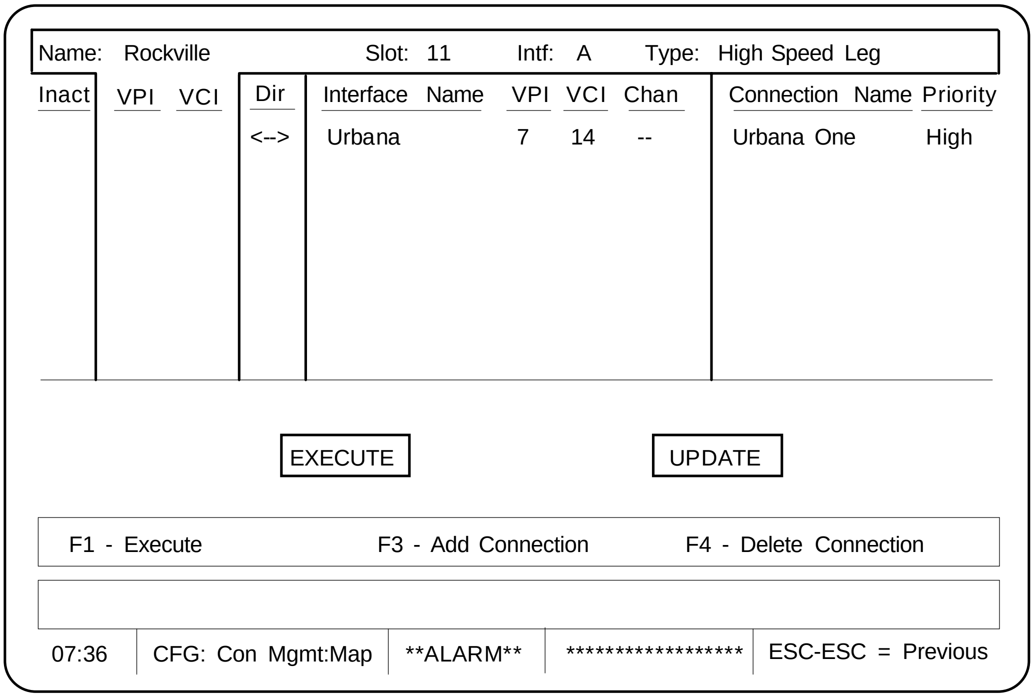


Figure 5-29. Connection Management Mapping Window – High-Speed Leg

Configuring connections to and from HSL interfaces is very similar to configuring other connections (see “Configuring Interface Connections”).

1. Select the **Connect Mgmt** command from the **Configure** menu.

2. To configure the connections, move the cursor to highlight one of the interfaces.

3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.

4. Use the Up/Down arrow key to move to the **Inact** field.

5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in “Configuring Interface Connections” to add new connections.

6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

High-Speed Serial Interface Legacy Module Configuration (HSSL)

Configuring Interfaces

To configure a new interface, follow the steps described in “Configuring Physical Interfaces” to enter the name, the interface type, the slot, the physical interface and the active status indication. Press **<F2>** to enter the interface configuration menu. Figure 5-30 shows the interface configuration menu with all fields set to the default values.

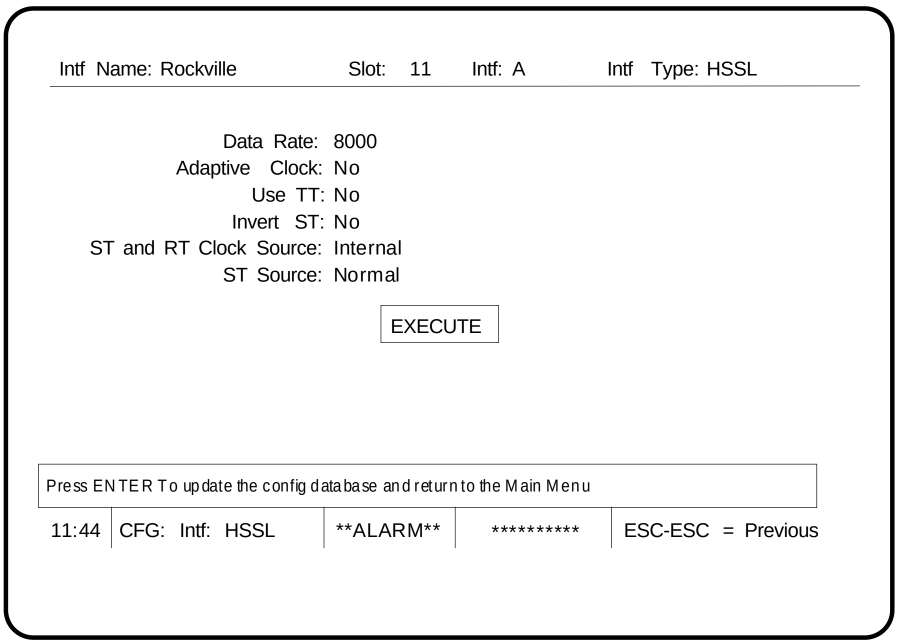


Figure 5-30. Interface Configuration Window – HSSL

The arrow keys are used to move between the different fields. Beginning at the Data Rate field, the down arrow key can be used to move the cursor through each field in the order shown. Enter text in the edit field using the keyboard. The space bar is used to move through the possible selections, which are given below in parentheses starting with the default:

- Data Rate (edit field)
- Adaptive Clock (No, Yes)
- Use TT (No, Yes)
- Invert ST (No, Yes)
- ST and RT Clock Source (Internal, Ref Clock, External)
- ST Source (Normal, From RT)

Configuring Connections

Connections are configured via the Connection Management menus, see “Configuring Interface Connections.” Configuring connections to and from synchronous legacy interfaces is very similar to configuring other connections. Figure 5-31 shows the configuration map for a HSSL interface.

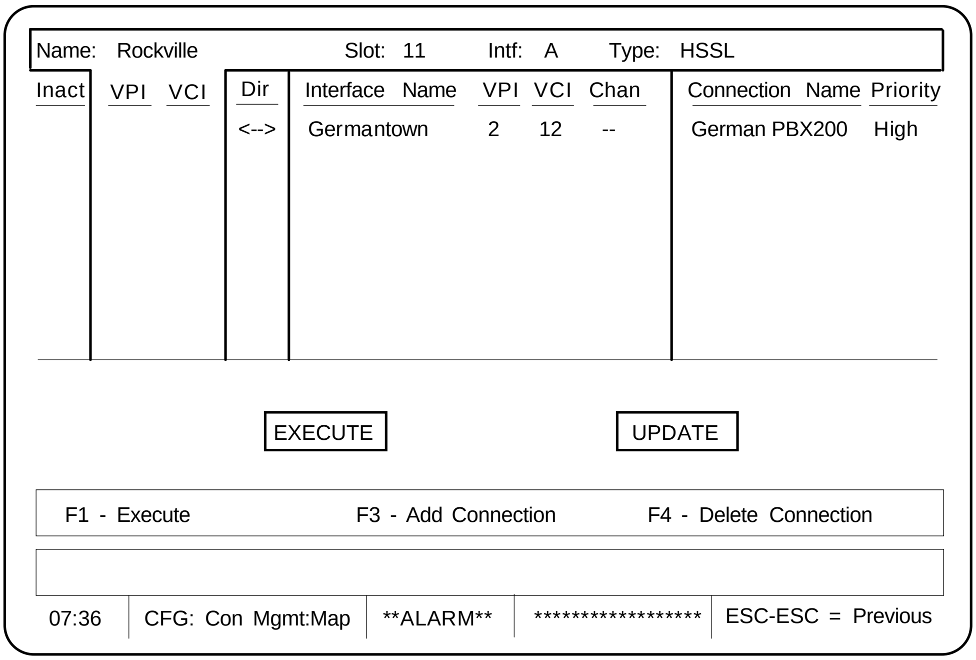


Figure 5-31. Connection Management Mapping Window – HSSL

Configuring connections to and from HSSL interfaces is very similar to configuring other connections (see “Configuring Interface Connections”).

1. Select the **Connect Mgmt** command from the **Configure** menu.
2. To configure the connections, move the cursor to highlight one of the interfaces.
3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.
4. Use the Up/Down arrow key to move to the **Inact** field.
5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in “Configuring Interface Connections” to add new connections.
6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

Hub Router Interface Module (HRIM)

A sample network topology using the HRIM is shown in Figure 5-32.

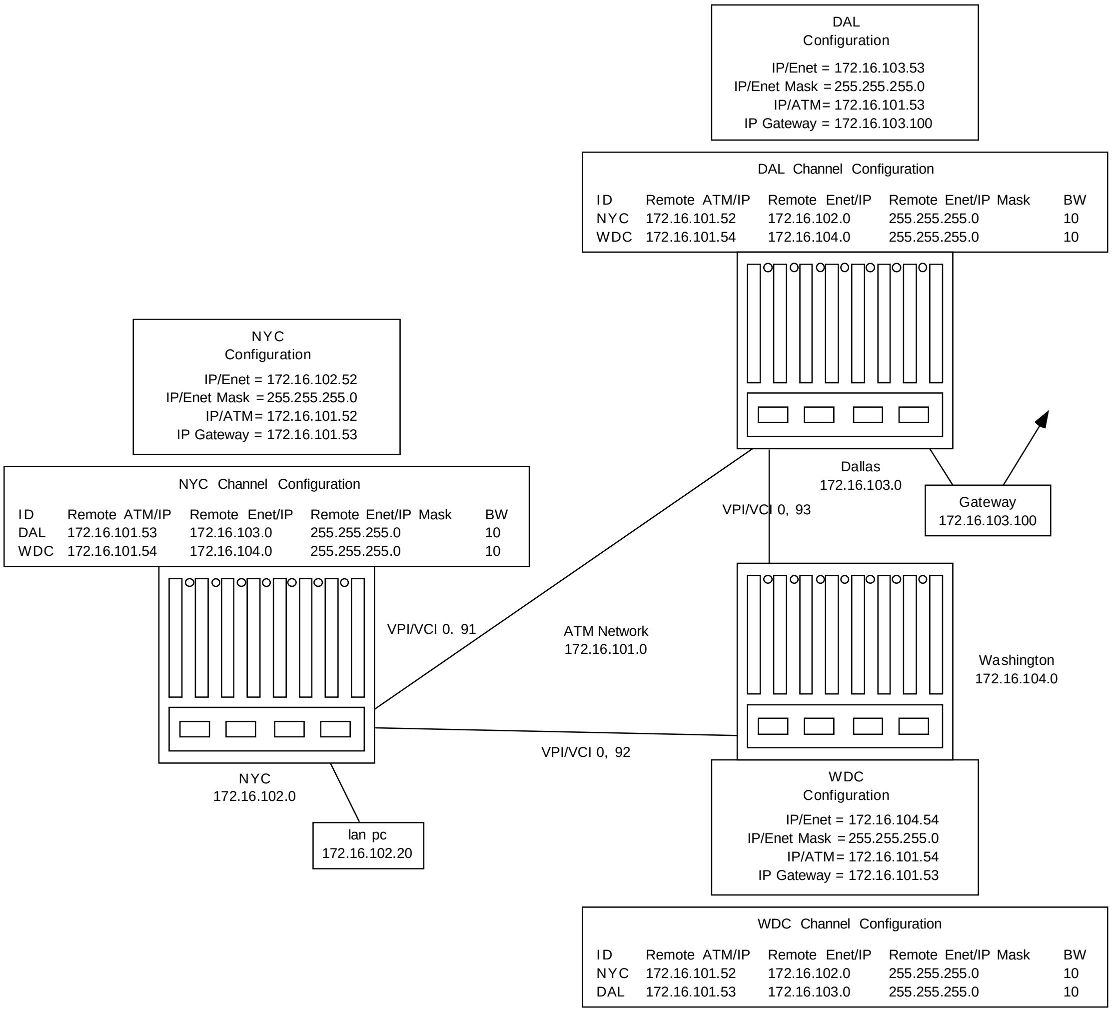


Figure 5-32. Sample Network Topography

Configuring Interfaces

To configure a new Hub Router Interface Module (HRIM) interface, follow the steps described in "Configuring Physical Interfaces" to enter the name, the interface type, the slot, the physical interface and the status indication. Press **<F2>** to enter the interface configuration menu. Figure 5-33 shows the HRIM interface configuration menu with all fields set to the default values.

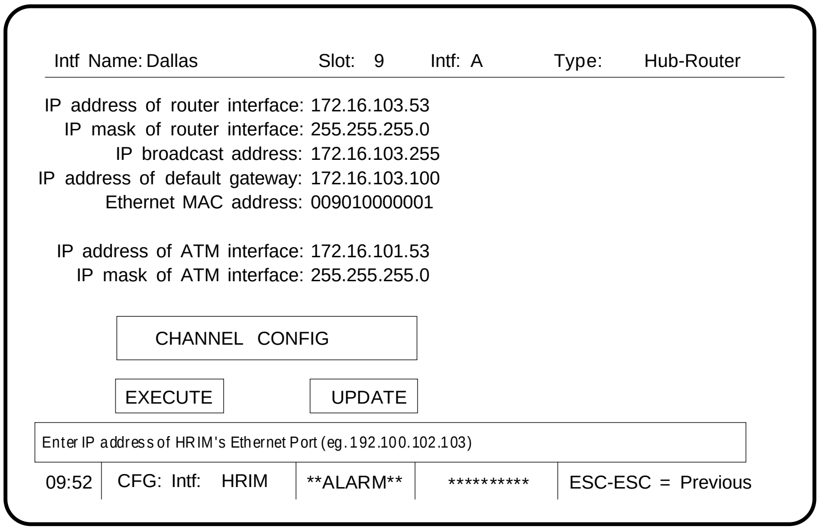


Figure 5-33. Interface Configuration Window – HRIM

The arrow keys are used to move between the different fields. Beginning at the IP address of router interface field, the down arrow key can be used to move the cursor through each field in the order shown. Enter text using the keyboard.

- IP address of router interface (edit field)
- IP mask of router interface (edit field)
- IP broadcast address (edit field)
- IP address of the default gateway (edit field)
- Ethernet MAC address (edit field)
- IP address of ATM interface (edit field)
- IP mask of ATM interface (edit field)

When done, move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu.

The "**IP address of router interface**" field is an edit field. Any valid IP address may be entered into this field. This field represents the IP address of the HRIM interface on the local Ethernet LAN.

The "**IP mask of router interface**" field is an edit field. Any valid IP subnet mask may be entered into this field. This field represents the IP subnet mask of the local Ethernet LAN.

The "**IP broadcast address**" field is an edit field. Any valid IP address may be entered into this field. This field represents the IP broadcast address of the local Ethernet LAN.

The "**IP address of the default gateway**" field is an edit field. Any valid IP address may be entered into this field. This entry adds a default route via the entered gateway address.

The "**Ethernet MAC address**" field is an edit field. Any valid 12 hex character MAC address may be entered here. The default value will be 009010000000 (hex). The 009010 represents the IEEE-assigned OUI for the SLI/TimePlex joint venture. The last three bytes can be any value between 000000 and FFFFFF (hex).

The “**IP address of ATM interface**” field is an edit field. Any valid IP address may be entered into this field. This field represents the IP address of the ATM interface for this HRIM.

The “**IP mask of ATM interface**” field is an edit field. Any valid IP subnet mask may be entered into this field. This field represents the subnet mask of the ATM interface for this HRIM.

NOTE: This window has a secondary window associated with it. Care must be taken that the configuration shown in the “primary” window is the one desired; moving to the secondary window automatically accepts or “executes” the configuration displayed in the primary window.

Channel Configuration

Selecting the Channel Config button will bring up the channel configuration screen shown in Figure 5-34. The channel configuration screen will allow the user to define an IP channel on the HRIM ATM interface. There may be a total of up to 32 IP interfaces. These IP channels define how LAN traffic is routed to a remote Ethernet LAN (HRIM), a remote CX CPU, or another IP router supporting classical IP. This IP channel will be coupled to a VPI/VCI pair of the HRIM ATM interface and navigated through the ATM network via standard VPI/VCI connection (connection screen). The HRIM supports RFC 1463, Multiprotocol over IP (IP routed only), and RFC 1577, Classical IP.

***NOTE**: All channels established in the management screens are referenced by the names assigned by the system operator.* **The operator should exercise caution**. *When changes are made on the management screen, they are implemented on the system database and will immediately reset the module. Since these changes can be implemented on active channels any changes should be made carefully by the system operator.*

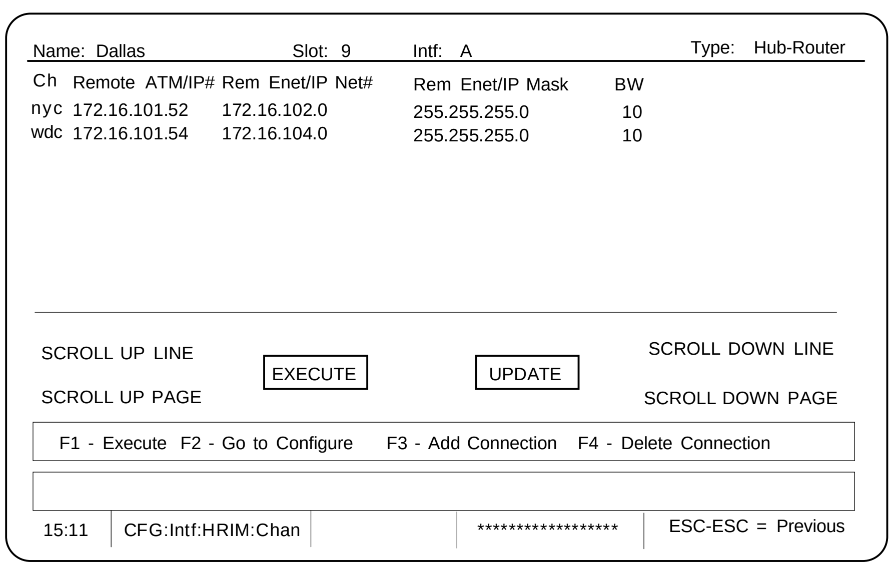


Figure 5-34. Channel Configuration Window - HRIM

Parameters that define an IP channel are:

The “**Ch**” field is an edit field. Any alphanumeric identifier up to 3 characters may be entered into this field. This field represents the identifier for this IP channel. This identifier will be used on other screens in the CX-1500 to associate the IP channel with some set of information (i.e. connections).

The “**Remote ATM/IP #**” field is an edit field. Any valid IP address may be entered into this field. This field represents the ATM/ IP address for the remote node.

The “**Remote Enet/IP Net#**” field is an edit field which represents the remote Ethernet/IP address for the remote LAN. For applications where no remote LAN exists (i.e., where connected to a remote CPU) enter all zeros.

The “**Remote Enet/IP Mask**” field is an edit field. Enter the IP address of the remote Ethernet/LAN subnet mask. This field represents the mask of the subnet supported by the node and permits association of different masks to different remote LANs to allow for variable length subnet masks (VLSM).

NOTE: *HRIM modules with release dates prior to 2/99 will not support the use of a variable length subnet mask. This variable (Remote Enet/IP Mask) should be left at the default.*

The “**BW**” field is an edit field. Any number from 1 to 99 may be entered into this field. This field represents the maximum bandwidth allocated for the ATM encapsulated IP channel measured in blocks of 280kbps (10=2.8Mbps dedicated to this channel). Once the BW value is entered the HRIM ATM components are optimized with regard to internal buffering and system resources to accommodate the physical throughput conditions of the actual ATM links through which the classical IP data travels.

For example, if a T1 cell-bearing interface existed between HRIM site A and HRIM site B, you would set the B/W parameter for Connection A→B to 5 (280 Kbps x 5 = 1.4 Mbps). Setting this parameter to a value greater than 5 may oversubscribe the ATM connection and possibly cause dropped packets.

The channel configuration screen is implemented like the connection map screens in that IP channels can be dynamically added and/or removed using the **<F3>** and **<F4>** function keys. The maximum number of IP channels that may be added is 32.

When done, move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu.

Configuring Connections

Connections are configured via the Connection Management menus. Figures 5-35 and 5-36 show the configuration maps for HRIM interfaces.

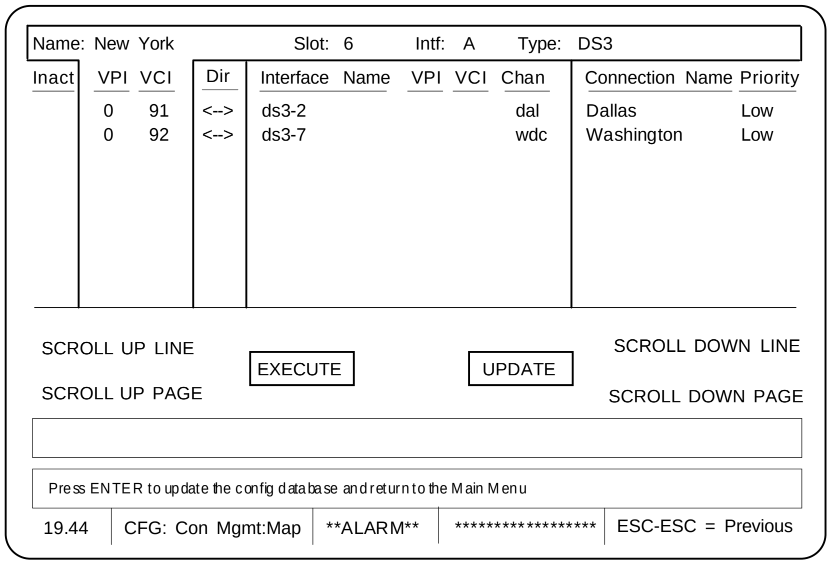


Figure 5-35. Connection Management Mapping Window – Cell-based Source Interface

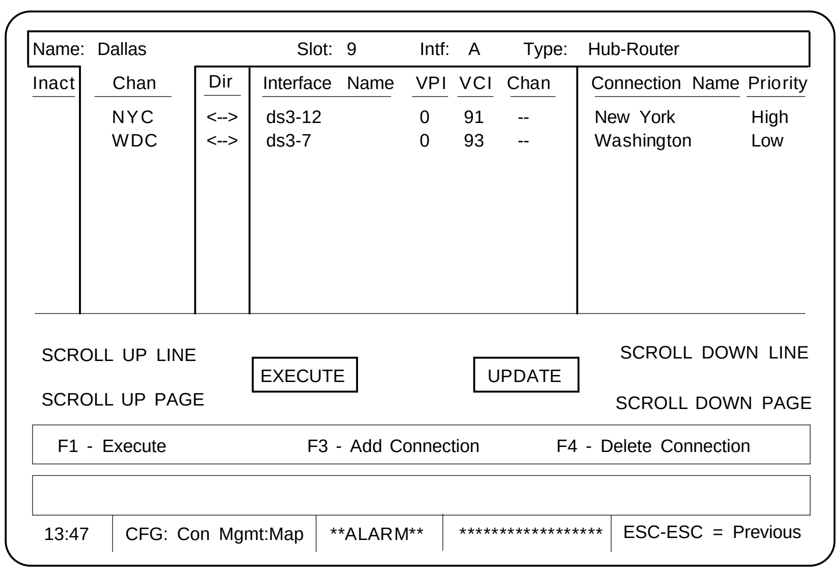


Figure 5-36. Connection Management Mapping Window – HRIM Source Interface

Configuring connections to and from HRIM interfaces is very similar to configuring other connections (see “Configuring Interface Connections”).

1. Select the **Connect Mgmt** command from the **Configure** menu.

2. To configure the connections, move the cursor to highlight one of the interfaces.

3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.

4. Use the Up/Down arrow key to move to the **Inact** field.

5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in "Configuring Interface Connections" to add new connections.

NOTE: It is recommended that the priority of HRIM connections be set to ***Low*** *(ABR). Setting to a higher priority will cause data throughput to degrade.*

6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

Verifying Network Operation

Once the network connections are established, both the Ethernet and ATM IP addresses should respond to PING. It is recommended that a PING be sent to each network element of the IP network to verify connectivity and some level of throughput.

NOTE: *Throughput will be a function of ATM line rates and the Bandwidth number assigned to each HRIM channel entered above.*

If the PING originates from a Windows PC, configure the Ethernet network to have an IP address on the assigned LAN segment. In this example a valid IP address for a PC in NYC might be 192.100.102.60. Also ensure that the PC's gateway address is the IP address of the HRIM Ethernet side (e.g. 192.100.102.52). Once the PC is configured, enter PING commands for each network element starting with the closest IP interface.

C:\windows>	ping 192.100.102.52	(NYC HRIM Ethernet)
	ping 192.100.101.52	(NYC HRIM ATM)
	ping 192.100.101.53	(Dallas HRIM ATM)
	ping 192.100.103.53	(Dallas HRIM Ethernet)
	ping 192.100.101.54	(WDC HRIM ATM)
	ping 192.100.104.54	(WDC HRIM Ethernet)
	ping 192.100.103.100	(Dallas Gateway)

Ping (ICMP) blocksizes directed to an HRIM card's own IP address that exceed the fixed MTU setting of 1500 (including framing bytes) will likely TIMEOUT. Use of pings of blocksize ≤ 1472 is recommended.

A sample network using a variable length subnet mask is shown in Figure 5-37.

NOTE: HRIM modules with release dates prior to 2/99 (indicated by a sticker on the module) will not support the use of a variable length subnet mask. This variable (Remote Enet/IP Mask) should be left at the default.

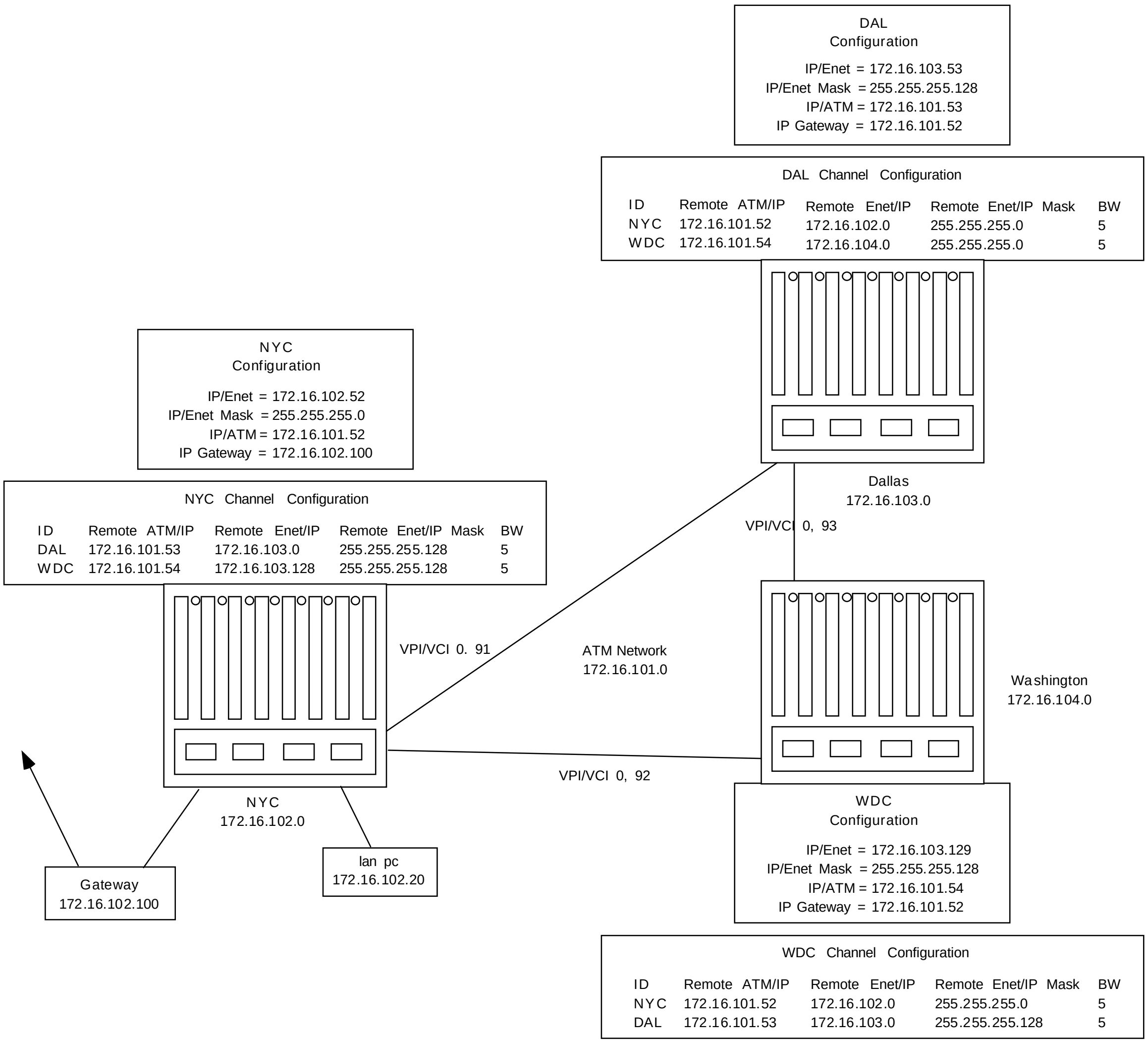


Figure 5-37. Sample Network Topography Using Variable Length Subnet Mask

Low Speed Asynchronous Legacy Interface Module (LSAL)

Configuring Interfaces

To configure a new Low Speed Asynchronous Legacy Interface Module (LSAL) interface, follow the steps described in “Configuring Physical Interfaces” to enter the name, the interface type, the slot, the physical interface and the active status indication. Press **<F2>** to enter the interface configuration menu. Figure 5-38 shows the interface configuration menu with all fields set to the default values.

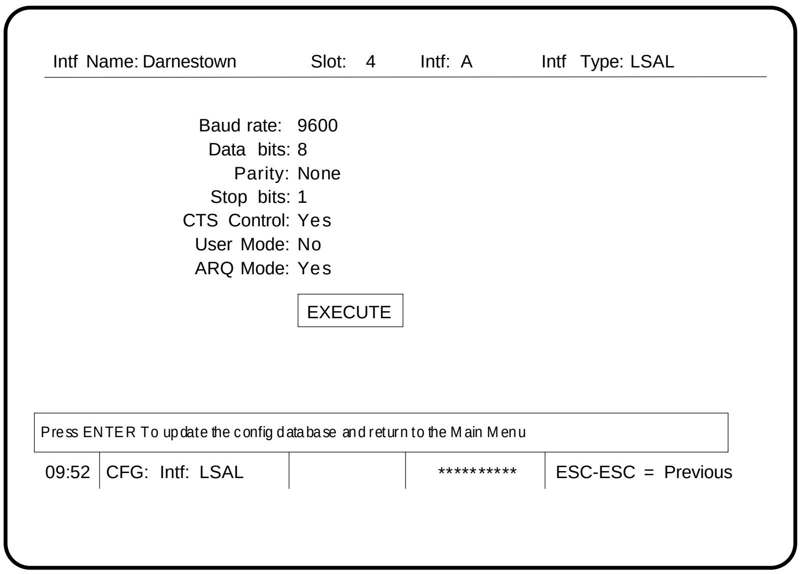


Figure 5-38. Interface Configuration Window – LSAL

The arrow keys are used to move between the different fields. Beginning at the "Baud rate" field, the down arrow key can be used to move the cursor through each field in the following order. The space bar is used to move through the possible selections, which are given below in parentheses starting with the default:

- Baud Rate (9600, 14400, 19200, 38400, 75,110, 300, 1200, 2400, 4800)
- Data bits (8, 5, 6, 7)
- Parity (None, Odd, Even)
- Stop bits, (1, 2)
- CTS Control (Yes, No)
- User Mode (No = maximum throughput, Yes = minimize latency)
- ARQ Mode (Yes = reliable LSAL-to-LSAL transfer enabled, No = cells dropped by ATM network are not retransmitted)

When done, move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu.

NOTE: Each of the eight interfaces is configured separately, as necessary.

Configuring Connections

Connections are configured via the Connection Management menus. Figure 5-39 shows the configuration map for the LSAL interface.

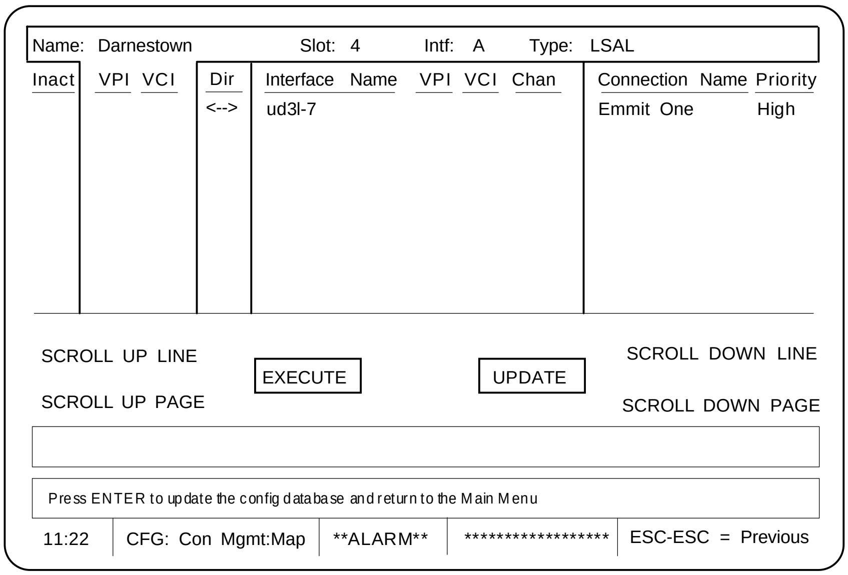


Figure 5-39. Connection Management Mapping Window – LSAL

Configuring connections to and from LSAL interfaces is very similar to configuring other connections (see “Configuring Interface Connections”).

1. Select the **Connect Mgmt** command from the **Configure** menu.
2. To configure the connections, move the cursor to highlight one of the interfaces.
3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.
4. Use the Up/Down arrow key to move to the **Inact** field.
5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in “Configuring Interface Connections” to add new connections.
6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

Unstructured T1 Legacy Interface Module (UTL)

Configuring Interfaces

To configure a new Unstructured T1 Legacy Interface Module (UTL) interface, follow the steps described in “Configuring Physical Interfaces” to enter the name, the interface type, the slot, the physical interface and active status indication. Press **<F2>** to enter the interface configuration menu. Figure 5-40 shows the interface configuration menu with all fields set to the default values.

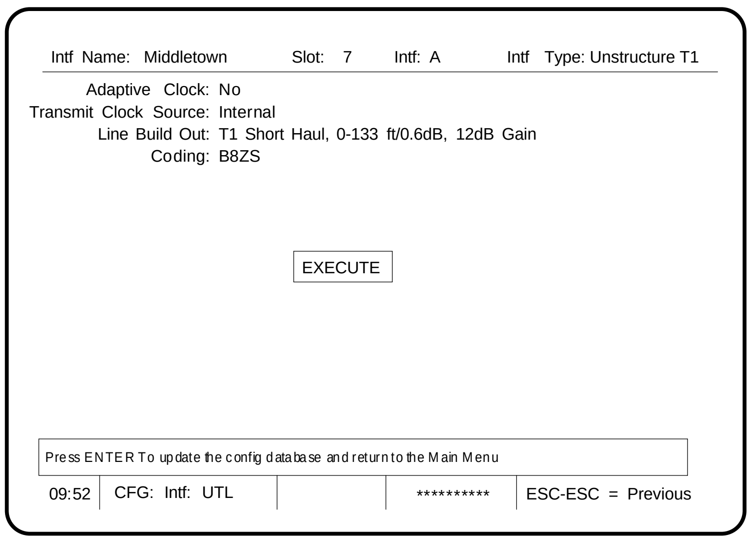


Figure 5-40. Interface Configuration Window – UTL

The arrow keys are used to move between the different fields. Beginning at the Adaptive Clock field, the down arrow key can be used to move the cursor through each field in the order shown. The space bar is used to move through the possible selections, which are given below in parentheses starting with the default):

- Adaptive Clock (No, Yes)
- Transmit Clock Source (Internal, Ref Clock, External, On Board)
- Line Build Out (T1 Short Haul, 0-133 ft/0.6dB, 12dB Gain; T1 Short Haul, 133-266 ft/1.2dB, 12 dB Gain; T1 Short Haul, 266-399 ft/1.8dB, 12dB Gain; T1 Short Haul, 399-533 ft/2.4dB, 12dB Gain; T1 Short Haul, 533-655 ft/3.0dB, 12dB Gain; T1 Long Haul, 0.0dB Pulse, 36dB Gain; T1 Long Haul, -7.5dB Pulse, 36dB Gain; T1 Long Haul, -15.0dB Pulse, 36 dB Gain; T1 Long Haul, -22.5dB Pulse, 36dB Gain; T1 Long Haul, 0.0dB Pulse, 24dB Gain; T1 Long Haul, -7.5dB Pulse, 24dB Gain; T1 Long Haul, -15.0dB Pulse, 24dB Gain; T1 Long Haul, -22.5dB Pulse, 24dB Gain)
- Coding (B8ZS, AMI)

When done, move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu.

Configuring Connections

Connections are configured via the Connection Management menus. Figures 5-41 and 5-42 show the configuration maps for UTL interfaces.

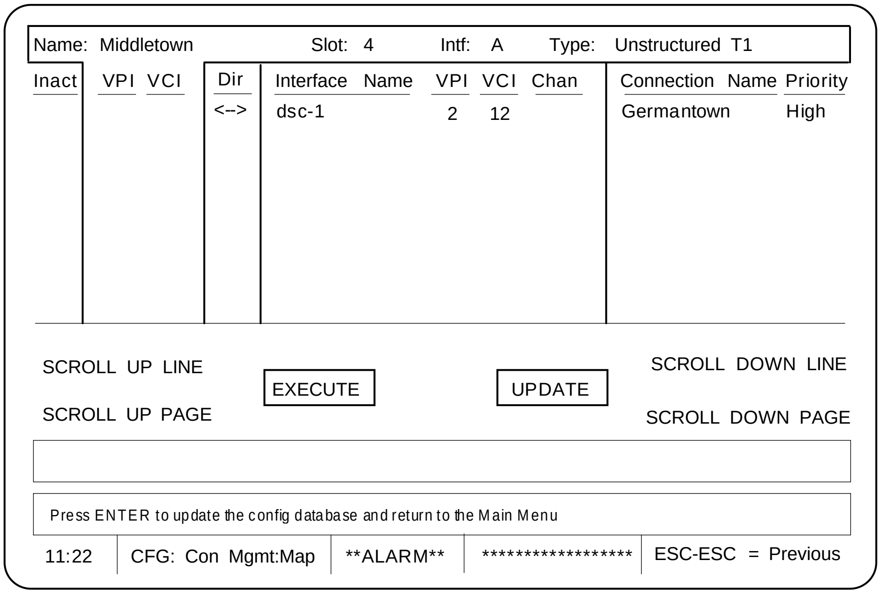


Figure 5-41. Connection Management Mapping Window – UTL to Cell Bearing

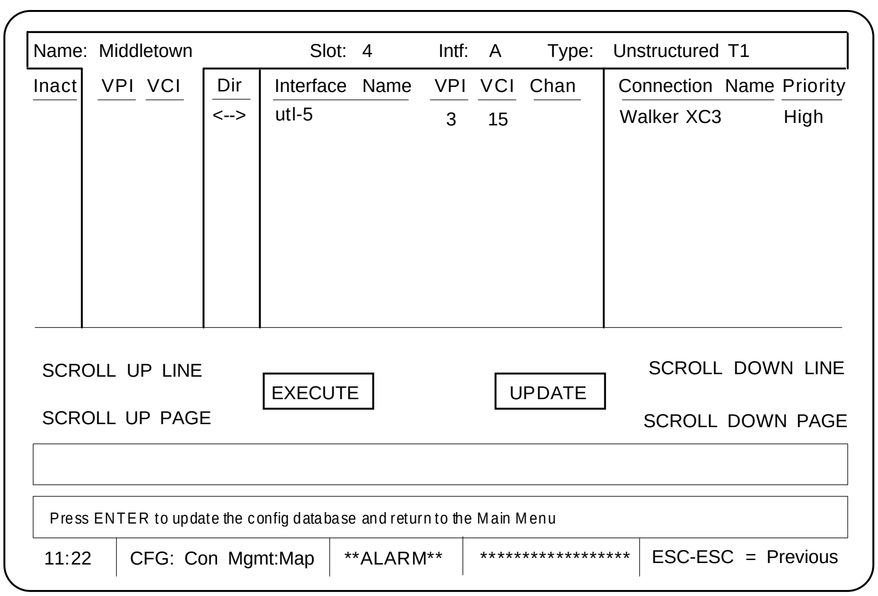


Figure 5-42. Connection Management Mapping Window – UTL to UTL

Configuring connections to and from UTL interfaces is very similar to configuring other connections (see “Configuring Interface Connections”).

1. Select the **Connect Mgmt** command from the **Configure** menu.

2. To configure the connections, move the cursor to highlight one of the interfaces.

3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.

4. Use the Up/Down arrow key to move to the **Inact** field.

5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in “Configuring Interface Connections” to add new connections.

6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

Unstructured E1 Legacy Interface Module (UEL)

Configuring Interfaces

To configure a new Unstructured E1Legacy Interface Module (UEL) interface, follow the steps described in “Configuring Physical Interfaces” to enter the name, the interface type, the slot, the physical interface and the active status indication. Press **<F2>** to enter the interface configuration menu. Figure 5-43 shows the interface configuration menu with all fields set to the default values.

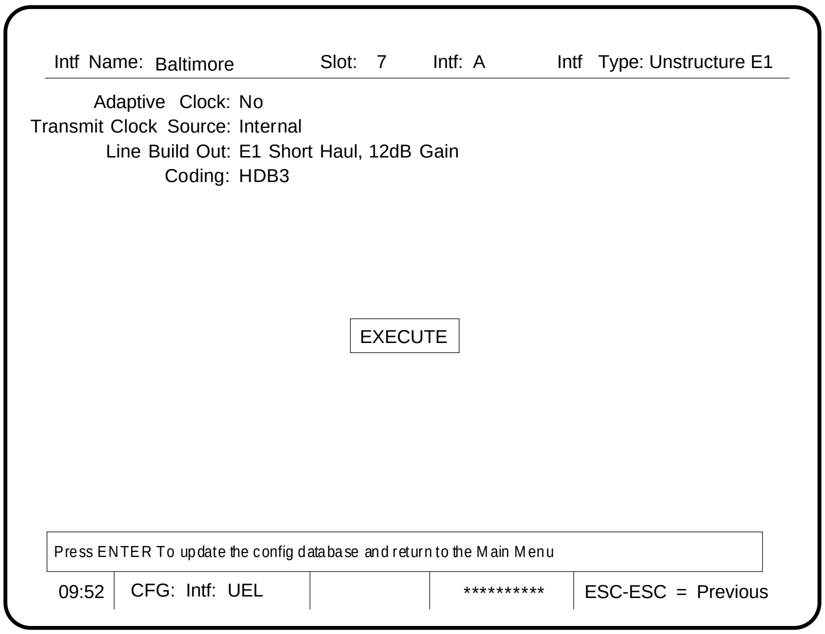


Figure 5-43. Interface Configuration Window – UEL

The arrow keys are used to move between the different fields. Beginning at the Adaptive Clock field, the down arrow key can be used to move the cursor through each field in the following order (the space bar is used to move through the possible selections, which are given below in parentheses starting with the default):

- Adaptive Clock (No, Yes)
- Transmit Clock Source (Internal, Ref Clock, External, On-Board)
- Line Build Out (E1 Short Haul, 12dB Gain; E1 Short Haul, 43dB Gain; E1 Short Haul, (Coax) 43dB Gain)
- Coding (HDB3, AMI)

When done, move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu.

Configuring Connections

Connections are configured via the Connection Management menus. Figures 5-44 and 5-45 show the configuration maps for UEL interfaces.

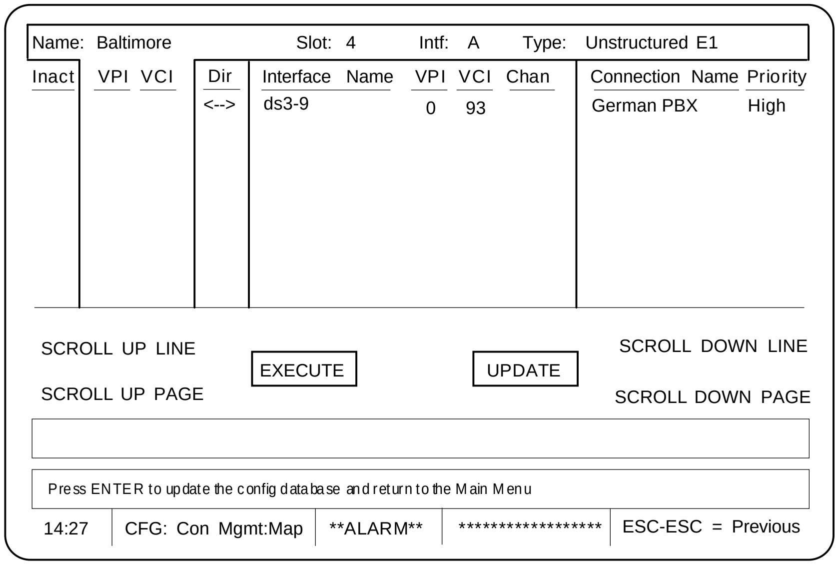


Figure 5-44. Connection Management Mapping Window – UEL to Cell Bearing

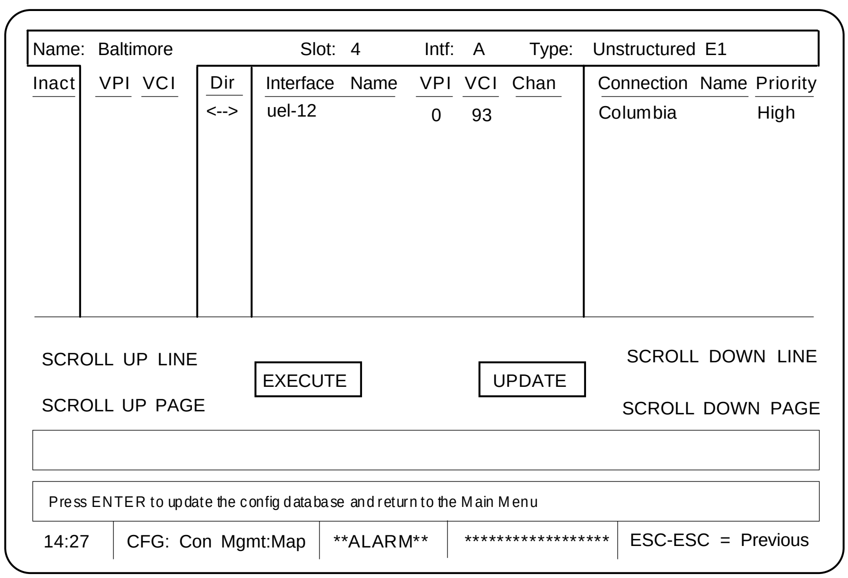


Figure 5-45. Connection Management Mapping Window – UEL to UEL

Configuring connections to and from UEL interfaces is very similar to configuring other connections (see “Configuring Interface Connections”).

1. Select the **Connect Mgmt** command from the **Configure** menu.

2. To configure the connections, move the cursor to highlight one of the interfaces.

3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.

4. Use the Up/Down arrow key to move to the **Inact** field.

5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in "Configuring Interface Connections" to add new connections.

6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

Unstructured DS3/T3 Legacy Interface Module Configuration (UD3L)

Configuring Interfaces (UD3L)

To configure a new interface, follow the steps described in “Configuring Physical Interfaces” to enter the name, the interface type, the slot, the physical interface and the active status indication. Press **<F2>** to enter the interface configuration menu. Figure 5-46 shows the interface configuration menu with all fields set to the default values.

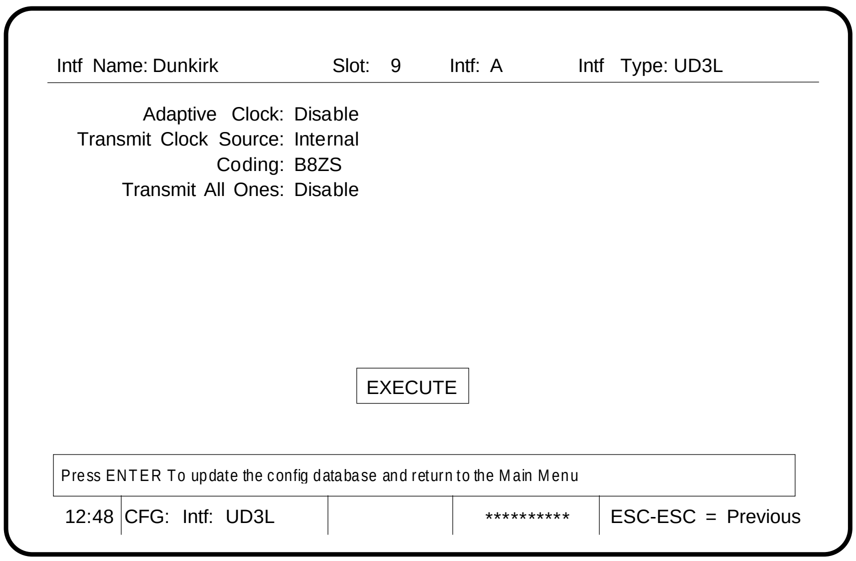


Figure 5-46. Interface Configuration Window – UD3L

The arrow keys are used to move between the different fields. Beginning at the Adaptive Clock field, the down arrow key can be used to move the cursor through each field in the order shown. The space bar is used to move through the possible selections, which are given below in parentheses starting with the default:

- Adaptive Clock (Disable/Enable)
- Transmit Clock Source (Internal, On Board, Recovered, Ref Clock)
- Coding (B8ZS, AMI)
- Transmit All Ones (Disable/Enable)

Configuring Connections

Connections are configured via the Connection Management menus, see “Configuring Interface Connections.” Configuring connections to and from synchronous legacy interfaces is very similar to configuring other connections. Figure 5-47 shows the configuration map for an Unstructured DS3/T3 interface.

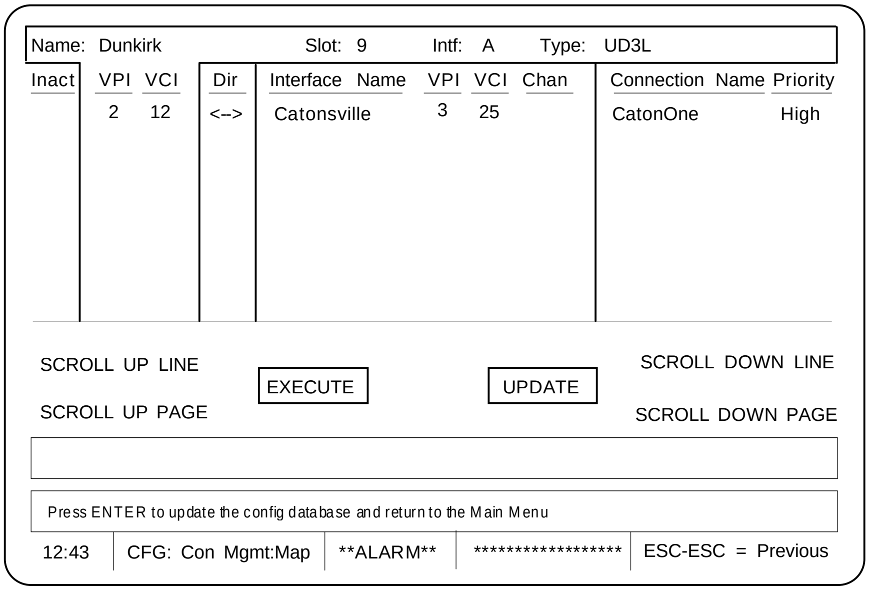


Figure 5-47. Connection Management Mapping Window – UD3L

Configuring connections to and from UD3L interfaces is very similar to configuring other connections (see “Configuring Interface Connections”).

1. Select the **Connect Mgmt** command from the **Configure** menu.

2. To configure the connections, move the cursor to highlight one of the interfaces.

3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.

4. Use the Up/Down arrow key to move to the **Inact** field.

5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in “Configuring Interface Connections” to add new connections.

6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

Unstructured E3 Legacy Interface Module Configuration (UE3L)

Configuring Interfaces (UE3L)

To configure a new interface, follow the steps described in “Configuring Physical Interfaces” to enter the name, the interface type, the slot, the physical interface and the active status indication. Press **<F2>** to enter the interface configuration menu. Figure 5-48 shows the interface configuration menu with all fields set to the default values.

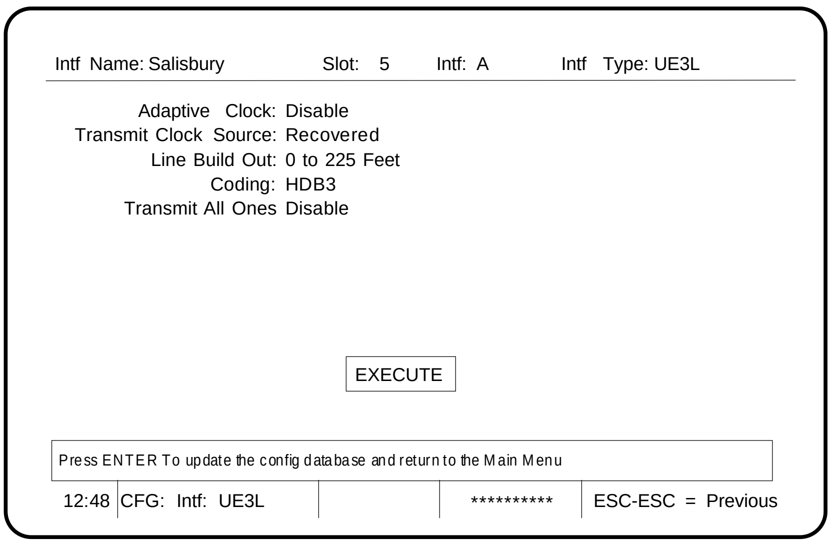


Figure 5-48. Interface Configuration Window – UE3L

The arrow keys are used to move between the different fields. Beginning at the Adaptive Clock field, the down arrow key can be used to move the cursor through each field in the order shown. The space bar is used to move through the possible selections, which are given below in parentheses starting with the default:

- Adaptive Clock (Yes, No)
- Transmit Clock Out (Recovered, Ref Clock, Internal, On Board)
- Line Build Out (0 to 225 Feet, 225 to 450 Feet)
- Coding (AMI, HDB3)
- Transmit All Ones (Disable, Enable)

Configuring Connections

Connections are configured via the Connection Management menus, see “Configuring Interface Connections.” Configuring connections to and from synchronous legacy interfaces is very similar to configuring other connections. Figure 5-49 shows the configuration map for an Unstructured E3 interface.

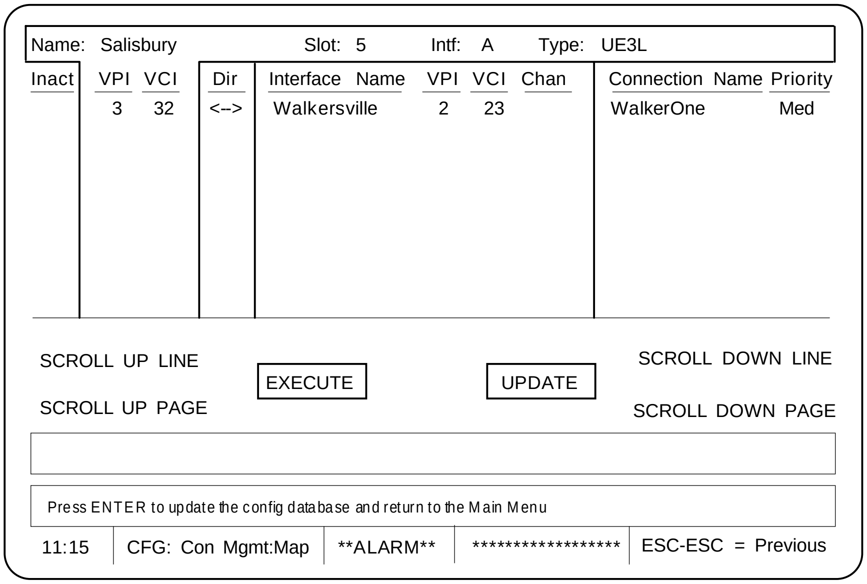


Figure 5-49. Connection Management Mapping Window – UE3L

Configuring connections to and from UE3L interfaces is very similar to configuring other connections (see “Configuring Interface Connections”).

1. Select the **Connect Mgmt** command from the **Configure** menu.

2. To configure the connections, move the cursor to highlight one of the interfaces.

3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.

4. Use the Up/Down arrow key to move to the **Inact** field.

5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in “Configuring Interface Connections” to add new connections.

6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

Basic Interface Module Configuration (BIM)

Configuring Interfaces (BIM)

To configure a new interface, follow the steps described in “Configuring Physical Interfaces” to enter the name, the interface type, the slot, the physical interface and the active status indication. Press **<F2>** to enter the interface configuration menu. Figure 5-50 shows the interface configuration menu with all fields set to the default values.

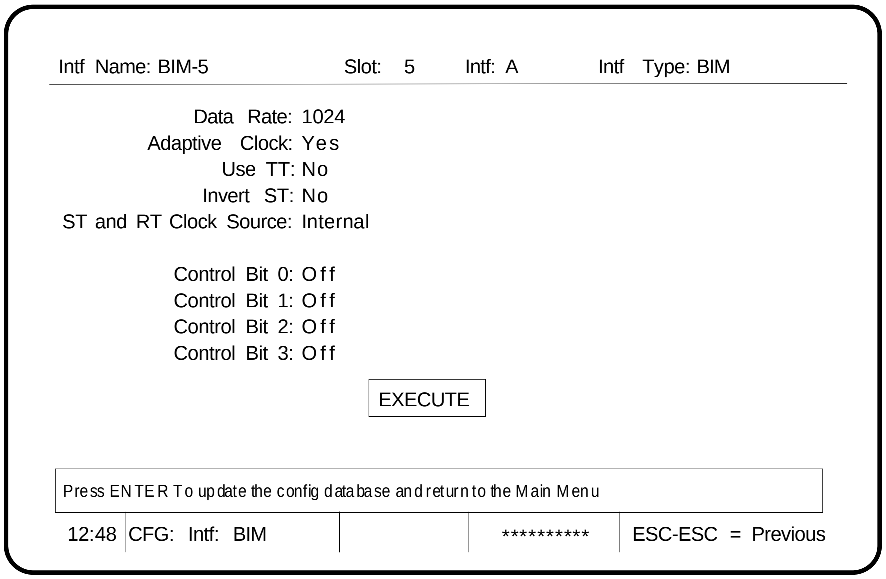


Figure 5-50. Interface Configuration Window – BIM

The arrow keys are used to move between the different fields. Beginning at the Data Rate field, the down arrow key can be used to move the cursor through each field in the order shown. Enter text using the keyboard. The space bar is used to move through the possible selections, which are given below in parentheses starting with the default:

- Data Rate (edit field, 8 to 2048 Kbps in 8 Kbps intervals)
- Adaptive Clock (Yes, No)
- Use TT (No, Yes)
- Invert ST (No, Yes)
- ST and RT Clock Source (Internal, Reference, External)
- Control Bit 0 through 3 (Off, On)

Configuring Connections

Connections are configured via the Connection Management menus, see “Configuring Interface Connections.” Configuring connections to and from synchronous legacy interfaces is very similar to configuring other connections. Figure 5-51 shows the configuration map for BIM interface.

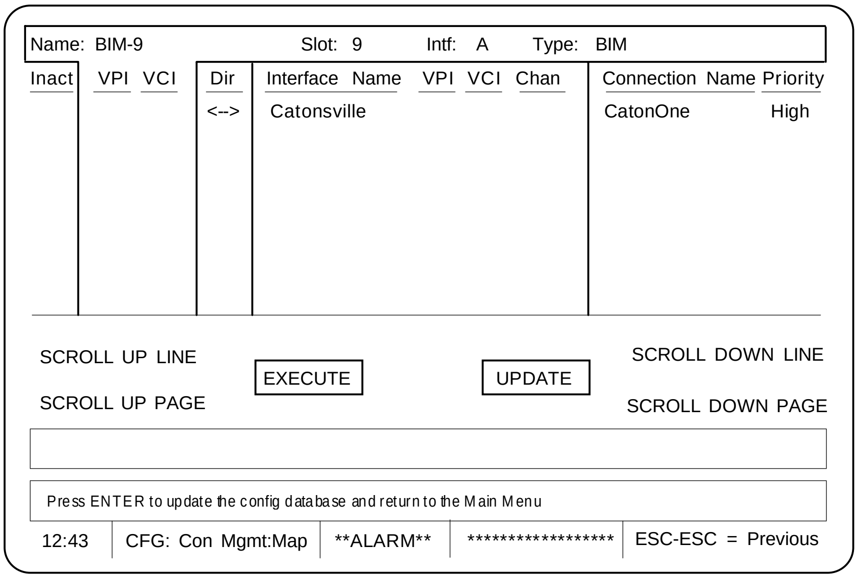


Figure 5-51. Connection Management Mapping Window – BIM

Configuring connections to and from BIM interfaces is very similar to configuring other connections (see “Configuring Interface Connections”).

1. Select the **Connect Mgmt** command from the **Configure** menu.

2. To configure the connections, move the cursor to highlight one of the interfaces.

3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.

4. Use the Up/Down arrow key to move to the **Inact** field.

5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in “Configuring Interface Connections” to add new connections.

6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

4-wire Analog Interface Module Configuration (EML)

Configuring Interfaces (4-Wire EML)

To configure a new interface, follow the steps described in “Configuring Physical Interfaces” to enter the name, the interface type, the slot, the physical interface and the active status indication. Press **<F2>** to enter the interface configuration menu. Figure 5-52 shows the interface configuration menu with all fields set to the default values.

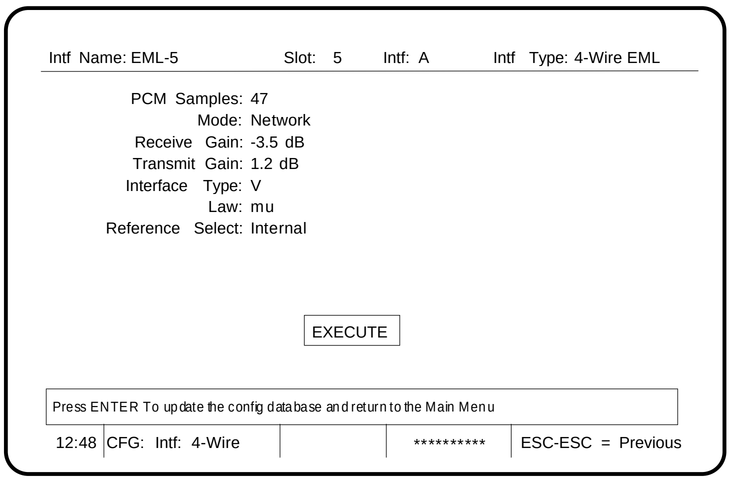


Figure 5-52. Interface Configuration Window – 4-Wire EML

The arrow keys are used to move between the different fields. Beginning at the PCM Samples field, the down arrow key can be used to move the cursor through each field in the order shown. The space bar is used to move through the possible selections, which are given below in parentheses starting with the default:

- PCM Samples (1 to 47)
- Mode (Network, PBX)
- Receive Gain (edit field, any value between –17.3 to 2.1 dBm in 0.1 dBm increments)
- Transmit Gain (edit field, any value between –0.4 to +19 dBm in 0.1 dBm increments)
- Interface Type (V, I, II)
- Law (mu, A) (See note)
- Reference Select (Internal, Ref Clock)

NOTE: *Configuration requirements for the law parameter are as follows:*

EML ⇔ EML: The law parameter must be the same for each end. If one end has the CD signaling parameter set to AB, the other end must also be set to AB. All combinations of fixed patterns are interchangeable.

EML ⇔ STL: The law parameter must be set to mu-law. The CD signaling parameter must be set to AB.

EML ⇔ SEL: The law parameter must be set to A-law. The CD signaling parameter must be set to one of the fixed patterns.

Configuring Connections

Connections are configured via the Connection Management menus, see "Configuring Interface Connections." Configuring connections to and from synchronous legacy interfaces is very similar to configuring other connections. Figure 5-53 shows the configuration map for a 4-Wire EML interface.

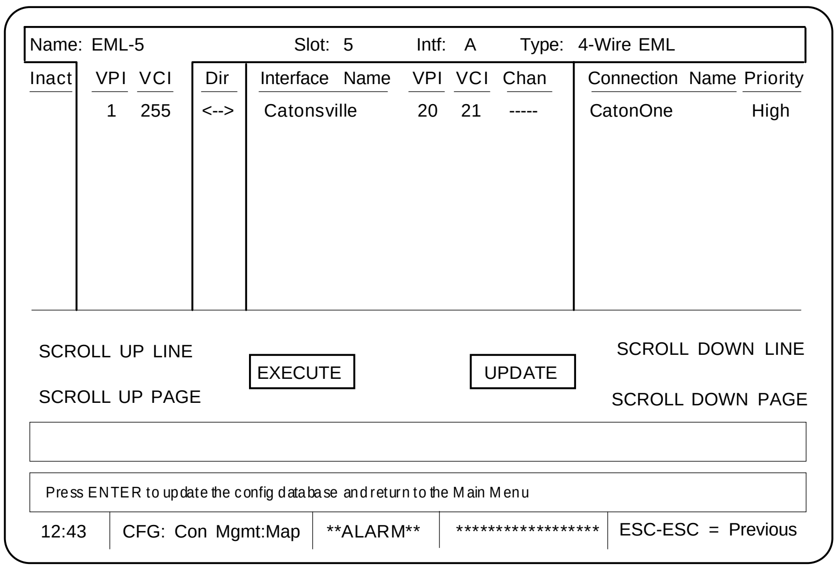


Figure 5-53. Connection Management Mapping Window – 4-Wire EML

Configuring connections to and from 4-Wire EML interfaces is very similar to configuring other connections (see "Configuring Interface Connections").

1. Select the **Connect Mgmt** command from the **Configure** menu.

2. To configure the connections, move the cursor to highlight one of the interfaces.

3. Press **<F2>** or **<ENTER>** to bring up the connection management map for that interface.

4. Use the Up/Down arrow key to move to the **Inact** field.

5. Press **<F3>** to add a new connection or **<F4>** to delete an existing connection. Follow the steps described in "Configuring Interface Connections" to add new connections.

6. When done, press **<F1>** or move to the **EXECUTE** button and press **<ENTER>** to update the configuration database and return to the main menu, or **UPDATE** and **<ENTER>** to update the configuration and remain in this window.

Multicast Feature Configuration

Multicast allows a single interface to deliver information to multiple destinations simultaneously. The Cell Exchange supports up to 16 different interfaces to act as the source of the multicast data traffic. Each of the 16 multicast interfaces is able to deliver data to 16 different destination interfaces, which are pre-selected during configuration of the multicast feature. The multicast feature supports only uni-directional data traffic from a single source to multiple destinations. Multicast utilizes multicast cell receive capability to support up to 256 VCIs. A source interface of a multicast group will be allowed to become a destination member of the same or any other multicast group.

Software to support the Multicast feature consists of:

- User interface support to enter, modify or delete configuration of up to sixteen multicast groups; up to sixteen multicast group “members” for each of the multicast groups and connections between all combinations of a multicast source port and members of a multicast group. User interface will include operator’s local access with a terminal via CX craft interface or remote access via Telnet.
- Database support to store configuration information about multicast groups, multicast group members and connections in non-volatile memory.

Configuring Interfaces

To configure the Multicast feature, select the **Multicast** command from the **Configure** menu. This will bring the screen shown in Figure 5-54.

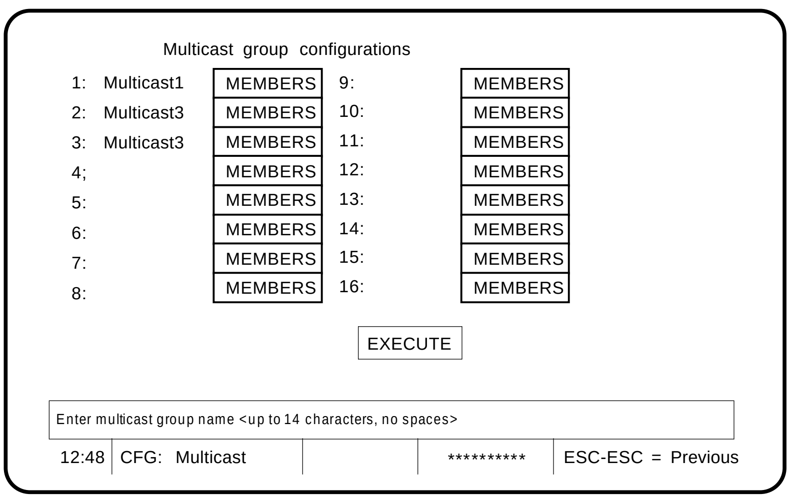


Figure 5-54. Multicast Configuration Window

This first screen is used to enter, modify or delete configuration of multicast group names for up to sixteen multicast groups. For each multicast group name configured, the user may select up to sixteen interfaces to join the multicast group membership. Interfaces may be joined to or removed from existing multicast groups dynamically without a need to reboot CX1500. If the multicast group is used in a connection, modifications to this group membership will not be permitted.

If a group name is not entered on this screen, the user will be prevented from opening the corresponding second screen. The screen alarm will come on and inform the operator that no group name was entered.

To configure the multicast group name with members, use the **<TAB>** key to move to the **MEMBERS** button for that group. Pressing **<ENTER>** will bring up the screen shown in Figure 5-55.

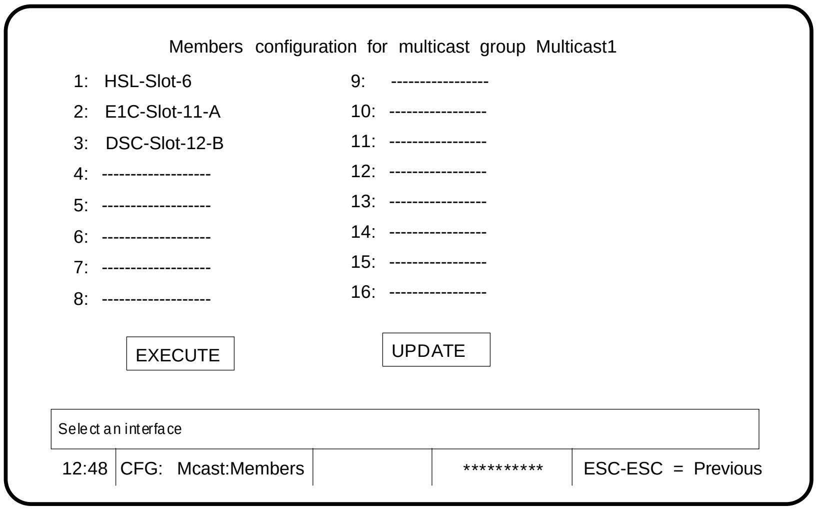


Figure 5-55. Configuring Member Interfaces

Enter up to 16 interfaces for the multicast group. When done, select **EXECUTE** and press **<ENTER>** to update the database and return to the previous screen, or **UPDATE** and **<ENTER>** to update the database and remain in this screen.

Multicast group names can only be configured as the destination for a uni-directional connection (connection source to the multicast group). The user will be prevented from configuring a bi-directional or uni-directional connection in the opposite direction (multicast group to the source). The appropriate screen alarm will come on.

NOTE: All multicast group members must use the same destination VPI/VCI for a particular ATM connection.

Limitations on Cell Exchange Multicast Operation Involving Legacy Interfaces

Legacy interfaces used in non-multicast (point-to-point) are assigned fixed VPIs and VCIs for use internal to the Cell Exchange. These are as follows:

Interface Type	VPI	VCI
LSAL port A	1	32
LSAL port B	2	32
LSAL port C	3	32
LSAL port D	4	32
LSAL port E	5	32
LSAL port F	6	32
LSAL port G	7	32
LSAL port H	8	32
4W-EM port A	1	32
4W-EM port B	2	33
STL, SEL, channel group (toward STL/SEL)	Intf #+1	32*(Intf #)+(first channel in group)+256
STL, SEL, channel group (from STL/SEL)	Intf #+1	32*(Intf #)+(first channel in group)

NOTE: When used as a multicast group member, the VPI and VCI used by the HSL, HSSL, UTL, UEL, UD3L, UE3L, DSL and BIM are unrestricted (except that the two ports on a single DSL card must use different VPI/VCIs, port a uses 1/32, port B uses 2/32).

This architectural feature of the Cell Exchange must be taken into account when including legacy interfaces in a multicast group. Since all members of the group must receive the multicast on the same VPI/VCI when one of the multicast group members is a legacy port, the VPI/VCI used must be that dictated by the legacy port. This presents two limitations, described below.

Limitations on Multicast Groups Containing Multiple Legacy Ports

Since all members of the multicast will receive the same VPI/VCI, combinations of legacy card ports that require differing VPIs or VCIs are prohibited from being present in the same multicast group. For example, a group containing ports A and B from a single DSL card would not be permitted.

Limitations on Cell-bearing Interfaces Participating in Multiple Multicasts, with each Multicast Containing a Legacy Port

Again, since all members of the multicast will receive the same VPI/VCI, two different multicasts will require the use of the same VPI/VCI if each multicast group contains legacy ports that require the use of the same VPI/VCI. This precludes having both multicasts appear on the same cell-bearing interface. For example, consider two multicasts, A and B. Multicast A includes an LSAL port A as a group member. Multicast B includes a different LSAL port A (on a different LSAL card) as a member. Since both of these legacy ports force the use of VPI 1, VCI 32, it would not be permitted to include a particular cell bearing port in both multicast groups A and B. Since both have the same VPI and VCI, having them both present on the same cell-bearing interface would effectively combine the two cell streams into a single composite stream of meaningless data.

NOTE: *The rules for determining the VPI and VCI used on STL channel groups are complex, requiring calculations that involve both the port (interface) number and the number representing the first channel in the channel group. As such, great care is required when including an STL channel group in a multicast. All of the limitations described above apply. Effectively, two STL channel groups belonging to the same multicast group must consist of the same port (interface) and the same starting channel on two different STL cards.*

NOTE: HRIM channels must be configured as bi-directional. This precludes the use of HRIM channels in a multicast since a multicast is inherently unidirectional.

Chapter 6

Troubleshooting

Alarms and Traps

Traps

SNMP traps are issued for alarm events and can be sent to up to three IP addresses programmed within the node. Traps include:

- Power Supply Up
- Power Supply Down
- Interface Up
- Interface Down
- Board Up
- Board Down
- Incorrect Board Configuration

Alarms - Craft Interface

Normally, the first indication of a malfunction will be an alarm display. An alarm is any out of parameter condition detected during Cell Exchange operation. If such a condition is detected, an alarm message is generated and placed in the alarm queue, and an alarm indicator is displayed on the status line. The alarm indicator provides the operator with an indication that an alarm has been generated since the last time the current list of alarms was viewed. This serves as an alarm acknowledgment mechanism for the operator.

The operator can view the current list of alarms held in the alarm queue by selecting the **View** menu and **Alarm Log** command. Upon execution, the alarm indicator being displayed is removed from the status line and the list of alarm messages is displayed in the alarm window. The current alarm is displayed in reverse video.

Alarms and their meaning are described in Table 6-1.

Table 6-1. Alarm Messages

Alarm Message	Meaning
General	
The CPU is now active, slot #	Indicates which slot has the active CPU.
Last reboot: file Unknown, line 0 [0](00/00/00,00:00:00)	Provides time stamp for las t reboot of system.
Incorrect card configuration slot # <slot>	A module was detected in a slot different than the way the system is configured.
Card is alive in slot # <slot> Card has died in slot # <slot>	A module has been detected and successfully booted up, or has subsequently failed.
Interface is up in slot # <slot> Interface is down in slot # <slot>	A configured interface/port has detected a valid signal or lost a valid signal.
Incorrect password	The user has attempted to log in using an invalid password.
Attempt to remove current operating software	User has attempted to remove the currently executing version of software.
Software load successful Software load failed	Software download succeeded or failed.
Attempt to configure connection for multicast interface	User has attempted to configure connection mappings for a Station Clock Module (SCM) or a multicast interface (not implemented yet). No connection mappings are allowed for SCM Modules.
Power supply is up: <A/B> Power supply is down: <A/B>	Power Supply Module has been detected as available or failed.
LAN Emulation Client is active LAN Emulation Client is down	The LAN Emulation Client has successfully connected to a LAN Emulation Server, or has subsequently been disconnected from the server.
Screen validation failed! <additional failure reason>	User has entered invalid configuration information. Where appropriate, the cursor is placed on the invalid item and the "failure reason" is given. Some of the additional failure reasons are: Connection Mapping Validation
Check destination interface (destination field is bogus)	VPI only must be consistent (one half of a connection was specified as VPI only, but the other half was not)
Source VCI exceeds max (connection vci was >65535) Destination VCI exceeds max (connection vci was >65535) Source VPI exceeds max (connection vpi was >255) Destination VPI exceeds max (connection vpi was >255)	Too many connections for interface (legacy interfaces are only allowed one connection in each direction)
Invalid STL source channel group	A connection to an STL interface did not specify a valid channel group id for that interface.
Invalid STL destination channel group	A connection to an STL interface did not specify a valid channel group id for that interface.

Table 6-1. Alarm Messages (Cont'd)

Alarm Message	Meaning
General (Cont'd)	
Duplicate source VPI/VCI pair	A source vpi/vci pair is used more than once for an interface
Duplicate source channel group	A source channel group of an STL, SEL, or HRIM interface is used more than once.
VPI/VCI pair used by SVC	The source vpi/vci pair for the interface is already being used by the system's LAN Emulation Client.
Destination VPI/VCI pair in use	The destination vpi/vci pair is used more than once for an interface.
Destination channel group in use	The destination channel group of an STL, SEL, or HRIM interface is used more than once.
Destination VPI/VCI used by SNMP SVC	The destination vpi/vci pair for the interface is already being used by the system's LAN Emulation Client.
Destination VPI/VCI used by SNMP PVC	The destination vpi/vci pair for the interface is already being used for an SNMP PVC connection.
Not Ready for Redundant CPU Switch	This message is only seen with a redundant CPU configuration. There is danger of unsuccessful Redundant CPU switch when this message is displayed.
Ready for Redundant CPU Switch	This message is only seen with a redundant CPU configuration. The CPU is prepared to perform a Redundant CPU switch after this message is displayed.
Logical Interfaces	
Cannot remove current system timer	User is trying to delete a logical interface that is being used as the source of system timing. User must first change the source of system timing before deleting this interface.
Can't remove/deactivate SNMP connections!	User is trying to delete a logical interface that is being used for SNMP connections. User must first change the interface used for SNMP before deleting this interface.
Can't change card type! Do REMOVE+ADD	To change the card type of an existing interface, the user should delete the old interface (F4) and add the new interface (F3).
Empty interface name slot# <slot >	User did not fill in the interface name field for a logical interface
Duplicate interface name slot# <slot>	Duplicate interface names exist.
Duplicate definition slot# <slot>	User has entered more than one logical interface for the same slot. For example, user may have tried to define one module type for port A and a different module type for port B.
Exceeded max interfaces slot# <slot>	User has defined more logical interfaces than are allowed for the type of interface module. For example, three logical interface for a Dual Sync Cell Module.

Table 6-1. Alarm Messages (Cont'd)

Alarm Message	Meaning
Interface Physical Connection	
Empty channel Id field	No channel ID field filled in for HRIM configuration.
Duplicate channel Id	Duplicate channel id field for HRIM configuration.
Channel bandwidth over limit	User has defined aggregate bandwidth that exceeds the bandwidth limit for HRIM configuration.
Can't modify group in use, chan# <channel>	For STL or SEL configuration.
READ COMMUNITY string < 5 chars	Community string must be at least five characters.
WRITE COMMUNITY string < 5 chars	Community string must be at least five characters.
TRAP COMMUNITY string < 5 chars	Community string must be at least five characters.
Connection <PVC connection #>: VPI/VCI pair in use	VPI/VCI pair is already in use for the selected interface.
Connection <PVC connection #>: invalid VPI/VCI choice	Invalid vpi/vci numbers were entered (e.g. 0-0).
Connection <PVC connection #>: VPI/VCI used by SVC	The pvc vpi/vci is already being used for a LAN Emulation Client connection.
Invalid CPU IP Add	Invalid IP address entered.
Invalid CPU Subnet Mask	Invalid IP subnet mask entered.
Invalid Gateway IP Addr	Invalid IP address entered.
No valid Trap IP Addr	Invalid IP address entered, or no address entered.
Management validation failed: <additional failure reason>	Configuration request from SNMP management failed. Failure reasons are similar to those for "Screen validation failed."

A typical alarm screen is shown in Figure 6-1.

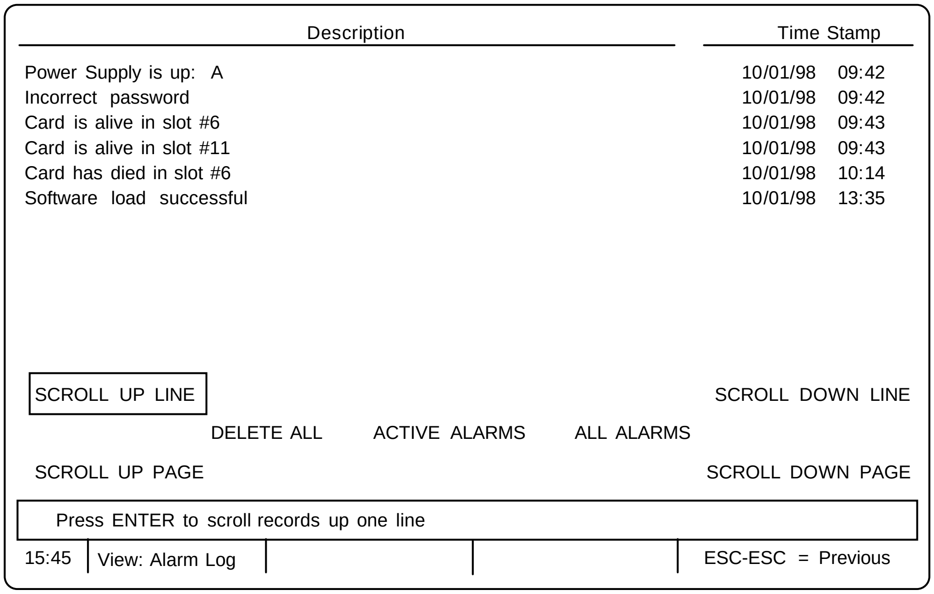


Figure 6-1. Alarm Log Window

The operator can delete all alarms from the alarm log:

- Using the <TAB> or <ARROW> key, move to the DELETE ALL button.
- Press the **<ENTER>** key.

Clearing alarms is at the operator's discretion, but it is recommended that alarms be cleared as soon as the condition is resolved or properly isolated. The alarm log will only store up to 54 alarms (3 pages). If the alarm log is full and a new alarm is detected, the system will automatically delete the oldest alarm and record the newest.

General Troubleshooting Procedures

If the Cell Exchange system that is not working properly is local, connect a VT100 terminal to the CPU module and enter the local management system (See Chapter 4).

If the Cell Exchange is remote, attempt to discover where the problem is by checking the communication paths.

1. Verify the path by building out from the local node to the node that is not responding.
2. Ping from the local node to the first node in the net (Node CX-1 in Figure 6-2).

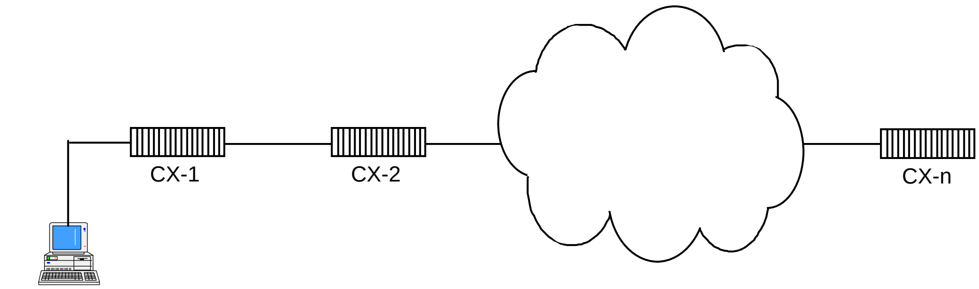


Figure 6-2. Path Connectivity Check

3. Ping the next node (CX-2, etc.) in succession until the problem is isolated.
4. If the ping was successful, open a Telnet session and verify cell interface to failed node.
5. If there are no errors, contact the service provider for the communications link or network.
6. If errors are noted, attempt to determine the problem by looking at alarms and module status.
7. If the interface is out of service, contact the service provider.

Module Indications

AC Power Supply Module

If the red “FAIL” LED illuminates on a Power Supply module, there is a possibility the module has failed. Here are a few quick checks to verify the status of the module.

1. If there is only one Power Supply Module installed, a failed module will shut down the Cell Exchange system.
   a. If the “FAIL” LED is illuminated and the Cell Exchange system is still operational, the power supply is OK, but there is a malfunction in the LED circuitry. The module should be replaced as soon as possible.
   b. If the Cell Exchange system is not operational, and the front panel of the power supply module is blank, AC input to the module has been lost or the fuse is blown.

2. If there is a redundant power supply installation, the backup power supply will automatically assume the load. Check the front panel LEDs for one of the following indications:
   a. If the red “FAIL” LED is illuminated, the power supply module has failed. (Since the green “POWER” LED only indicates that +5 VDC is being read at the bus, the LED may be illuminated even though the power supply has failed.)
   b. If the front panel of the power supply module is blank, AC input to the module has been lost or the fuse is blown.

DC Power Supply Module

If the red "FAIL" LED illuminates on a Power Supply module, there is a possibility the module has failed. Here are a few quick checks to verify the status of the module.

1. If there is only one Power Supply Module installed, a failed module will shut down the Cell Exchange system.
   a. If the "FAIL" LED is illuminated and the Cell Exchange system is still operational, the power supply is OK, but there is a malfunction in the LED circuitry. The module should be replaced as soon as is practicable.
   b. If the Cell Exchange system is not operational, and the front panel of the power supply module is blank, DC input to the module has been lost or the fuse is blown.
2. If there is a redundant power supply installation, the backup power supply will automatically assume the load. Check the front panel LEDs for one of the following indications:
   a. If the red "FAIL" LED is illuminated, the power supply module has failed. (Since the green "POWER" LED only indicates that +5 VDC is being read at the bus, the LED may be illuminated even though the power supply has failed.)
   b. If the front panel of the power supply module is blank, DC input to the module has been lost.
3. If the "FUSE" LED is illuminated, the internal fuse has blown.

CPU Module

If the red "FAIL" LED illuminates on a CPU module, the module has possibly failed.

1. In a single CPU installation, a failed CPU module may not be immediately evident because it only affects cell bus timing and configuration. Over a short period of time, however, performance of the Cell Exchange system will degrade.
2. In a dual CPU configuration, if one module fails, the other will automatically take over. This will be indicated by the illumination of the "ACTIVE" LED. If the primary CPU module has in fact failed, its "ACTIVE" LED should extinguish, and the secondary module's "ACTIVE" LED should illuminate.

Other Modules

Information on the front panel indicators for other Cell Exchange system modules is provided in Chapter 3, Modules. If any module indicator is not indicating normal operation for that module, the module may be defective.

User-initiated Tests

The user can diagnose a range of system components, from a single interface module to network connectivity. The operator can control each data port's role in the diagnostic procedure. Each port has the capability to loop the data traffic in either direction: back to the external connecting equipment; or back into the Cell Exchange system. The loopbacks are unique to the port used. The configuration screen for conducting loopback testing is shown in Figure 6-3. The loopback data flow is shown in Figure 6-4.

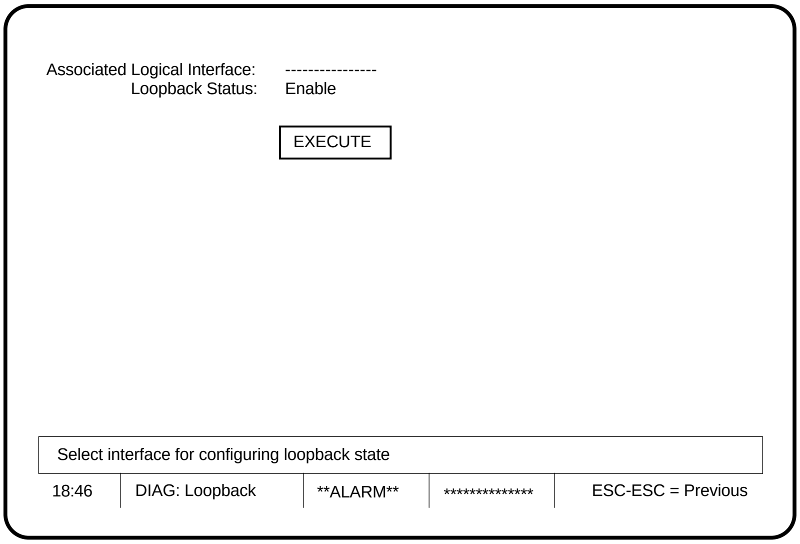


Figure 6-3. Loopback Window from Diagnostics Menu

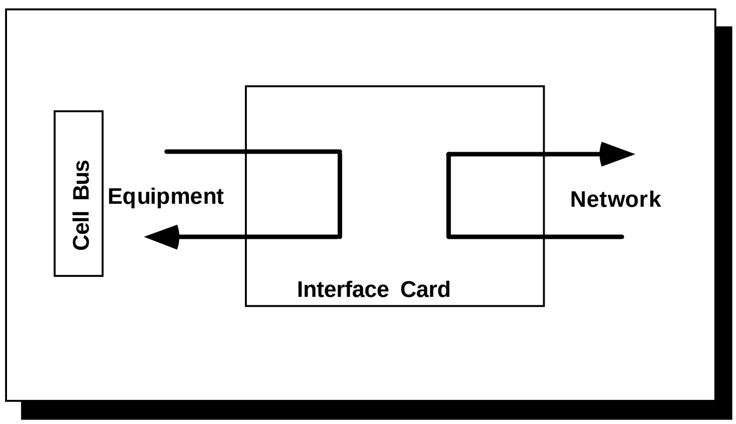


Figure 6-4. Loopback Data Flow

To execute a loopback test:

1. Select **Loopback** from the **Diagnostics** menu.
2. Use the **<SPACE>** bar to move through the logical interface selections until the desired interface is reached.
3. Use the arrow keys to move to **Loopback Status** and the **<SPACE>** bar to select **ENABLE**.
4. Use the arrow keys to move to the **EXECUTE** button and press **<ENTER>**.

NOTE: *Loopback tests on all modules will remain active* **indefinitely** *after they have been initiated. Loopback tests must be deactivated through operator intervention.*

Replacement Procedures

This section provides information for replacement of failed modules on the Cell Exchange system. The basic maintenance concept for the Cell Exchange system is limited to on-equipment repair.

Electrostatic Discharge (ESD) Anti-Static Procedure

When performing any maintenance action on the Cell Exchange system, observe the following procedures:

1. Ensure that the Cell Exchange system is properly grounded.
2. Connect an ESD wrist strap to the same ground as the Cell Exchange system.
3. Put the wrist strap on before handling any module or the chassis of the Cell Exchange system.
4. Use protective ESD bags to handle, store, or ship Cell Exchange system components.
5. If the maintenance or replacement action requires removing a module, do the following:
   - Remove the replacement module from its protective ESD bag and lay it on the bag.
   - Remove the defective module and lay it on another ESD bag or on the same bag.
6. When maintenance or replacement is complete, remove the wrist strap and disconnect it from ground.

Removing and Replacing Chassis

To remove the Cell Exchange system from the rack:

1. Turn the power switch(es) to the OFF (0) position if the chassis is an AC version or de-energize power feed cable(s) if the chassis is a DC version..
2. Unplug the power cord(s) from the power source receptacle and rear panel connector for AC version or disconnect DC power feed cable(s) if DC version.
3. Remove the grounding strap from the grounding lug on the rear panel (backplane).
4. Remove the screws attaching the chassis to the equipment rack.
5. Slide the chassis out of the rack.

To replace the chassis:

1. Slide the new chassis into the rack.
2. Replace the screws attaching the chassis to the equipment rack.

3. Attach the grounding strap to the grounding lug on the rear panel.
4. Plug the power cord(s) into the rear panel connector and power source receptacle if AC version or if DC version attach DC power feed cable(s).
5. Turn the power switch(es) to the ON (I) position for AC version or energize power feed cable(s) if DC version.

PRECAUTION: ***Secure the power cable to the connector on the rear panel before connecting the cable to the power source. Failure to comply with this procedure may result in electrical shock.***

Removing and Replacing Modules

All modules in the Cell Exchange system may be removed and replaced without removing electrical power from the chassis (hot swap). Figure 7-1 represents the removal of a Power Supply Module, but the removal process for all Cell Exchange system modules is similar.

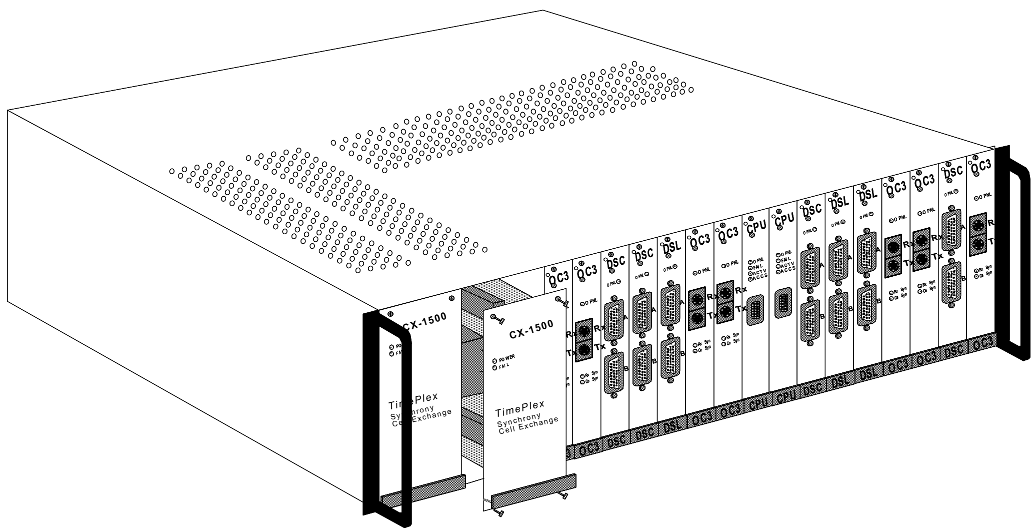


Figure 7-1. Removal of a Cell Exchange System Module (Power Supply)

Model CX-1500 Power Supply Module (AC or DC)

PRECAUTIONS: ***Observe electrostatic discharge (ESD) precautions when handling any Cell Exchange system module. If ESD precautions are not taken, sensitive components may be permanently damaged.***

Individual external DC power must be turned off to the chassis prior to removal/installation of the individual power supply. Severe damage to components may occur if power is not turned off.

Note that Power Supply A is the left hand supply and Power Supply B is the right hand supply when looking at the front of the CX-1500.

To remove the Power Supply Module:

1. Turn off the power for the power supply you wish to replace. Use the rear AC switch for the AC chassis or the external DC breaker for the DC chassis. The Power Supply FAIL LED will illuminate on the face plate and system will provide an alarm that the power supply is down. The POWER LED will remain illuminated indicating that +5VDC backplane power is still present.

2. Loosen the four captive screws securing the power supply to the chassis.

3. Remove the power supply by pulling it straight out. Be careful not to twist or bend the module.

To replace the Power Supply Module:

1. Confirm that the power is turned off for the power supply slot. Use the rear AC switch for the AC chassis or the external DC breaker for the DC chassis.

2. Slide the replacement module straight back into the chassis, aligning the power connector and DIN connector with the backplane slot. Make sure the connector is fully seated. The POWER LED will illuminate indicating that +5VDC backplane voltage is present.

3. Tighten the four screws in the module front panel securely.

NOTE: *Never force the screws when starting them. If they become difficult to turn, back them off and start over*

4. Turn on power on the power supply. Use the rear AC switch for the AC chassis or the external DC breaker for the DC chassis. The Power Supply FAIL LED will go off on the face plate and system will provide an alarm that the power supply is up.

CPU Module

PRECAUTION: ***Observe electrostatic discharge (ESD) precautions when handling any Cell Exchange system module. If ESD precautions are not taken, sensitive components may be permanently damaged.***

PRECAUTION: ***The CPU Module must be installed in slot 8 of Model CX-1500 (slots 7 and 8 for redundant CPUs) and in any slot except slot 1 of Model CX-1540.***

PRECAUTION: ***Slot 1 of the CX-1500/1540 is used for initialization. Installing the CPU module in Slot 1 will cause the database to be erased (initialized).***

To remove the CPU Module:

1. Loosen the two captive screws securing the module to the chassis.
2. Remove the module by pulling it straight out. Be careful not to twist or bend the module.

To replace the CPU Module:

1. Slide the replacement module straight back into the chassis, aligning the DIN connector with the backplane slot. Make sure the connector is fully seated.
2. Tighten the two screws in the module front panel securely.

NOTE: *Never force the screws when starting them. If they become difficult to turn, back them off and start over.*

Other Modules

PRECAUTION: Observe electrostatic discharge (ESD) precautions when handling any Cell Exchange system module. If ESD precautions are not taken, sensitive components may be permanently damaged.

To remove the modules:

1. Remove any cables from the connectors on the front panel.

NOTE: Observe the following precautions when removing the OC3/OC3C Interface Module:

   a. Remove the fiber optic cable connectors individually and cap with protective plastic caps.

   b. Stow any removed fiber optic cables in a protected spot where they will not be pulled or bent tighter than a 6-inch radius.

PRECAUTION: Working with fiber optic cables can be hazardous to personnel and, if mishandled, can cause permanent damage to the cables.

WARNING: THE FIBER-OPTIC CONNECTORS MAY EMIT LASER LIGHT THAT CAN INJURE YOUR EYES. NEVER LOOK INTO AN OPTICAL FIBER CONNECTOR OR CABLE.

PRECAUTION: Fiber optic cables require special handling. They must not be bent to a radius of less than six inches. When exposed, optical fibers (contained within the fiber-optic cable) are extremely brittle and fragments from the fiber can easily penetrate the skin or eyes. Wear protective goggles and clothing when working with the optical fibers.

2. Loosen the two captive screws securing the module to the chassis.
3. Remove the module by pulling it straight out. Be careful not to twist or bend the module.

To replace the module:

1. Slide the replacement module straight back into the chassis, aligning the DIN connector with the backplane slot. Make sure the connector is fully seated.
2. Tighten the two screws in the module front panel securely.

NOTE: *Never force the screws when starting them. If they become difficult to turn, back them off and start over.*

3. Reattach any cables to the front panel connectors.

Asynchronous Transfer Mode Overview

Asynchronous Transfer Mode (ATM) technology was developed for the high-speed transfer of voice, video, and data through private networks and across public networks. ATM technology provides a way of linking a wide range of devices (from telephones to computers) using one seamless network. It removes the distinction between local area and wide area networks, integrating them into one network. ATM can integrate all traffic types, eliminating parallel networks supporting different applications (like voice and data) and multiple links to the same location. It supports both bursty data and delay sensitive traffic.

ATM is a cell-switching and multiplexing technology that combines the benefits of circuit switching (constant transmission delay and guaranteed capacity) with those of packet switching (flexibility and efficiency for intermittent traffic). ATM uses an unchannelized bandwidth approach for traffic transport. Like X.25 and Frame Relay, ATM defines the interface between the user equipment (such as workstations and routers) and the network. This interface is referred to as the User-Network Interface (UNI).

The asynchronous in ATM refers to the way in which ATM achieves its unchannelized bandwidth allocation. ATM differs from synchronous transfer mode methods, where time-division multiplexing (TDM) techniques are employed to pre-assign users to time slots. ATM time slots are made available on demand, with information identifying the source of the transmission contained in the header of each ATM cell. Relative to ATM, TDM is inefficient because a time slot is wasted when a station has nothing to transmit. Also, when a station has more information to transmit that can fit into its allotted time slots, only part of the information can be sent at that time even though other time slots may be empty. With ATM, a station can send cells whenever necessary.

ATM networks allow for strict quality-of-service guarantees because network resources are allocated on a per connection basis. Cell sequence integrity is maintained because routing decisions are made only at connection establishment time.

ATM Networks

ATM networks are connection-oriented, where virtual connections are established between end-systems, and cells are switched according to connection identifiers. The network architecture uses unchannelized network transports. Since there are no physical channels to distinguish the traffic in an ATM network, logical connections are established. Instead of voice and video channels, ATM has voice and video connections. These logical connections are established and maintained by means of a two-part identifier structure: the virtual path and the virtual channel.

A virtual path (VP) is a concept used to describe the transport of cells belonging to a set of virtual channels. Each VP is assigned a unique identification value, called the virtual path identifier (VPI). A virtual channel (VC) is a concept used to describe the transport of ATM cells associated by a unique identification value, called the virtual channel identifier (VCI). A VP is a logical grouping of VCs that allows an ATM switch to perform operations on groups of virtual circuits. ATM switches use the VPI and VCI fields located in the cell header to identify the next network segment that a cell needs to transit on its way to its final destination. A virtual channel is equivalent to a virtual circuit; both terms describe a logical connection between the two ends of a communications connection. As a result, ATM offers a private switched connection for each user.

The concept of virtual circuit simplifies routing once a path is established, and allows components within the network to simply distinguish among different traffic flows for purposes of admission, congestion control, and security. Multiplexing and switching in ATM are always done on VPs first and then on VCs.

ATM Cell

ATM uses very large-scale integration (VLSI) technology to segment data at high speeds into units called cells. Cells transit ATM networks by passing through switches, which analyze information in the header to switch the cell to the appropriate output port. The cell moves from switch to switch as it works its way to its destination.

ATM technology is based entirely on cell structure. The ATM cell is a 53-byte fixed length cell consisting of a 48-byte information field (cell payload) to carry user or network information, and a 5-byte header that contains information used to route the cell to its destination (Figure A-1). The header and cell payload remain constant at both the user-network interface (UNI) and network-network interface (NNI). Cells are assigned on demand, depending upon the source activity and available resources. Unlike earlier LAN or WAN techniques, ATM cells can be sent over a wider variety of media types (e.g., copper wire or fiber optic cable) and a wider range of transmission speeds (e.g., up to 622 Mbps).

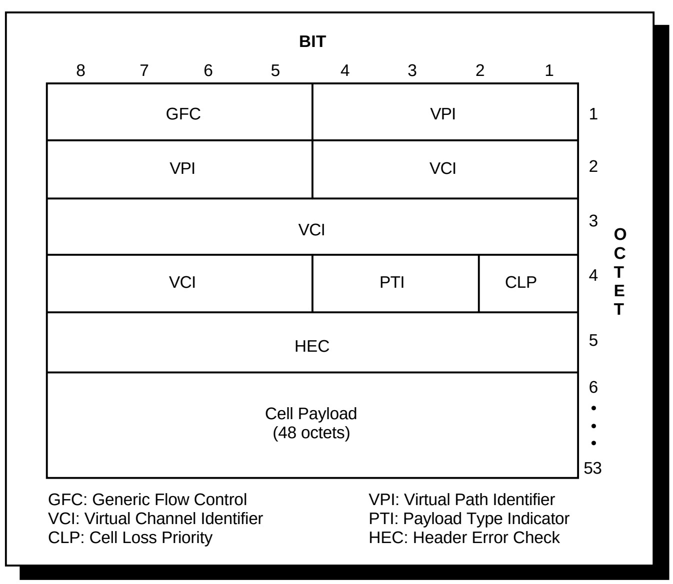


Figure A-1. ATM Cell Structure

The main function of an ATM switch is to receive cells on one port and switch those cells to the proper output port based on the VPI and VCI values of the cell. This switching is dictated by a switching table that maps input ports to output ports based on the values of the VPI and VCI fields.

ATM Reference Model

The ATM transport network common to all services is structured into an ATM layer and a physical layer. Figure A-2 is a reference model that illustrates the organization of ATM functionality and the interrelationships between the layers of functionality.

In the ATM reference model, the ATM layer and the ATM adaptation layers are roughly analogous parts of the data link layer of the Open System Interconnection (OSI) reference model, and the ATM physical layer is analogous to the physical layer of the OSI reference model. The control plane is responsible for generating and managing signaling requests. The user plane is responsible for managing the transfer of data. Above the ATM adaptation layer are higher-layer protocols representing traditional transports and applications.

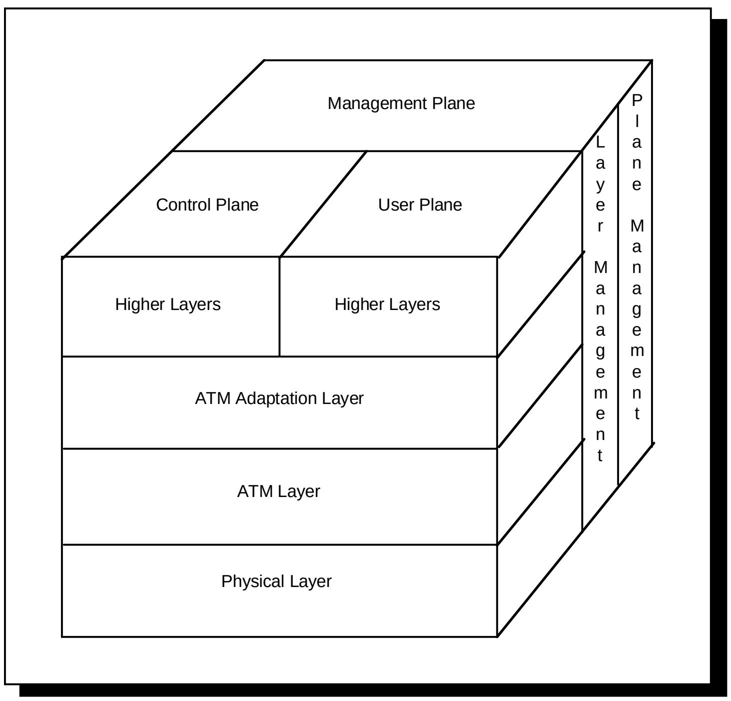


Figure A-2. ATM Reference Model

Physical Layer

The ATM physical layer controls the transmission and receipt of bits on the physical medium. It also keeps track of ATM cell boundaries and packages cells into the appropriate type of frame for the physical medium being used. ATM can use any physical medium capable of carrying ATM cells. Some existing standards that can carry ATM cells are SONET (Synchronous Optical Network)/SDH, DS-3/E3, 100-Mbps local fiber (Fiber Distributed Data Interface [FDDI] physical layer), and 155-Mbps local fiber (Fiber Channel physical layer).

ATM Layer

The ATM layer is fully independent of the physical medium (physical layer) used to transport the ATM cells and applications it supports above the ATM layer. This allows a wide range of upper-layer services to be supported by a single transfer mode over multiple physical media. The result is not only an integrated data transfer but also the ability to support novel integrated applications.

The ATM layer is responsible for establishing connections and passing cells through the ATM network. To do this, it uses the information contained in the header of each ATM cell. The ATM layer maps network layer addresses to ATM addresses.

The primary function of the cell header is to identify cells that belong to a virtual channel (VC). The ATM layer also supports a virtual path (VP), identified by the virtual path identifier (VPI). The information field of a cell is transported transparently by the ATM layer. In addition, the ATM layer preserves the cell sequence integrity on a virtual channel connection. The ATM layer provides single bit error correction on the ATM header.

ATM Adaptation Layer

The ATM adaptation layer (AAL) translates between the larger service data units (SDUs) (for example, video streams and data packets) of upper-layer processes and ATM cells. Specifically, the ATM adaptation layer (AAL) receives packets from upper-level protocols (such as AppleTalk, Internet Protocols [IP], and NetWare) and breaks them into the 48-byte segments that form the payload field of an ATM cell.

The primary function of the ATM adaptation layer (AAL) is to segment user data into ATM cells and to reassemble the ATM cells into user data at the destination end system. This layer can provide end-to-end error control, buffering, flow control, and multiplexing based on the applications requirements. The AAL is divided into 4 classes of service, as shown in Figure A-3.

	Class A	Class B	Class C	Class D
Timing Relationship Between Source and Destination	Required		Not Required	
Bit Rate	Constant	Variable		
Connection Mode	Connection Oriented			Connectionless

Figure A-3. Service Classification for AAL

Some examples of different service classifications include:

Class A: Circuit Emulation, Video

Class B: Variable Bit Rate Video and Audio

Class C: Connection-oriented Data Transfer

Class D: Connectionless Data Transfer

Quality of Service

When an ATM end station connects to the ATM network, it is essentially making a contract with the network based on quality of service (QoS) parameters. This contract specifies an envelope that describes the intended traffic flow. This envelope specifies values for peak bandwidth, average sustained bandwidth, and burst size.

It is the responsibility of the ATM device to adhere to the contract by means of traffic shaping. Traffic shaping is the use of queues to constrain data bursts, limit peak data rate, and smooth jitter so that the traffic will fit within the promised envelope.

ATM switches have the option of using traffic policing to enforce the contract. The switch can measure the actual traffic flow and compare it against the agreed upon traffic envelope. If it finds that traffic is outside of the agreed upon parameters, the switch can set the Cell Loss Priority (CLP) bit of the offending cells. Setting the CLP bit makes the cell eligible for discard, which means that the switch, or any other switch handling the cell, is allowed to drop the cell during periods of congestion.

Congestion control is a primary concern of ATM designers. For example, dropping just one cell that is part of a FDDI frame can result in the retransmission of 93 cells. Retransmission can lead to an exponential increase in congestion. As ATM switches drop individual cells from different packets, more packets are retransmitted, causing even more cells to be dropped.

ATM References

There are a number of commercial books available that will provide a good primer or additional information regarding ATM networks. Two are cited here.

Black, Uyless; *ATM: Foundation for Broadband Networks*; Prentice-Hall; 1995

Goralski, Walter J.; *Introduction to ATM Networking*; McGraw-Hill, Inc.; 1995

Cable Diagrams

This appendix contains wiring diagrams for CX-1500/CX-1540/CX-1580 cables. Tables B-1 and B-2 define which cables are applicable to each module. Table B-3 provides an index of the available cables listed by part number.

Table B-1. Cable Applicability Matrix -Cell

		Module Type								
Part Number	**Description**	**CPU**	**SCM**	**T1C**	**OC3**	**OC3C**	**DSC**	**DS3**	**E1C**	**E3C**
650252-X	DB-9 (F) to DB-9 (F)	X								
650074-X	DB-9 (F) to DB-25 (F)	X								
650075-X	DB-9 (F) to DB-25 (M)	X								
610133-X	DB-9 (F) to DB-25 (M)	X								
613008-X	HDB-26 (M) to DB-25 (M), RS-530		X				X			
613009-X	HDB-26 (M) to DB-25 (F), RS-530		X				X			
613012-X	HDB-26 (M) to DB-15 (M)						X			
613005-X	HDB-26 (M) to DB-37 (M)		X							
613006-X	HDB-26 (M) to DB-37 (F)		X							
613003-X	HDB-26 (M) to DB-34 (M)		X				X			
613007-X	HDB-26 (M) to DB-34 (F)		X				X			
610127-X	RJ-45 to RJ-45 (Straight)			X					X	
610126-X	RJ-45 to RJ-45 (Crossover)			X					X	
61362	RJ-45 to DB-15 (F)			X						
61385	DB-15 (M) to DB-15 (M)			X						
120405-X	BNC (M) to BNC (M)							X	X	X
FOXN0004	SC (M) to ST (M)				X					
FOXN0005	SC (M) to SC (M)				X					

Table B-2. Cable Applicability Matrix - Legacy

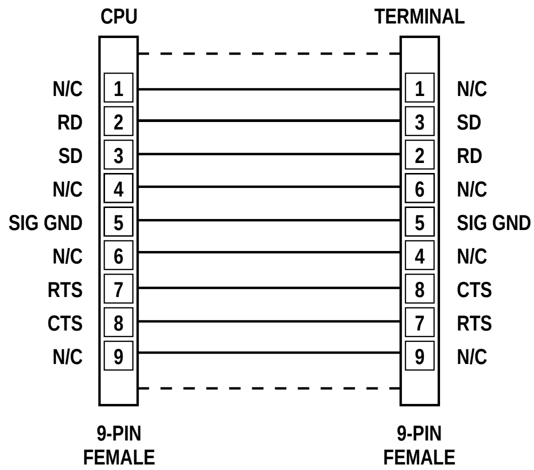
		Module Type								
Part Number	**Description**	**STL**	**DSL**	**HSL**	**HRIM**	**LSAL**	**UTEL**	**HSSL**	**UD3L**	**UE3L**
613008-X	HDB-26 (M) to DB-25 (M), RS-530		X	X						
613009-X	HDB-26 (M) to DB-25 (F), RS-530		X	X						
613012-X	HDB-26 (M) to DB-15 (M)									
613004-X	HDB-26 (M) to DB-25 (M)		X	X						
613005-X	HDB-26 (M) to DB-37 (M)		X	X						
613006-X	HDB-26 (M) to DB-37 (F)		X	X						
613003-X	HDB-26 (M) to DB-34 (M)		X	X						
613007-X	HDB-26 (M) to DB-34 (F)		X	X						
610127-X	RJ-45 to RJ-45 (Straight)	X					X			
610126-X	RJ-45 to RJ-45 (Crossover)	X					X			
612751-X	HSSI (M) to DCE (M)							X		
612529-X	HSSI (M) crossover (M)							X		
613013-X	RJ-45 (M) to 25-pin DTE (M)					X				
613014-X	RJ-45 (M) to 25-pin DTE (F)					X				
613015-X	RJ-45 (M) to 9-pin DTE (M)					X				
613016-X	RJ-45 (M) to 9-pin DTE (F)					X				
61362	RJ-45 to DB-15 (F)	X								
120405-X	BNC (M) to BNC (M)				X		X		X	X
COMATPX-1013	RJ-45 (M) to RJ-45 (M) Straight				X					
COMATPX-1162	RJ-45 (M) to RJ-45 (M) Crossover									

Table B-3. Cable Index

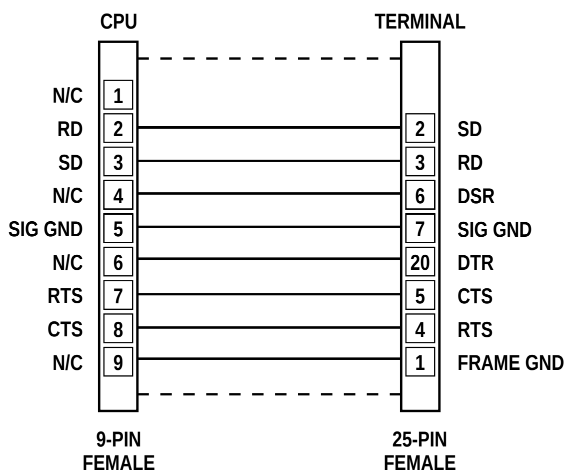
Part No.	Cable Model	Connector	Figure	Description
650252-X	CPU-VT100/9F	9 Pin DB (F) –9 Pin DB (F)	B-1A	CPU craft interface to VT100 terminal
650074-X	CPU-VT100/25F	9 Pin DB (F) – 25 Pin DB (F)	B-1B	CPU craft interface to VT100 terminal
650075-X	CPU-VT100/25M	9 Pin DB (F) – 25 Pin DB (M)	B-1C	CPU craft interface to VT100 terminal
610133-X	ST/NCP-MDM	9 Pin DB (F) – 25 Pin DB (M)	B-3A	CPU craft interface to VT100 terminal via modem
613008-X	DSC-530M	26 Pin HDB (M) – 25 Pin DB (M)	B-4	DSC Module (DTE) to RS-530 ATM facility DSL/ HSL Modules (DCE) and SCM Module to V.11 (RS-530)
613009-X	DSC-530F	26 Pin HDB (M) – 25 Pin DB (F)	B-4	DSC Module (DTE) to RS-530 ATM facility DSL/HSL Modules (DCE) and SCM Module to V.11 (RS-530)
613004-X	DSL/HSL-ILC	26 Pin HDB (M) – 25 Pin DB (M)	B-5	DSL/HSL Modules to LINK/2+ or entréeLINK+ ILC Module
613005-X	DSL/HSL/SCM-449M	26 Pin HDB (M) – 37 Pin DB (M)	B-6	DSL/HSL Modules to LINK/100+ DLI.0 Module and RS-449 SCM Module to RS-449
613006-X	DSL/HSL/SCM-449F	26 Pin HDB (M) – 37 Pin DB (F)	B-6	DSL/HSL/SCM Modules to RS-449
613003-X	DSL/HSL/SCM-V35M	26 Pin HDB (M) – 34 Pin DB (M)	B-7	DSC/DSL/HSL/SCM Modules to V.35 Winchester
613007-X	DSL/HSL/SCM-V35F	26 Pin HDB (M) – 34 Pin DB (F)	B-7	DSC/DSL/HSL/SCM Modules to V.35 Winchester
61362	BADP	8 Pin Mod – 15 Pin DB (F)	B-10	STL Module to ST Dpanel-4/DSX-1 via BIM/PBX cable (61359) T1C Module to CSU/Smart Jack (straight) via DSX-1/CSU cable (61385)
61359	BIM-PBX-F	15 Pin DB (M) – 15 Pin DB (M)	B-11	STL Module (via BADP cable) to ST Dpanel-4/DSX-1
61385	DSX-1/CSU	15 Pin DB (M) – 15 Pin DB (M)	B-12	T1C Module (via BADP cable) to CSU/Smart Jack
120405-X	TX3-DS3	Male/Male BNC	B-13	DS3 Module to DS3 (45Mbps) facility (ANSI T1.107) E3C Module to E3 equipment (34 Mbps) E1C/UTEL Modules to G.703 unbalanced (via Balun) HRIM Module to 10Base 2 Ethernet

Table B-3. Cable Index (Cont'd)

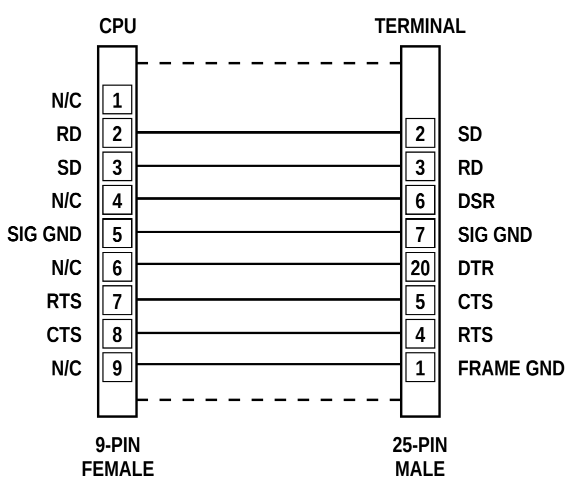
Part No.	Cable Model	Connector	Figure	Description
610126-X	ST/MOD-XFR	8 Pin Mod – 8 Pin Mod	B-9	T1C Module to CSU/Smart Jack (crossover) E1C Module to E1 equipment (crossover) UTEL Module to non-framed E1 or T1 equipment (crossover)
610127-X	ST/MOD-MOD	8 Pin Mod – 8 Pin Mod	B-8	STL Module to LINK/2+ BFM/BIM.1, LINK/100+ DLI.1 Module, entréeLINK+ CSU Module, or ST Dpanel-4/PRI (T1M/E1M) T1C Module to CSU/Smart Jack (straight) E1C Modules to E1 equipment (straight) UTEL Module to non-framed E1 or T1 equipment (straight)
612529-X	CXHSSI-XVR	HSSI (M) crossover (M)	B-23	HSSL Module crossover, HSSI 50-pin connector
612751-X	CXHSSI-DCE	HSSI (M) to DCE (M)	B-22	HSSL Module to DCE, HSSI 50-pin connector
613012-X	DSC – X.21	26 Pin HDB (M) – 15 Pin DB (M)	B-16	DSC Module to V.11/X.21 (DCE)
613013-X	LSAL-RJ45-25DTE-M	RJ-45 (M) to 25-pin DTE (M)	B-18	LSAL Module to 25-pin DTE (for PCs or workstations)
613014-X	LSAL-RJ45-25DTE-F	RJ-45 (M) to 25-pin DTE (F)	B-19	LSAL Module to 25-pin DTE (for most non-PC DTEs)
613015-X	LSAL-RJ45-9DTE-M	RJ-45 (M) to 9-pin DTE (M)	B-20	LSAL Module to 9-pin DTE (for most non-PC DTEs)
613016-X	LSAL-RJ45-9DTE-F	RJ-45 (M) to 9-pin DTE (F)	B-21	LSAL Module to 9-pin DTE (for PCs or workstations)
COMATPX 1013	10 BASE T	RJ-45 (M) – RJ-45 (M)	B-17	HRIM Module to hub, 10Base-T Ethernet (straight)
FOXN0004	OC3-SM	SC SM (M) – ST SM (M)	B-14	OC3 Module to 155 Mbps single mode service (SONET)
FOXN0005	OC3-MM	SC MM (M) – SC MM (M)	B-15	OC3 Module to 155 Mbps multimode service (SONET)



A. 9-PIN FEMALE TO 9-PIN FEMALE (650252-X)

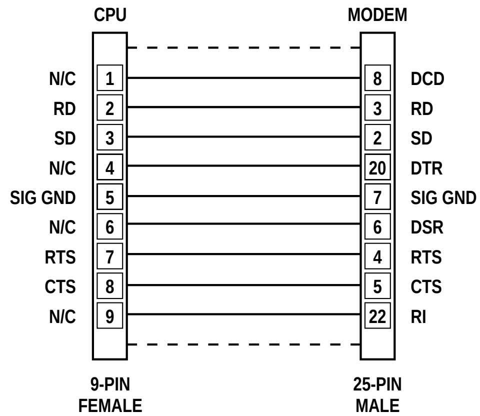


B. 9-PIN FEMALE TO 25-PIN FEMALE (650074-X)



C. 9-PIN FEMALE TO 25-PIN MALE (650075-X)

Figure B-1. CPU Craft Interface to VT100 Terminal (Non-redundant)



NON-REDUNDANT (610133-X)

Figure B-2. CPU Craft Interface to Modem

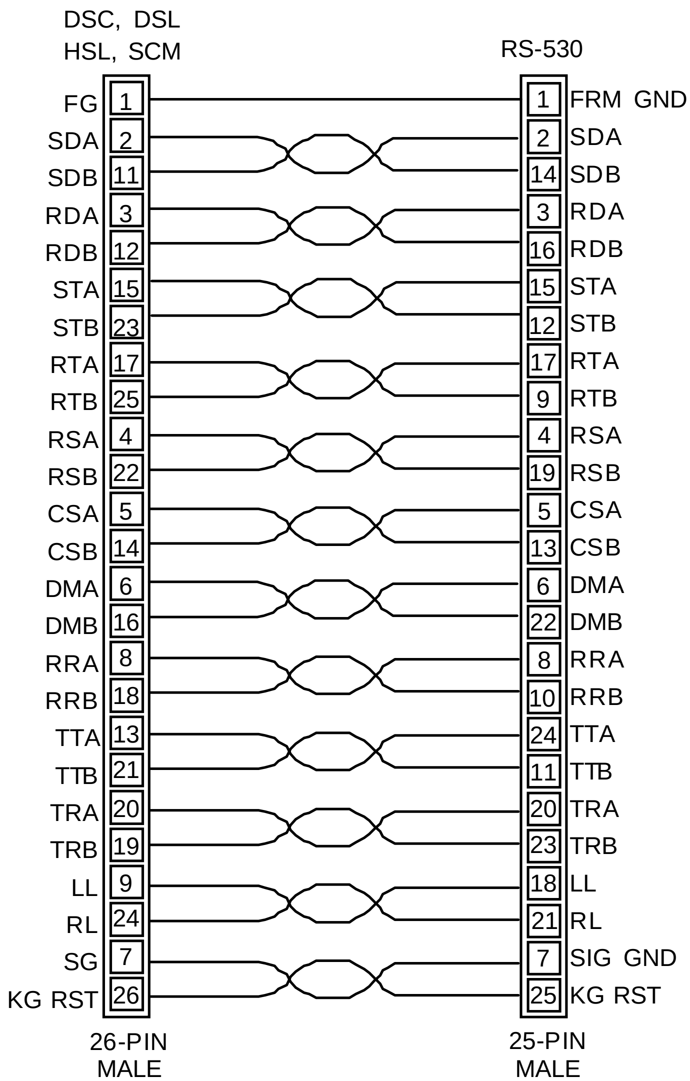


Figure B-3. DSC/DSL/HSL/SCM Modules to RS-530 (V.11) (613008-X) (Sheet 1 of 2)

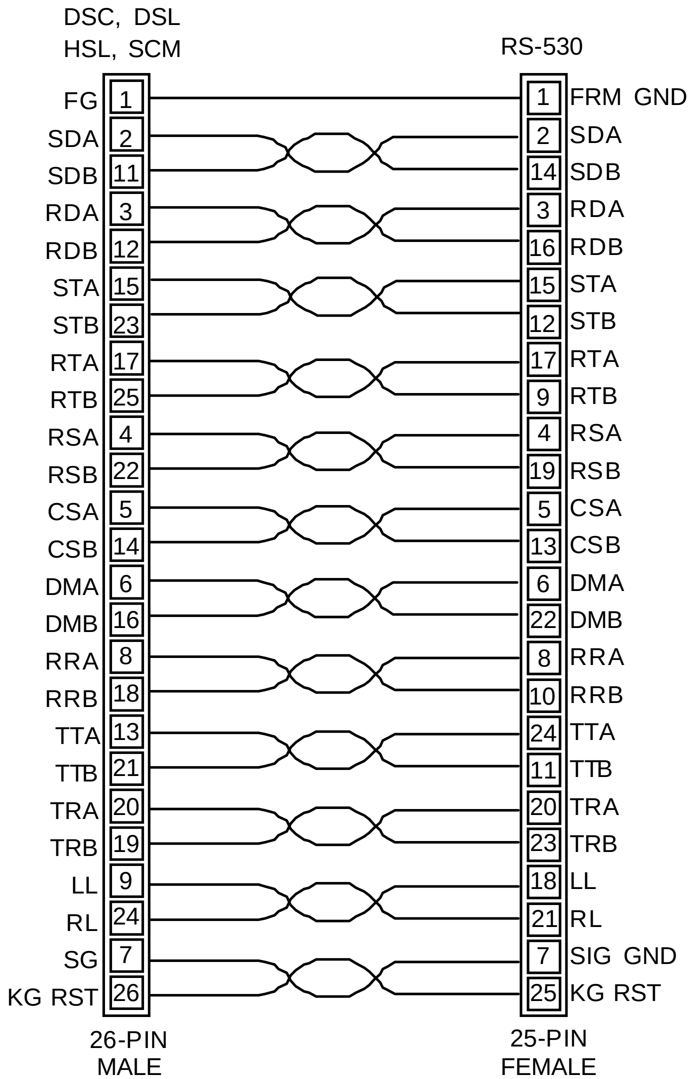


Figure B-3. DSC/DSL/HSL/SCM Modules to RS-530 (V.11) (613009-X) (Sheet 2)

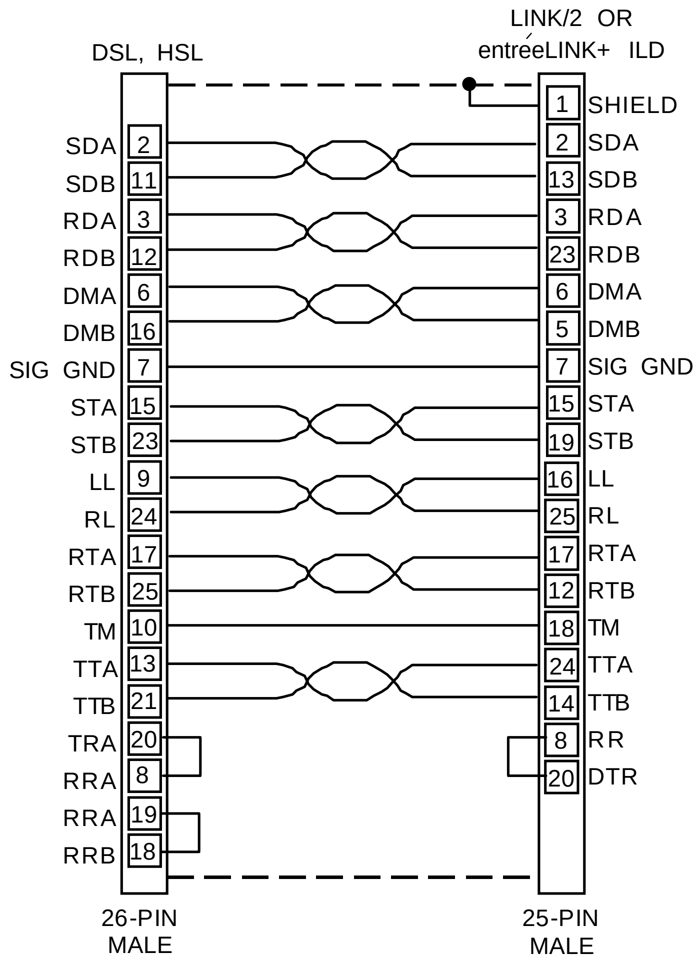


Figure B-4. DSL/HSL Modules (DCE) to LINK/2+ or entréeLINK+ ILC Module (613004-X)

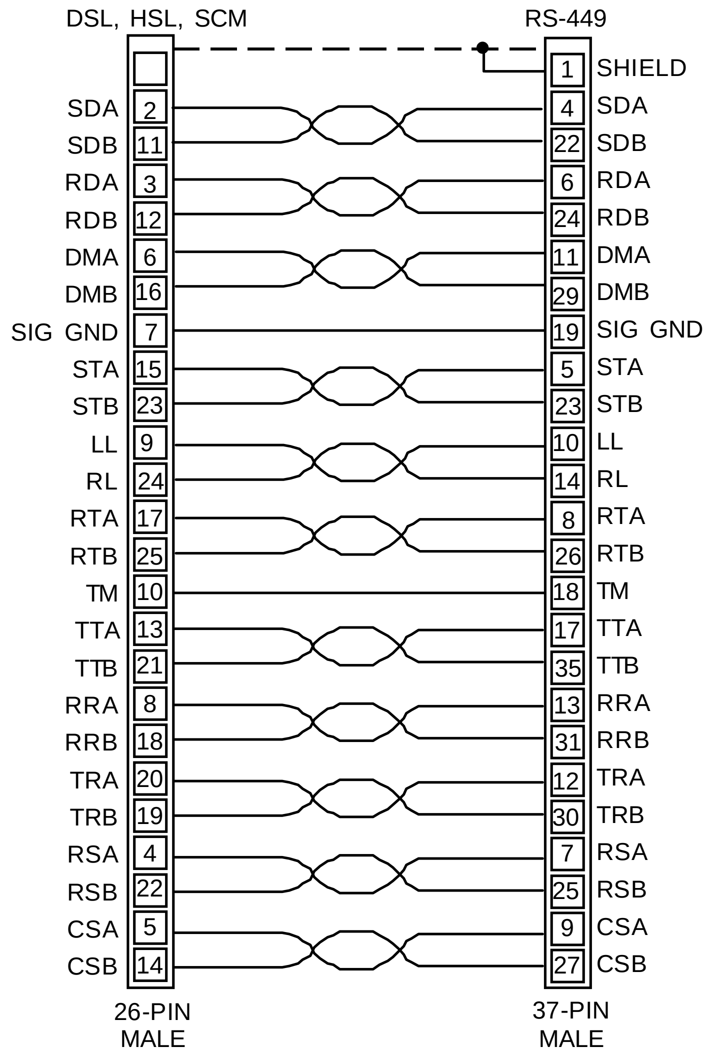


Figure B-5. DSL/HSL/SCM Modules to RS-449 (613005-X) (Sheet 1 of 2)

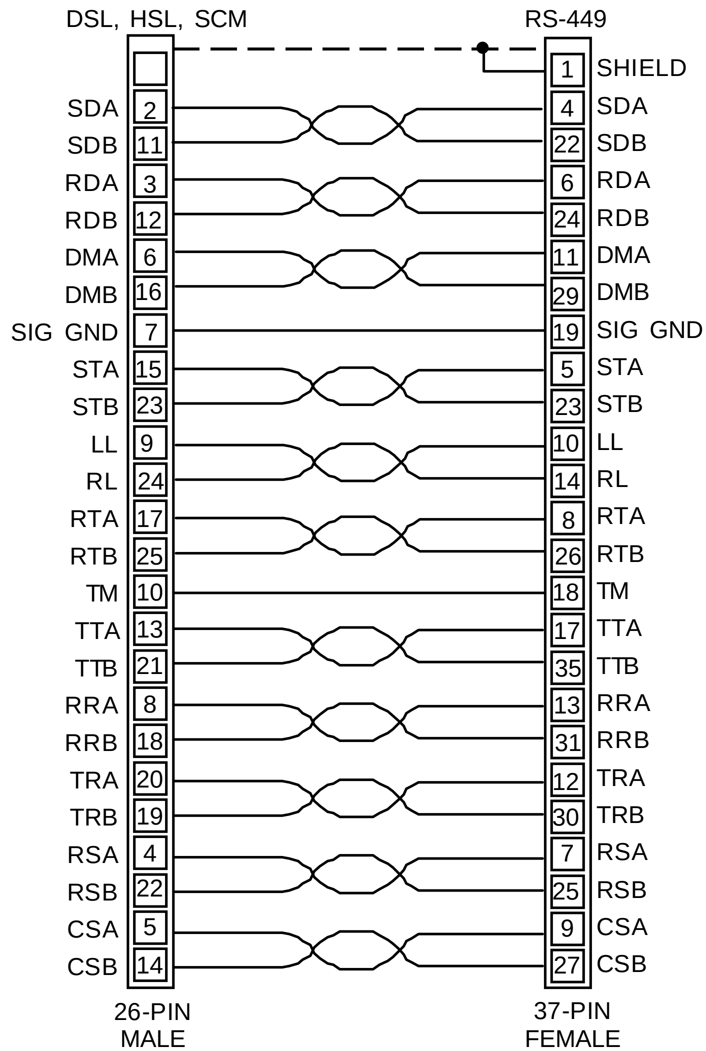


Figure B-5. DSL/HSL/SCM Modules to RS-449 (613006-X) (Sheet 2)

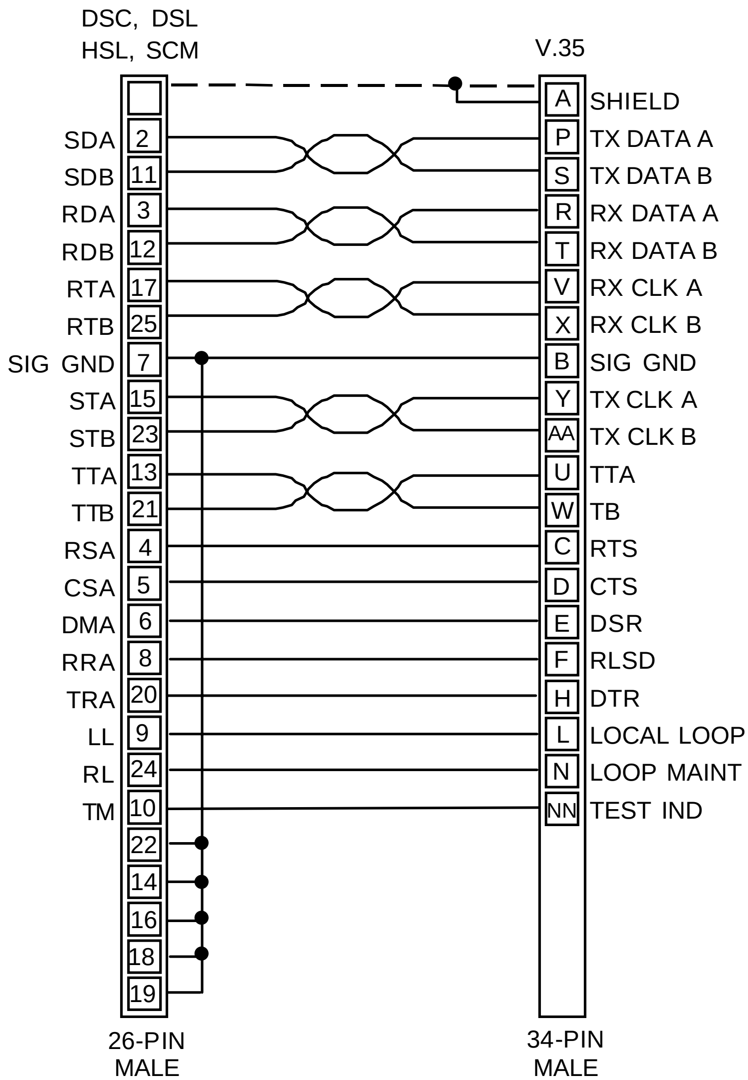


Figure B-6. DSL/HSL/SCM Module to V.35 (613003-X) (Sheet 1 of 2)

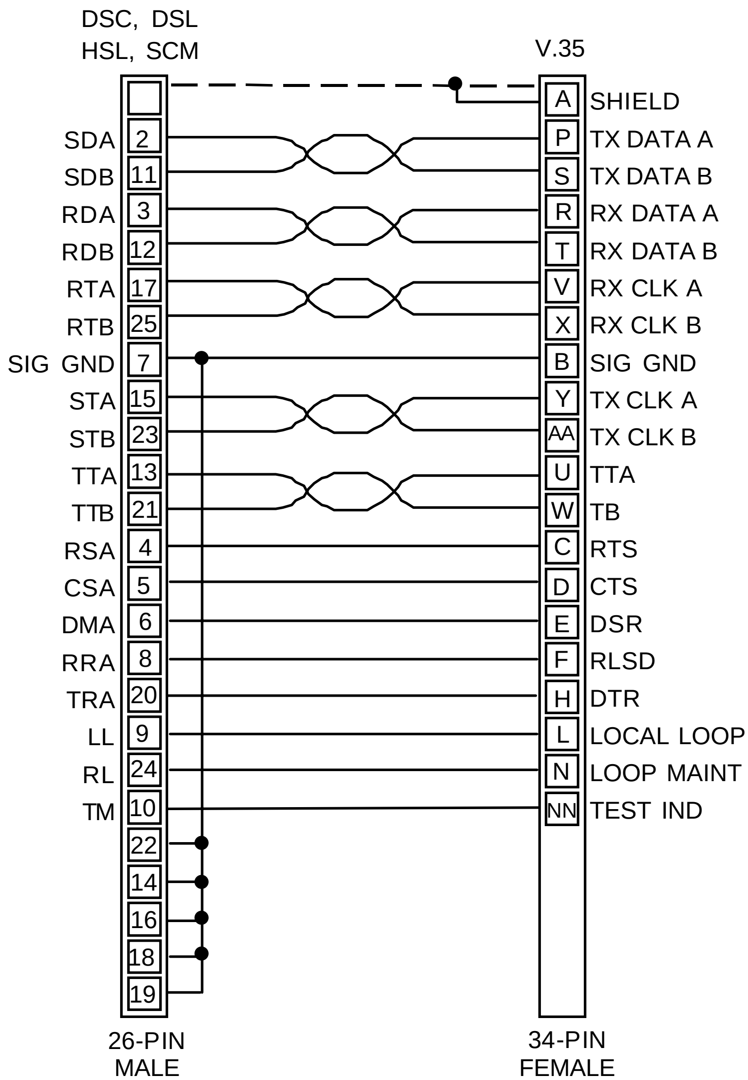


Figure B-6. DSL/HSL/SCM Module to V.35 (613007-X) (Sheet 2)

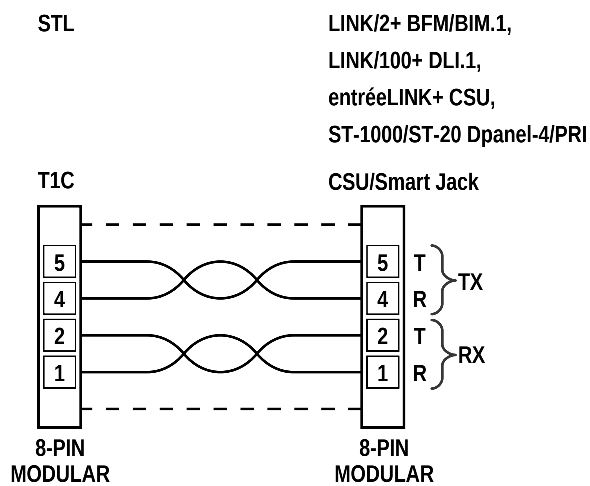


Figure B-7. STL Module to LINK/2+ BFM/BIM.1 Modules, LINK 100/+ DLI.1 Module, entréeLINK+ CSU Module, or ST D Panel-4/PRI (T1M/E1M); T1C to CSU/Smart Jack (Straight) (610127-X)

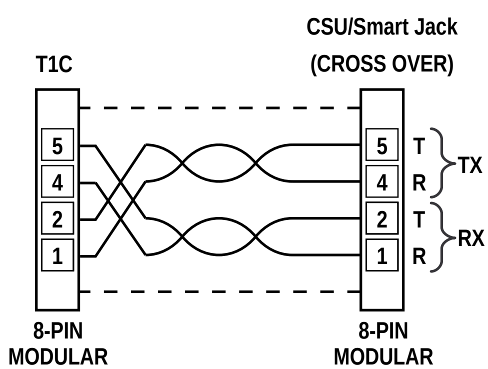


Figure B-8. T1C to CSU/Smart Jack (Crossover) (610126-X)

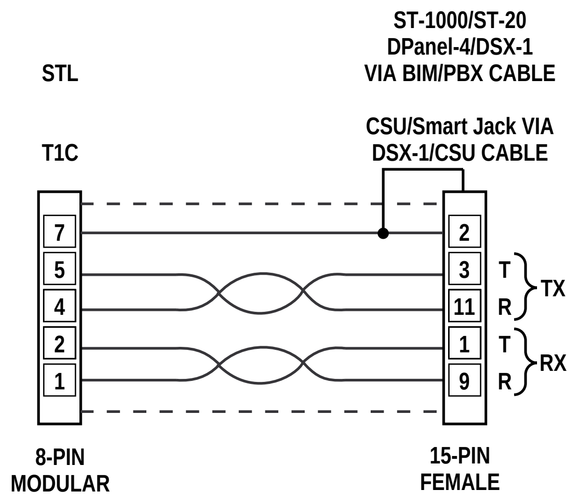


Figure B-9. STL Module to ST D Panel-4/PRI (T1M/E1M) Via BIM/PBX Cable, T1C to CSU/Smart Jack (Straight) Via DSX-1/CSU Cable (61362)

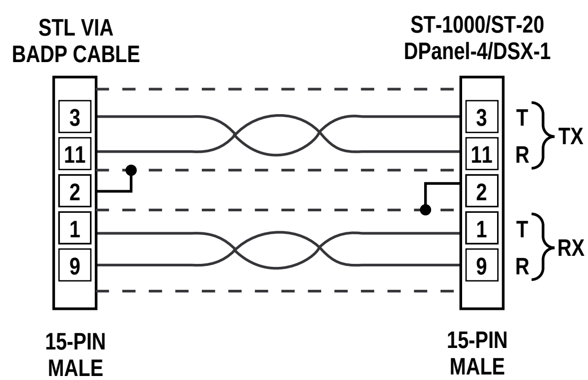


Figure B-10. STL (Via BADP Cable) to ST D Panel-4/DSX-1 (61359)

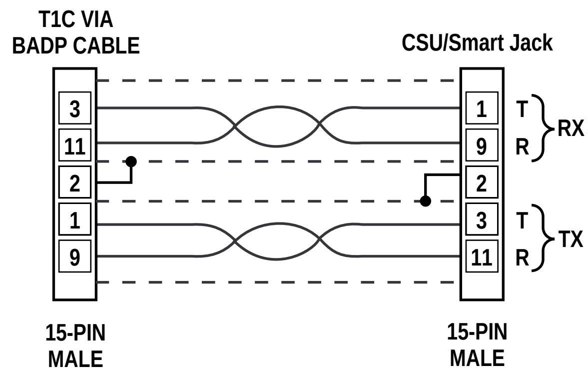


Figure B-11. T1C (Via BADP Cable) to CSU/Smart Jack (Crossover) (61385)

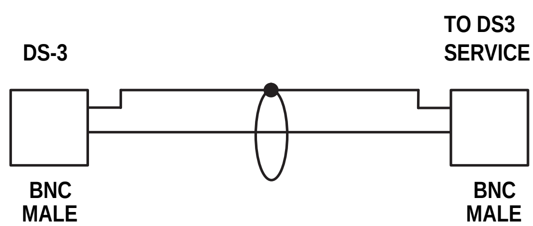


Figure B-12. DS3 Module to DS3 (45 Mbps) Service (120405-X)

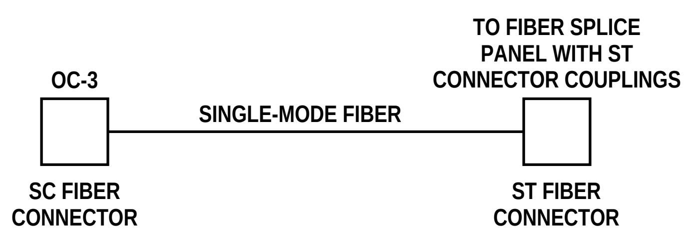


Figure B-13. OC3 Module to 155 Mbps (SONET) (Single Mode Fiber) (FOXN0004)

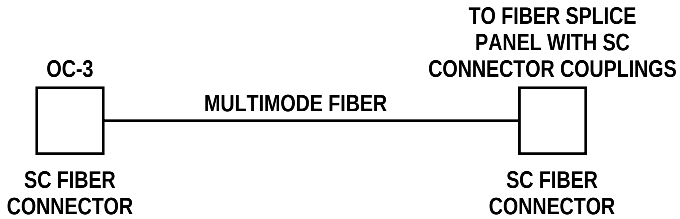


Figure B-14. OC3 Module to 155 Mbps (SONET) (Multimode Fiber) (FOXN0005)

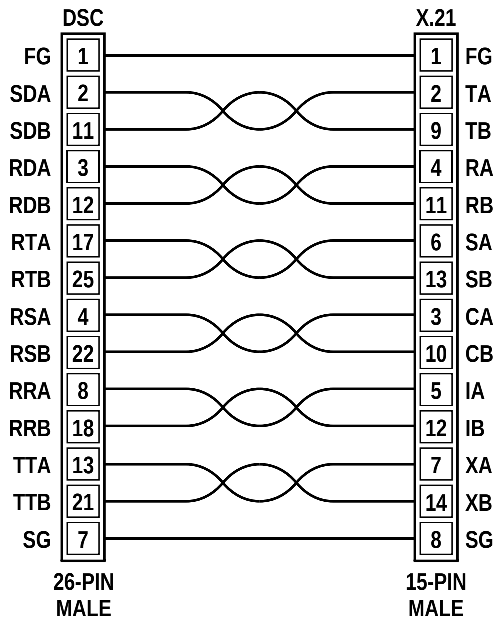


Figure B-15. DSC Module to V.11/X.21 (613012-X)

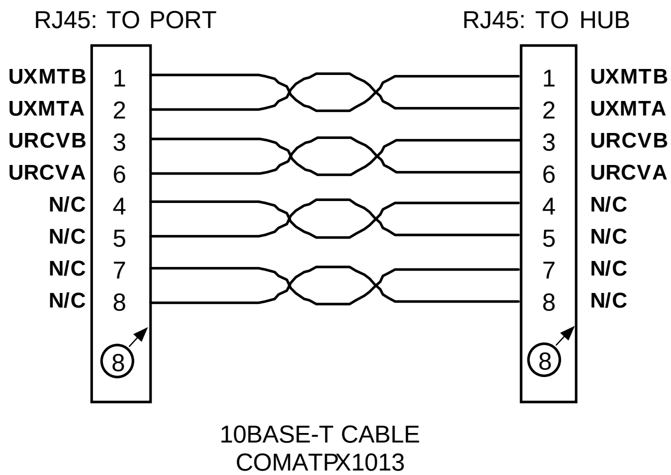


Figure B-16. IEEE 802.3 Ethernet II Cable Wiring

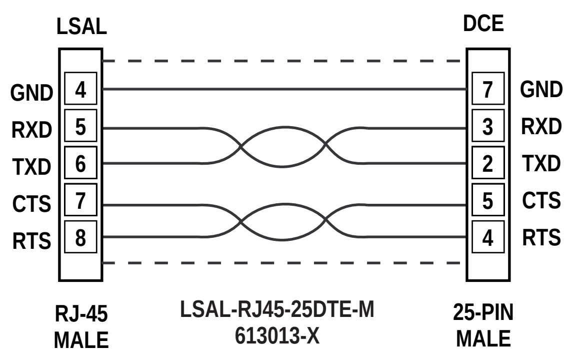


Figure B-17. LSAL to 25-Pin DTE Male

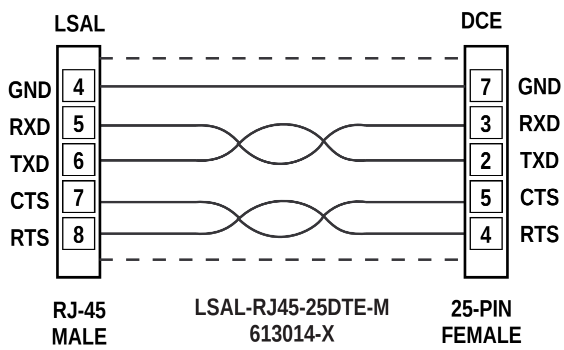


Figure B-18. LSAL to 25-Pin DTE Female

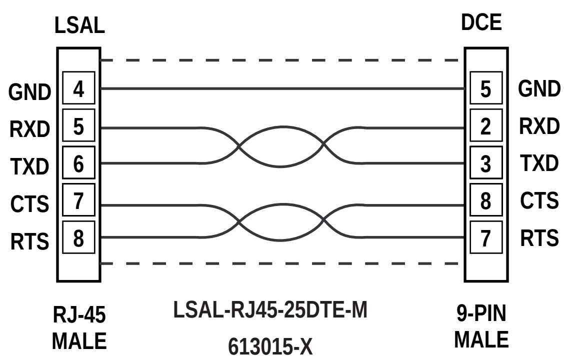


Figure B-19. LSAL to 9-pin DTE Male

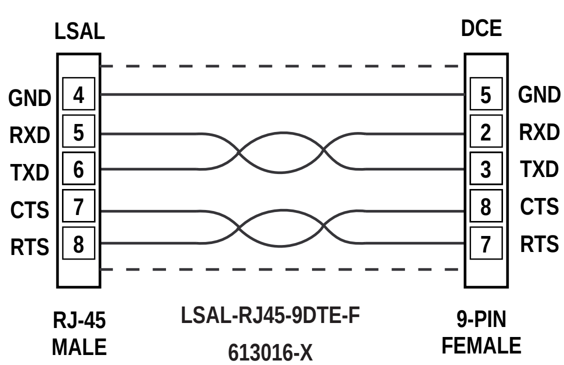


Figure B-20. LSAL to 9-pin DTE Female

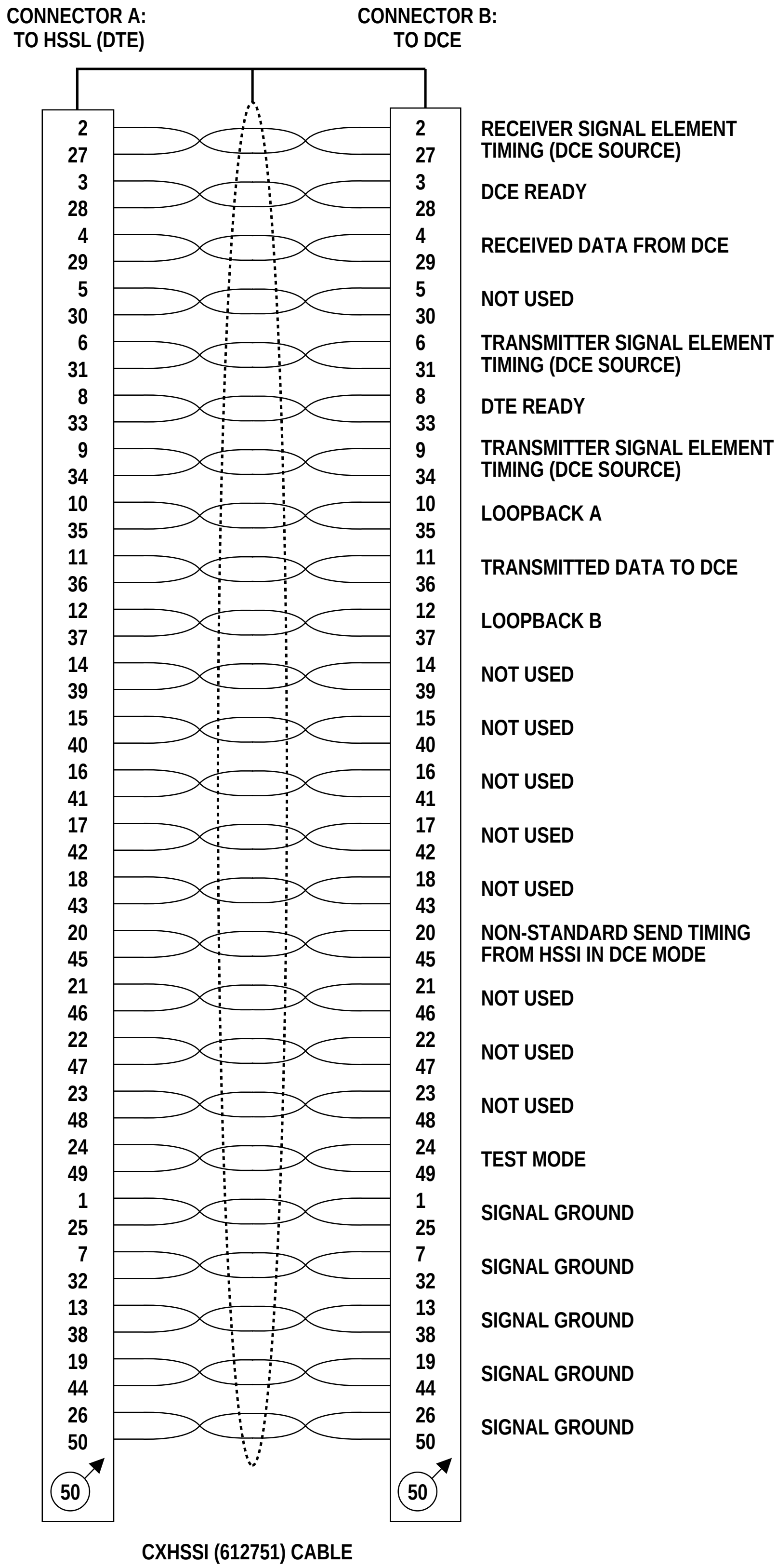


Figure B-21. HSSL HSSI to DTE

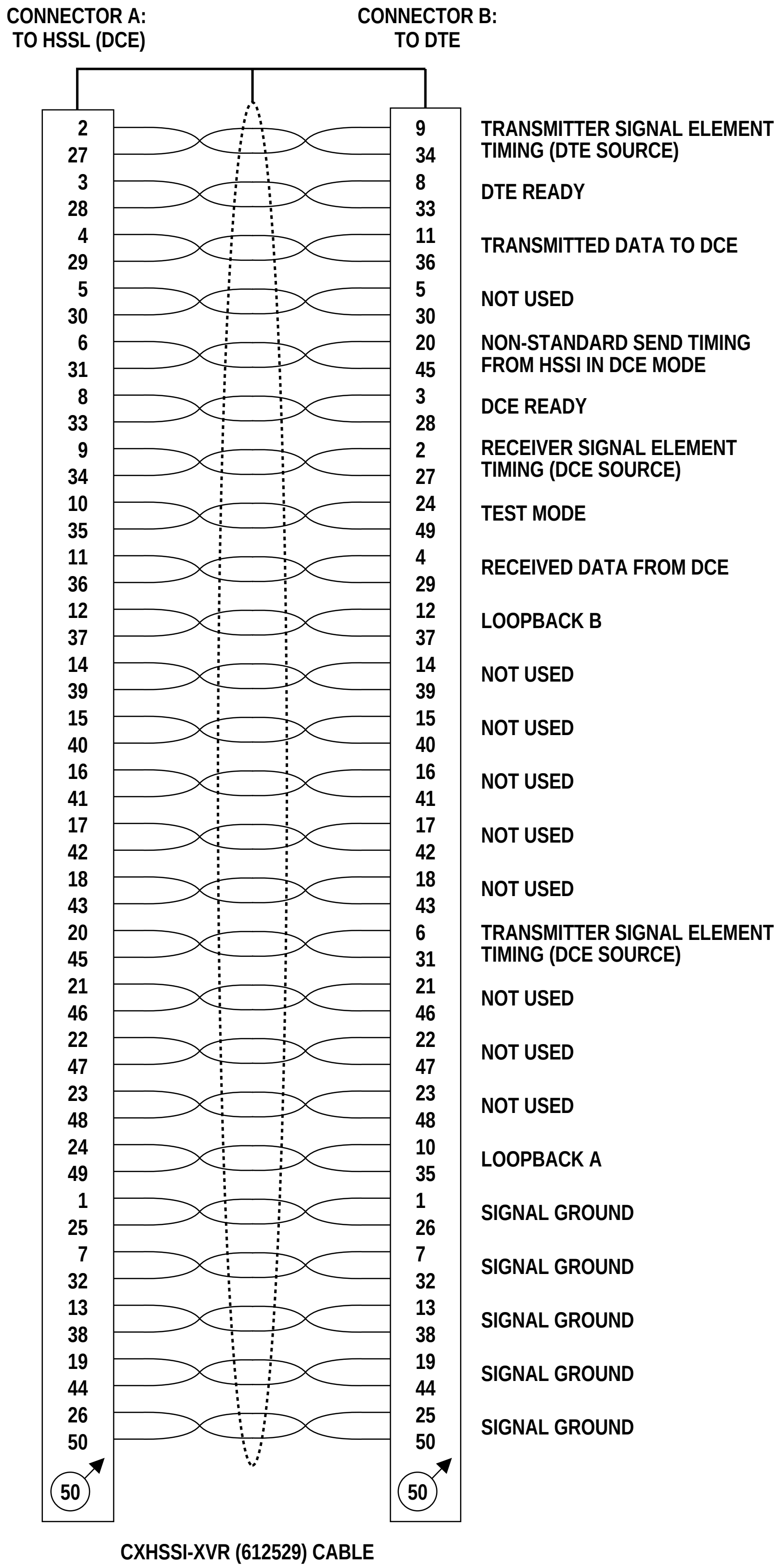


Figure B-22. HSSL HSSI Crossover

Cable Applications

This appendix provides functional application diagrams for all available CX device cables.

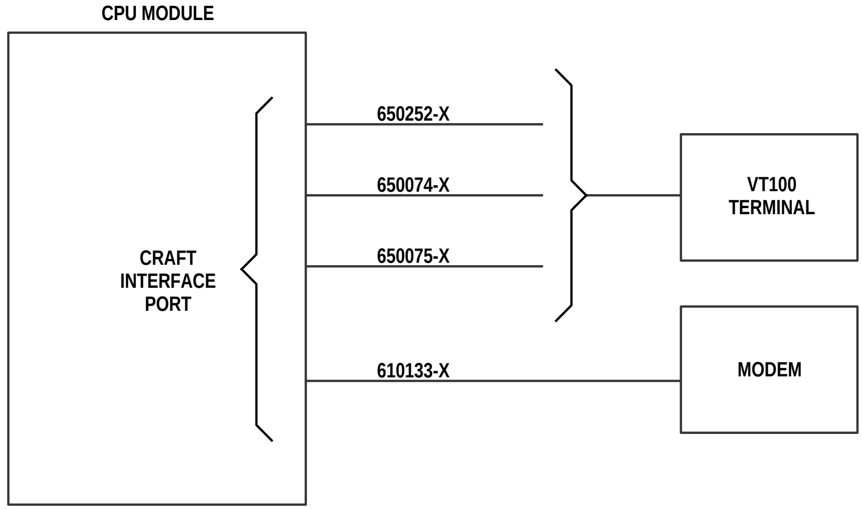


Figure C-1. Nonredundant CPU Module Cabling

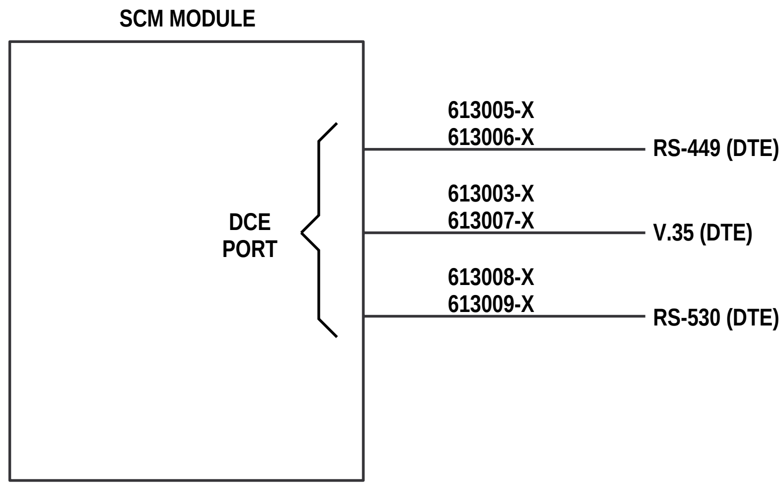


Figure C-2. SCM Module Cabling

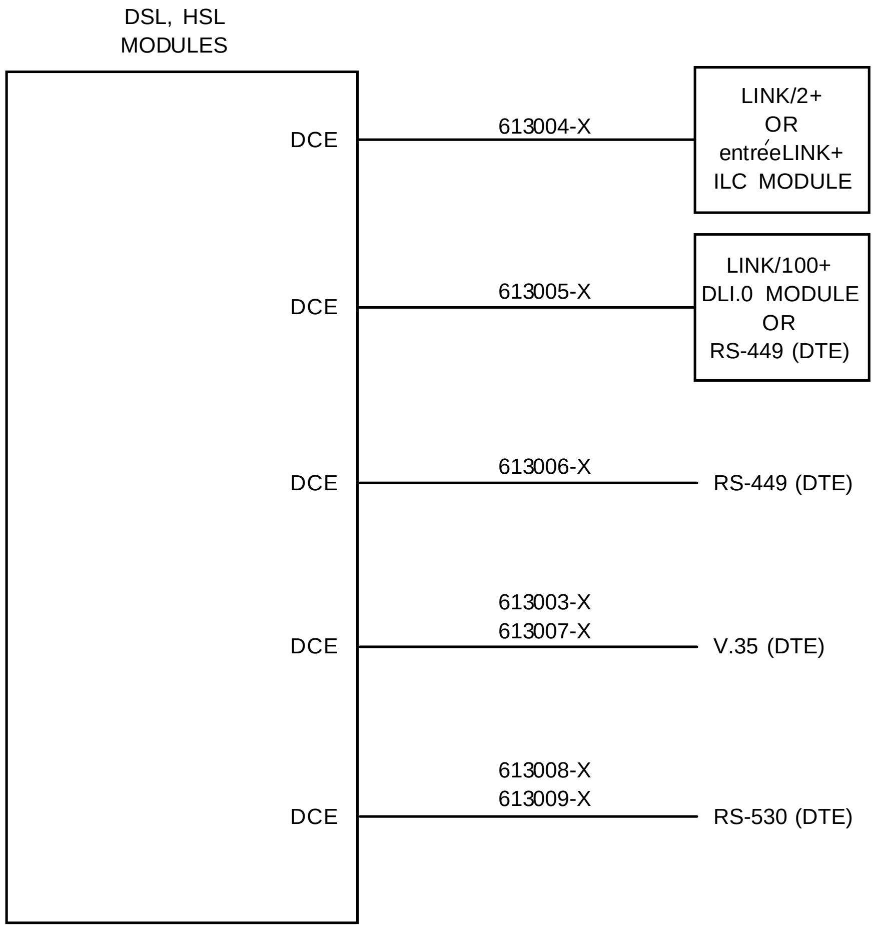


Figure C-3. DSL and HSL Module Cabling

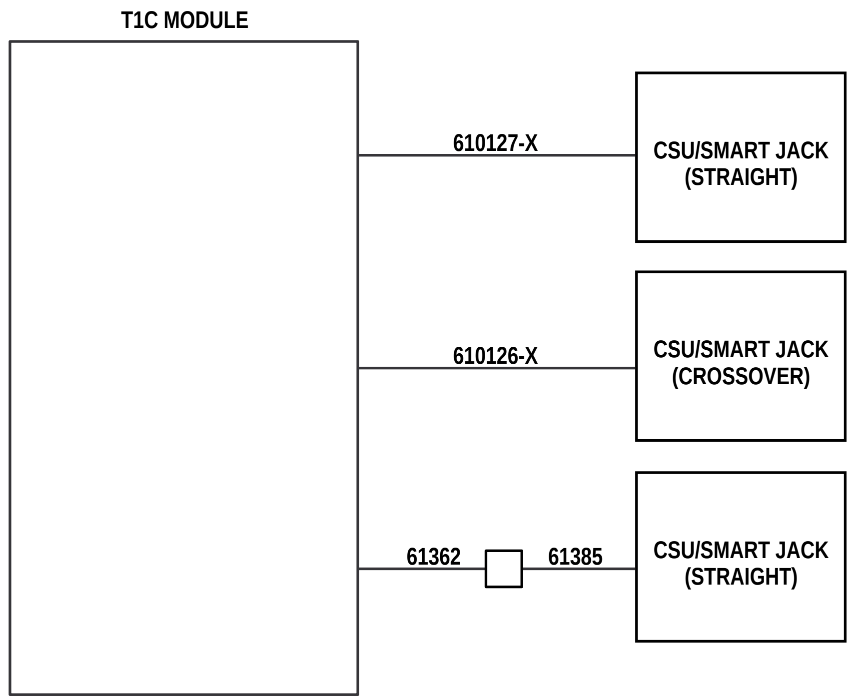


Figure C-4. T1C Module Cabling

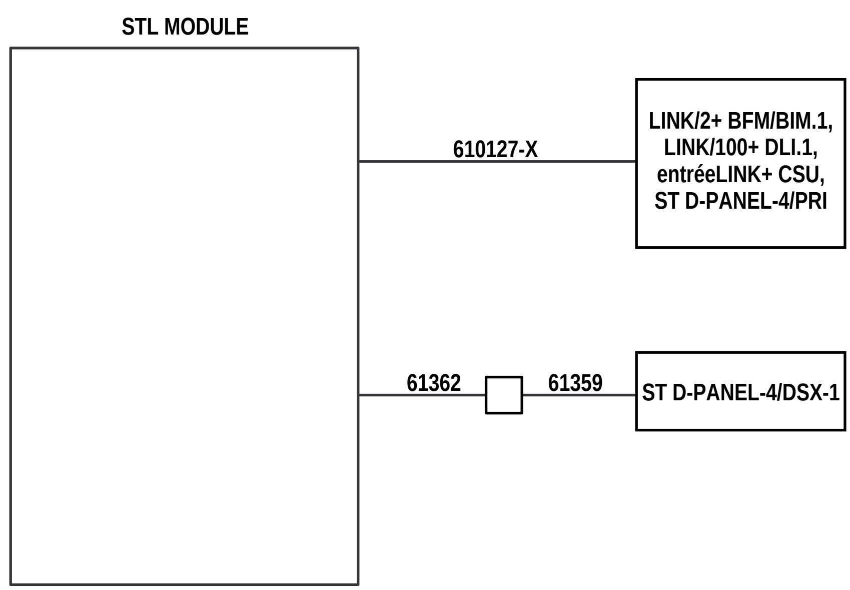


Figure C-5. STL Module Cabling

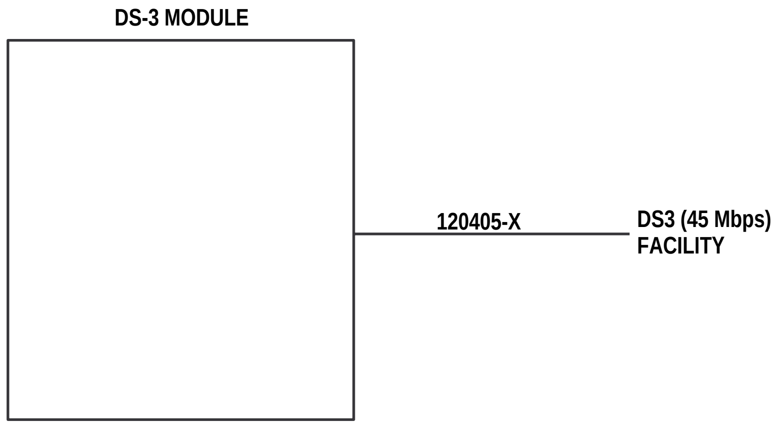


Figure C-6. DS3 Module Cabling

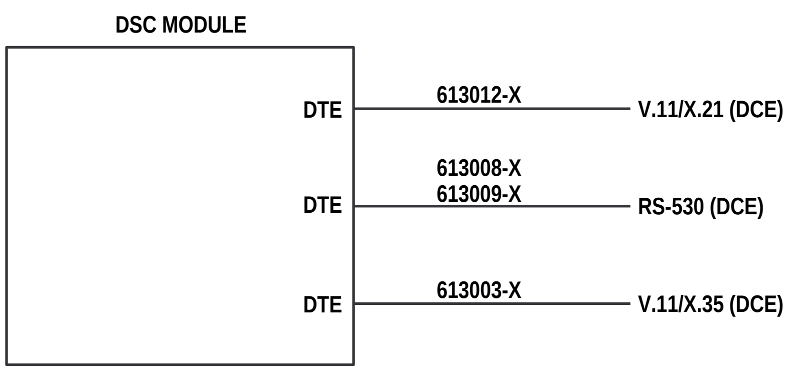


Figure C-7. DSC Module Cabling

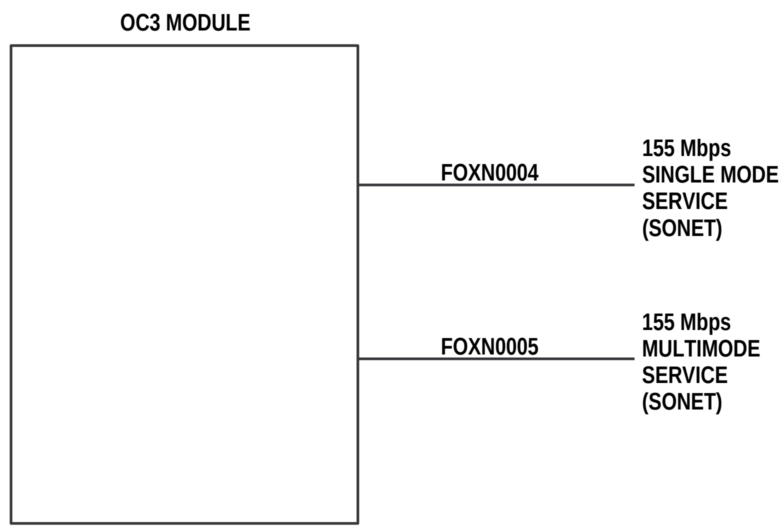


Figure C-8. OC3 Module Cabling

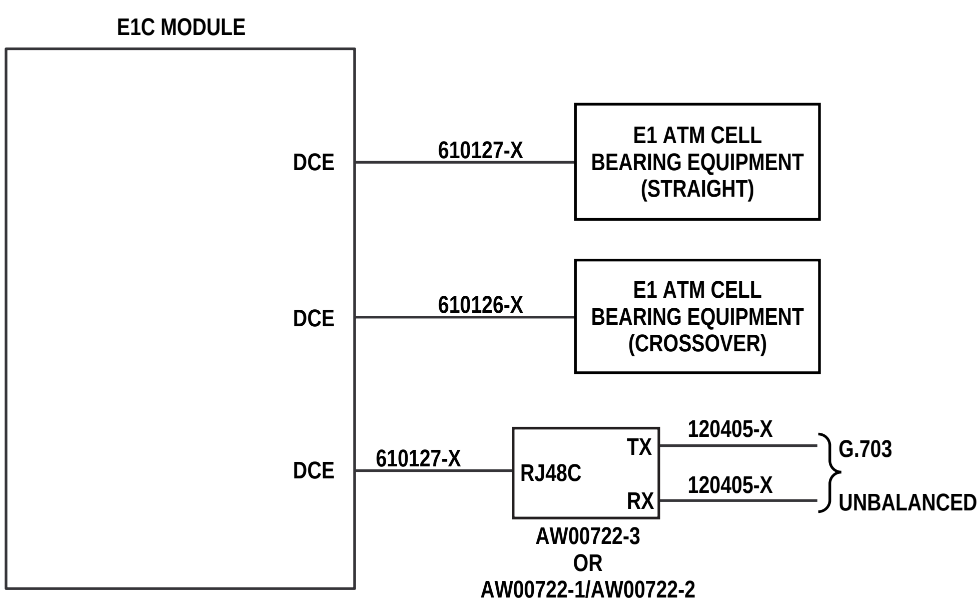


Figure C-9. E1C Module Cabling

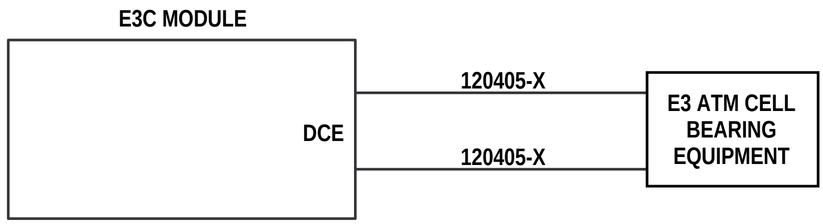


Figure C-10. E3C Module Cabling

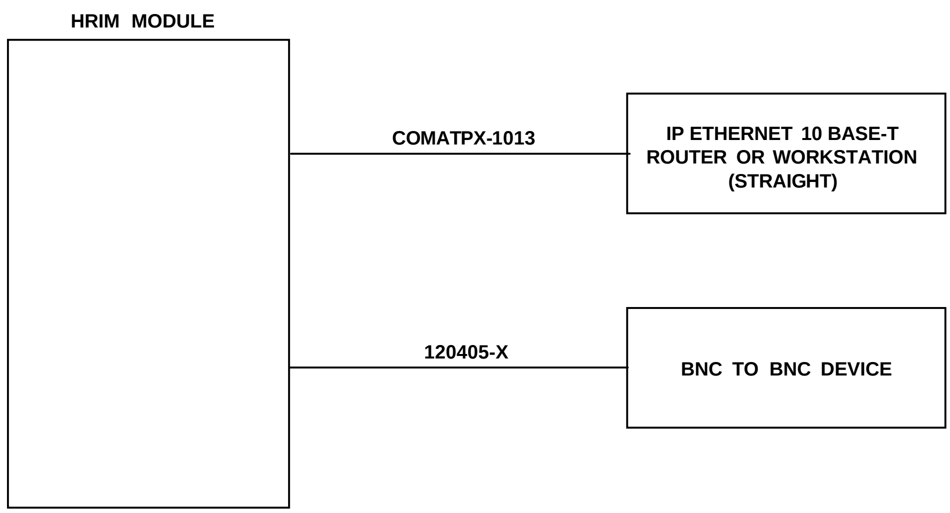


Figure C-11. HRIM Module Cabling

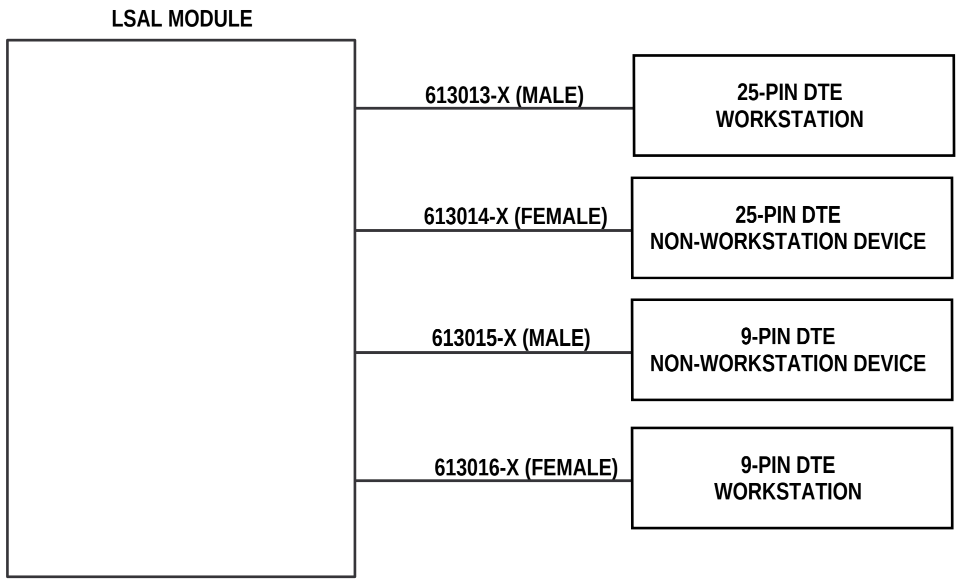


Figure C-12. LSAL Module Cabling

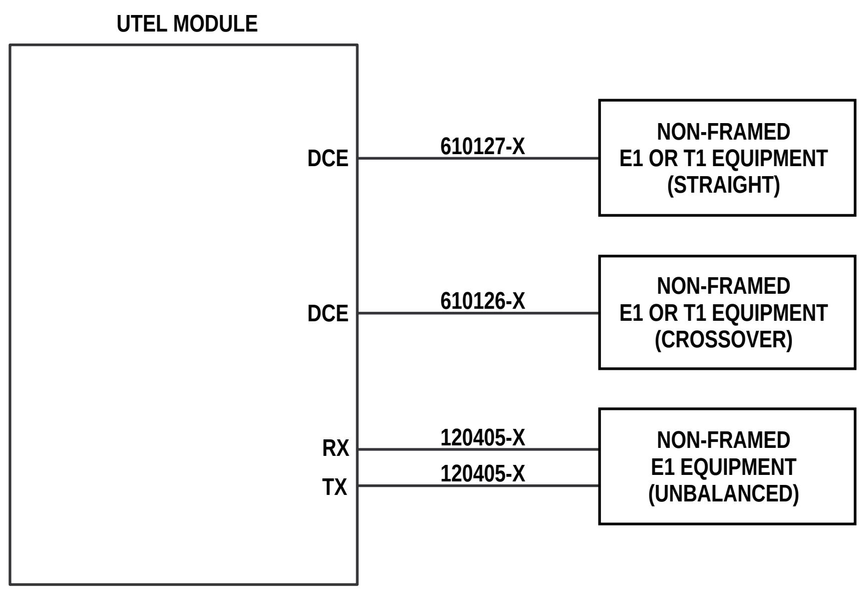


Figure C-13. UTEL Module Cabling

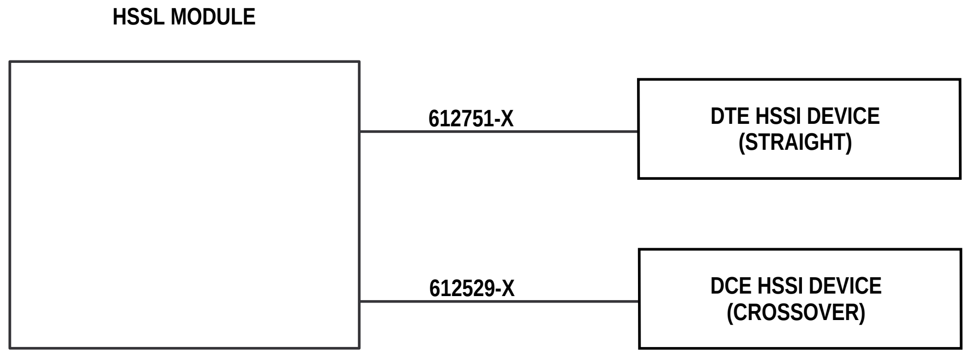


Figure C-14. HSSL Module Cabling

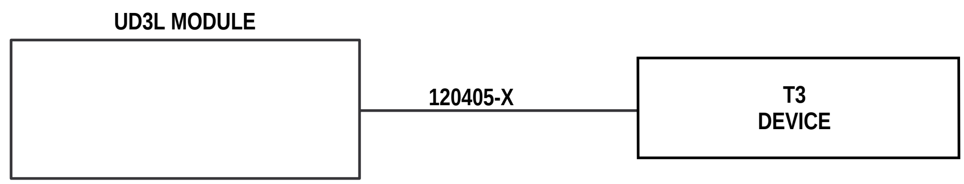


Figure C-15. UD3L Module Cabling

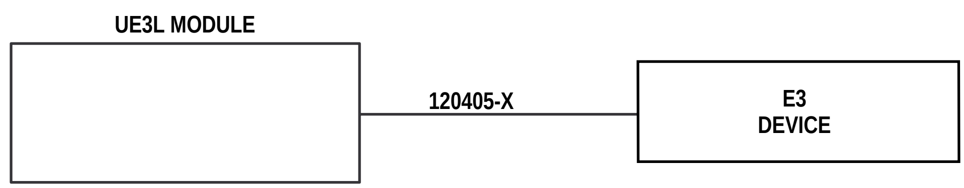


Figure C-16. UE3L Module Cabling

Field-Replaceable Units

The tables in this appendix list the replacement parts that are available. Please note that part numbers sometimes change. Each part number should be verified with customer support (or a sales representative) before ordering.

Table D-1. CX-1500/CX-1540/CX-1580 Field-Replaceable Units

Part Number	Unit Description
	CX-1500, 15-Slot Base System
160402-1	CX-1500, Basic Unit, 15-Slot Chassis with Backplane
160400-1	CX-1500 Chassis, 15 Slot
160218-1	CX-1500 Backplane, 15-Slot
	AC Power Supply Unit (included with the base CX-1500/CX-1540 system)
160401-1	AC Power Supply Unit—Redundant Unit for CX-1500
160224-1	DC Power Supply Unit
	CX-1540, 4-Slot Base System
170401-1	CX-1540 Basic Unit, 4-Slot Chassis with Backplane
170400-1	CX-1540 Chassis, 4-Slot
170200-1	CX-1540 Backplane, 4-Slot
	CX-1580, 8-Slot Base System
171401-1	CX-1580 Basic Unit, 8-Slot Chassis with Backplane
SM171402-1	CX-1580 Chassis, 8-Slot
171201-1	CX-1580 Backplane, 8-Slot
AW00705-2	230 VAC, 19” CE Marked Fan Fan Tray
AW00722-1	19” Rack Panel (for Multi-Port E1 Balun)
AW00722-2	120 to 75 Ohm, Multi-Port E1 Balun
AW00722-3	120 to 75 Ohm, Single-Port E1 Balun

Table D-2. Modules

Part Number	Module	Description
160228-1	CXBIM	Basic Interface Module
160201-1	CXCPU	CPU Module (included with basic CX-1500 system)
160204-1	CXDS3	DS-3 Cell Interface Module
160208-1	CXDSC	Dual Synchronous Cell Interface Module
160210-1	CXDSL	Synchronous Legacy Interface Module, Dual Port
160206-2	CXE1C	E1 Cell Interface Module
160205-1	CXE3C	E3 Cell Interface Module
171200-1	CXEML	4-Wire Analog Interface Module
160217-1	CXHRIM-4	Hub Router Interface Module, 4-Port
160217-2	CXHRIM-8	Hub Router Interface Module, 8-Port
160209-1	CXHSL	High Speed Synchronous Legacy Interface Module
160223-1	CXHSSL	High Speed Serial Interface Legacy Module
160216-1	CXLSAL	Low Speed Asynchronous Legacy Interface Module
160200-1	CXOC3	OC3 Interface Module, Multimode, STS
160200-2	CXOC3	OC3 Interface Module, Single Mode, STS
160200-3	CXOC3	OC3 Interface Module, Multimode, STM
160200-4	CXOC3	OC3 Interface Module, Single Mode, STM
160225-1	CXOC3C MM	OC3C Interface Module, Multimode
160225-2	CXOC3C SM-15KM	OC3C Interface Module, Single Mode, 15 Km
160225-3	CXOC3C SM-40KM	OC3C Interface Module, Single Mode, 40 Km
160203-1	CXSCM	Station Clock Module
160212-3	CXSEL-4	Structured E1 Legacy Interface Module, 4-Port
160212-4	CXSEL-8	Structured E1 Legacy Interface Module, 8-Port
160212-1	CXSTL-4	Structured T1 Legacy Interface Module, 4-Port
160212-2	CXSTL-8	Structured T1 Legacy Interface Module, 8-Port
160206-1	CXT1C	T1 Cell Interface Module
160227-1	CXUD3L	Unstructured DS3 Legacy Interface Module
160227-2	CXUE3L	Unstructured E3 Legacy Interface Module
160220-1	CXUTEL	Unstructured T1/E1 Legacy Interface Module

Table D-3. Cables

Part No.	Cable Model	Description
650252-X	CPU-VT100/9F	CPU craft interface to VT100 terminal
650074-X	CPU-VT100/25F	CPU craft interface to VT100 terminal
650075-X	CPU-VT100/25M	CPU craft interface to VT100 terminal
613001-X	RCPU-232F	Redundant CPU craft interface to VT100 terminal
613002-X	RCPU-232M	Redundant CPU craft interface to VT100 terminal
610133-X	ST/NCP-MDM	CPU craft interface to VT100 terminal via modem
610131-X	ST/NCP-RMDM	Redundant CPU craft interface to VT100 terminal via modem
613008-X	DSC-530M	DSC Module (DTE) to RS-530 ATM facility DSL/ HSL Modules (DCE) and SCM Module to V.11 (RS-530)
613009-X	DSC-530F	DSC Module (DTE) to RS-530 ATM facility DSL/HSL Modules (DCE) and SCM Module to V.11 (RS-530)
613004-X	DSL/HSL-ILC	DSL/HSL Modules to LINK/2+ or entréeLINK+ ILC Module
613005-X	DSL/HSL/SCM-449M	DSL/HSL Modules to LINK/100+ DLI.0 Module and RS-449 SCM Module to RS-449
613006-X	DSL/HSL/SCM-449F	DSL/HSL/SCM Modules to RS-449
613003-X	DSL/HSL/SCM-V35M	DSC/DSL/HSL/SCM Modules to V.35 Winchester
613007-X	DSL/HSL/SCM-V35F	DSC/DSL/HSL/SCM Modules to V.35 Winchester
610127-X	ST/MOD-MOD	STL Module to LINK/2+ BFM/BIM.1, LINK/100+ DLI.1 Module, entréeLINK+ CSU Module, or ST Dpanel-4/PRI (T1M/E1M) T1C Module to CSU/Smart Jack (straight) E1C/SEL Modules to E1 equipment (straight) HRIM Module to 10Base-T Ethernet (straight) LSAL Module to asynchronous equipment (straight) UTEL Module to non-framed E1 or T1 equipment (straight)
610126-X	ST/MOD-XFR	T1C Module to CSU/Smart Jack (crossover) E1C/SEL Modules to E1 equipment (crossover) LSAL Module to asynchronous equipment (crossover) UTEL Module to non-framed E1 or T1 equipment (crossover)
61362	BADP	STL Module to ST Dpanel-4/DSX-1 via BIM/PBX cable (61359) T1C Module to CSU/Smart Jack (straight) via DSX-1/CSU cable (61385) LSAL Module to data terminal equipment
61359	BIM-PBX-F	STL Module (via BADP cable) to ST Dpanel-4/DSX-1

Table D-3. Cables (Cont'd)

Part No.	Cable Model	Description
61385	DSX-1/CSU	T1C Module (via BADP cable) to CSU/Smart Jack
120405-X	TX3-DS3	DS3 Module to DS3 (45Mbps) facility (ANSI T1.107) E3C Module to E3 equipment (34 Mbps) E1C/SEL/UTEL Modules to G.703 unbalanced (via Balun) HRIM Module to 10Base 2 Ethernet
613012-X	DSC – X.21	DSC Module to V.11/X.21 (DCE)
COMATPX-1160		LSAL module to asynchronous equipment
FOXN0004	OC3-SM	OC3 Module to 155 Mbps single mode service (SONET)
FOXN0005	OC3-MM	OC3 Module to 155 Mbps multimode service (SONET)

Index

Regulatory Requirements

This section contains regulatory information for geographical areas that require specific text to appear in the manual documentation. This equipment has been approved for use in areas other than those listed in this section. For areas not listed below, regulatory requirements and approvals information can be obtained from your local Timeplex office.

The information in this section includes mandatory or recommended requirements of certification authorities for the following areas:

- Canada
- Europe
- United States

NOTE: *All ports on this equipment are Safe Extra Low Voltage (SELV) unless otherwise noted and should only be connected to SELV ports on other equipment.*

Canada

Telephone Line Connection Information

The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements documents. The department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment also must be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe systems, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION: ***Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.***

The required connection arrangement (telephone jack) for this product is CB1D.

Canadian Compliance Statement

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émat pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Réglement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

Europe

General pan-European requirements

With the harmonization of Telecommunications in Europe, the connection of Terminal Equipment to the Public Telecommunications Networks, is regulated by Directives issued by the European Commission. Public Telecommunication Network Services provided to Terminal Equipment users may be supplied as a National Service, with interface standards specific to the country in which it is provided, or as a Pan-European Service, with a common interface standard throughout all European countries.

In this section, it is stated which product interfaces are compatible with the National and which with the Pan-European standards. In principle, products with the **CE** markings are intended for use in any European country. But, in practice, products with multiple interfaces require a clearer definition of their compatibility with the public network.

CE Marked Equipment

Certain Timeplex equipment is marked with one of the following:

CE The equipment, when correctly installed in accordance with the user manual instructions, meets the requirements of the European Electromagnetic and Low Voltage Directives.

CE168X The equipment, when correctly installed in accordance with the user manual instructions, meets the requirements of the European Electromagnetic, Low Voltage, and Telecommunications Terminal Directive, and may be connected to the Public Telecommunications Networks of the European Union Countries.

CE⊗ The equipment, when correctly installed in accordance with the user manual instructions, meets the requirements of the European Electromagnetic, Low Voltage, and Telecommunications Terminal Directive, but cannot be connected to the pan-European Public Telecommunications Networks of the European Union Countries.

CE❑ Where **CE** ❒ is a National Approval Label, implies the equipment, when correctly installed in accordance with the user manual instructions, meets the requirements of the European Electromagnetic, and Low Voltage Directives, and in addition has been granted Public Network Attachment Approval in those countries whose labels are affixed.

NOTE: *Refer to the country specific sections of this regulatory section to determine the National Attachment Approvals granted to the equipment.*

Timeplex, Inc. has endeavored to undertake the mandatory "TYPE APPROVAL TESTING" of Public Network Interfaces on their products to both Pan-European and selected country specific requirements. Certificates and reports permitting the CE marking of the products "Placed On The European Market" and the Public Network Attachment Approval Certificates associated with National Interfaces are held on file by the company. Please contact Timeplex, Inc. for further information.

NOTICE

PUBLIC NETWORK ATTACHMENT APPROVAL HAS BEEN GRANTED ON THE BASIS THAT THE EQUIPMENT IS IDENTICAL TO THAT CERTIFIED DURING "TYPE APPROVAL TESTING". USERS MUST ENSURE CONFIGURATION, AND INSTALLATION IS PERFORMED IN ACCORDANCE WITH THE USER MANUAL INSTRUCTIONS, AND USING THE SPECIFIED APPROVED CABLES.

Declaration of Conformity

In association with the CE marking of the product, Timeplex, Inc. declares under its sole responsibility that the product known as the *Synchrony* ST-1000 and the *Synchrony* ST-20 are in conformity with the following Directives and standards. An official copy of the Declaration of Conformity is available upon request.

European Low Voltage Directive	(LVD)	73/ 23/EEC
Telecommunications Terminal Equipment Directive	(TTE)	91/263/EEC
Electromagnetic Compatibility Directive	(EMC)	89/336/EEC
CE Marking Directive	(CEM)	93/ 68/EEC

EN 60950:1992	Safety of information technology equipment, & electrical business equipment
EN 55022:1987	Limits of radio disturbance characteristics of IT equipment, Class A
EN 50082-1	Immunity characteristics: Residential, Commercial, & Light Industry
IEC 1000-4-2:	Electrostatic Discharge
IEC 1000-4-3:	Radiated Electromagnetic Field
IEC 1000-4-4:	Electrical Fast Transients / burst requirements
NET.2 / CTR 2	V.11 Point to Point Digital Leased Lines (V.35, X.21)
CTR 12	2.048M/s G.703 120Ω Digital Lease Line - Unstructured
CTR 13	2.048M/s G.703 120Ω Digital Lease Line - Structured
NTR4	2.048M/s G.703 75Ω Digital Lease Line (U.K.)
CTR 24	34M/s Digital Unstructured and Structured Lease Line

Regulatory Guidance

It is considered a criminal offence to install Telecommunications Terminal Equipment which is not approved, or to install it in a non-compliant manner. Advice should be obtained from a competent Engineer BEFORE making Public Network Connections.

European Telecommunications Regulatory legislation is concerned mainly with the following aspects of connection to Public Telecommunications Networks:

1. That all equipment in a Network connected directly or indirectly to a public network is approved, and appropriately marked to show this.

2. That all equipment connected directly to a Public Network is approved for connection to the service concerned.

3. That any equipment connected directly to the Public Network does not present hazardous conditions to the network or place the user at risk from hazards present on the Public Network.

4. That the equipment used as a direct or indirect attachment to the Public Network does not affect the integrity of that Public Network.

5. That networks installed in one country, but linked to international circuits, comply with international agreements.

6. That the equipment, approved for operation under certain conditions, and connected in an acceptable manner to the Public Network, is used in accordance with suitable user installation and operating instructions supplied with the equipment.

Principles of Product Attachment Approval Requirements

The Public Network Attachment Approval of this equipment shall be invalidated in the event of the connection of any apparatus or cabling which does not comply with the following:

1. Digital attachments to PTO Services shall be equipment approved for the purpose in which they are being used.

2. Attachments shall not materially affect the electrical performance characteristics of the interface to the PTO service.

3. All cables and wiring shall be compliant with appropriate codes of practice and relevant standards.

4. Apparatus approved for connection to PTO services must be connected to the Network Termination Point (NTP) using the approved listed cable or an alternate cable meeting the electrical characteristics of the Timeplex specified cable.

5. National requirements may restrict the carrying or interfacing of speech derived from, or destined for the PSTN.

Safety Information and Warnings

This equipment is only approved for use when operated in the following environment:

- **Temperature Range** 0° to 45°C
- **Humidity** To 95% (noncondensing)
- **Atmospheric Pressure** 13,000 feet (4000 meters)
- **Power Input Range** 90 to 240Va.c., 50/60 Hz

WARNING: THIS EQUIPMENT HAS BEEN CERTIFIED COMPLIANT WITH EN55022 CLASS A ELECTROMAGNETIC EMISSIONS STANDARDS AND IS SUITABLE FOR USE IN COMMERCIAL AND LIGHT INDUSTRIAL ENVIRONMENTS WHEN INSTALLED IN ACCORDANCE WITH THE USER INSTRUCTIONS.

WARNING: THIS EQUIPMENT IS NOT APPROVED FOR USE IN PARTICULARLY DAMP ENVIRONMENTS WHERE WATER OR MOISTURE IS PREVALENT.

WARNING: THIS EQUIPMENT MUST BE CONNECTED TO A PROTECTIVE EARTH IN ACCORDANCE WITH THE INSTRUCTIONS IN THE INSTALLATION AND MAINTENANCE MANUAL. IMPROPER EARTHING MAY RESULT IN AN ELECTRICAL SHOCK HAZARD.

WARNING

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

EUROCABLES

With the advent of Pan-European Public Network Interface Standards, Timeplex Equipment is approved for connection to European Public Networks using standard cables applicable to the European Marketplace. These cables form part of the Attachment Approval and should be ordered using their associated Part Numbers.

To maintain full compliance with the Interface specifications, attention is drawn to the maximum and minimum lengths, and baud rates specified on some interfaces which are known to be fully compliant. Reference should be made to **ITU-T** (formerly CCITT) documents which recommend the expected relationship between length and baud rate for reliable operation.

The **"CX"** modules present their network interfaces either on module card connector or at the end cable connecting to the card.

Specified below are the cables used to interconnect the CX modules to the Public Network Interfaces.

Timeplex has taken into account the following aspects of cable design to ensure compliance with European legislation applicable to equipment used in "Commercial and Light Industrial" environments:

- Impedance/meter
- EMC Earthing practices
- Interface connections
- Immunity to interference
- Capacitance/meter
- Connector type
- Transition rise times
- Emissions characteristics
- Screen coverage/type
- Connector screening
- Balance about earth
- Safety earthing aspects

PRECAUTION: ***Before installing the equipment in other environments, or using alternative cabling, the advise of a competent Engineer should be taken.***

E1C Module

E1 G.703 120• Balanced	
Cable Type	8 conductor with modular RJ45 connectors
Cable Part Number	Timeplex 610127-X
Minimum Cable Length	2 meters
Maximum Cable Length	5 meters
Maximum Baud Rate	2.048Mb/s
E1 G.703 75• Unbalanced	
Uses 120 to 75• balun: single port part number	AW00722-3
Uses 120 to 75• balun: multi-port part number	Up to 16 AW00722-2 balun installed in AW00722-1 panel
Cable Type	Coaxial with two BNC connectors
Cable Part Number	Timeplex 120405-X
Cable Length	See ITU-T Rec. G.703
Maximum Baud Rate	2.048Mb/s

E3C Module

E3 G.703 75• Unbalanced	
Cable Type	Coaxial with two BNC connectors
Cable Part Number	Timeplex 120405-X
Cable Length	See ITU-T Rec. G.703
Maximum Baud Rate	34Mb/s

UTEL Module

E1 G.703 120• Balanced	
Cable Type	8 conductor with modular RJ45 connectors
Cable Part Number	Timeplex 610127-X
Minimum Cable Length	2 meters
Maximum Cable Length	5 meters
Maximum Baud Rate	2.048Mb/s
E1 G.703 75• Unbalanced	
Uses 120 to 75• balun: single port part number	AW00722-3
Uses 120 to 75• balun: multi-port part number	Up to 16 AW00722-2 balun installed in AW00722-1 panel
Cable Type	Coaxial with two BNC connectors
Cable Part Number	Timeplex 120405-X
Cable Length	See ITU-T Rec. G.703
Maximum Baud Rate	2.048Mb/s

DSC

V.11/X.21	
Cable Type	26M pin High Density DSUB to 15Mpin DSUB
Cable Part Number	Timeplex 613012-X
Minimum Cable Length	2 meters
Maximum Cable Length	5 meters
Maximum Baud Rate	2.048Mb/s
V.11/V.35	
Cable Type	26M pin High Density DSUB to 34M pin MRAC
Cable Part Number	Timeplex 613003-X
Minimum Cable Length	2 meters
Maximum Cable Length	5 meters
Maximum Baud Rate	2.048Mb/s

PAN-EUROPEAN PUBLIC NETWORK CERTIFICATION

The following table lists Timeplex equipment that has received pan-European public network certification and is marked **CE168X**.

Pan-European Public Network Certification

PUBLIC NETWORK INTERFACE STANDARD	TIMEPLEX CERTIFIED MODULES	PUBLIC NETWORK INTERFACE CABLE
CTR 2 X.21 / V.11 Digital Leased Lines	DSC	Cable Part No. 613012-X
CTR 2 V.35 / V.11 Digital Leased Lines	DSC	Cable Part No. 610121-X
CTR 12 G.703 / 2.048Mb/s / 120Ω / unstructured	SEL-4, SEL-8 UTEL E1C	Cable Part No. 610127-X
CTR 13 G.703 / 2.048Mb/s / 120Ω structured	SEL-4 SEL-8	Cable Part No. 610127-X
CTR 24 G.703 / 34Mb/s / 75Ω unstructured / structured	E3C	Cable Part No. 120405-X

UK National Attachment Approvals

The following table lists Timeplex equipment that has been granted UK national attachment approvals.

PUBLIC NETWORK INTERFACE STANDARD	TIMEPLEX CERTIFIED MODULES	PUBLIC NETWORK INTERFACE CABLE
NTR 4 G.703 / 2.048Mb/s 75Ω unstructured	UTEL	Cable Part No. 120405-X with either AW00722-2 or AW00722-3 balun's.

United States

Federal Communication Commission Part-68 Registration Information

WARNING

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, and (2) this device must accept any interference received, including interference that may cause undesirable operation. In accordance with FCC Part 15 Subpart B requirements, changes or modifications made to this equipment not expressly approved by Timeplex, Inc. could void user's authority to operate this equipment.

General Information Regarding the Use of Customer-Provided Telephone Equipment

FCC regulations and telephone company procedures prohibit connection of customer-provided equipment to telephone company-provided coin service (central office implemented systems). Connection to party lines service is subject to State tariffs.

The goal of the telephone company is to provide you with the best service it can. To do this, it may occasionally be necessary for them to make changes in their equipment, operation, or procedures. If these changes might affect your service or the operation of your equipment, the telephone company will give you notice, in writing, to allow you to make any changes necessary to maintain uninterrupted service.

If you have any questions about your telephone line, such as how many pieces of equipment you can connect to it, the telephone company will provide this information upon request.

In certain circumstances, it may be necessary for the telephone company to request information from you concerning the equipment that you have connected to your telephone line. Upon request of the telephone company, you must provide the FCC registration number of the equipment that is connected to your line. The FCC registration number is listed on the equipment label.

If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. If advance notice is not practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

TELECOM INTERFACE PORT CODES

Facility Interface Codes	Manufacturer's Port Identifier	Service Order Code	Network Jacks
04DU9-BN	T1C, STL-4, STL-8	6.0F	RJ48C
04DU9-DN	T1C, STL-4, STL-8	6.0F	RJ48C
04DU9-1KN	T1C, STL-4, STL-8	6.0F	RJ48C
04DU9-1SN	T1C, STL-4, STL-8	6.0F	RJ48C

Radio Frequency Interference

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at the user's own expense.

If Problems Arise

If trouble is experienced with this equipment, please contact Timeplex Customer Support at (800) 366-0126 for repair and/or warranty information. If the trouble is causing harm to the telephone network, the telephone company may request that you remove the equipment from the network until the problem is resolved.

The following repairs may be done by the customer: None.

This equipment cannot be used on telephone company-provided coin service. Connection to Party Line Service is subject to state tariffs.

In the event repairs are ever needed on this equipment, they should be performed by Timeplex, Inc., or an authorized representative of Timeplex, Inc. For information contact:

Timeplex, Inc.
1619 North Harrison Parkway
Sunrise, Florida 33323-2802
1-800-366-0126