USER'S MANUAL

D/I Mux III System

For D/I Mux III Shelf and Common Equipment

USER'S MANUAL

30000-100-MOD

Issue C

November 2005

COASTCOM

1141 Harbor Bay Parkway
Alameda, CA 94502-6511
Corporate: 800-433-3433
Fax: 510-523-6150
E-mail: info@coastcom.com
Web site: www.coastcom.com

PUBLICATION RELEASE RECORD

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DATE	ISSUE	ECO NO.	REASON FOR CHANGE
Aug 1997	A		Combine CCU and AMCU. Add new standard LIUs. Add FLIU. Revise to Feature Group upgrade.
February 2002	B	302-267	Delete FLIU Appendix. Add new warranty page. New cover.
November 2005	C		Add new Power Supplies and Ringing Generator

RELEASE NOTE December 2005

UPGRADED –24VDC Power Supply for D/I Mux III

Coastcom has released part number 30314-902, -24Volt DC Power Supply to replace 30314-101.

30314-902 Power Supply –24 VDC Redundant

The 30314-902 is a DC-to-DC converter used to power D/I Mux equipment from an external -24 VDC input supply. Generates +/-12 and +/-5 volt outputs as well as failure alarm signals. Also provides primary (-24v) power fusing. Can be used in a redundant or load sharing configuration when two power supplies are installed. When configured with FXS cards order modular Ring Generator 30333-121. Can be used in an 8/12/24 slot chassis. Replaces 30314-101.

RELEASE NOTE August 2005

UPGRADED POWER SUPPLY UNITS FOR D/I Mux III

In August 2005, Coastcom released upgraded power supply units for the D/I Mux III. The following two new units replace part numbers 30338-102, 30315-105A, 30338-103A, and 30308-102A.

30338-902 Power Supply -48 VDC Redundant

The 30338-902 is a DC-to-DC converter used to power D/I Mux equipment from an external -48 VDC input supply. Generates +/-12 and +/-5 volt outputs as well as failure alarm signals. Also provides primary (-48v) power fusing. Can be used in a redundant or load sharing configuration when two power supplies are installed. When configured with FXS cards order modular Ring Generator 30333-101. Can be used in an 8/12/24 slot chassis. Replaces 30338-102.

30315-505 Power Supply 120 VAC

An AC/DC self-contained single-slot power supply that provides all of the voltages necessary to operate a D/I Mux III - except ringing voltage. When configured with FXS feature cards, order modular Ringing Generator 30333-101. Provides +/-12, +/-5, and –48 volts. Can be used in an 8/12/24 slot chassis. Replaces a 30308-102A and the combination option of 30315-105A with 30338-103A. *Cannot be used in combination with any other power supply.*

RELEASE NOTE August 2005

RING GENERATOR MODULE FOR D/I Mux III

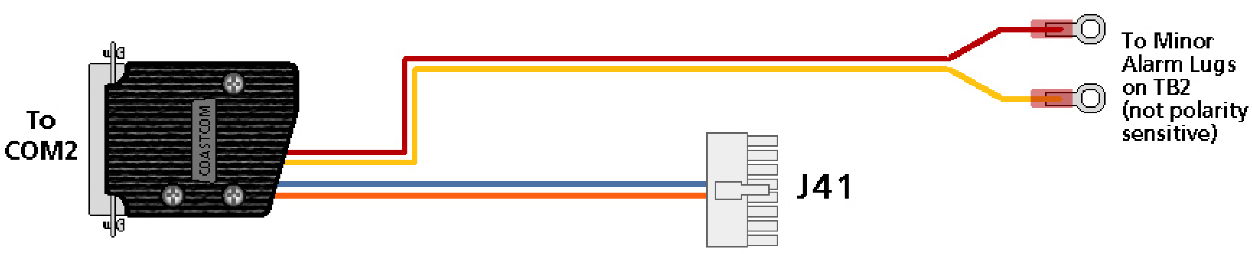
Introduction:
The 30333-101 / 121 Ring Generator provides internally generated ringing voltage for AC or DC powered D/I Mux III shelves with 2W FXS and Smart Omni-Orderwire feature cards. The 30333-101 is a –48 volt powered unit while the 30333-121 is a –24 volt powered unit. It provides up to 15 watts of continuous, superimposed (ringing voltage referenced to the negative battery supply voltage) sine wave ringing voltage. The nominal frequency is 20 Hertz. A front panel green LED indicates the presence of power to the card. A red LED and relay contact closure indicate generator failure.

Installation:

The 30333-101 / 121 Ring Generator can be installed in any of three available areas of the D/I Mux III shelf: Power Supply, Feature Card or UCOM (FDLP). In any of the three locations, it automatically configures itself to operate. It can be installed or removed while the shelf is in operation (hot swapped).

When installed in the UCOM location the accessory 30333-101-UC cable must be in place on the back of the shelf to complete installation.

> Installation of 30333-101-UC cable. **Note:** this cable is installed only when the Ring Generator is located in the UCOM (FDLP) card slot. This cable is included with each 30333-101 or 30333-121 unit.
>
> > At the rear of the shelf, plug the 30333-101-UC cable's DB-25 male connector into the DB-25 female UCOM2 location. Plug the white Molex connector into the mating shelf Molex connector marked "AUX SHF I/F". Unscrew the two screws marked "MNR ALM" on the screw-down barrier strip. Install the two cable wires with the ring lugs. Put one under each screw head. Connections for failure alarm are made at this location on the barrier strip.



DB – 25 – M		**MOLEX**	**WIRE**
AMP 205208-1	Shell	39-01-2160	18 AWG
AMP 66570-3	Pins	w/39-00-0039	Insulated
AMP 206478-3	Hood	Female Pins	Hookup,
			Pairs
			Twisted

PIN-OUT CONNECTIONS

COLOR	NAME	PIN	MOLEX
RED	Alarm 1	2	Ring Lug
ORANGE	+5V	3	11
YELLOW	Alarm 2	4	Ring Lug
BLUE	Ringer	6	6

Failure Alarm:

The 30333-101 / 121 provides relay contact closure (1 ampere maximum) for an external alarm upon ringing generator failure. For Power Supply and UCOM locations, the connection location is at the "Minor Alarm" terminals on the back of the D/I Mux III shelf. For a Feature Card location the alarm contacts appear on the associated card slot's DB-25 connector on the rear panel, at pins 18 and 20.

Providing Ringing Voltage to Other Equipment:

The ringing voltage from the generator is available at the back of the shelf (marked "20 Hz") for connection to other applications (including D/I Mux III shelves) that require superimposed ringing voltage. Be sure to securely ground all equipment using common ringing voltage to the common ground connection on the D/I Mux III shelf that houses the Ring Generator. Care should be exercised to keep the total continuous ringing load at or below the specified 15 watt capability.

Attention should also be paid to overall loading – if an internal AC/DC power supply is installed in the shelf with the 30333-101 Ring Generator and the unit also powers additional shelves – the AC/DC power supply has to power all –48 Volt requirements in the shelf (CSU and talk battery for FXS and Smart Omni Orderwire, etc.) along with powering the Ring Generator. If in doubt regarding an application with high internal AC powered loading, contact Coastcom application engineering (800-433-3433).

Caution:

This unit must be installed in a properly grounded D/I Mux III shelf.

Hazardous voltages are present on the Modular Ring Generator printed circuit card traces. Do not operate this card on a card extender while operating in the shelf.

Product Description

Coastcom's D/I Mux III™ is an intelligent drop-and-insert T1 multiplexer for voice, data, and special service applications. It offers programmable software for monitoring and controlling configurations, transmissions, alarms, and diagnostics. Intelligent channel cards permit software access to individual circuits.

D/I Mux III accesses one or two T1 transmission lines, and interfaces up to 48 DS0 transmission channels. Voice, data, video, and special services are provided in any combination within a D/I Mux III. With the addition of Coastcom's 5-port Subrate Data Multiplexer (SDM) line cards, up to 120 data circuits are supported in a single multiplexer.

Special features of the D/I Mux III are its network compatibility, remote control capability, integral T1 channel service unit, and standard copper wire Line Interface Units (LIU). Also, AC power supply with ringer, redundant DC power supply option, and Automatic Loop Protection Switching (ALPS™) as an optional feature for data protection in the event of transmission failure. There are also several unique channel cards that offer services such as high quality audio, links to other T1 systems, and on-line selectable high speed data.

All equipment specifications subject to change without notice.

Specifications

Multiplexer Requirement

Model:	D/I Mux III

Software Versions:

Common Control Unit (**CCU**) (30305-106/108):	8.1/9.1 (or above)
Previous CCU Feature Group:	6.0/8.0 (or above)
Common Control Unit (**CCU**) (30305-110)	1.8 (or above)
ALPS CCU (30305-109)	9.8 (or above)
Multiplexer Control Unit (**MCU**) (40305-103)	1.4 (or above)
Previous MCU Feature Group:	1.3 (or above)
Advanced Multiplexer Control Unit (**AMCU**) (40305-104)	1.8 (or above)

Line Interface Units Requirement

LIU Models:	30309-104/114

Design Compliance

Complies with applicable sections of AT&T publications 43801, 54018, 54075, 62310 and 62411

Complies with applicable sections of ANSI publications T1.403, and T1.107

Complies with regulatory standards:

FCC Part 15, Subpart B, Class A;
FCC Part 68
DOC CS-03
UL/CSA standards certified by CSA

D/I Mux III User's Manual Organization

This D/I Mux III User's Manual is written for use by technical planners as well as operation and installation personnel.

The D/I Mux III User's Manual is organized in the following order:

- System Overview and Modes of Operation
- Applications
- Installation
- Configuration and Operation
- Diagnostics
- Appendices

Coastcom recommends a thorough review of the content and organization of this manual. An extensive table of contents provides easy access to installation and maintenance information. At each step of the installation process, applicable procedures should be re-read carefully to ensure that the required tools and components are available for successful installation and operation.

REGULATORY INFORMATION

FCC NOTICE

Federal Communications Commission (FCC)
Part 15 Regulations For Telephone Equipment

NOTE: This equipment has been tested and found to comply with the limits for 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 their own expense.

IMPORTANT: This product was tested for FCC compliance under conditions that included the use of shielded cables and connectors between components. Changes or modifications to this product not authorized by the manufacturer could void your authority to operate the equipment.

FCC Part 68 Requirements

Note:	FCC Rules Part 68 require the following information to be included in this publication. Some of the information may not be relevant to Coastcom 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 line service is subject to state tariffs. The applicable state public service commission should be contacted for information.

The telephone company may require disconnection of the user provided equipment in the event of a natural disaster or other situation where damaged equipment could cause harm to the public telephone network.

Upon request, local telephone companies will provide information concerning questions about telephone lines, such as how many pieces of equipment may be connected to it.

FCC Requirements for Connection of Systems to the Telephone Network

This equipment complies with the requirements of part 68 of the FCC rules.

Coastcom, Inc.
Coastcom Series of T1 Multiplexers
FCC Registration Number CRGUSA-17575-XD-N (with DSX Interface)
FCC Registration Number CRGUSA-60682-DD-N (with Internal CSU Interface)

Affixed to the equipment is a label containing the FCC registration number and the Ringer Equivalence Number (REN) for this equipment. A list of the system interfaces, their Facility Interface Codes (FICs), and their Universal Service Order Codes (USOCs) is provided. The telephone company has the right to request the following information:

- Quantities and USOC numbers of the required jacks
- Sequence in which the trunks are to be connected
- FICs by position
- REN or service code, as applicable, by position

The REN is used to determine the quantity of devices that may be connect to the telephone line and still have assurance that all of those devices will ring properly when the applicable number is called. In most, but not all areas, the sum of the RENs of all devices should not exceed five (5). To be certain of the number of devices that may be connect to a line, as determined by the RENs, the local telephone company should be contacted for information on the maximum REN for that calling area.

Regulatory Codes

Type of Interface	USOC Jack Connector	REN/Service Order Code	Facility Interface Code
1.544 Mbps	N/A	6.0p	*
2 Wire Loop Start	RJ21X	2.4 A (AC) 4.4 (DC)	02LS2
2 Wire Ground Start	RJ21X	2.4 A (AC) 4.4 (DC)	02GS2
2 Wire E&M Type I	RJ2EX	9.0F	TL11E
2 Wire E&M Type II	RJ2FX	9.0F	TL12E
4 Wire E&M Type I	RJ2GX	9.0F	TL31E
4 Wire E&M Type II	RJ2HX	9.0F	TL32E
OPS Class C	RJ21X	9.0F	OL13C
T1 (D4 Framing)**	RJ48C	6.0P	04DU9-B
T1 (ESF Framing)**	RJ48C	6.0P	04DU9-C
OCUDP	RJ48S	6.0P	04DU5-56
Integral CSU (D4 Framing)**	RJ48C	6.0P	04DU9-B
Integral CSU (ESF Framing)**	RJ48C	6.0P	04DU9-C
Dual 4 Wire Deluxe	RJ2GX	9.0F	TL31E
Dual 4 Wire Deluxe	RJ2HX	9.0F	TL32E
Tandem T1 Unit	N/A	6.0P	04DU9-BN
Tandem T1 Unit	N/A	6.0P	04DU9-DN
Tandem T1 Unit	N/A	6.0P	04DU9-1KN
Tandem T1 Unit	N/A	6.0P	04DU9-1SN
All Rate OCUDP	RJ48S	6.0P	04DU5-24
All Rate OCUDP	RJ48S	6.0P	04DU5-48
All Rate OCUDP	RJ48S	6.0P	04DU5-96
All Rate OCUDP	RJ48S	6.0P	04DU5-56

* In some cases connection of this system requires filing an affidavit with the telephone company. When connecting a system configured without an integral CSU, report the FCC registration number which contains the equipment code "XD". An external FCC registered CSU is required to connect "XD" category equipment to the 1.544 Mbps public network. The Facility Interface Code is determined from the CSU.

** In some cases, connection of this type of system requires filing an affidavit with the telephone company. When connecting a system configured with an integral CSU, report the FCC registration number which contains the equipment code "DD".

For metallic channel ports, please be aware that metallic pair services may not be available in all locations.

If any telephone equipment causes harm to the telephone network, the telephone company may temporarily discontinue service to that line. If possible, the phone company will give advance notice of such discontinuance. If advance notice is not practical, notice will be given as soon as possible. The telephone company will also advise of the right to file a complaint with the FCC.

The telephone company may make changes in its facilities, equipment operations, or procedures that could affect the proper operation of user equipment. Advance notice of changes should be given by the telephone company to provide an opportunity to maintain uninterrupted service.

Repair Services

In the event equipment repairs are necessary, contact Coastcom for factory service. Customer repairs of Coastcom equipment should be limited to module replacement and/or front panel servicing. For information, contact:

Coastcom
1141 Harbor Bay Parkway
Alameda, CA 94502-6511
Tel: 800 433-3433
510 523-6000
FAX: 510 523-6150
Technical Support: 800 385-4689

SAFETY AGENCY CERTIFICATIONS

Canadian Standards Association (CSA) certifies that D/I Mux III equipment meets the requirements of Underwriter’s Laboratories (UL), as applicable, for the United States, and those of CSA, as applicable, for Canada.

When a DC powered system is purchased to be resold to another customer, or when purchased to be used as part of another system, the system is referred to as a Rack Mounted Card Cage and is CSA Certified. Power supplies and channel line cards which connect to the public telephone network are CSA Certified as components.

When a system is sold directly to a customer, and the system is configured with an internal AC power supply, for customer premises applications, then the product is referred to as an Intelligent Multiplexer Card Cage and is CSA Listed. To satisfy safety agency requirements, the user is advised that D/I Mux III equipment is “To be installed only in Restricted Access Areas (Dedicated Equipment Rooms, Equipment Closets, or the like) in Accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code, ANSI/NFPA No. 70.”

INFORMATION FOR CANADIAN CUSTOMERS

Equipment Attachment Limitations
(Canada Only): CP-01, Part I, Section 10.1

NOTICE: The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. 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 must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). 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 made by an authorized Canadian maintenance facility 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 system, 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.

CP-01, Part I, Section 10.2

NOTICE: The **Load Number** (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the LN (Load Numbers) of all the devices does not exceed 100.

TABLE OF CONTENTS

Chapter 1. SYSTEM OVERVIEW AND MODES OF OPERATION

This manual details the Coastcom D/I Mux III multiplexer for use with T1 connections. Users unfamiliar with T1 technology are encouraged to refer to commercially published material on T1 for more information, however the basic concepts of T1 are relatively simple. Essentially, a T1 line is a 4 wire, high speed phone line capable of carrying many individual phone connections, analogous to a large conduit.

The T1 network facilitates high speed transmission of large volumes of digitized voice and data signals over extended distances. T1 standards provide transmission of up to twenty-four 64 Kbps channels (DS0s) sequentially.

A multiplexer is a device that takes voice and data inputs from various types of telecommunication devices and converts them into a data stream which is sent over the T1 line. This technology is called multiplexing, and it allows telecomm users to send and receive a large volume of traffic over wide areas efficiently, while still enjoying direct connections to individual phones, modems, and other similar equipment. The T1 line constitutes what is referred to as a DS1 channel. The individual channels that make up the DS1 are referred to as DS0s.

D/I Mux III Capabilities

Coastcom's D/I Mux III family of intelligent T1 multiplexers offers fully programmable, easy to use software-controlled voice and data multiplexing.

One or two T1 digital transmission systems are easily accessed with a D/I Mux III. Voice, data, and special service circuits are all available within one compact system. The D/I Mux III supplies 48 DS0 transmission channels, and with 5-port Subrate Data Multiplexer (SDM) channel cards, up to 120 data circuits can be accessed in a single system.

All of the D/I Mux III card slots can be mapped to any T1 span. Drop-and-insert users can also reuse DS0s that are dropped from one T1 span (for example, the T1-1 span) by inserting them in the opposite T1 span (T1-2).

D/I Mux III multiplexers can be placed in several modes of operation without changing hardware. The D/I Mux III can be configured for channel bank, drop-and-insert, dual channel bank, or optionally, Automatic Loop Protection Switching (ALPS™) operation. ALPS is designed to maintain communications after a T1 line break, or system failure; and with system redundancy, ALPS operation requires special common equipment hardware. With ALPS hardware all modes of operation are accessible. For more details on ALPS see the *ALPS User's Manual*.

The D/I Mux III meets AT&T's T1 compatibility specifications for electrical performance, and for alarm and restoration sequences (AT&T Publications 43801 and 62411).

D/I Mux III Functions

The D/I Mux III can be configured to communicate over T1-1 or T1-2 (up or down the T1 span), or over both. As a drop-and-insert system, the D/I Mux III drops (extracts and distributes) the channel contents from either or both of the T1 Receive (Rx) signals, and makes them available to external devices. It then inserts (picks up and adds) the channel contents from these devices to either or both of the T1 Transmit (Tx) signals.

The D/I Mux III provides an economical means of connecting to remote external devices such as telephones, modems, computers, terminal controllers, PBX units, etc. The D/I Mux III, in all modes of operation, supports local and remote control functions, networking management, transmission quality, and failure protection.

D/I Mux III Features

A D/I Mux III system includes the following features:

- A multi-tasking microprocessor for rapid reconfiguration and quick response to changing network conditions
- Software control and configuration
- Automatic alarm notification
- Eight preconfigured maps for easy reconfiguration of the DS0 transmission channels
- Time, event, manual, and alarm control of maps (alarm map control requires Feature Group X.4 or higher)
- Selectable timing sources
- Real-time alarm reporting and recording
- Alarm LED indicators
- External alarm contacts
- T1 equalization
- Optional T1 test jacks
- Lightning protection
- AC or DC power supplies
- Optional redundant DC power supplies
- Internal ringing generator (with AC power supply systems)
- Voice, data, and subrate data circuits
- High fidelity audio circuits
- Circuit level loopbacks and testing
- Optional integrated Channel Service Unit (CSU)
- Optional Simple Network Management Protocol (SNMP) to streamline network management
- With SNMP, Serial Line Internet Protocol (SLIP) feature allowing communication between network manager and a far-end D/I Mux that is not connected directly via a LAN, or router
- With SNMP, a gateway feature enabling message transfer between different networks
- With AIM-Net, a network management system

D/I Mux III Software Control

As depicted in Figure 1-1, the D/I Mux III can be controlled in one of the following ways:

- Locally, through use of an asynchronous ASCII terminal
- Via a personal computer with terminal emulation software
- Through the use of SNMP software command options, (requires AMCU card option)

Most D/I Mux III configuration and diagnostic functions (transmission channel mapping, shelf operating modes, T1 formats, clock sources, alarm generation and reporting, as well as password access) are under software control. Software also controls the configuration of intelligent channel cards.

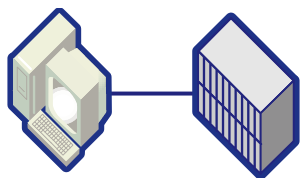


Figure 1-1. Software Control

AIM-NET EMS

Coastcom's AIM-Net is a Windows-based enhanced Element Management System (EMS) designed to simplify the construction and mapping of complex voice and data networks. This unique software management tool was designed in support of our AIM and D/I Mux III product lines, empowering the user to set up, configure, view, and manage an entire mixed network from a single location. Simple point and click navigation alleviates the need for highly trained technicians to manage your networks and reduces costly travel time to remote sites for maintenance. (For D/I Mux, requires an AMCU controller card). (See separate *AIM-Net User's Manual* for further features and functionality).

AIM-Net Features:

- Point and click mapping of once complex voice and data networks
- The unique ability to automatically select routing
- Maintains a comprehensive record of all equipment and software within the network
- Reports critical feature card information from throughout the network
- Provides a platform for network and inventory management
- The ability to export network and node information to any Open Database Connectivity (ODBC) where customized management reports can be generated
- Allows for the design and simulated connection of networks in a virtual environment for review before taking the network live.

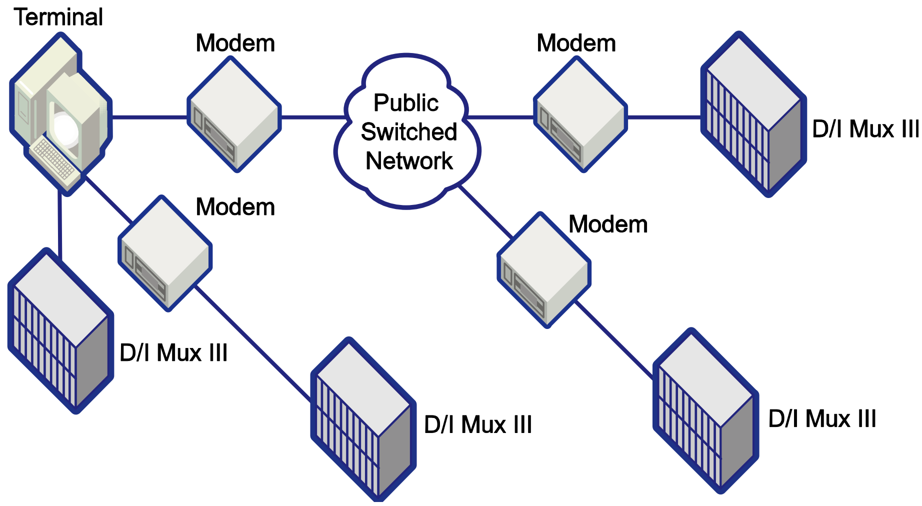


Figure 1-2. AMCU System Network

Remote Control with AMCU

Remote control of the D/I Mux III system is made possible through the use of a modem connection to the D/I Mux III COM port (also referred to as the control port). A terminal and modem are connected at the user site, and call up the remote system using terminal emulation software. Figure 1-3 illustrates remote control through use of AMCU system software.

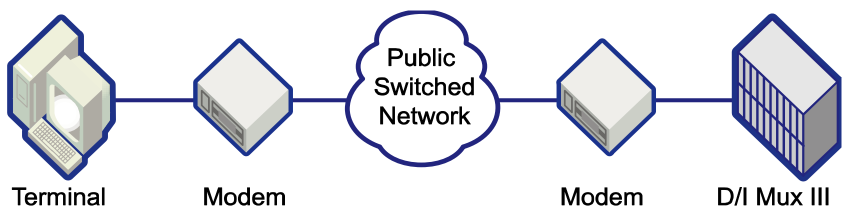


Figure 1-3. System Remote Control Via AMCU

SNMP

Advances in internetworking during the 1980s forced the definition of a new network management standard, creating the Simple Network Management Protocol (SNMP), the most widely used market standard to date. The optional Advanced Multiplexer Control Unit (AMCU) provides the SNMP option by adding networking capability to an enhanced, modular version of the CCU card.

SNMP provides a set of features that allows management of T1 devices by more than one SNMP manager from anywhere in an Ethernet 10Base-T Local Area Network (LAN), as depicted in Figure 1-4. Coastcom's SNMP products communicate with SNMP managers from vendors whose products comply with Request for Comment (RFC) 1157.

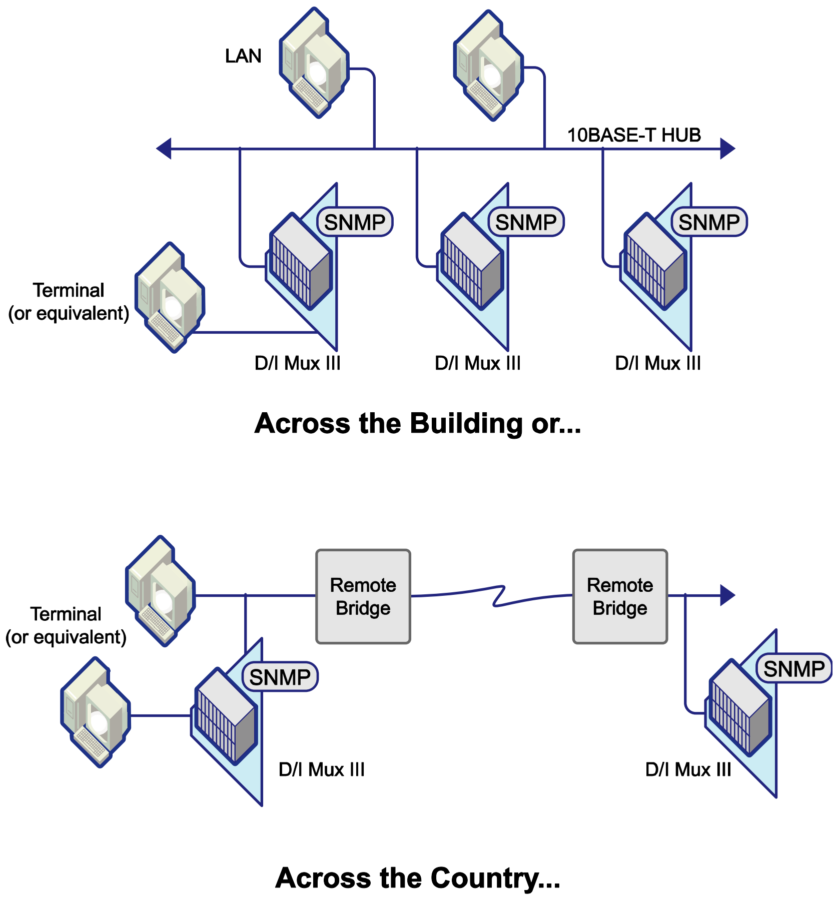


Figure 1-4. SNMP Helps Manage Network Elements via LANs Close at Hand or Over Long Distances

While most of the connectivity and interoperability issues in networking have been resolved, it is still vital that network devices be monitored, network performance checked, and that network problems be remotely diagnosed and corrected. Network management achieves these goals, and SNMP is the most widely accepted market standard for Transmission Control Protocol-Internet Protocol (TCP/IP)-based environments.

Coastcom implements SNMP using a powerful AMCU that offers the following features:

- *Native* SNMP that eliminates the need for proxy hardware
- Support of Management Information Base 2 (MIB2) and DS1 MIB
- Intel i960 RISC processor-based AMCU speeds data processing
- Local serial interface allows programming of the unit through use of a dumb terminal, or via a PC with terminal emulation
- An Ethernet 10Base-T port offering Telnet VT-100, or VT-220 terminal emulation over a LAN
- Downloadable code support via a Personal Computer Memory Card International Association (PCMCIA) card.

Serial Line Internet Protocol (SLIP)

A D/I Mux III with the SNMP option will usually be connected through a Local Area Network (LAN) to one or more SNMP managers. The network connection can be made either through an Ethernet 10Base-T, or serial port connection.

A direct Ethernet connection is preferred. This is accomplished by connecting the 10Base-T jack, located on the AMCU front panel, to a hub or other suitable network device with an appropriate cable.

If a direct Ethernet connection is not feasible, the Serial Line Internet Protocol (SLIP) connection can be used. A serial connection is accomplished by linking the SLIP/PPP jack on the AMCU front panel to a router or other suitable network device by any means appropriate for a serial connection. The router must be configured for a SLIP connection.

While a serial network connection is significantly slower than an Ethernet connection, it is more flexible. The serial link can be carried by a D/I Mux Subrate Data Multiplexer (SDM) channel, or in any of a number of other ways in addition to a direct cable connection.

While it is possible to use both the Ethernet and SLIP/PPP ports simultaneously, this is usually not done because the AMCU card has no internal bridging or routing capabilities. Additionally, the SLIP feature does not currently support the use of modems.

Figure 1-5 depicts SLIP operation with a network manager sending message traffic through a router, via RS-232 cabling, and through an SDM or other transport medium, to the SLIP COM port of a far-end D/I Mux.

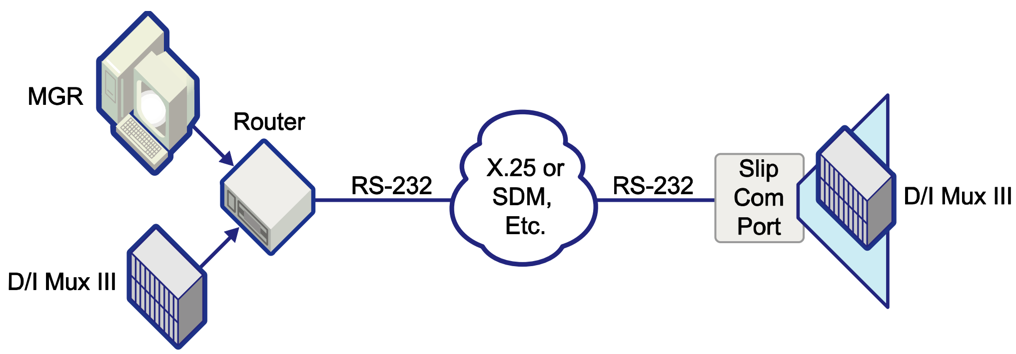


Figure 1-5. Serial Line Internet Protocol (SLIP) Connection

Gateway

The AMCU makes special provision for the case where it is connected to a network that is linked to other networks by a Gateway (special router). In this case, messages to the manager must be addressed to pass through the Gateway, and the address of the Gateway must be known to the AMCU. If the AMCU is configured with a "default Gateway address," messages to SNMP managers with IP Addresses not on the same network as the AMCU will not be properly addressed and forwarded by the indicated Gateway.

Figure 1-6 depicts a typical Gateway connection across two networks with different IP Addresses.

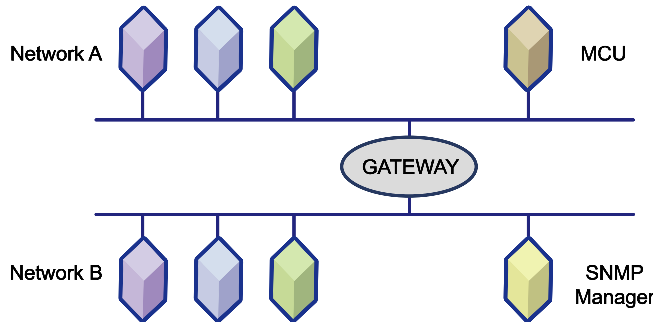


Figure 1-6. Gateway Connection

Transmission Control

T1 equipment operates at 1.544 Mbps, which is the product of the twenty-four 64 Kbps channels, plus 8 Kbps for overhead. This is known as the DS-1 rate and a T1 facility is known as a DS-1 facility. The common (inter-exchange) carriers (e.g., AT&T, MCI, SPRINT, etc.) divide the DS-1 signal into the 24 64-Kbps DS0 channels, using this signal rate as a standard digital communications interconnection method within North America. Local Exchange carriers, such as Pacific Bell and Southwest Bell, etc., also offer this service for private networks.

The T1 signal is based upon what are known as DS1 Frame, and DS1 Extended Super Frame (ESF). Simply defined, the DS 1 ESF scheme is as follows:

- DS0 Data Signal - Unframed, continuous bit stream, at a rate of 64 Kbps
- DS0 Octet - Eight consecutive bit portions comprising DS0 data signal
- DS1 Frame - Twenty-four DS0 octets, preceded by one framing bit
- DS1 ESF - Twenty-four consecutive DS1 frames
- DS1 Data Signal - Continuous stream of DS1 frames, at the standard DS1 data rate of 1.544 Mbps

The DS1 signal consists of 24 time slots, each of which transmits and/or receives one DS0 within the multiplexer. Some external signals are capable of more or less than one DS0, in which case several DS0s might be required for one type of signal, while in other cases several signals might occupy just one DS0. This determination is based upon the application, and number of channel cards included in the system. DS0 time slots are user-configurable. Installing a channel card does not automatically assign its transmission path. Time slots and physical card slots are independent of one another, and the transmission path must be mapped.

D/I Mux III line card circuits transmit and receive information over user-assigned (mapped) DS0 channels as data or voice. The map assignments are user programmed and the information is recorded in a line card map.

Transmission Channel Assignments

A line card circuit which is not assigned a DS0 (T1 transmission channel) can be configured for operation, but will not perform its transmission function until a DS0 has been assigned. Transmission direction is configured using software commands that specify the mode of operation, the port, and applicable timing options. Typically, the T1-1 port is automatically “on”.

The signaling type for a DS0 channel, whether voice or data, is designated in the DS0 assignment map. When a DS0 is mapped to an intelligent line card it will allocate the correct voice or data signaling type automatically. A hardware-configured card, or empty card slot, signaling type must be entered manually in the DS0 assignment map. DS0 designations are listed in the maps as data, voice, transmit (T), receive (R), through or unused (X).

When DS0 information passes through the multiplexer without being processed, it is referred to as a *through DS0.*

Unused DS0s are those not assigned to a line card circuit.

Maps

Mapping is the process of defining which of the line card circuits use which of the 24 DS0 transmission time slots. Mapping is controlled by software stored in the Common Control Unit (CCU). Up to seven maps can be stored, with the map currently operating called the working map.

A map change alters the circuit-to-time-slot assignments. By changing to a new working map, the system is able to change time slot assignments without causing data errors on unchanged DS0s.

Maps are set to start in response to user-specified times, an event, an alarm, or a manual keyboard command.

Time triggered maps reconfigure the multiplexer automatically at a specified time. Voice circuits can be decreased, and high-speed data capacity can be increased for evening or weekend operation. This allows data backups and file transfers to process more quickly when voice traffic is low.

Event triggered maps are switched on by an event, such as a disaster situation or a demand requirement, to meet unscheduled network traffic rerouting. The event is triggered when a physical contact at the back of the multiplexer is grounded.

Alarm triggered maps are switched on by one of three alarm conditions: Bit Error Rate (BER) Alarm, Red Alarm, or Yellow Alarm.

Manual maps are switched on only when a keyboard command is entered. Use a manual map when only one map is required for the network, or to reconfigure a map. The time, event, and alarm maps can also be switched on manually for testing or special requirements.

The D/I Mux III has eight preconfigured maps of commonly used configurations for setup without a terminal. See *Appendix D. Preconfigured Maps,* for details.

Timing and Clock Source

Transmit clocks for the T1-1 and T1-2 transmission ports are derived from the sources illustrated in Table 1-1 below.

Table 1-1. Clock and Timing Source

Clock Source	Timing Source
T1-1/T1-2 Recovered	Loop
Internal T1	Local
External	Local
T1-2	Local
Slot-2	Local

With loop timing, the D/I Mux III in channel bank operation is synchronized to the T1 network. Clocks recovered from the T1 network are used to create the T1 transmit clocks.

In local timing, the clock source for the T1 outputs is derived from the D/I Mux III internal 1.544 MHz (Stratum IV) oscillator. This oscillator can either run freely, or be synchronized to an external clock.

In the drop-and-insert or dual channel bank loop timing mode, the D/I Mux III recovers clock from T1-1, and uses this to create the T1-2 transmit clock. The T1-2 recovered clock is used to create the T1-1 transmit clock.

Alarms and Monitoring

Alarm detection is provided for both the T1-1 and T1-2 transmission lines. Common Bell System alarms, as follows, are supported:

- Local alarm
- Remote alarm
- Carrier Group Alarm (CGA)

Audible, visual, and minor alarm contacts are provided. The audible and visual contacts indicate major alarms. A major alarm indicates a service-affecting problem that requires maintenance action. Visual contacts indicate a minor alarm, which is not service-affecting. However, it does require maintenance action.

Alarms are indicated by front panel Light Emitting Diodes (LEDs), and are reported by the closing of alarm relay contacts. Alarms are reported to both the CCU and AMCU.

Loss of frame synchronization, or loss of the receive signal, activates a local alarm. If the condition persists for 2.5 seconds, the local terminal sends a yellow alarm to the remote end. The direction of yellow alarm transmission is user-configurable to either T1-1, T1-2, or both.

If a local alarm exists for a user-defined period, or if a remote alarm is received, a Carrier Group Alarm (CGA) is generated to initiate trunk processing in the D/I Mux III. Trunk processing “busies out” (removes) circuits in an orderly fashion.

There are many other alarms in the D/I Mux III system. Alarms are rated as major, minor, and informational. Details of the various alarms are described in *Chapter 5. Diagnostics*.

Power Failure Alarm

All of the alarm contacts on the D/I Mux III are open during non-alarm conditions. Power failure, or removing a power supply (or both supplies if redundant DC units are installed), will cause the visual and audible alarm contacts to close.

Alarm LED Indicators, Alarm Cut-off, and Bypass

The D/I Mux III has Light Emitting Diode (LED) indicators for alarms, alarm cut-off, and bypass. After an alarm has occurred, an alarm cut-off (ACO) button, or corresponding software selection, allows the user to turn off the audible alarm relay. The bypass (BYP) button, or software bypass, allows the D/I Mux III to be bypassed. The bypass button only activates when there is a major alarm. Bypass is only possible in drop-and-insert or ALPS mode with a Dual Digital Signal Cross-Connect (DSX-1) interface during a power failure. (A Dual DSX-1 Interface will cause the shelf to go into bypass immediately if it loses power.) In redundant DC power systems, both power supplies must fail at any given output before the system enters the bypass mode.

Power Supply Failure Indicator LEDs

The red failure indicator will turn on if any power supply-regulated voltage is out of tolerance, or if fuses F1, F2, or F3 are blown on, or removed from the -48 V DC power supplies.

In redundant DC power systems, the system software indicates if one power supply has failed. This allows insertion and removal of either power supply without interrupting service unless both power supplies are being used to provide power to the channel cards.

Minor Alarm

The minor alarm relay closes for minor alarm reporting. These pins are accessible on the D/I Mux III backplane, at the contacts labeled *MNR*. The minor alarm can be activated by the system reporting a minor alarm, such as a Cyclic Redundancy Code (CRC) error, or redundant power supply failure. (Refer to *Chapter 5. Diagnostics* for more information on alarms.)

Bypass

When the D/I Mux III is configured for drop-and-insert operation, bypass causes the T1-1 span to be connected to the T1-2 span, bypassing the D/I Mux III so that “through T1” is uninterrupted.

The bypass operation can occur automatically, through software selection, or through manipulation of front panel switches.

When a Dual Digital Signal Cross-Connect (DSX-1) Interface is installed in a D/I Mux III, bypass automatically occurs when any of the common equipment is removed, or if an out-of-tolerance voltage is supplied to the system (a brownout occurs). Dual Channel Service Unit (CSU) interfaces do not go into bypass because protected DC power is used for their operation.

During an alarm condition, bypass can be selected using the bypass switch on the CCU, or AMCU, front panel. Before bypass can be activated, the alarm condition must be acknowledged by selecting Alarm Cut-off (ACO) via software, or at the front panel. Bypass can be software-selected at any time.

Trunk Processing

When a local alarm, remote alarm, or system failure causes a Carrier Group Alarm (CGA) to occur, trunk processing removes line cards from service in the D/I Mux III. When the problem is cleared, service is restored. Disabling CGA is optional on some line cards. Refer to the individual user manuals for further description of CGA operation with specific line cards.

T1 Interfaces - CSUs

There are three versions of Dual Channel Service Unit (CSU) interfaces available: T1/DSX-1, T1/T1, and DSX-1/DSX-1. Each CSU provides slightly different options and capabilities for equalizing output across twisted-pair cable. This process is called line build-out (LBO). This is required to compensate for the characteristics of the twisted-pair cable so that the correct signal level and shape is received at the DSX-1.

With the T1/DSX-1 version, LBO is provided on the T1-1 (network) side, and an equalizing network is provided on the DSX-1 (terminal) side. This version can be used, for example, between a T1-2 network and a digital PBX.

The T1/T1 version provides line build-outs on both sides as well as on both T1-1 and T1-2 to interface to T1 carriers. This version is used in drop-and-insert or dual channel bank applications.

The DSX-1/DSX-1 version provides DSX equalization on both sides. This version is for private networks which require T1 test capabilities. DSX-1 interfaces work well with transmission equipment such as microwave radios and fiber optic modems.

Lightning Protection

When installed as an option with a CSU interface unit, lightning protection circuitry is included with the T1 inputs and outputs. It protects against high-voltage surges and spikes on the T1 line only; it does not provide protection on the line card side.

T1 Testing With the CSU

The Dual CSU interface option provides integrated Channel Service Unit functions for the D/I Mux III T1-1 and T1-2 transmission paths, along with limited test functions.

A Dual CSU interface installed in a D/I Mux III shelf operates in conjunction with the other common control units to provide the integrated CSU features. The CSU features are provided for both T1-1 and T1-2 transmission spans, and include the following:

- Test loopback, network loopback, and bypass
- Lightning protection
- T1 span line build-out equalization
- *Keep-alive* signal (channel bank mode loopback)
- Span power can be terminated, looped back, or sent through the shelf
- Jackfield, for ease of maintenance

Power Supplies

-48 Volt DC Power Supplies

Two DC power supplies can be used to provide redundancy. In a redundant system, both power supplies share the work. If one fails, the other automatically assumes the full load. In such a configuration, either power supply can be inserted or removed without interrupting service.

Some applications require two power supplies for normal operation, as with Subrate Data Multiplexer (SDM) line cards. In such cases where more than 12 data line cards require the use of both power supplies, redundant operation is not possible.

The power supplies are designed to withstand a reverse polarity input connection without sustaining internal damage.

The -48 V DC power supplies provide the following:

- Power-on indicator
- Power supply voltage monitor circuitry
- Alarm reference voltage regulator
- Alarm detect fuse failure and power supply fail indicator circuitry

The power supply has built-in over-voltage and under-voltage failure detection circuitry. It monitors +5 V, -5 V, +12 V, and -12 V outputs, and will initiate an alarm if the voltages are approximately 10 percent out of tolerance.

-24 Volt DC Power Supplies

-24 V DC power supplies are available for special applications. They provide the same features as the -48 V DC supplies, and operate with the line cards shown in *Appendix B. -24 Volt Compatibility*. The Dual CSU interface, with integrated CSU capability (part numbers 30318-101, 30318-102, and 30318-103), will not operate in -24 V DC powered systems.

110 Volt AC Power Supply

An AC power supply is available for customer premise applications where only standard 110 V AC power is available. Coastcom currently offers an AC/DC self-contained single-slot power supply that provides all of the voltages necessary to operate a D/I Mux III - except ringing voltage. When configured with FXS feature cards, a modular Ringing Generator 30333-101 will also be needed. Provides +/-12, +/-5, and -48. Can be used in 8, 12 and 24-slot shelves. Replaces a 30308-102A and the combination option of 30315-105A with 30338-103A. *Cannot be used in combination with any other power supply.*

NOTE: Previous to August of 2005, Coastcom offered two AC power supplies:

- The 30315-105 110 Volt AC supply worked in conjunction with the 30338-103 -48 V DC power supply. It occupied one power supply card slot, and converted AC power into -48 V DC. The -48 V DC power supply used the -48 V DC supplied by the AC power supply and converted it into the required voltages normally used by 12-slot shelves.
- The 30308-102 AC power supply occupied both power supply card slots in a D/I Mux III 8-slot or 24-slot shelf, and was not available for 12-slot shelves. The 30308-102 supplied all the voltages required by the D/I Mux III, and allowed software voltage checks.

D/I Mux III User Circuit Interfaces

D/I Mux III circuit interfaces include:

- High speed synchronous data
    - 56 Kbps to 1.536 Mbps (*n* times 56 or 64 Kbps)
    - V.35 interface, RS-422/449, or RS-232C interface
- Low speed data
    - 1.2 Kbps to 19.2 Kbps
    - asynchronous or synchronous
    - Digital Dataphone System (DDS) subrate compatible
        - DS0A format
        - DS0B format
    - RS-232C interface
- DDS Interfaces
    - Office Channel Unit Data Ports (OCUDP)
        - 56 Kbps
        - Switched 56 Kbps
        - All Rate (2.4, 4.8, 9.6, 56 Kbps)
- 2-Wire Voice
    - Foreign Exchange Service (FXS)
    - Foreign Exchange Office (FXO)
    - Private Line Automatic Ringdown (PLAR)
    - Tandem Access (TA)
    - 800 Service
    - Megacom
    - 2-Way Megacom
    - Direct Inward Dialing (DID)
    - Dial Pulse Origination (DPO)
    - Dial Pulse Termination (DPT)
    - MXS, MXO (used with Northern Telecom Meridian PBX)
    - Orderwire

- 4-Wire Voice
  - E&M (Types I, II, III, & V)
  - Pulse Link Repeater (PLR)
  - Transmission Only (TO)
  - Modem
  - Deluxe card with 2713 Hz loopback tone
  - SCG
- High fidelity audio
  - 8 kHz Bandwidth
  - 15 kHz Bandwidth

Circuit Features

Status information on circuits includes:

- Option status
- Card type
- Serial number
- Card revision
- Firmware revision

Data Circuit Features

- Polling (most circuits)
- Test loopbacks
- Reset
- T1-1/T1-2 (bi-directional) provisioning

Voice Circuit Features

- Transmission level adjust (Tx and Rx)
- Test loopbacks
- T1-1/T1-2 (bi-directional) provisioning

Refer to individual circuit card user manuals for further information on options offered.

COMPONENT OVERVIEW

The Coastcom D/I Mux III multiplexer incorporates a modular design that is cost effective in meeting specific applications, and requiring purchase of only what is needed. Modular system components are easily added or removed as network requirements change, also simplifying maintenance.

There are three main system components to a D/I Mux III multiplexer: the shelf, the common equipment units, and the line cards. It takes all three of these elements to make a complete D/I Mux III.

The **shelf** is the housing for the modular common control units and line cards. The shelf has a multilayered backplane with card edge connectors inside to receive the various modules. On the back of the shelf (backplane) are wiring connections for voice circuits, data circuits, T1 circuits, power, and synchronization.

Common equipment units are the essentials of every multiplexer. They control the system, perform the multiplexing function, and interface to the T1 transmission lines. A D/I Mux III must have either a Common Control Unit (CCU) or an Advanced Multiplexer Control Unit (AMCU), two Line Interface Units (LIUs), a Dual DSX-1 or Dual CSU Interface, Strobe cards (upper and lower strobe cards for the 24-slot shelf), and a power supply. These are the units common to every system, and they reside in specific shelf card slots.

Line cards offer application-specific circuits to the user. They include voice, data, and special services. Unless otherwise specified, a line card can be installed in any shelf line card slot. The circuits from the line cards are multiplexed into the T1 transmission signal through the common equipment and shelf backplane. Figure 1-7 depicts a simple D/I Mux III system in block diagram.

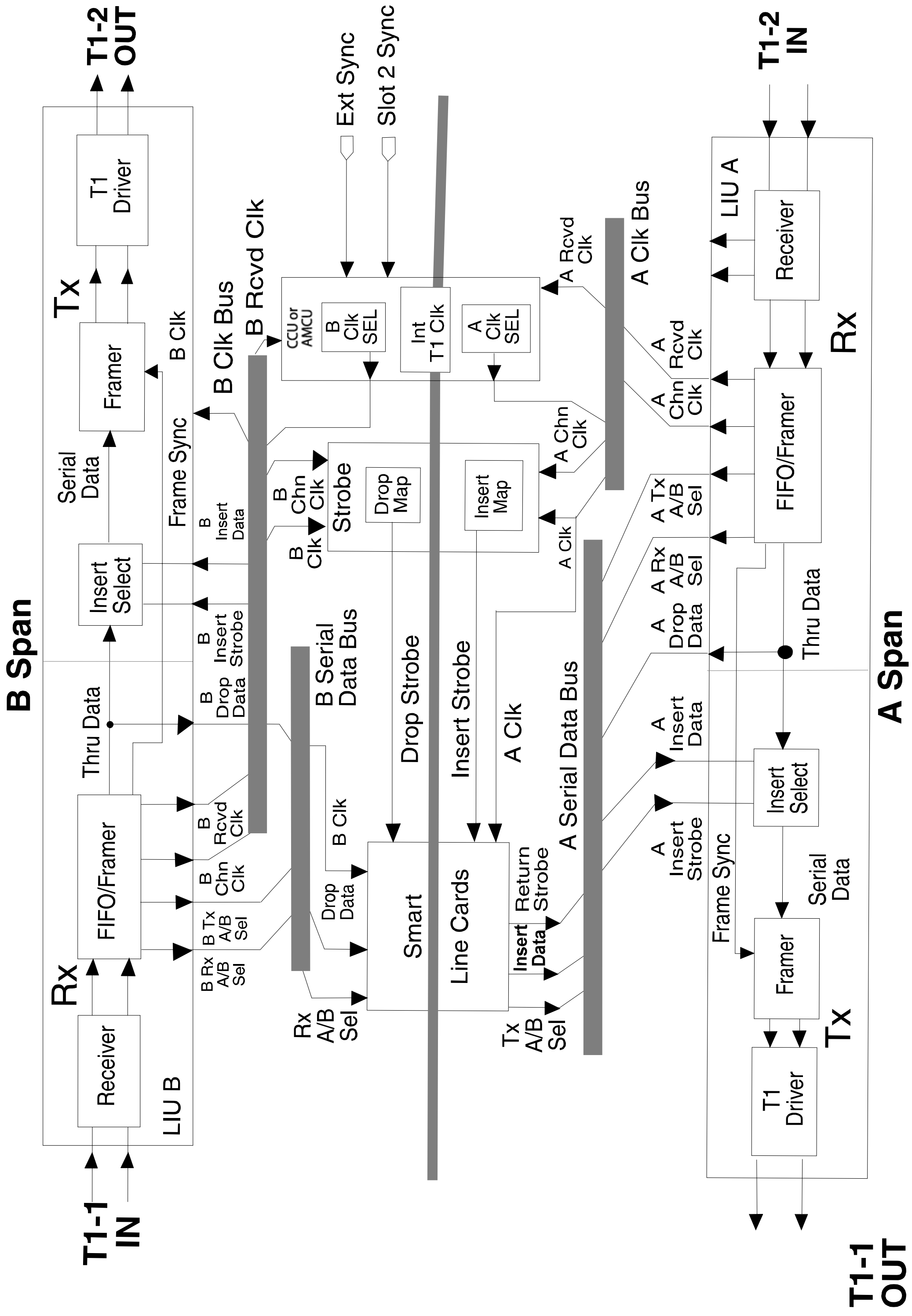


Figure 1-7. D/I Mux III System Block Diagram

Shelves

Shelves house the common equipment and channel units. The shelf backplane supplies the bus connectivity for provisioning the common equipment and channel units.

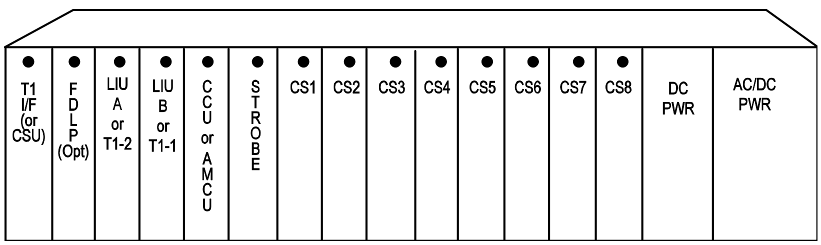
Coastcom D/I Mux III multiplexers include the following shelf types (see Figure 1-8).

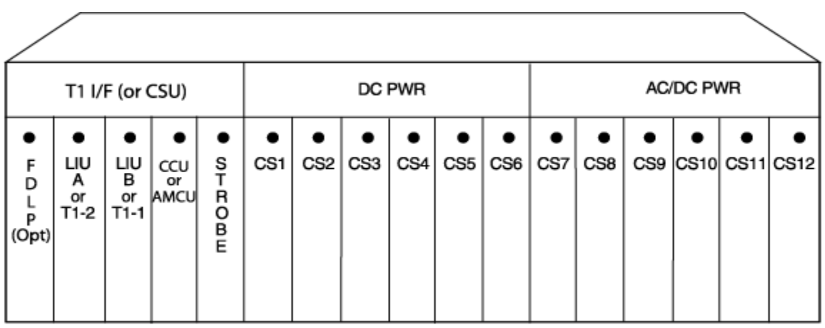
- D/I Mux III, 8-slot with 8 line card slots and 2 T1 transmission ports
- D/I Mux III, 12-slot with 12 line card slots and 2 T1 transmission ports
- D/I Mux III, 24-slot with 24 line card slots and 2 T1 transmission ports

The number of slots (i.e., 8, 12, and 24) refers to the number of slots available for installation of line cards after the common equipment has been installed. Common equipment, such as the CCU, AMCU, and LIUs, do not occupy any of the 8, 12, or 24 slots.

The three shelves accommodate the same common equipment and line cards (except the 12-slot, which will not accept the now obsolete 30308-102A AC/DC power supply, due to physical layout of the shelf).

All D/I Mux III shelves include an Electrostatic Discharge (ESD) strip located at the base of each card slot. The ESD strip protects data transmission from errors caused by electrostatic discharge. The ESD strip is labeled, or silk-screened, with the correct common equipment component name for that particular slot.





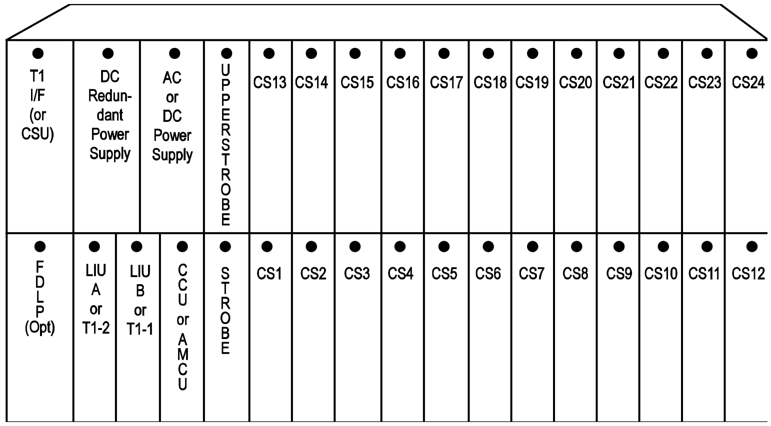


Figure 1-8. D/I Mux III 8-, 12- and 24-Slot Shelves

Shelf Backplane Connectors

A DB-9 female connector can be used as a synchronous input/output (Sync I/O) port to synchronize the D/I Mux III with other systems. Both the synchronous output and the external clock input are available on the DB-9 simultaneously. The Sync I/O provides an 8 kHz frame-aligned Transistor Transistor Logic (TTL) output clock. The external clock input can be either a single ended (TTL), or differential (V.35/RS-422) signal.

A DB-25 male connector is used for the COM port, which connects the system control terminal to the D/I Mux III with an RS-232C cable.

The DB-25 male COM2 connector is reserved for future use.

The DB-25 female COM1 connector is used to connect a serial printer for a permanent record of T1 transmission performance. It is only operational when a Facility Data Link Processor (FDLP) is installed, and a network Line Monitoring Unit requests performance per AT&T Publication 54016.

DB-15 female connectors, or RJ-48 connectors, are used to connect to the T1 transmission lines. Both connectors are wired in parallel for convenient selection. The T1-1 connector is used for channel bank mode. Both T1-1 and T1-2 connectors are used for drop-and-insert, dual channel bank, and ALPS modes.

Line cards connect to the shelf backplane via a 50-pin male Amphenol-type connector. DB-25 female connectors connect each card to the network. Jumpers select whether each card slot uses the DB-25 or 50-pin connectors. For data applications, the D/I Mux III end of the cable must have a male DB-25 connector. The opposite end of the cable will have the appropriate connector to match the user's equipment.

The DB-25 connector always has voice/data on it when a line card is installed, even if the 50-pin connector is being used. The VF/Data jumper should be in the VF position when using the 50-pin connector.

See Figures 3-8 through 3-11 for backplane illustrations.

Common Equipment Units and Line Cards

The common equipment units and line cards are separately packaged plug-in circuit boards that are installed into the D/I Mux III shelf. The upper front edge of each unit is fitted with a captive screw that secures it to the D/I Mux III shelf. Inputs and outputs are terminated in gold-plated contacts on the rear edge of the circuit board. See Figure 1-9 for an illustration of a D/I Mux III channel card unit including descriptive front panel.

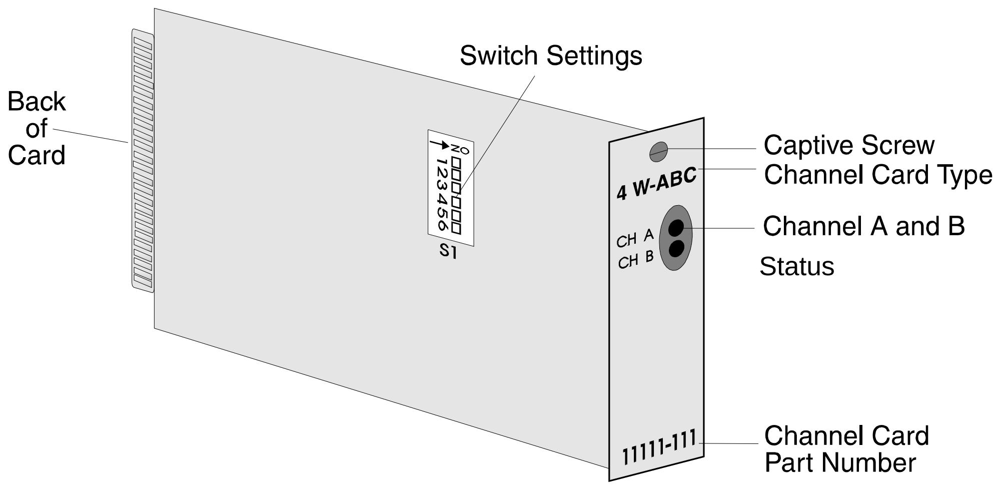


Figure 1-9. Typical D/I Mux III Channel Card

Common Equipment

The following section lists and describes the D/I Mux III system common equipment. The common equipment functions are illustrated in simplified block diagrams.

Common Control Unit

The Common Control Unit (CCU) stores the operating parameters for control and monitoring of all common equipment and channel cards in the D/I Mux III. The primary functions of the CCU are as follows.

- Provide an interface for an asynchronous terminal or network management system
- Control and monitor other common equipment and channel cards
- Manage all alarm functions
- Control T1 clock selection
- Control alarm cutoff (ACO) and bypass (BYP) functions
- Provide a date and time clock (“real time” clock)
- Provide nonvolatile storage of the shelf configuration

See Figure 1-10 for a detailed CCU motherboard circuit flow block diagram.

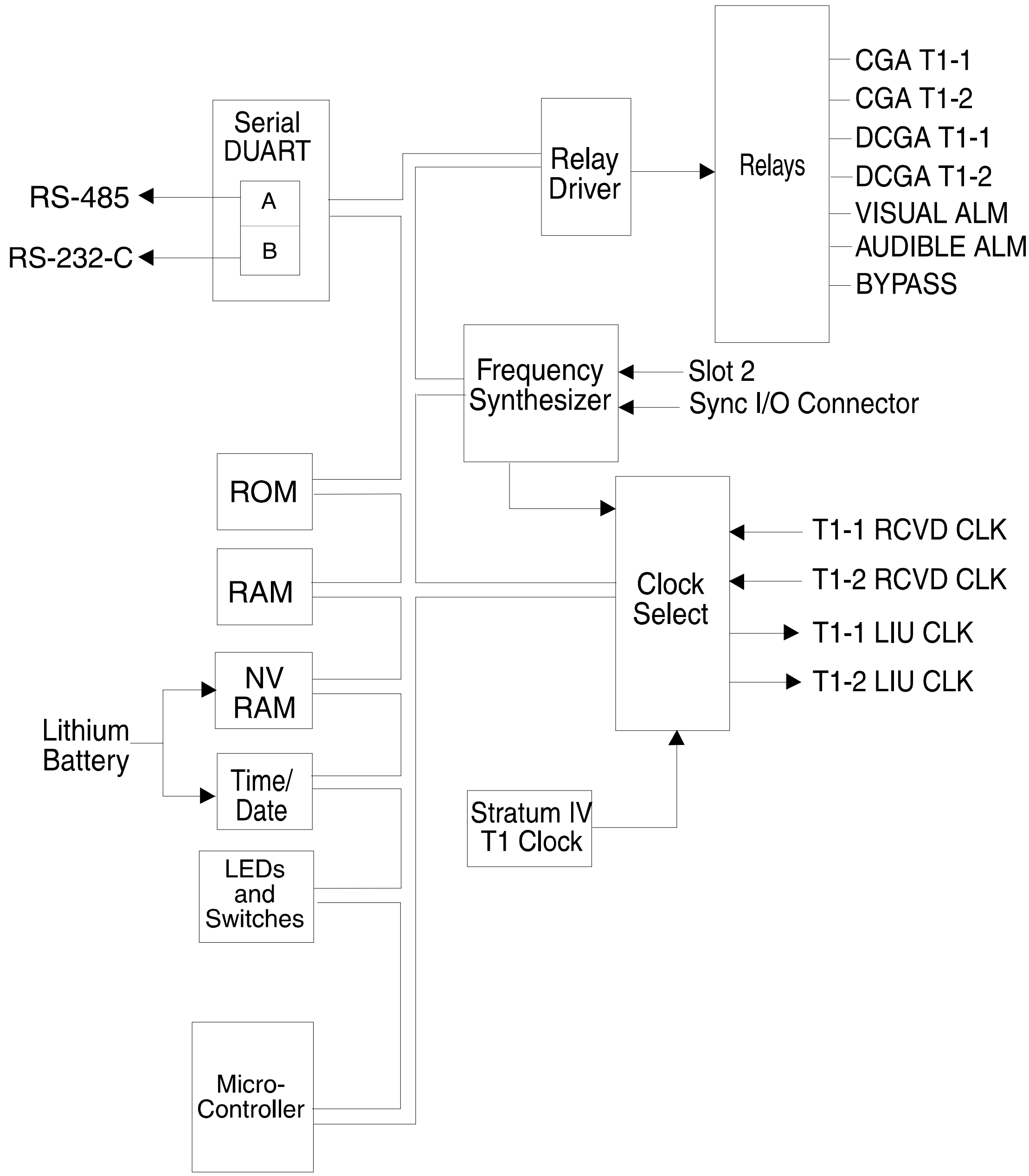


Figure 1-10. Common Control Unit Block Diagram

CCU Circuit Description

The following section lists and describes the various components comprising the Common Control Unit (CCU).

Microcontroller

The microcontroller, running a real time multi-tasking operating system, controls all the functions of the CCU, provides alarm integration, accepts user commands over either the asynchronous terminal or network interface, and issues commands to other provisionable units over the RS-485 provisioning bus.

RS-485 Provisioning Bus Interface

Communication between the common equipment and channel cards takes place over a balanced serial bus at 19.2 Kbps. This polled multidrop system allows only one unit to transmit over the bus at any time. All equipment may monitor and receive messages simultaneously.

RS-232C Interface

The RS-232C electrical interface provides the communications to the system control terminal. The serial interface supports the following standard asynchronous communication data rates: 300, 1200, 2400, 4800, 9600, and 19,200 bps. The default setting from the factory is 1200 bps.

ROM

The Read Only Memory (ROM) contains the instructions used by the microcontroller.

RAM

The microcontroller uses the Random Access Memory (RAM) for "scratch pad" memory.

Nonvolatile RAM

Onboard Nonvolatile Random Access Memory (NVRAM) provides nonvolatile storage of map information and other critical data for configuring the system. All channel card settings and parameters are also stored in NVRAM. A 7-year lithium battery included on the card preserves the information stored in NVRAM when power to the card is removed.

Date and Time Clock

The date and time (real time) clock provides accurate time information (day, date, hour, minute, second) used for shelf configuration and operation. The date and time clock is also powered by the 7-year battery.

Alarm Relay Circuits

The alarm relay circuits operate the relay contacts that are normally open for the visual, audible, and minor alarms.

Alarm Cut-Off and Bypass Switch Circuits

The Alarm Cut-Off (ACO) and Bypass (BYP) circuits can be activated from front panel switches on the CCU, or through terminal control.

LEDs

Light Emitting Diode (LED) circuits activate the LEDs for the current status of alarms, operation modes, and switches.

Clock Select

The clock select function provides independent T1 clock selection options for T1-1 and T1-2 as follows. Only in a drop and insert or dual channel bank configuration is this valid.

- Recovered clock T1-1
- Recovered clock T1-2
- Internal Stratum IV (1.544 MHz) clock source
- External clock with the backplane DB-9 Sync I/O connector
- Slot 2 synchronization source

Frequency Synthesizer

The frequency synthesizer produces a 1.544-MHz Stratum IV clock. It can synchronize an external clock input that is 8 kHz or greater, and a multiple of 1600 Hz up to 1.544 MHz. The external clock is from either the backplane Sync I/O or the Slot 2 Synchronization source; selection is under software control.

Advanced Multiplexer Control Unit (AMCU)

The Advanced Multiplexer Control Unit (AMCU) is a two-circuit board assembly, comprising the control functions of the D/I Mux III system with the SNMP feature. It is incompatible with all releases of NCC products, and does not support Coastcom proprietary Machine Machine Language (MML). For information on downward compatibility with CCU releases, contact Coastcom’s Application Engineering Department.

The AMCU is comprised of a motherboard and a sub-board, offering the following features.

- Software download capability in FLASH ROM via a PCMCIA-compatible FLASH memory module
- Support of all current line cards via the provisioning bus physical interface and protocol
- Current D/I Mux III control by dumb terminal, and PC terminal programs
- Ethernet 10Base-T port for SNMP manager and Telnet terminal emulation over a LAN

AMCU Motherboard Circuit Description

The following section lists and describes the various components of the AMCU module.

Microcontroller

The microcontroller, running a real time multi-tasking operating system, controls all the functions of the AMCU, provides alarm integration, processes user commands, and issues commands to other provisionable smart units over the RS-485 provisioning bus.

RS-485 Provisioning Bus Interface

Communication between the common equipment and line cards takes place over a balanced serial bus at a data rate of 19.2 Kbps. This polled multidrop system allows only one unit to transmit over the bus at any given time. All equipment can monitor and receive messages simultaneously.

UART

The Universal Asynchronous Receiver/Transmitter (UART) device interfaces the motherboard to the sub-board.

FLASH ROM

The FLASH Read Only Memory (ROM) contains the operating instructions used by the microcontroller.

RAM

The Random Access Memory (RAM) is used by the microcontroller for "scratch pad" memory.

Nonvolatile RAM (NVRAM)

Onboard Nonvolatile Random Access Memory (NVRAM) provides nonvolatile storage of map information and other critical data for configuring the system. All channel card settings and parameters are also stored in NVRAM. A 7-year lithium battery included on the card preserves the information stored in NVRAM when power to the card is removed.

Date and Time Clock

The date and time (real time) clock provides accurate time information (day, date, hour, minute, second) used for shelf configuration and operation. The date and time clock is also powered by the 7-year battery.

Alarm Relay Circuits

The alarm relay circuits control and operate the relay contacts that are normally open for the visual, audible, and minor alarms.

Alarm Cut-Off and Bypass Switch Circuits

The Alarm Cut-Off (ACO) and Bypass (BYP) circuits can be activated from front panel switches on the MCU, or through terminal control.

LEDs

Front panel Light Emitting Diodes (LEDs) display alarm status, ACO status, and bypass status.

Clock Select

The clock select function provides T1 clock selection options for T1-1 and T1-2 as follows:

- Recovered clock T1-1
- Recovered clock T1-2

Clock should only be present on either/or, not both , unless sourced form the same reference.

- Internal Stratum IV (1.54
- External clock with the backplane DB-9 Sync I/O connector
- Slot 2 Synchronization source

Frequency Synthesizer

The frequency synthesizer produces a 1.544 MHz Stratum IV clock. It can synchronize an external clock input that is 8 kHz or greater, and a multiple of 1600 Hz up to 1.544 MHz. The external clock is from either the backplane Sync I/O, or the Slot 2 Synchronization source; selection is under software control.

See Figure 1-11 for a detailed AMCU motherboard circuit flow block diagram.

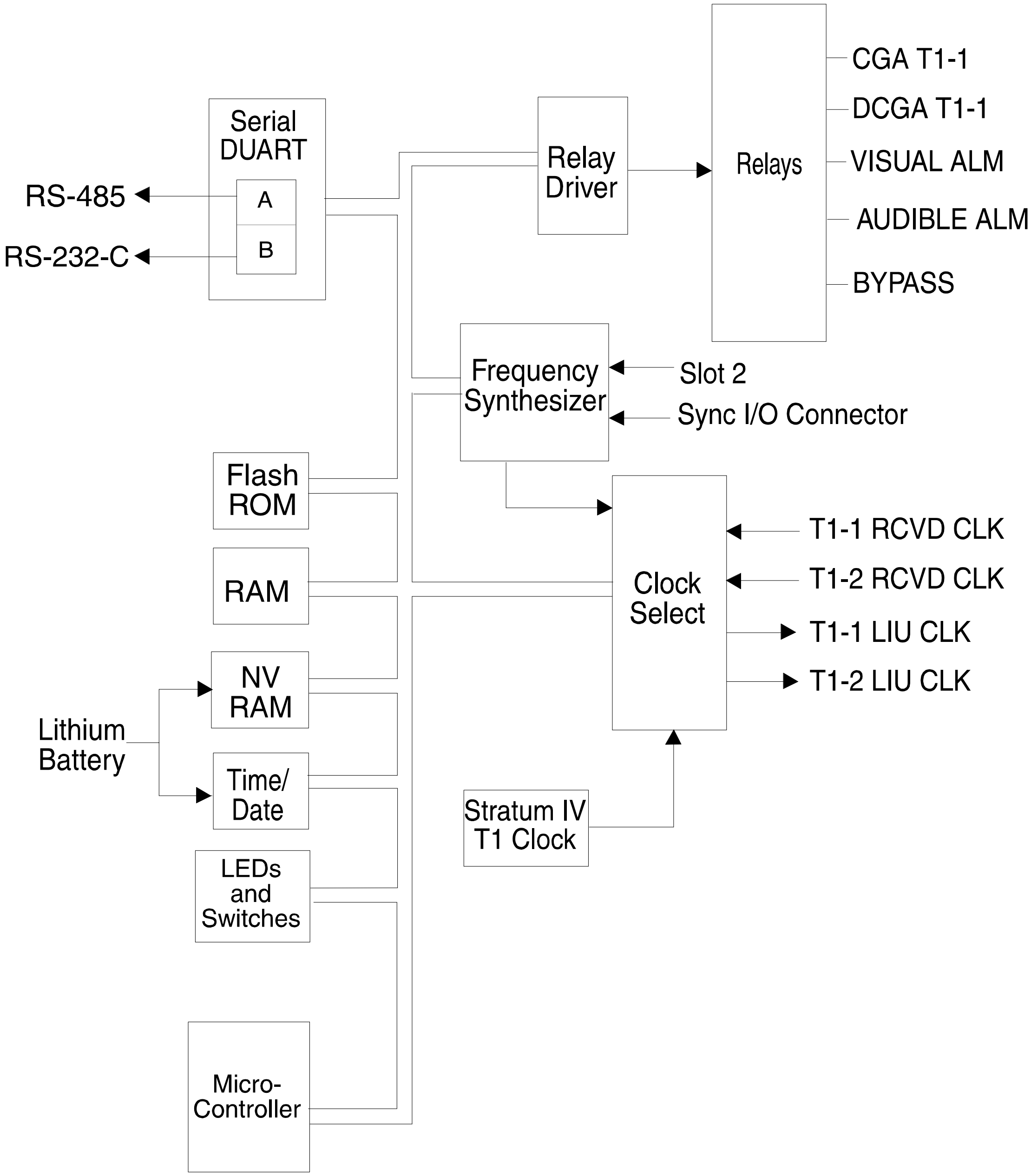


Figure 1-11. AMCU Motherboard Circuit Flow Block Diagram

AMCU Sub-Board Circuit Description

The AMCU sub-board interfaces to the AMCU motherboard via a 20-pin connector, and includes the hardware that supports SNMP. A full TCP/IP communication protocol stack allows SNMP and Telnet to communicate with a centrally located Network Operations Center (NOC). A network manager uses automated tools (for example, to read or compile a Management Information Base, or MIB) to manage distributed node devices, including D/I Mux III multiplexers.

See Figure 1-12 for a detailed AMCU sub-board block diagram.

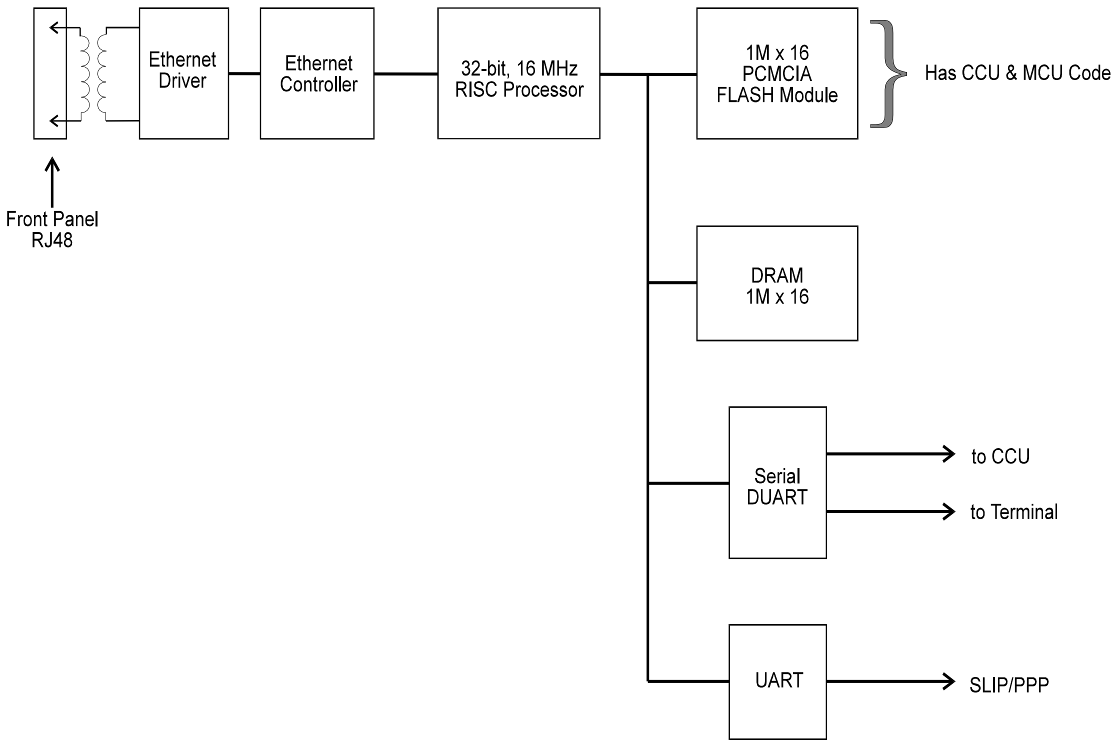


Figure 1-12. AMCU Sub-board Circuit Flow Block Diagram

The following section lists and describes the various elements and components comprising the AMCU sub-board circuit.

Microprocessor

The 32-bit Reduced Instruction Set Computer (RISC) microprocessor controls all functions on the AMCU sub-board. The microprocessor executes the protocol stack, and handles communication with the Ethernet 10Base-T and serial interfaces.

Flash EPROM

The *FLASH EPROM* is 1 M x 16.

DRAM

The *DRAM* is 1 M x 16.

EEPROM

The *EEPROM* is 256 x 16. It provides nonvolatile storage of AMCU card information, such as card type, card serial number, Media Access Control (MAC) address, and hardware revision and date. EEPROM data is entered during the factory test procedure, and is read only during normal AMCU operation.

LEDs

The front panel of the AMCU has four Light Emitting Diode (LED) indicators. Two of the LEDs glow green. One, marked **ACO,** indicates alarm cutoff, while the other green LED, marked **BYP**, indicates that the multiplexer is being bypassed.

Another LED glows red to indicate a major alarm condition impacting service. It is marked **MAJ** (major). The LED marked **MIN** (minor)**,** which glows yellow, indicates faults occurring that do not impact service. For more information on LEDs, see *Chapter 3. Installation,* and *Chapter 5. Diagnostics*.

I/O Ports

The AMCU utilizes the standard CCU provisioning bus port and a COM port for “normal” operation. The provisioning bus is an RS-485 half-duplex asynchronous port, while the COM port is a full-duplex asynchronous RS-232C port with user-selectable data rates. (Refer to *Chapter 3. Installation,* for details.)

An Ethernet 10Base-T port allows terminal emulation over a LAN for SNMP and Telnet network management.

Code Download

Code download by the AMCU can be initiated in one of three ways:

1. Automatically on system start-up
2. External indication (pressing the **ACO** and **BYP** buttons at system power-up, and holding for one minute)
3. Software menu selection

Code download occurs at *system start-up* after the AMCU computes the checksum of its stored code. If a bad checksum is detected, the AMCU requests a code download from the sub-board.

Code download occurs by external indication when a PCMCIA card is inserted, and an NVRAM power-up is initiated by pressing the **ACO** and **BYP** buttons for one minute, at system power-up. During the power-up, the AMCU will compare its software revision with that on the PCMCIA card and, if different, it will download the code to the AMCU. For information about code download through menu selection, see *Chapter 4. Configuration and Operation.*

AMCU Power Consumption

The AMCU consumes more power on the +5 V line than does the CCU, due chiefly to the RISC processor, peripheral Integrated Circuits (ICs), and the Ethernet 10Base-T port.

AMCU User Interfaces

The AMCU may be accessed in three ways:

- *An SNMP manager, such as Hewlett Packard's OpenView*© - An SNMP manager accesses all Management Information Base II (MIB-II) parameters supported by the SNMP agent, and all the DS1 MIB values supported by the current D/I Mux III software. (See *MIB-II* and *DS1 MIB* in *Appendix H*.) Special configuration screens allow the user to branch to either the LAN, and login parameters, or to the standard screens supported by the CCU.

- *A local terminal (all values available by local terminal will also be available via the Telnet connection except IP address and subnet mask)* - The local terminal is an RS-232 serial connection. The user must use the local terminal to enter an initial IP Address and subnet mask. Using the local terminal will also lock out a Telnet session. However, a keyboard idle timer can disconnect the serial connection and allow a Telnet session.

- *A Telnet session* - A Telnet session can be connected over Ethernet 10Base-T as a virtual terminal (VT) connection, normally providing VT-100, or VT-220 functionality. A Telnet client is required by the user to make this connection and, once connected, the Telnet screen presentation is that of a serial connection.

Strobe Units

The Strobe Units activate the line card transmission paths (for transmit and receive) on the T1 digital bus by sending strobe signals corresponding to DS0 timeslots, to the line cards. The strobed line cards then read and/or write to the T1 digital bus during the strobed period.

DS0 time slots and physical card slots are independent of each other; further, installing a line card does not assign its transmission path within the D/I Mux III system. Mapping controls strobe assignments, and the transmission path must be mapped. For more information on mapping, refer to *Chapter 4. Configuration and Operation*.

Strobe signals are assigned and placed in software-configurable maps in both the CCU and AMCU. The signals are downloaded to the Strobe units during system initialization and map programming. Informational changes to a map are sent to the Strobe unit from the CCU. These changes can include altering connections from line cards to time slots, or switching to another configuration map. By changing to a new working map, the Strobe unit is able to change DS0 assignments without causing data errors on unaffected DS0s. The maps can be set to start in response to a user-specified time, event, or keyboard entry.

High-speed Dual Synchronous Data Channel Unit (DSDCU), Digital Program Channel cards (DPCs), and the Tandem Access Unit (TAU) can require more than one strobe, and can move a greater amount of data on one circuit.

The Upper Strobe unit (P/N 30307-101 or 30307-103) is functionally equivalent to the Lower Strobe unit (P/N 30307-102 or 30307-104A). The Upper Strobe is used only for the D/I Mux III 24-slot shelf, and provides transmission control for the line cards in the top half of the shelf. The Lower Strobe unit provides transmission control for the line cards in the bottom half of a 24-slot shelf, and for 8-slot and 12-slot shelves.

Strobes perform the following functions:

- Provide transmission control of the line cards
- Store map configuration data when power is on (the CCU and AMCU store maps during power-off)
- Change maps as required by event, time, or demand

Map Select Option Switches

DIP switches on the Lower Strobe unit can be used to manually select a preconfigured map. Eight different maps are available to load into one map location (e.g., map number 1) after power-up and initialization (see *Appendix D. Preconfigured Maps*.) The switches on the Upper Strobe unit do not affect map selection.

Initialization

On power-up, the Strobe units perform a diagnostic check of program memory, operating Random Access Memory (RAM), and dual-port map RAM. The Strobe units also receive map configuration data from the CCU and AMCU.

Figure 1-13, following, is an illustration of a strobe unit block diagram.

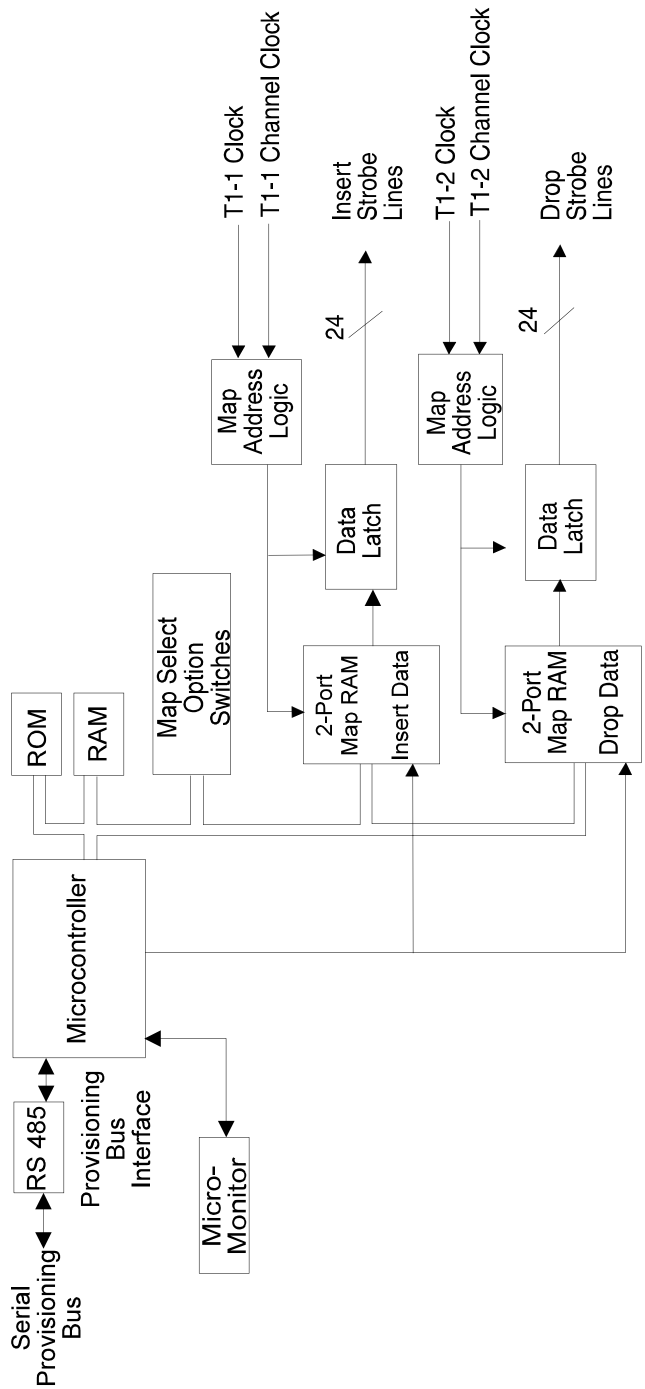


Figure 1-13. Strobe Unit Block Diagram

Line Interface Units

Line Interface Units (LIUs) perform the primary multiplexing functions in the D/I Mux III system. Information from the various line cards is combined and converted to T1 format, and information from the network is distributed to the line cards, through the LIUs. Circuitry to option various framing and coding takes place in the LIUs. LIUs also recover and supply T1 clock and framing.

The D/I Mux III system, whose architecture was designed primarily for drop-and-insert operation, requires the use of two LIUs in every mode of operation. Channel bank mode, where only one T1 is accessed, also requires a pair of LIUs. The two LIUs are slightly different and must be installed in their designated card slot.

There are three paired versions of LIUs available for the D/I Mux III, depending upon configuration. They include the standard LIUs for use with twisted-pair cable, the ALPS LIUs, and the Fiber LIU module for use with fiber optics.

For channel bank, drop-and-insert, or dual channel bank operation, use:

- Line Interface Unit B (T1-1) - Part Number 30309-104A
- Line Interface Unit A (T1-2) - Part Number 30309-114A

For channel bank, drop-and-insert, dual channel bank, with ALPS operation, use:

- ALPS Line Interface Unit B (LIU-B) - Part Number 30309-105
- ALPS Line Interface Unit A (LIU-A) - Part Number 30309-115

Note: ALPS LIUs are not discussed in this manual. Refer to the *ALPS User's Manual* for information on the ALPS LIUs.

LIU Functions

The primary functions of the LIUs are as follows.

- Recover clock
- Attenuate jitter
- Detect framing and adjust multi-frame alignment
- Drop data to channel units and insert data into T1 line
- Generate outgoing Alternate Mark Inversion (AMI)
- Provide LEDs for status information
- Provide provisioning ability
- DS0 blocking (30309-105 and 30309-115 LIUs only)
- Provide T1 loop code generation
- Receive loop code from T1; notify CSU interface to loop up

See Figure 1-14 for a detailed LIU block diagram.

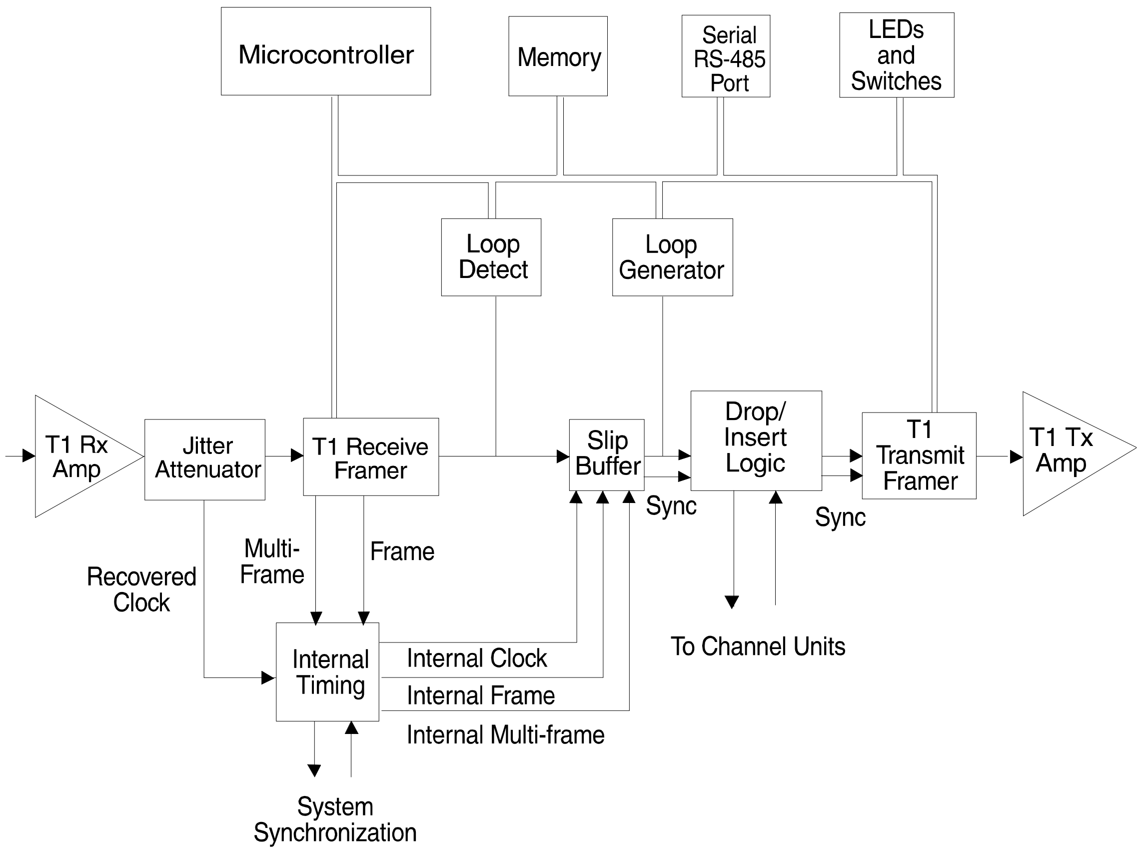


Figure 1-14. Line Interface Unit Block Diagram

LIU Network Loop Switch

The LIU Network Loop switch sends a standard loopback code to another D/I Mux III or Channel Service Unit (CSU) at the remote end. After a network loop is established, the information sent to the remote end will return to the local D/I Mux III as a loopback. The LIU Network Loop only functions when a Dual CSU Interface is installed.

T1 Interface Units

Coastcom offers five interfaces to the T1 transmission lines for various types of applications. There are three versions of the Dual Channel Service Unit (CSU) Interface (with integral CSU functionality), and two versions of the Dual Digital Service Cross-Connect DSX-1 Interface (with no CSU functionality).

Dual CSU Interface

The Dual CSU interface offers dual DS1 interfaces for D/I Mux III. The Dual CSU interface provides either a Channel Service Unit (CSU) interface or a DSX-1 interface between the T1 line and the equipment. A Dual CSU interface provides test, network, and loop/bypass functions for both the T1-1 and T1-2 directions.

The Dual CSU interface is available in three models:

- Dual CSU interface (T1/DSX-1) (P/N 30318-101) with a CSU interface on T1-1 and a DSX-1 interface on T1-2
- Dual CSU interface (DSX-1/DSX-1) (P/N 30318-102) with two DSX-1 interfaces
- Dual CSU interface (T1/T1) (P/N 30318-103) with two CSU interfaces

Dual CSU interfaces have a front panel *power-on* LED as well as access and monitor jacks for line and equipment testing. The bantam jacks provide access for monitoring the transmit and receive T1 lines. Access jacks allow for breaking and testing the signal. Monitor jacks do not interrupt the signal. Dual CSU interfaces include line build-out options at 0, -7.5, and -15 dB.

Note: The monitor jacks do not directly monitor the T1 lines. The T1 signal first passes through a lightning protector and a repeater chip. If true T1 measurements are required, use either a DB-15, or RJ-48, connector not already used for that circuit, located on the back of the shelf. See Figures 3-12 & 3-13 page 3-20 for pinout information.

Should any common equipment fail, Dual CSU Interfaces enter the bypass mode and the shelf is looped on itself as a self-check.

In channel bank mode, the shelf outputs an Alarm Indication Signal (AIS) to the network.

If power fails in drop-and-insert mode, the T1 signal bypasses the shelf using the equalization and repeater networks as long as -48 V DC is still applied to the shelf, or is available from the internal AC power supply.

Dual DSX-1 Interfaces

The Dual DSX-1 Interfaces provide three main functions:

- Line equalization (optional)
- Equipment and monitor jacks for testing (optional)
- Shelf bypass contacts

The *Dual Enhanced DSX-1 Interface* (Model 30118-102) provides switch-selectable output equalization for connecting the system to different lengths of twisted-pair cable. This is required to compensate for the characteristics of the twisted-pair cable so that the required signal level and shape is present at the DSX-1 cross-connect. Equalization for cable lengths of 0 to 150 feet, 150 to 450 feet, and 450 to 750 feet is switch-selectable. Bantam jacks are provided to access and monitor both the T1-1 and T1-2 lines (east and west). Access jacks break-and-test the signal. Monitor jacks do not interrupt the signal.

The *Dual Basic DSX-1 Interface, Model 30118-101,* provides standard DSX-1 (150 feet) equalization, and has no access or monitor jacks.

In the event of failure of any common equipment, Dual DSX-1 Interfaces enter bypass mode, and the Pulse Code Modulation (PCM) generated by the LIUs is looped back on itself in a self test. In channel bank mode, the shelf outputs an Alarm Indication Signal (AIS, an unframed all-ones T1 signal) to the network. If power fails in drop-and-insert mode, the T1 signal bypasses the shelf using only the equalization networks.

Power Supplies

Coastcom currently offers two (2) different power supplies for use with the D/I Mux III.

-48 VDC Redundant (P/N 30338-902)

The 30338-902 is a DC-to-DC converter used to power D/I Mux equipment from an external -48 VDC input supply. Generates +/-12 and +/-5 volt outputs as well as failure alarm signals. Also provides primary (-48v) power fusing. Can be used in a redundant or load sharing configuration when two power supplies are installed. When configured with FXS cards order modular Ring Generator 30333-101. Can be used in 8/12/24 slot chassis. Replaces 30338-102.

120 VAC Power Supply (P/N 30315-505)

An AC/DC self-contained single-slot power supply that provides all of the voltages necessary to operate a D/I Mux III - except ringing voltage. When configured with FXS feature cards, order modular Ringing Generator 30333-101. Provides +/-12, +/-5, and -48. Can be used in 8/12/24 slot chassis. Replaces a 30308-102A and the combination option of 30315-105A with 30338-103A. *Cannot be used in combination with any other power supply.*

Line Cards

Line cards provide an interface between user equipment and the D/I Mux III. The three types of line cards offered by Coastcom include data cards, voice cards, and digital program cards.

Data Line Cards

Data line cards interface various Data Terminal Equipment (DTE) directly with D/I Mux III multiplexers, without the use of modems for full-duplex transmission over T1 lines.

Software-programmable data line cards support synchronous data rates of 1.2 Kbps to 1.536 Mbps, and asynchronous data rates from 1.2 to 19.2 Kbps.

The **Dual Synchronous Data Channel Unit** (DSDCU) is ideal for computer- aided design (CAD), computer-aided manufacturing (CAM), and high speed batch data applications. This protocol-transparent card also finds applications in multi-site polled or packetized LAN environments, and videoconferencing. The DSDCU card incorporates proprietary local and remote loopback, plus diagnostic and control capability.

The **All Rate Office Channel Unit Data Port** (OCUDP) supports both standard and Switched 56 Kbps Digital Data System (DDS) applications. It provides an interface between the DDS 4-wire Alternate Mark Inversion (AMI) loop signal and D/I Mux III common equipment.

The **Subrate Data Multiplexer** (SDM) line card offers low speed synchronous and asynchronous transmission. SDM channel units offer DDS-compatible operation and proprietary operation.

The ***premium* SDM** (*p*SDM) line card offers multipoint polling operation.

Voice Line Cards

D/I Mux III voice line cards provide the interface between the Pulse Code Modulation (PCM) timeslot and the baseband voice and data signals.

Both hardware-configured and dual channel software-controlled 2-Wire FXS & FXO and 4-Wire E&M, E&M/PLR; TO 4W with/SCG; MXS, MXO (for use with Northern Telecom Meridian PBX) voice line cards and Orderwire cards are available for D/I Mux III multiplexers. .

Digital Program Line Cards

Digital program line cards provide an easily installed, economical radio program transmission service over existing T1 carrier facilities. The transmit line card and the receive line card are both required to make a complete circuit.

Transmit digital program line cards are used to transmit monaural or stereo audio programs over T1 carrier facilities. The receive digital program line card provides studio-to-transmitter channel lines over the T1 carrier facilities. The programming of the transmission path and allocation of timeslots are user-programmable features.

The D/I Mux III offers the following digital program capabilities:

Transmits and receives monaural or stereo audio program over T1 carrier facilities

- 8 kHz or 15 kHz bandwidth
- Optionally equalizes frequency characteristics of various cable lengths

MODES OF OPERATION

There are four modes of operation available with a D/I Mux III system. The three main modes of operation are single channel bank, drop-and-insert, and dual channel bank. These modes relate to the setup, timing, and structure of the T1 network. The fourth mode, Automatic Loop Protection Switching (ALPS), is described in Coastcom's *ALPS User's Manual*.

Channel Bank Operation

In channel bank mode, a D/I Mux III terminates a single T1 transmission line on its T1-1 port, as depicted in Figure 1-17. The D/I Mux III can synchronize with the T1 network (loop timing mode), or supply timing to the T1 network (local timing mode).

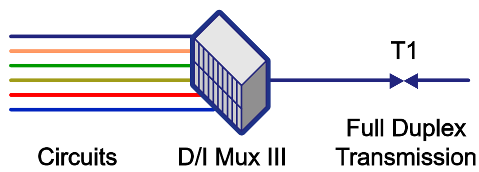


Figure 1-15. Channel Bank Operation

Loop Timing

System loop timing is provided by the clock recovered from the incoming T1-1 signal. If the incoming T1 reference clock fails, timing is derived from the D/I Mux III's local timing source.

Local Timing

Local timing clock source for the T1-1 output is derived from the system's internal 1.544 MHz oscillator. This oscillator can run freely, or be synchronized to one of three different clock sources as follows.

- *DB-9 Clock* - The DB-9 clock is an 8 Kbps to 1.544 Mbps external clock (provided by another system), brought into the Sync I/O connector on the back of the D/I Mux III shelf. The DB-9 clock is either a V.35/RS-422 differential Signal, or a Transistor Transistor Logic (TTL) signal.
- *Slot 2 Synchronization Clock* - The Slot 2 Sync clock is an 8 Kbps to 1.544 Mbps clock recovered from a line card in slot 2 of the D/I Mux III shelf.
- *Recovered T1-2 (Rcvd T1-2) Clock* - The Rcvd T1-2 clock is the clock recovered from a T1 input signal connected to the T1-2 port.

Drop-and-Insert Operation

In drop-and-insert operation a D/I Mux III connects two T1 transmission lines in a unique fashion, as depicted in Figure 1-18. The D/I Mux III takes clock and DS0 channels from one T1 transmission port and passes them through the system to the other T1 transmission port. Channels can be pulled from (dropped), or placed on (inserted) the T1 line in either direction. The D/I Mux III line card circuits access any of the 24 time slots in the DS1 signal. In drop-and-insert mode the system is always synchronized to the network except during an alarm condition.

Any channels not accessed by the D/I Mux III in drop-and-insert mode are passed through digitally. This unique multiplexing scheme introduces less than 20 ms of delay into the T1 line at each drop-and-insert point.

In the event of a power outage in drop-and-insert operation, the T1 line bypasses the D/I Mux III automatically, with a Dual DSX-1 interface installed. The Dual CSU interface requires -48 V DC to operate.

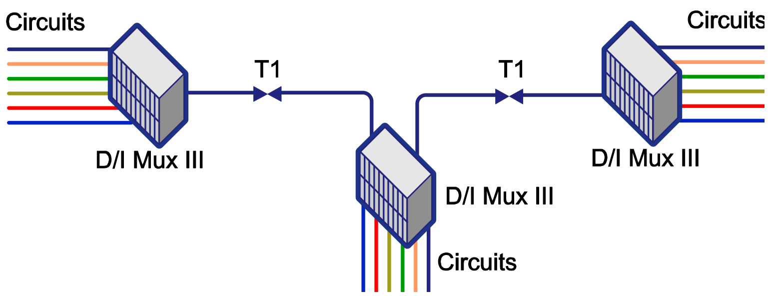


Figure 1-16. Drop-and-Insert Operation

Recovered Timing

T1 basic timing is independent for each transmission direction in drop-and-insert mode, and is not selectable. In this mode, both T1-1 and T1-2 clocks must be the same. T1-1 transmission timing is provided by clock recovered from T1-2, and T1-2 transmission timing is provided by clock recovered from T1-1. If one of the recovered clocks fails, the system can derive timing from the internal clock or from the other T1 input. The choice of back-up clocks is software selectable. Clock should not be present on both T1-1 and T1-2.

Dual Channel Bank Operation

In Dual Channel Bank (DCB) operation, a D/I Mux III terminates two T1 transmission lines. DCB mode allows the system to synchronize with the T1 network (loop timing mode), or supply timing to the T1 network (local timing mode), as depicted in Figure 1-19.

DCB operation requires Line Interface Units (LIUs) (P/N 30309-104A and 30309-114A), which contain “slip buffers.” In DCB mode the “slip buffer” LIUs align all clocks, bytes, frames and multiframes to one common multiframe. T1 inputs and outputs are therefore synchronized to the same multiframe signal.

The “slip buffer” LIUs permit the T1 trunks of a D/I Mux III to operate in loop timing mode, recovering clock from the network, or to be the source of network timing.

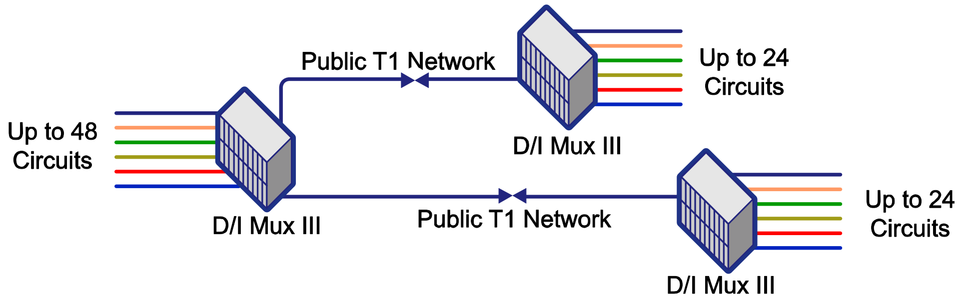


Figure 1-17. Dual Channel Bank Operation

Loop Timing

System loop timing is provided by clock recovered from the incoming T1 signals. If the incoming T1 reference clock fails, then timing is derived from the internal timing source. This works like drop-and-insert mode in which the T1-1 Receive clock sources the T1-2 Transmit clock, and the T1-2 Receive clock sources the T1-1 Transmit clock.

The three loop timing clock sources used to set up the backup clock status include the following.

- T1-1 receiver
- T1-2 receiver
- T1-1 and T1-2 receivers

The *T1-1 receiver* and *T1-2 receiver* selections determine which span "faces" toward the clock source. The "downstream" location (i.e., away from the clock source) must be set to recovered timing.

The *T1-1 and T1-2 receivers* selection compensates for clock frequency variations between two similarly timed T1 paths, as may be found between two different carriers. **Note** that while this may imply that there are two clock sources here there are **not**. The D/I Mux III can only have **one clock source** per multiplexer.

Local Timing

Local timing clock source for the T1 outputs is derived from the system's internal 1.544 MHz oscillator. This oscillator can run freely or be synchronized to one of two different clock sources as follows:

- *DB-9 Clock* - The DB-9 Clock is an 8 Kbps to 1.544 Mbps TTL or V.35 external clock brought into the SYNC I/O connector on the back of the D/I Mux III system shelf.
- *Slot 2 Synchronization* - The Slot 2 Sync is an 8 Kbps to 1.544 Mbps clock recovered from a data line card in slot 2 of the D/I Mux III shelf.

Chapter 2. APPLICATIONS

The D/I Mux III is a feature-rich product that can be configured to meet specific communications requirements. Since the diversity of T1 networks and the circuits they transport is vast, users continue to find new and innovative ways to use the D/I Mux III.

Several major applications and their modes of operation are described in this manual. These examples can be used to gain an understanding of various network topologies.

Channel Bank

Channel bank operation is used to connect directly to the public network, or to create a point-to-point private network.

Point-to-Public Network

In a point-to-public network a D/I Mux III is connected directly to the public network, as depicted in Figure 2-1. In this configuration, the D/I Mux III connects T1 to the public digital switching system.

Network-compatible circuits are a requirement, and include all of Coastcom's standard voice frequency interfaces and Digital Dataphone Service (DDS) data cards. Each circuit is given a telephone number or circuit identifier. Calls are routed and set up by the public digital switching network. Calls and connections are initiated at the D/I Mux III, or at any location in the network with a compatible type circuit.

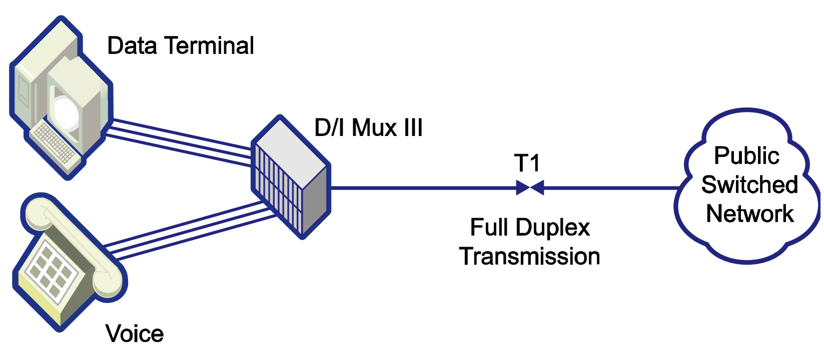


Figure 2-1. Point-to-Public Network

<u>Telephone Services</u>

Standard telephone services are available for use with channel bank operation. The D/I Mux III can connect directly to telephones, key systems, and Private Branch Exchanges (PBXs). It can also connect to 800, Megacom, Direct Inward Dialing (DID) services, and direct outbound dialing (DOD).

Dual 2-Wire Foreign Exchange Subscriber (FXS) line cards connect directly to telephones to supply standard telephone service. The circuits are assigned numbers at the digital switch and standard telephones call out or receive calls.

The FXS card can also be used to access the available 800 and Megacom services. A user with heavy customer service 800 lines has an economical and direct access to the public networks 800 service switch.

Digital Dataphone Systems (DDS) Compatible Data

Data that is compatible with the DDS standard is distributed by the public digital switching network. Most DDS data connections are point-to-point connections between two circuits. The equipment at the far end does not have to be Coastcom equipment. Any equipment that supports a compatible data rate and DDS type can communicate with Coastcom equipment.

Office Channel Unit Data Port (OCUDP) line cards support 2.4, 4.8, 9.6, 19.2, 56 and 64 Kbps data rates, and are DS0A DDS type circuits. The public digital switching network can take data from several OCUDPs, and distribute the data to divergent locations.

The OCUDP also includes an option for Switched 56 operation. In the Switched 56 mode the data is directed to various locations by the user. A keypad on a Switched 56 Channel Service Unit/Digital Service Unit (CSU/DSU) (ancillary equipment) can then call up other Switched 56 locations similar to a standard telephone.

Coastcom's 5-port Subrate Data Multiplexer (SDM) line card offers DS0B DDS data rates of 2.4, 4.8, 9.6, and 19.2 Kbps. The circuits are set up in a point-to-point configuration with devices of the same data rate and DDS type. The DS0B DDS format makes efficient use of bandwidth by placing up to five data circuits onto a single 64 Kbps DS0 transmission channel. In the Proprietary mode, the DS0B can support synchronous and asynchronous transmission.

Coastcom's single-port SDM line card offers DS0A DDS type data at rates of 2.4, 4.8, and 9.6 Kbps. A single DS0A data circuit takes up all of a 64 Kbps DS0 transmission channel.

Point-to-Point Private Network

In a point-to-point private network, two D/I Mux III systems communicate only with each other, as depicted in Figure 2-2. The T1 link between the two D/I Mux III systems is dedicated. The link can be a variety of transmission types, including, microwave, fiber optic, or a leased line. Communications carriers offer dedicated T1 links so a corporate network can remain private even though it is being transported by several organizations.

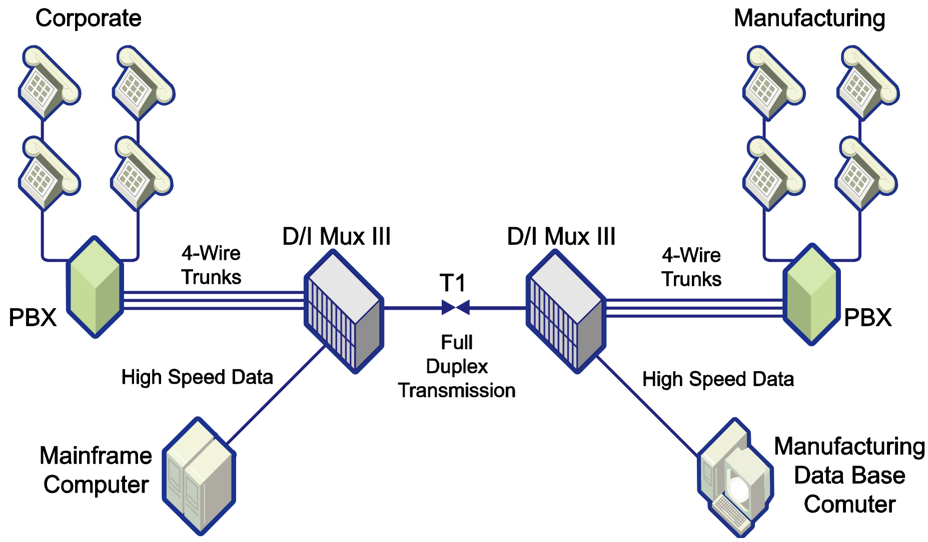


Figure 2-2. Point-to-Point Private Network

4-Wire Trunks

Private Branch Exchanges (PBXs) distribute calls from a local telephone central office. PBXs are an economical way to minimize the connections, and cost, of doing business with the local telephone company. The connections to the telephone company are trunked (shared). Historically, the common connection between PBXs and local central offices has been 4-Wire Earth and Magnet (E&M) trunks.

Coastcom offers 4-Wire E&M line cards for connection of PBXs within a private T1 network. Corporations that conduct a large amount of communication between their various facilities can benefit by dedicating a T1 network to internal communications.

High-Speed Data

A Dual Synchronous Data Channel Unit (DSDCU) can transfer data many times faster than an analog modem. The point-to-point network is required because the DSDCU requires more than one channel. High-speed data links can be used to transfer or backup data.

Drop-and-Insert

Drop-and-insert operation is used to transport information to several locations along a single T1 transmission line, as depicted in Figure 2-3. Systems connected to the drop-and-insert network can be used to communicate with several locations.

Running one T1 line, instead of several, is highly cost effective in that transmission line costs are minimized, and a drop-and-insert network uses less equipment than does channel bank technology. The D/I Mux III also allows re-utilization of DS0s in the opposite T1 direction from which they were originally dropped.

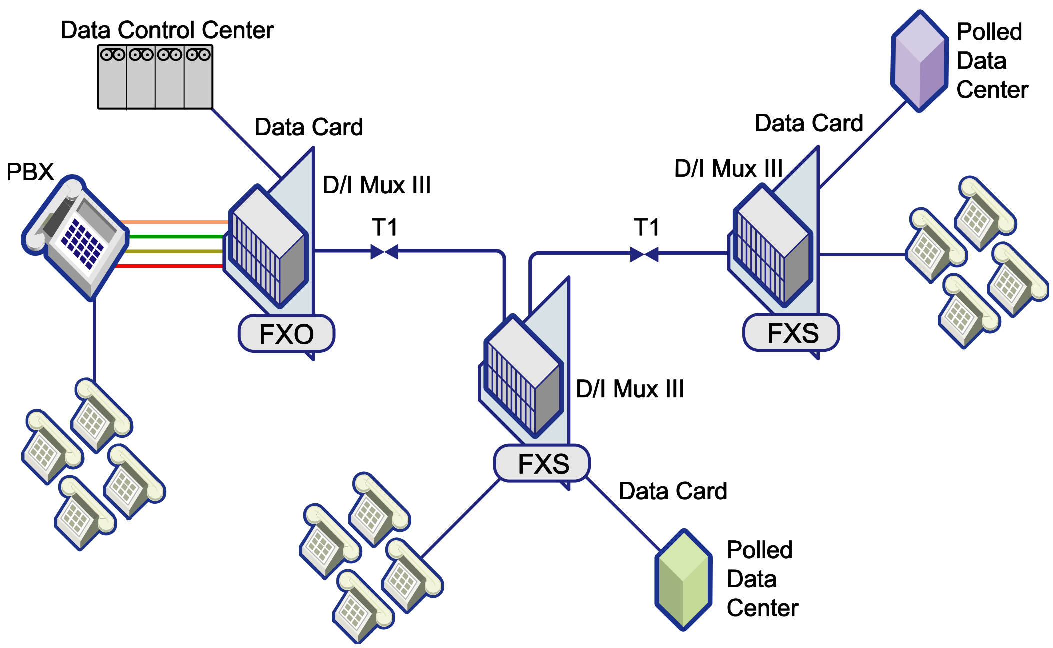


Figure 2-3. Drop-and-Insert Network

Sharing Switch and FXS Applications

With a drop-and-insert system, a single switch can be used to distribute calls to local and remote locations. Minimizing the connections to the local telephone company's central office, or private user's switch, simplifies and economizes the network.

Foreign Exchange Office (FXO) channel cards receive calling information from a central office, or user’s switch, which perceives the FXO to be a standard telephone. The switch supplies talk battery, ringing, busy signals, and all other telephone requirements. The FXO supplies on-hook, off-hook, and dial pulse or touch-tone number signalling.

The digital output from the FXO is transported along the T1 to a Foreign Exchange Subscriber (FXS) line card. The FXS uses these received digital signals to emulate the original central office or user’s switch. The FXS then communicates to a standard telephone, or to another switch or key system.

With a drop-and-insert network, the FXO line cards are located at the switch location, and the FXS line cards reside at any or all the remote locations.

Dropping Data - Polled Data Network

Drop-and-insert operation is ideal for polled data networks. A data line card at a control center sends data on one of the T1 channels to all the data line cards that occupy the same DS0 transmission channel. Only the polled Data Terminal Equipment (DTE) will communicate back to the control center. (In this network configuration, the T1 carriers must have the same timing source.)

Dual Channel Bank

Dual channel bank operation allows public and private networks to be easily merged. The T1 ports can be connected to separate communications carriers, or to private networks. Figure 2-4 illustrates radio station operation, and depicts a dual channel bank network.

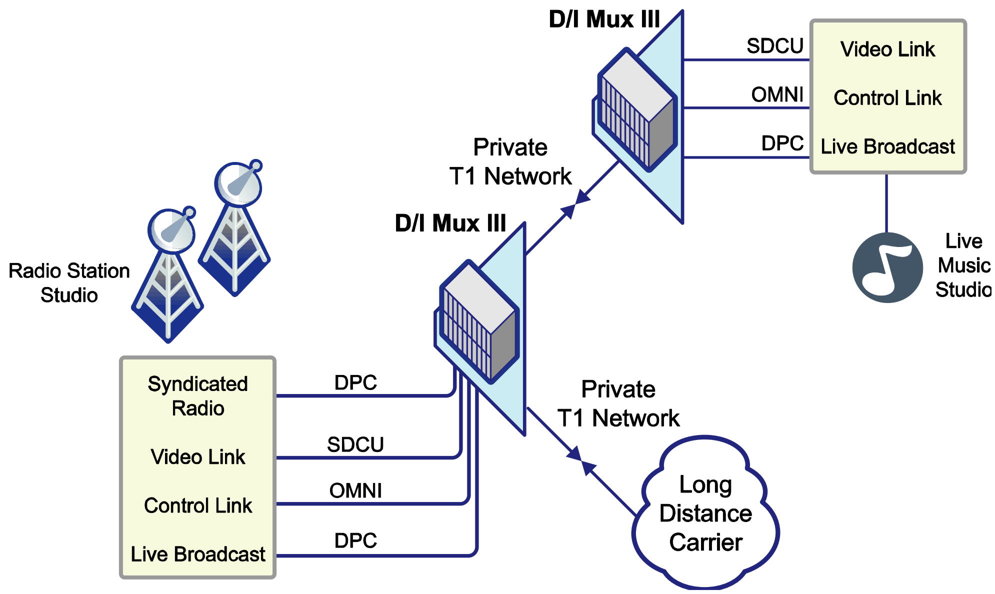


Figure 2-4. Dual Channel Bank Network

Voice, Video, and Special Services Networks

Dual channel bank operation is ideal for audio and compressed video networks. From the public network, standard telephone lines, 800 lines, and syndicated radio shows are brought into the studio. FXS cards are used for the voice traffic, and Digital Program Channels (DPCs) are used to bring in high-quality audio from the special services network for the syndicated radio shows. The T1-2 port connects to a private network to access a remote studio. Live performances are broadcast from the remote studio over DPCs. A compressed video signal from the remote studio helps queue the music. The compressed video is carried over a high-speed data channel. A control voice channel between the station and remote studio, implemented with the Omni-orderwire line card, is used for standard voice communication generally used for station to station (troubleshooting) where voice quality is not an issue.

Chapter 3. INSTALLATION

This chapter describes the D/I Mux III system shelf and common equipment hardware installation. Installation of the shelves, wiring, common equipment, and the control terminal are given in detail. A brief description of line card installation is included. Refer to individual line card user manuals for more detailed installation instructions for each line card. The system software installation is described in *Chapter 4. Configuration and Operation*.

Equipment Location

The D/I Mux III shelf can be installed in an equipment rack, or can be wall-mounted or desktop-mounted, as applicable.

Place the D/I Mux III in an area free from extreme fluctuations of temperature, humidity, and vibration, and avoid dusty areas. (Refer to *Appendix A. D/I Mux III Specifications.)* Allow one mounting space (1.75 inch) above and below the D/I Mux III for ventilation purposes. To avoid electromagnetic susceptibility, the D/I Mux III multiplexer must be located at least six feet from sources of switching impulse noise, such as large power supplies.

Space Requirements

Enough space must exist to accommodate the following:

- D/I Mux III shelf
- System control terminal
- Wiring and line card access in front of, and behind the shelf

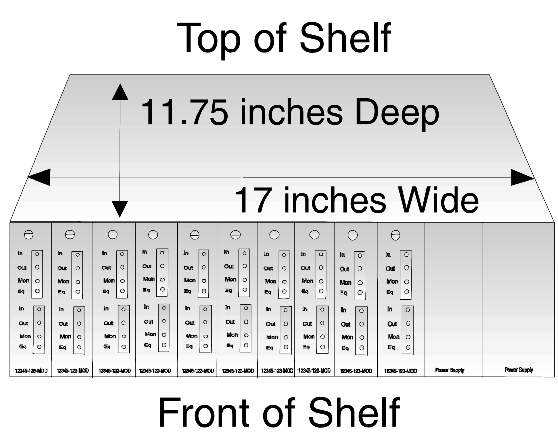


Figure 3-1. D/I Mux III Space Requirements

Shelves

The D/I Mux III multiplexers are approximately 17 inches wide (not including the mounting ears) and 11.75 inches deep.

The height of the D/I Mux III is different for each of the three models. See Figure 3-1, and Table 3-1, for shelf measurements and requirements.

Table 3-1. Height Requirements for Various D/I Mux III Models

D/I Mux III Model	Height (in inches)
8-slot shelf	5.25
12-slot shelf	7.00
24-slot shelf	10.50

Access Requirements

Wiring and connections to the D/I Mux III shelf are made at the rear of the unit, except for the Advanced Common Control Unit (AMCU), Smart Omni-Orderwire (S/OS), Subrate Data Multiplexer (SDM), and Dual Synchronous Data Channel Unit (DSDCU) line cards which have cable connections through their respective front panels.

The D/I Mux III line card and common equipment modules are approximately 10 inches long. Because all modules are inserted into the front of the shelf, enough space must exist in front of the system to allow installation and access to the modules. Coastcom recommends allowing an unobstructed depth of 18 inches at the back of the shelf for wiring access, and an unobstructed space of 30 inches at the front of the shelf for module access.

Power Requirements and Capacity

D/I Mux III systems are powered from three different types of power sources.

- -48 VDC
- -24 VDC
- 110 V AC

When connecting several systems to a single power source, a fuse panel should be employed to prevent a group power failure and to isolate each system. When using AC power, a surge protector, or use of an uninterruptable power supply, is recommended.

-48 VDC Power Systems

The D/I Mux III requires currents ranging from 1.25 Amps to 4 Amps at -48 V DC. To compensate for surge conditions, a slow-blow fuse should be used between the D/I Mux III and -48 V DC power source. A 6 Amp fuse will cover worst-case requirements for overload protection of a -48 V DC powered system.

-48 V DC Power Supply Capacity

Coastcom's -48 V DC Power Supply (P/N 30338-902), either by itself or with a second 30338-902, can power all combinations of line cards up to the maximum D/I Mux III shelf capacity of 24. (See Tables 3-12, 3-13, and 3-14 for more details on power supply capacity.)

-24 V DC Power Systems

The D/I Mux III requires currents ranging from 2.5 Amps to 8 Amps at -24 V DC. To compensate for surge conditions, a slow-blow fuse should be used between the D/I Mux III and -24 V DC power source. A 10 Amp fuse will cover worst-case requirements for overload protection of a -24 V DC powered system.

All -24 V DC systems configured with single or redundant -24 V DC supplies require modified common control equipment. See *Appendix B. 24 V Compatibility*, regarding which common equipment and line cards operate from -24 V DC power.

-24 VDC Power Supply Capacity

Coastcom's Applications Engineering group is available to assist in determining power requirements for systems requiring more than 12 data circuits with -24 V DC power systems.

110 VAC Power Systems

Standard 110 V AC power with a 15-Amp circuit breaker or fuse is adequate for up to five systems.

110 VAC Power Supply Capacity

The Coastcom Applications Engineering group is available to assist in determining power requirements for systems requiring more than 12 data circuits with 110 V AC power systems.

Required Equipment for D/I Mux III Installation

Before installing the D/I Mux III, make sure that the following equipment is on hand. See *Appendix E. Wiring and Cable Tables* for specific cable part numbers.

- T1 cables with DB-15 male connectors, or RJ-48 connectors (available from Coastcom)
- 16-gauge wire to connect the D/I Mux III to the -48 V DC or -24 V DC power source
- Adapter cables for the DB-9 male connector, if Sync I/O (clock synchronization) is required

- Adapter cables to connect from the D/I Mux III DB-25, or 50-pin connectors to the Data Terminal Equipment (DTE) (cables available from Coastcom)
- Rack adapter brackets, if the D/I Mux III is to be mounted in a 23-inch rack or cabinet (Coastcom P/N 115632-02)
- Slot-tip and Phillips head screwdrivers (not available from Coastcom)
- Wire cutter/stripper (not available from Coastcom)
- System control terminal (not available from Coastcom)
- System control terminal-to-D/I Mux III cable (available from Coastcom)
- Grounded wrist strap to prevent electrostatic damage (not available from Coastcom)

Shelf Installation

The D/I Mux III is commonly installed in a 19-inch or, with rack adapter brackets, in a 23-inch rack, or cabinet. Accessory equipment also allows the D/I Mux III to be wall- or desktop-mounted. There are two methods for wall mounting a D/I Mux III system. A description of all the installations follows.

Rack and Cabinet Installation

D/I Mux III shelves mount on standard 19-inch or 23-inch mounting racks. External brackets must be ordered for the 23-inch rack installation (Coastcom P/N 115632-02). One set of brackets is required for 8-slot and 12-slot shelves, and two sets are required for 24-slot shelves. When rack mounted, both Electronic Industries Association (EIA) and Western Electric Company (WECo) mounting patterns are accommodated. The shelf mounting ears are reversible, accommodating flush mount or center mount.

The D/I Mux III 8-slot shelf requires three vertical rack mounting spaces (5.25 inches); the D/I Mux III 12-slot shelf requires four vertical rack mounting spaces (7.00 inches); and the D/I Mux III 24-slot shelf requires six vertical rack mounting spaces (10.50 inches). One empty rack space is required above and below the D/I Mux III for ventilation. Review Figure 3-2 when planning space requirements prior to installation. Cabinet installation usually conforms to the same space requirements as rack mounting.

WARNING

Adequate ventilation is critical. Allow one rackspace (1.75”) beneath and Above each D/I Mux shelf. Not doing so will void the warranty. It is recommend that hear producing devices such as a large power supply not be placed immediately under a D/I Mux. Maximum ambient operating temperature is 50ºC.-

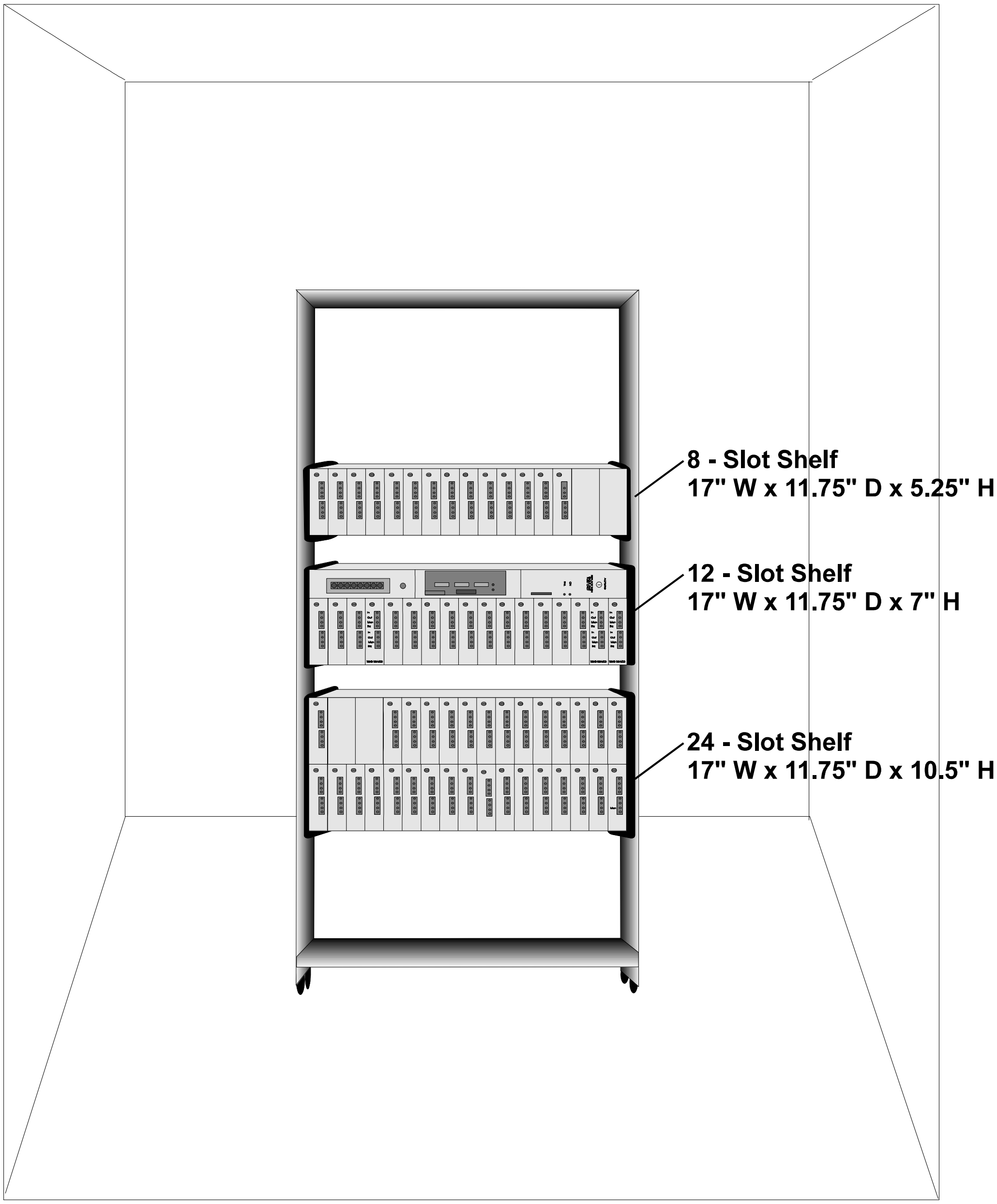


Figure 3-2. Rack Installation

Desktop

The D/I Mux III can be mounted on a table or desk top using the Coastcom Table Mount Base (P/N 117667-01). The Table Mount Base is recommended because it allows for proper air circulation under and through the D/I Mux III.

Install the D/I Mux III onto the Table Mount Base by removing the shelf mounting ears located on the sides of the shelf. Reuse the screws (that held the mounting ears in place) to secure the shelf to the Table Mount Base. Refer to Figure 3-3 for a depiction of the shelf and base.

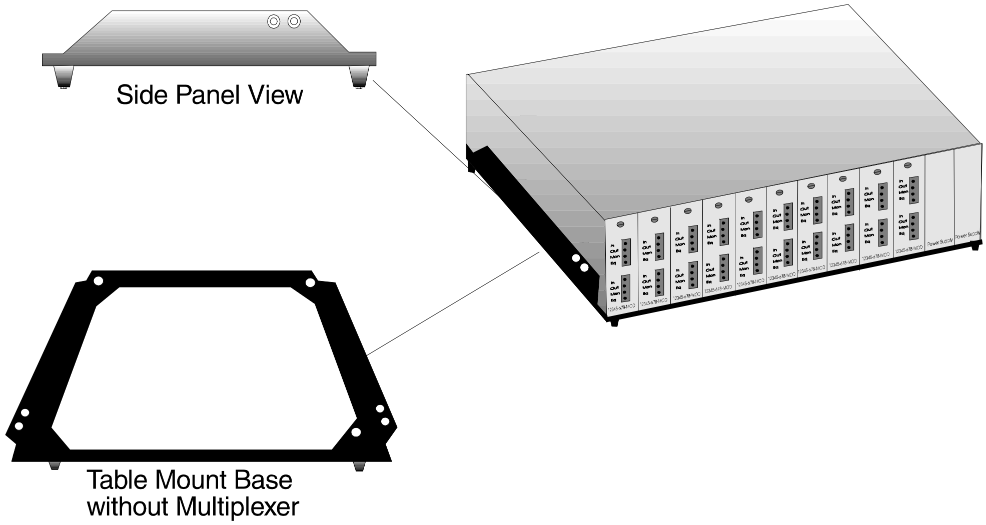


Figure 3-3. Table Mount Base

Wall Mounting

The D/I Mux III can be wall mounted when no rack mounting facilities are available. Research applicable building codes to ensure compliance. Mount the shelf where ventilation is best. Cooler operation of the unit will prolong the life of components and circuitry. Avoid wet or extremely humid locations. Give careful attention to mounting the multiplexer to a wall that has sufficient strength to bear the weight of the system. Conformal coating is available for D/I Mux III equipment installed in areas subject to high humidity, heat, or salt corrosion.

Basic Wall Mount Installation Without Wall Mount Bracket

Detach both mounting brackets from the shelf by unfastening the four flat head #6-32 screws on each bracket. Rotate the brackets 90 degrees so that the bent-up flanges extend approximately one inch beyond the bottom of the shelf. The hole patterns on the brackets should match the pre-drilled patterns on the side panels. Re-attach the brackets in the new positions with the same four screws.

With the bracket now repositioned, the multiplexer must be mounted vertically with the bottom of the shelf facing toward the wall, and the card slots facing either to the left or right. (Installing the power supplies on top of the shelf allows for better heat dissipation.)

When mounting to concrete walls, use the outside holes of the mounting brackets as a template to mark the wall. Leave the brackets on the shelf to expedite the job. Have an assistant steady the shelf while marking the hole. A masonry drill is recommended for making the holes for the #8 x 1-1/2 inch anchor bolts. Anchors can vary, so select the appropriate drill sizes. Insert the anchors into the holes, then mount the multiplexer to the inserts.

To mount the multiplexer to a finished wall with 2 x 4 inch wood or metal studs, the multiplexer must be mounted so that the two center holes are positioned over the stud, and the screws can be toed inward to obtain better engagement of the stud. (The two center holes of each bracket should straddle the vertical stud.) Both screws must engage the stud at top and bottom brackets. If additional framework exists within the wall, this procedure can be modified to utilize the additional holes in the brackets. Use #8 x 1-1/2 or 2 inch screws. A good variable speed electric drill with a Phillips head type driver will help facilitate this installation. Refer to Figures 3-5 and 3-6 for depictions of this type of installation.

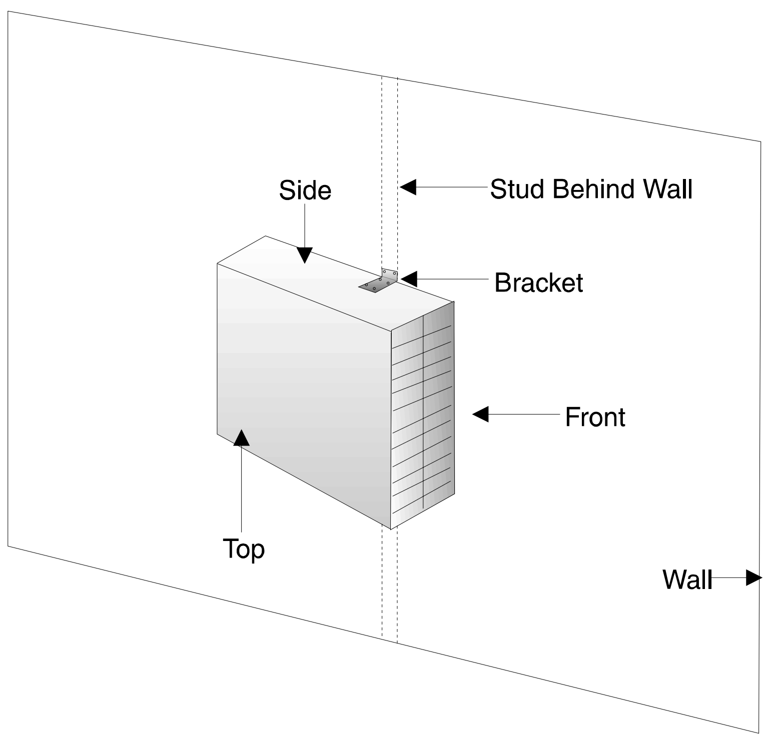


Figure 3-5. Basic Wall Mount Orientation

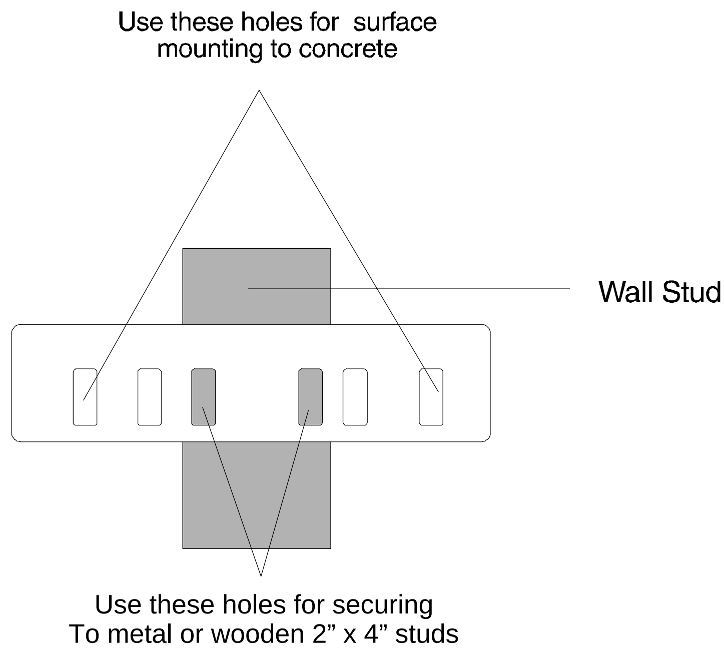


Figure 3-6. Basic Wall Mount Fastening

Planning and Installation

Off-premises connections:

Telecommunication cables that leave the facility (off-premises wiring) can be subject to lightning and / or power surge conditions. Care must be taken that proper surge protection devices for such lines are installed prior to connecting them to a D/I Mux III multiplexer.

Primary and Secondary Surge Protection:

Primary (first line of defense) protection must be provided at the entry point of off-premises wiring. This is typically accomplished by connecting each line to a gas tube or carbon block protector that is in turn connected to a substantial ground connection (one connected directly to earth ground via a heavy conductor). A primary protection device activates during lightning or a power surge event and conducts away nearly all of the surge energy to earth ground. When this occurs a short but intense (up to several hundred volts) post-primary protection surge is left on the cabling to be handled by secondary protection devices. The D/I Mux III has secondary protection built in for all interfaces that are intended for *off-premises connections.* It should be emphasized that the D/I Mux III (or any similar multiplexer) *without primary surge protection* cannot survive a lightning strike.

Protected Interfaces:

The following D/I Mux III interfaces are designed for off-premises ("outside plant") connections. They are designed to absorb the surge conditions typically encountered when connected to primary protectors. These interfaces can also be used in on-premises (non-surge) applications if so desired.

FXO
FXS
Omni Orderwire
AC Power Supplies
OCUDP
T1 Interface Cards (30318-101 / 102 / & 103)

Non protected Interfaces:

Note that all D/I Mux III interfaces not on the above list are not designed for surge conditions and *must* be connected to *on-premises equipment.*

Non protected interfaces such as 4-Wire Channel Units cannot withstand post-primary protection surges such as encountered with lightning. All interfaces not on the list do not have surge protection and are designed to be installed only in protected environments – i.e. connections to equipment *within* the premises.

Grounding:

Protection against safety fault or surge current is provided by connecting the D/I Mux III chassis to the facility earth ground. Since both safety fault currents and surge events are conducted to earth ground by this connection, it should be made with a short, direct, heavy grounding conductor, # 10 AWG or heavier. If not grounded in this manner, an adequate ground may be obtained through the D/I Mux III mounting ears if the facility equipment rack is securely grounded to the facility earth ground via a heavy, direct conductor.

References for further study:

Whitham D. Reeve. *Subscriber Loop Signaling and Transmission Handbook: Analog*. IEEE Press, 1992

Outside Plant Engineering Handbook. Winston-Salem, NC: AT&T Document Development Organization, January 1990

Telecommunication Electrical Protection. AT&T Technologies, Inc. 1985

System Cabling

Figures 3-8 through 3-11 depict the backplane of the four different D/I Mux III shelves. The F and M designations in the backplane figures correspond to female and male connectors respectively. Cabling is connected to the D/I Mux III backplane. Some line cards, such as the Subrate Data Multiplexer (SDM), *premium* Subrate Data Multiplexer (*p*SDM), Multipoint Subrate Data Multiplexer (MSDM), and Smart Omni-Orderwire Station cards, also include cabling at their front panels.

The 8-slot D/I Mux III is available in both the DB-25 connector style, and a combination “Universal” configuration that includes both the two each DB-25 and three each 50-pin connectors.

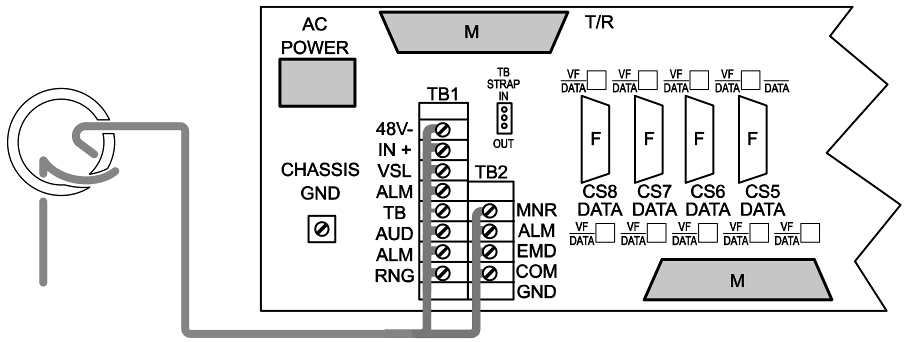
FCC Radio Frequency Emission Compliance

Electrical connections to D/I Mux III shelves (except terminal block connections) must be made with shielded cables. To ensure compliance with FCC emission levels, each shield must cover all of the conductors, and connect along the cable's outside perimeter to the metal shell of the mating connector. Pigtail grounds (or grounds made to a ground pin instead of the metal shell) will result in inadequate shielding. A ferrite shielding core, (P/N 0180-0106) looped twice around the backplane terminal block 1 (TB1) and terminal block 2 (TB2) wiring, is required to limit radio frequency emissions on both the Common Control Unit (CCU), Multiplexer Control Unit (MCU), and the Advanced Common Control Unit (AMCU). The MCU requires two additional ferrite shielding cores installed on any RJ-48 cabling connected through its front panel.

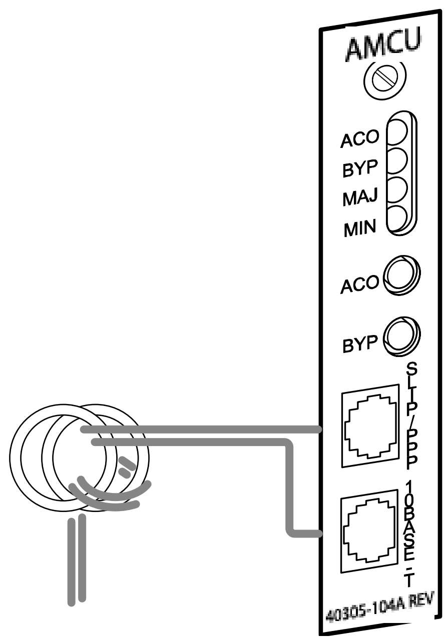
In both cases, the appropriate number of ferrite shielding cores is supplied in the kit bag that comes attached to the D/I Mux III shelf. Proper installation of the cores ensures compliance with FCC Part 15 rules for limiting radio frequency emissions from the unshielded wires. The terminal block connections are screw terminals. When wiring the terminal block connections, loop each wire two complete turns through the ferrite shielding cores as shown in Figure 3-7. Place the cores within five inches of the terminal block.

Warning!

Failure to use shielded cables can result in violation of FCC rules for which the user is responsible.



CCU/AMCU 8-Slot Shelf Backup



AMCU Front Pantel

Figure 3-7. Containment of Radio Frequency Emissions

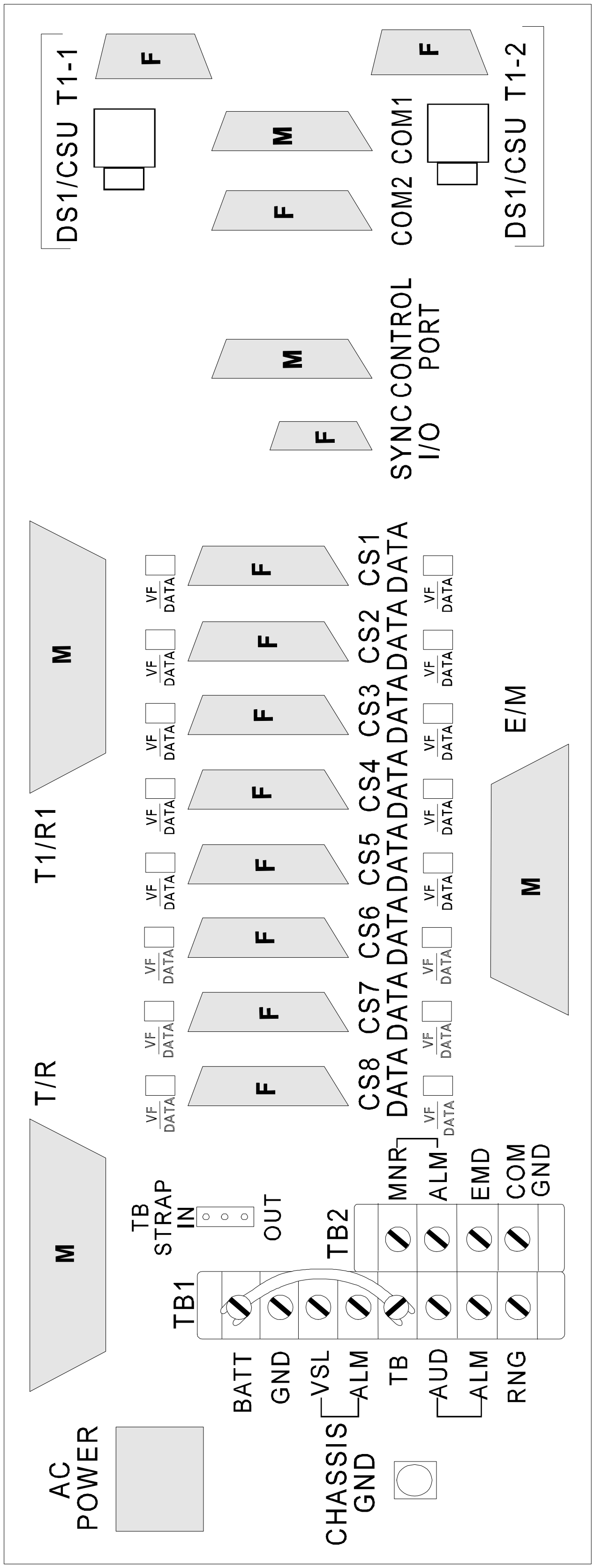


Figure 3-8

Backplane for 8-Slot Voice and Data Shelf (F=Female, M=Male)

(P/N 91620-308)

.

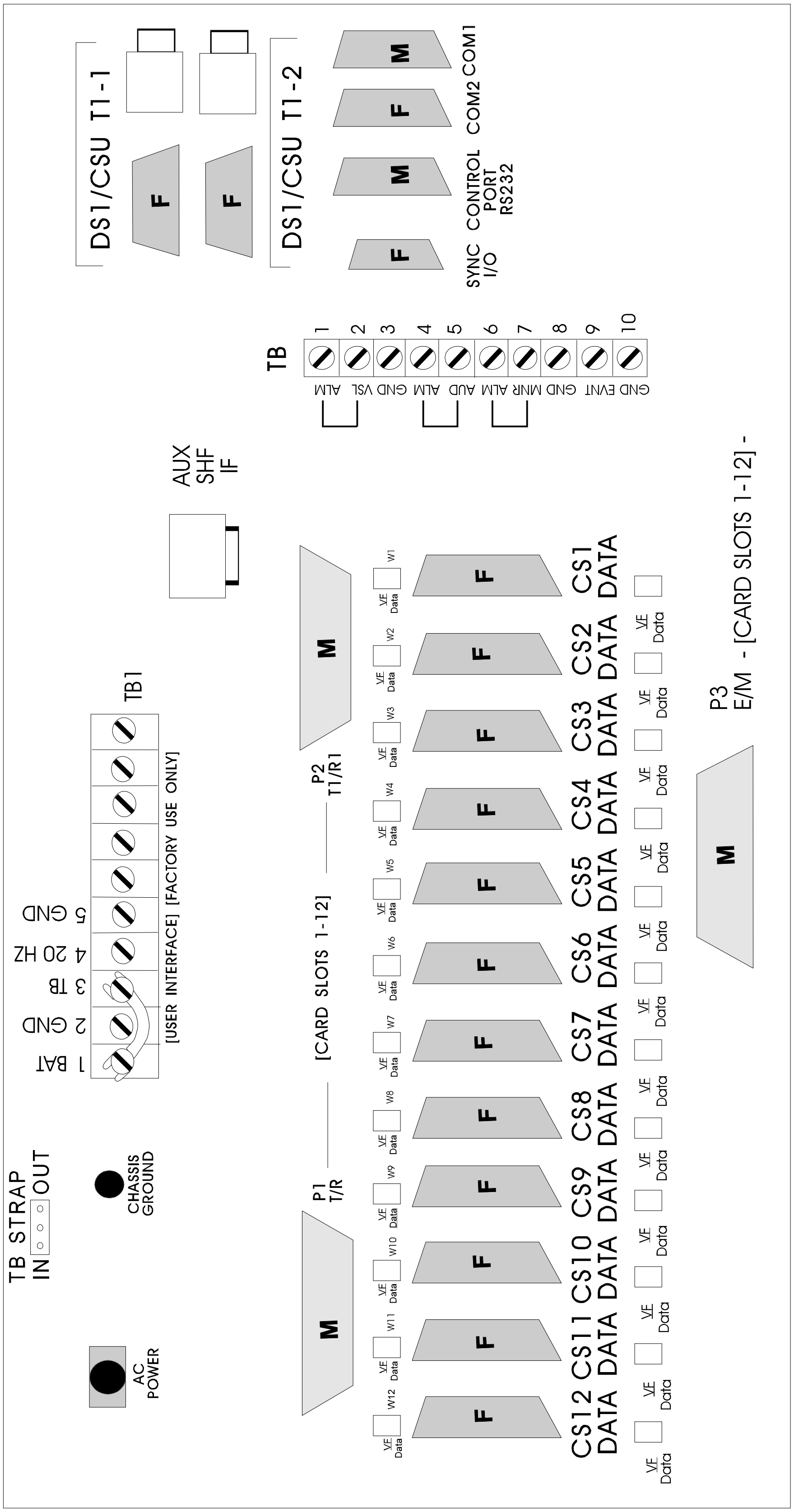


Figure 3-9

Backplane for 12-Slot Voice and Data Shelf (F=Female, M=Male)

(P/N 91620-312)

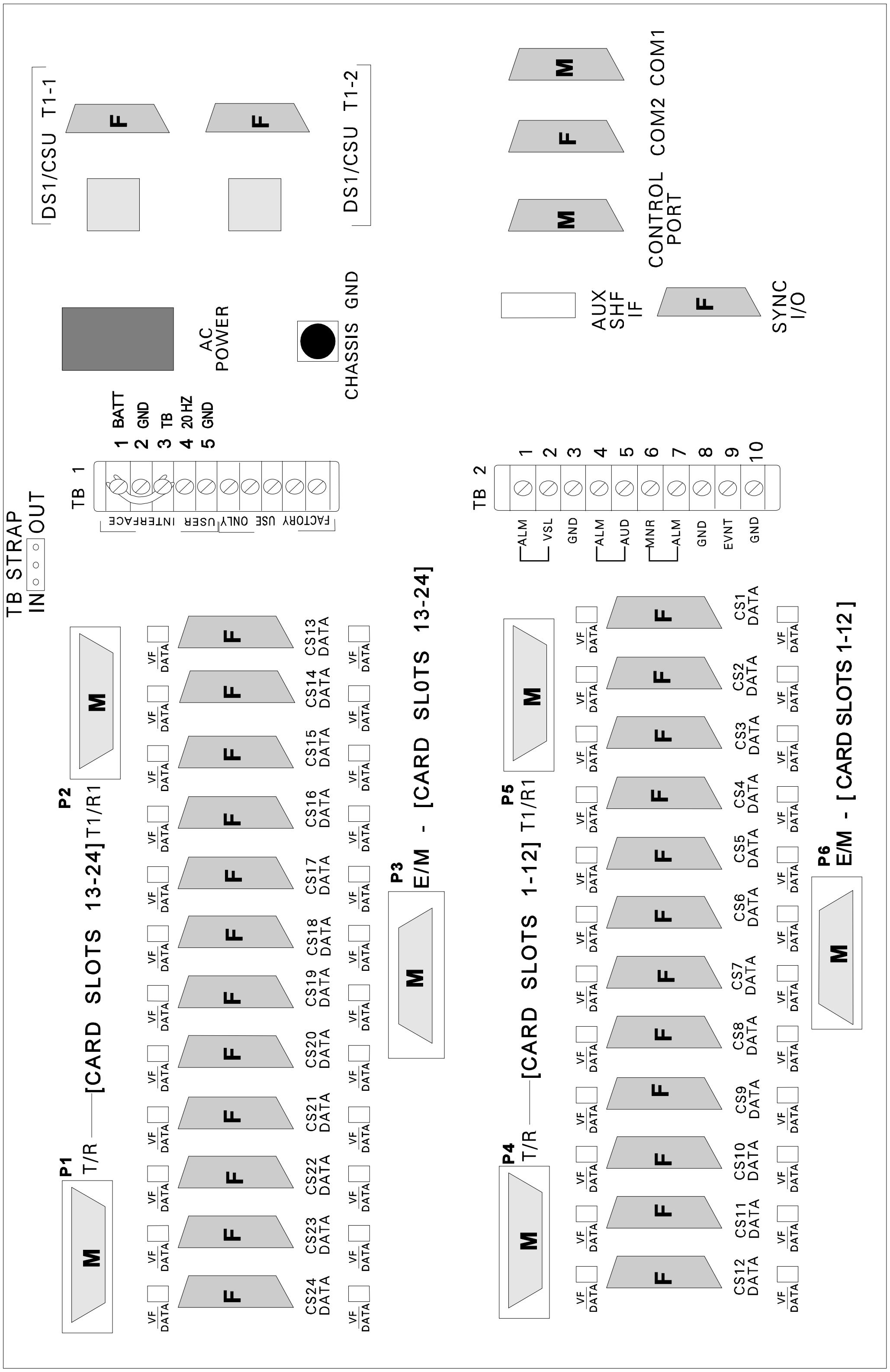


Figure 3-10

Backplane for 24-Slot Voice and Data Shelf (F=Female, M=Male)

(P/N 91620-324)

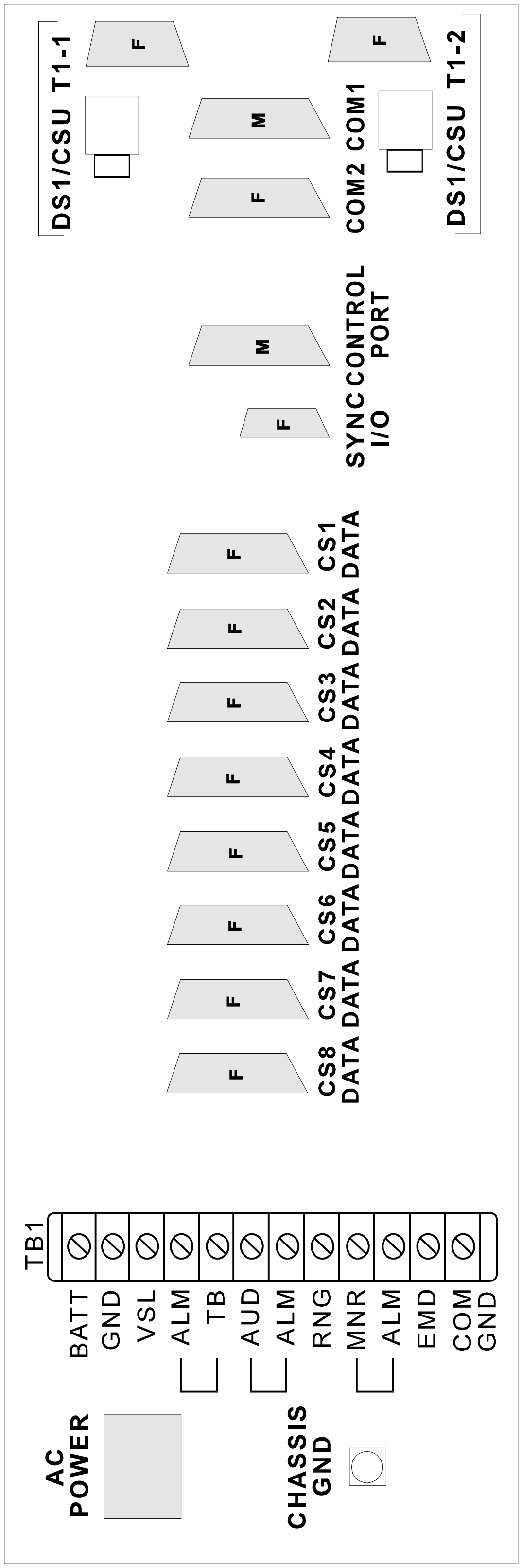


Figure 3-11. Backplane for DB-25 8-Slot T1M Data Only Shelf (F=Female, M=Male) (P/N 91319-608)

Power and Alarms

Power and alarm contacts are connected with 18-gauge wire, which should be cut to fit. Wire the multiplexer before installing power supplies or other equipment in the shelf. If equipment arrives with the common equipment units and line cards already installed, remove the power supply units and T1 Interface units (Dual DSX-1 Interface or Dual CSU Interface) before installing the shelf.

> **Warning!**
>
> Failure to follow safety precautions noted above could result in damage to the equipment, or injury to the installer.

Talk Battery

Talk battery supplies DC voltage for telephone operation. Foreign Exchange Subscriber (FXS) cards, and Smart Omni-Orderwire Station cards require talk battery. Connect the talk battery terminal (TB) on the terminal block (TB1) to an outboard talk battery power supply, or use the DC power connection on the back of the shelf to supply the talk battery. To do this, connect the DC power input terminal, labeled **BATT**, to the talk battery terminal with 18-gauge wire. On some D/I Mux III models the DC power input terminal is labeled **-48 V** or **BATT**.

On shelves shipped after 1993 there is a jumper connecting the talk battery terminal to the DC power source. This connection can be broken by setting the talk battery strap located on the back panel to the **OUT** position.

> **Note**: If using an external talk battery source, ensure that the talk battery strap is set to the **OUT** position.

DC Power

Ideally, power should be turned off to the D/I Mux III system before wiring. With a battery powered system this may not be possible.

If connecting live (hot) power, be certain the D/I Mux III system power supply and T1 Interface units are removed to prevent current from flowing when connecting to power.

> **CAUTION!**
>
> If connecting hot power, be certain to connect to the D/I Mux III system first and then to the DC power source. This minimizes the possibility of a hot wire becoming grounded. Coastcom does not recommend connecting live or hot power.

Use the following procedure for connecting DC power.

1. Remove the power supply units and Dual DSX-1 Interface or Dual CSU Interface Unit, if already installed.
2. The D/I Mux III has a positive ground. Connect the DC power source ground to the D/I Mux III positive terminal, labeled **GND**. On some D/I Mux III models, the positive terminal is labeled **IN+**.

3. Connect the D/I Mux III negative terminal, labeled **BATT**, to the negative terminal of the DC power source.

> **CAUTION!**
>
> For -24 V DC systems, ensure that only -24 V DC power is applied to the DC power source. Connecting -48 V DC will result in system damage.

Use an alarm fuse panel if several D/I Mux III systems or other devices are using the same DC power source. Without a fuse panel, one device failure can overload the DC power source, causing multiple failures. Contact Coastcom's Applications Engineering department to determine the appropriate fuse panel for a particular application.

AC Power

The D/I Mux III AC power cord plugs into the back of the multiplexer only after the AC power supply is installed. Install the AC power cord using the following procedure.

1. Remove the ground lug nut, then install the AC power supply, securing it to the system with the ground lug nut.
2. Plug one end of the power cord into the back of the shelf.
3. Plug the other end of the power cord into a standard 110 V AC power outlet.

Extension cords are NOT recommended. If an extension cord is necessary, use only an extension cord that is fused, or has a circuit breaker, and is grounded (such as a multiple outlet power strip). Under applicable fire codes, unprotected extension cords are illegal in most areas for use on any equipment located on commercial property.

> **Note**: When using 4-Wire E&M cards, ensure that the multiplexer is grounded to the same grounding connection to which the switch or key system, and 4-Wire E&M cards, are connected.

Alarm Contacts

The alarm contacts are controlled by the internal circuitry of the D/I Mux III. Alarm contacts are either open (no connection between them) or closed (connected). Use standard 18-gauge wire to connect to the alarm contacts.

> **CAUTION!**
>
> For safety, connect to the alarm contacts with the alarm indication devices turned off.

T1 Transmission Lines

The T1 transmission lines are connected to either the DB-15 or RJ-48 connectors. One connector (T1-1) is used for channel bank mode. Both connectors (T1-1 and T1-2) are used for drop-and-insert mode, dual channel bank mode, and ALPS mode.

For T1 connections, use 100-Ohm dual twisted pair individually shielded cable.

1. Locate the two DB-15 or RJ-48 connectors on the shelf backplane. They are labeled DS1/CSU T1-1 and DS1/CSU T1-2. See Figures 3-12 and 3-13 for details.
2. For single channel bank mode, plug the T1 transmission line into the T1-1 connector on the shelf backplane; for drop-and-insert mode or dual channel bank mode, plug the T1 transmission lines into the T1-1 connector and T1-2 on the shelf backplane.

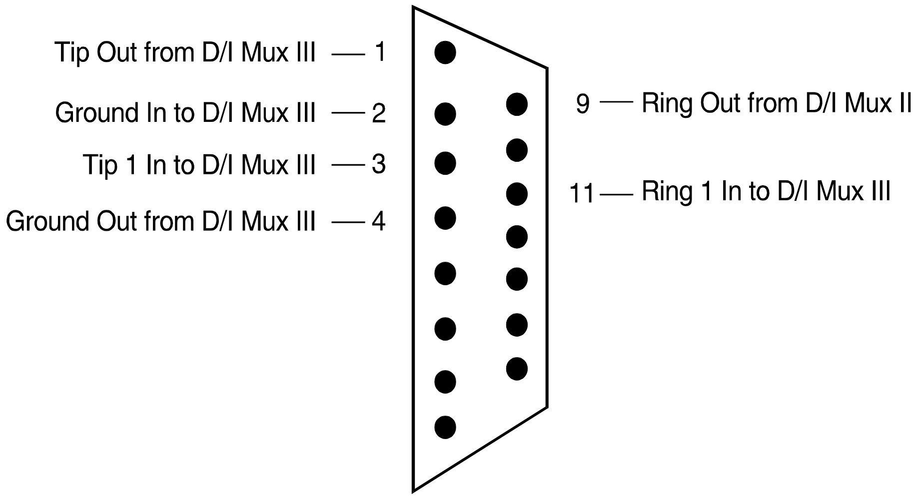
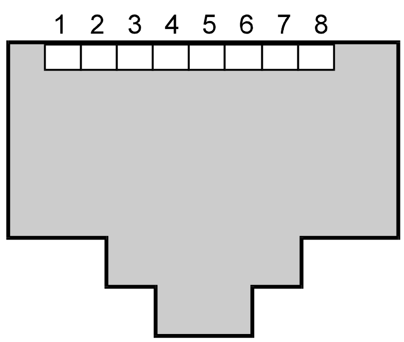


Figure 3-12. DB-15 T1 Female Connectors



1 - Tip 1 In to D/I Mux III
2 - Ring 1 In to D/I Mux III
3 -
4 - Tip Out from D/I Mux III
5 - Ring Out from D/I Mux III
6 -
7 - Ground In to D/I Mux III
8 - Ground Out from D/I Mux III

Figure 3-13. RJ-48 T1 Connectors

T1 Cabling Considerations

Connection of the D/I Mux III in channel bank mode to the T1 network is a DTE-to-DCE connection. Some examples of D/I Mux III-to-DCE connections are: Channel Service Units (CSUs), Smart Jacks, Fiber Optic Modems, and Fiber Multiplexers. See Table 3-2 for details.

Table 3-2. T1 Connection to Data Communications Equipment (DCE)

D/I Mux III (DTE)	DB-15 Connector	RJ-48 Connector	Transmission Direction	DB-15 Connector	RJ-48 Connector	Connection (DCE)
Tip 1 Rx	3	1	⇐	3	1	Tip 1
Ring 1 Rx	11	2	⇐	11	2	Ring 1
Tip Tx	1	4	⇒	1	4	Tip
Ring Tx	9	5	⇒	9	5	Ring

Connection of two D/I Mux III multiplexers in channel bank mode, each communicating with the other in a point-to-point private network, is a DTE-to-DTE connection. Use Table 3-3 for cabling information.

When connecting a D/I Mux III in drop-and-insert mode, the T1-1 port typically connects to the T1 network, and the T1-2 port connects to Data Terminal Equipment (DTE). Some examples of D/I Mux III-to-DTE connections are: Digital Private Branch Exchanges (T1 PBXs), Channel Banks, and T1 Multiplexers (as indicated in Table 3-3).

D/I Mux III in dual channel bank mode can be wired to communicate with either DTE or DCE devices.

Table 3-3. Connection to Data Terminal Equipment (DTE)

D/I Mux III (DTE)	DB-15 Connector	RJ-48 Connector	Transmission Direction	DB-15 Connector	RJ-48 Connector	Connection (DTE)
Tip 1 Rx	3	1	⇐	1	4	Tip
Ring 1 Rx	11	2	⇐	9	5	Ring
Tip Tx	1	4	⇒	3	1	Tip 1
Ring Tx	9	5	⇒	11	2	Ring 1

Timing Sync I/O

External synchronization can be achieved with a DB-9 female external Synchronous Input/Output (Sync I/O) connector. With it, the D/I Mux III can be configured for master or slave clock timing. (Refer to Figure 3-14.)

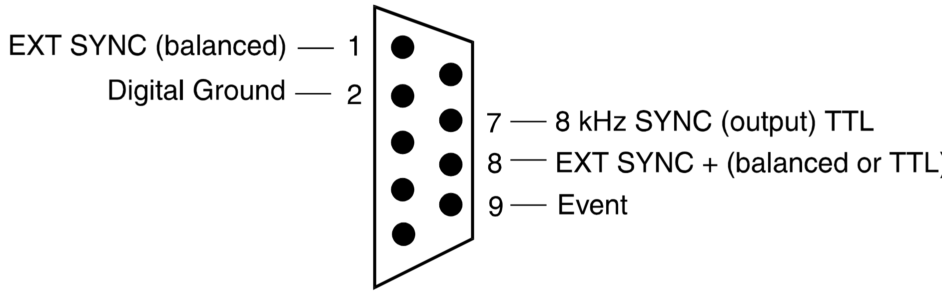


Figure 3-14. Sync I/O Connector (Female)

Use external timing to synchronize two systems or networks. With external synchronization, the D/I Mux III is the master timing source for the T1 network. Connect the DB-9 Sync I/O connector to 8 kHz Sync (Pin 7) and Digital Ground (Pin 2) to achieve external synchronization. The DB-9 external sync connector provides an 8 kHz frame-aligned, TTL-compatible, output clock for timing between co-located D/I Mux III shelves. (To connect to another D/I MUX III, connect pin 2 and pin 8 TTL 8 kHz input.)

The Sync I/O input function can synchronize the D/I Mux III to another timing source. The input to the Sync I/O must be 8 kHz or greater, and a multiple of 1600 Hz, up to 1.544 MHz. The driving balanced or TTL signal amplitude cannot exceed plus or minus 5 volts, ground-to-peak value. The D/I Mux III shelf will not synchronize to a composite clock (i.e., a 64K/8K source). Table 3-4 lists the most commonly used frequencies and their tolerances. The synthesized 1.544 MHz T1 clock must have an accuracy of ±50 Hz to qualify as a Stratum IV clock source. Accordingly, the input clock must be within this range to allow this degree of accuracy. To calculate the reference clock frequency tolerance, use the following formula.

Frequency Tolerance = [Frequency x (3.24 x 10^{-5})]

Table 3-4. Common Synchronization Frequencies

Reference Clock Frequency (in Hz)	Reference Clock Frequency Tolerance (+/- Hz)
8,000	0.26
9,600	0.31
56,000	1.81
64,000	2.07
128,000	4.15
256,000	8.29
768,000	24.87
1,536,000	49.74

Slot 2 Synchronization (Optional)

The Slot 2 Synchronization feature allows data line cards to provide local timing for the D/I Mux III. A data line card plugged into card slot 2 is the external input used to produce a 1.544 MHz clock reference. The external input is 8 kHz or greater and is a multiple of 1600 Hz up to 1.544 MHz. To use this option, install a data card in slot 2, and set up the D/I Mux III for Slot 2 Sync timing using the following software commands. (For further detail on software configuration, refer to *Chapter 4. Configuration and Operation*).

- **SC** - Use the **SC** command to set the mode of operation to Channel Bank or Dual Channel Bank and the shelf timing to local.
- **SS** - Use the **SS** command to set the non-alarm clock source to External Slot 2 line card.
- **SL** - Use the **SL** command to set the line card data rate to which the D/I Mux III will be synchronized.

Event Switch

The event switch is a screw terminal marked labeled **EMD** (some cards are labeled **EVNT**) on the backplane terminal block. An event switch is also available on pin 9 of the SYNC I/O connector. Connect to the event terminal with standard 18- to 26-gauge wire. An event map change occurs when the event terminal is connected to the D/I Mux III ground.

Voice and Data Connections

Standard 50-pin voice frequency (VF) connectors are available for connecting voice and some data circuits to the D/I Mux III equipment. Every line card slot also has a DB-25 connector that corresponds to its card slot number. The DB-25 connector is used for data or voice circuits.

Note: The T1M shelf does not have 50-pin voice frequency (VF) connectors. The nonuniversal 8-slot does not support 50 pin.

Voice or Data Jumpers

Each card slot in the D/I Mux III shelf using the 50-pin Amphenol type connector has a 6-pin jumper block, located above and below its DB-25 connector, to designate whether the line card uses the DB-25 or the 50-pin VF connector. Sensitive data signals can be corrupted by voice card high voltage signaling circuits (E&M signalling is at -48 V DC). Jumper selection separates the wiring of voice and data circuits on the D/I Mux III backplane, and prevents data errors.

Each voice card using the 50-pin VF connector must have its jumper plug set to the "**VF**" position. (Even though the jumper is set to **VF**, voice/data traffic still appears on the DB-25 connector. The traffic is parallel.) Each data card and voice card using the DB-25 connector must have its jumper set to the "**DATA**" position.

Figure 3-15 shows how to position the Voice/Data jumpers.

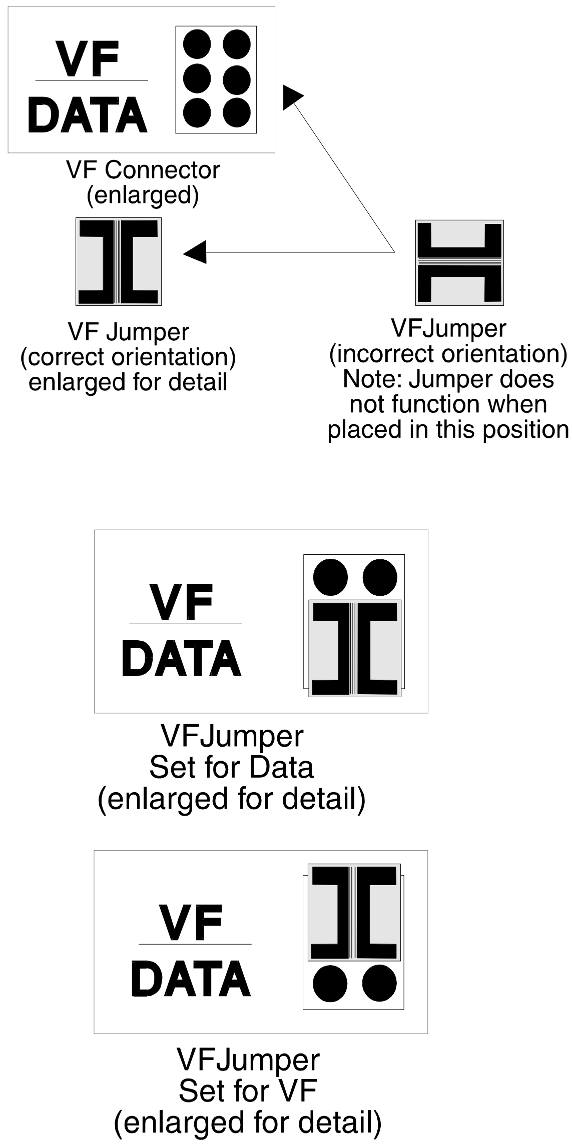


Figure 3-15. Voice/Data Jumpers

Voice Circuits

The 8-slot Universal and 12-slot D/I Mux III shelves have three 50-pin VF connectors, and the 24-slot shelf has six 50-pin VF connectors. They are designated P1, P2, and P3 on the 8-slot and 12-slot shelves, and P1, P2, P3, P4, P5, and P6 on the 24-slot shelf. These connectors provide access to tip (T), ring (R), tip 1 (T1), ring 1 (R1), and Earth and Magnet (E&M) signalling leads.

Note: Use the DB-25 connectors to connect a voice card using types II or III E&M signalling. Types II and III signalling require signal ground and battery not available on the 50-pin VF connector.

Each 50-pin connector has two sets of pins for each line card slot, Channel A and Channel B. 2-Wire voice cards require the T and R connections. 4-Wire voice cards require T, R, T1, and R1 connections. E&M signalling requires the addition of the E&M connections.

Tables on the following pages give detailed instructions connections appropriate for the 8-, 12-, and 24-slot D/I Mux III shelf models. Make the connections to the 50-pin connectors according to Tables 3-9 and 3-10. Table 3-11 shows the color coding for the 50-pin connector. (For more information on connector pinouts, refer to *Appendix E. Wiring and Cable Tables*.)

Table 3-9. 50-Pin Connector Pin-Outs for the 8- and 12-Slot Shelves

Card Slot	Channel A			Channel B		
	R & T	R1 & T1	M & E	R & T	R1 & T1	M & E
1	P1 - 1/26	P2 - 1/26	P3 - 1/26	P1 - 13/38	P2 - 13/38	P3 - 13/38
2	P1 - 2/27	P2 - 2/27	P3 - 2/27	P1 - 14/39	P2 - 14/39	P3 - 14/39
3	P1 - 3/28	P2 - 3/28	P3 - 3/28	P1 - 15/40	P2 - 15/40	P3 - 15/40
4	P1 - 4/29	P2 - 4/29	P3 - 4/29	P1 - 16/41	P2 - 16/41	P3 - 16/41
5	P1 - 5/30	P2 - 5/30	P3 - 5/30	P1 - 17/42	P2 - 17/42	P3 - 17/42
6	P1 - 6/31	P2 - 6/31	P3 - 6/31	P1 - 18/43	P2 - 18/43	P3 - 18/43
7	P1 - 7/32	P2 - 7/32	P3 - 7/32	P1 - 19/44	P2 - 19/44	P3 - 19/44
8	P1 - 8/33	P2 - 8/33	P3 - 8/33	P1 - 20/45	P2 - 20/45	P3 - 20/45
9	P1 - 9/34	P2 - 9/34	P3 - 9/34	P1 - 21/46	P2 - 21/46	P3 - 21/46
10	P1 - 10/35	P2 - 10/35	P3 - 10/35	P1 - 22/47	P2 - 22/47	P3 - 22/47
11	P1 - 11/36	P2 - 11/36	P3 - 11/36	P1 - 23/48	P2 - 23/48	P3 - 23/48
12	P1 - 12/37	P2 - 12/37	P3 - 12/37	P1 - 24/49	P2 - 24/49	P3 - 24/49

Table 3-10. 50-Pin Connector Pin-Outs for the 24-Slot Shelf

Card Slot	Channel A			Channel B		
	R & T	R1 & T1	M & E	R & T	R1 & T1	M & E
1	P4 - 1/26	P5 - 1/26	P6 - 1/26	P4 - 13/38	P5 - 13/38	P6 - 13/38
2	P4 - 2/27	P5 - 2/27	P6 - 2/27	P4 - 14/39	P5 - 14/39	P6 - 14/39
3	P4 - 3/28	P5 - 3/28	P6 - 3/28	P4 - 15/40	P5 - 15/40	P6 - 15/40
4	P4 - 4/29	P5 - 4/29	P6 - 4/29	P4 - 16/41	P5 - 16/41	P6 - 16/41
5	P4 - 5/30	P5 - 5/30	P6 - 5/30	P4 - 17/42	P5 - 17/42	P6 - 17/42
6	P4 - 6/31	P5 - 6/31	P6 - 6/31	P4 - 18/43	P5 - 18/43	P6 - 18/43
7	P4 - 7/32	P5 - 7/32	P6 - 7/32	P4 - 19/44	P5 - 19/44	P6 - 19/44
8	P4 - 8/33	P5 - 8/33	P6 - 8/33	P4 - 20/45	P5 - 20/45	P6 - 20/45
9	P4 - 9/34	P5 - 9/34	P6 - 9/34	P4 - 21/46	P5 - 21/46	P6 - 21/46
10	P4 - 10/35	P5 - 10/35	P6 - 10/35	P4 - 22/47	P5 - 22/47	P6 - 22/47
11	P4 - 11/36	P5 - 11/36	P6 - 11/36	P4 - 23/48	P5 - 23/48	P6 - 23/48
12	P4 - 12/37	P5 - 12/37	P6 - 12/37	P4 - 24/49	P5 - 24/49	P6 - 24/49
13	P1 - 1/26	P2 - 1/26	P3 - 1/26	P1 - 13/38	P2 - 13/38	P3 - 13/38
14	P1 - 2/27	P2 - 2/27	P3 - 2/27	P1 - 14/39	P2 - 14/39	P3 - 14/39
15	P1 - 3/28	P2 - 3/28	P3 - 3/28	P1 - 15/40	P2 - 15/40	P3 - 15/40
16	P1 - 4/29	P2 - 4/29	P3 - 4/29	P1 - 16/41	P2 - 16/41	P3 - 16/41
17	P1 - 5/30	P2 - 5/30	P3 - 5/30	P1 - 17/42	P2 - 17/42	P3 - 17/42
18	P1 - 6/31	P2 - 6/31	P3 - 6/31	P1 - 18/43	P2 - 18/43	P3 - 18/43
19	P1 - 7/32	P2 - 7/32	P3 - 7/32	P1 - 19/44	P2 - 19/44	P3 - 19/44
20	P1 - 8/33	P2 - 8/33	P3 - 8/33	P1 - 20/45	P2 - 20/45	P3 - 20/45
21	P1 - 9/34	P2 - 9/34	P3 - 9/34	P1 - 21/46	P2 - 21/46	P3 - 21/46
22	P1 - 10/35	P2 - 10/35	P3 - 10/35	P1 - 22/47	P2 - 22/47	P3 - 22/47
23	P1 - 11/36	P2 - 11/36	P3 - 11/36	P1 - 23/48	P2 - 23/48	P3 - 23/48
24	P1 - 12/37	P2 - 12/37	P3 - 12/37	P1 - 24/49	P2 - 24/49	P3 - 24/49

Table 3-11. 50-Pin Amphenol Connector With Jumper Set to VF

Pair	Circuit	P1/P4	P2/P5	P3/P6
Bl/Wh	1A	TR	T1R1	E&M
Or/Wh	2A	TR	T1R1	E&M
Gr/Wh	3A	TR	T1R1	E&M
Br/Wh	4A	TR	T1R1	E&M
Sl/Wh	5A	TR	T1R1	E&M
Bl/Rd	6A	TR	T1R1	E&M
Or/Rd	7A	TR	T1R1	E&M
Gr/Rd	8A	TR	T1R1	E&M
Br/Rd	9A	TR	T1R1	E&M
Sl/Rd	10A	TR	T1R1	E&M
Bl/Bk	11A	TR	T1R1	E&M
Or/Bk	12A	TR	T1R1	E&M
Gr/Bk	1B	TR	T1R1	E&M
Br/Bk	2B	TR	T1R1	E&M
Sl/Bk	3B	TR	T1R1	E&M
Bl/Yel	4B	TR	T1R1	E&M
Or/Yel	5B	TR	T1R1	E&M
Gr/Yel	6B	TR	T1R1	E&M
Br/Yel	7B	TR	T1R1	E&M
Sl/Yel	8B	TR	T1R1	E&M
Bl/Vio	9B	TR	T1R1	E&M
Or/Vio	10B	TR	T1R1	E&M
Gr/Vio	11B	TR	T1R1	E&M
Br/Vio	12B	TR	T1R1	E&M
Sl/Vio				

50-Pin Voice Cable Installation

1. Locate the 50-pin VF connectors on the shelf backplane.
2. Connect VF lines to the 50-pin connectors.
3. Position the jumper above and below the data connector corresponding to each voice card slot using the 50-pin connector. Place the jumper in the **VF** position.

DB-25 Voice Cable Installation

The DB-25 data connectors can be used for voice connections which require Type II and Type III signalling. The DB-25 connector pin-outs are shown in Figures 3-16 through 3-20. Figure 3-16 shows the DB-25 pin-outs for single-channel (A only), and dual-channel (A and B) voice line cards, while Figure 3-17 describes the DB-25 to wire-wrap connections. Figures 3-18 through 3-20 detail connections for use with RS-232C, RS-449 and V.35 interfaces respectively.

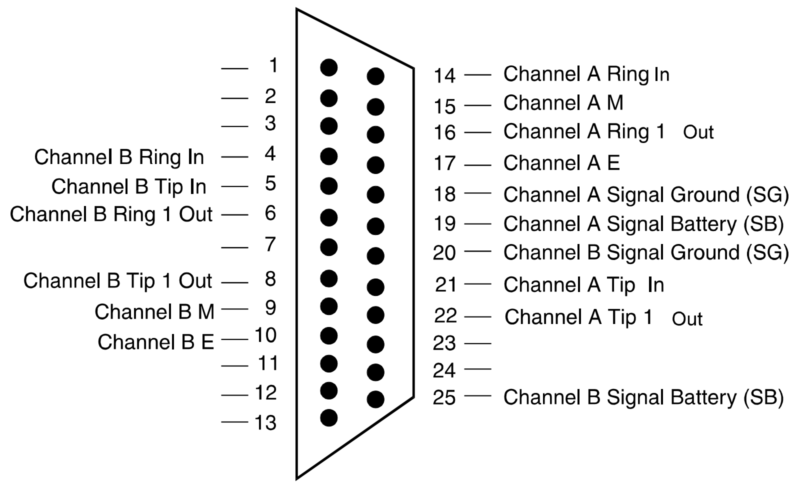


Figure 3-16. Single Channel, Dual Channel, and ADPCM Voice Cards on DB-25 Female Connectors

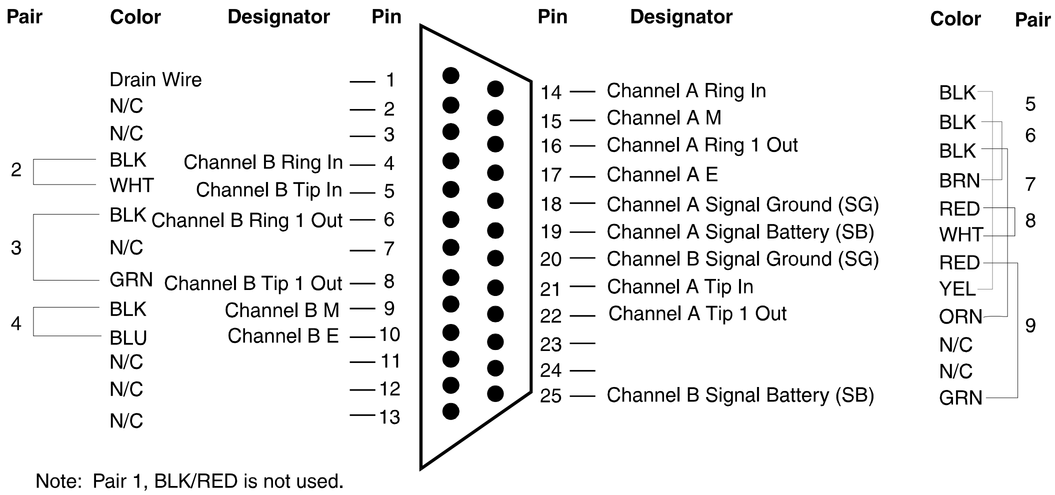


Figure 3-17. Dual Channel Voice on DB-25 Female Connectors to Wire-Wrap Connections (Coastcom Cable Nos. 0600-0235/236/237)

Use the following procedure for installing voice cable with the DB-25 connectors.

1. Obtain an appropriate cable for the selected line card application.
2. Connect the cable to the equipment, and route the cable to the D/I Mux III.
3. At the D/I Mux III backplane, plug the cable into the DB-25 connector which corresponds to the desired voice circuit.
4. Set the jumper located under the DB-25 connector to the **DATA** position, connecting the voice circuit through the DB-25 connector.
5. If accessible, tie cables to the rack or cabinet frame rails to provide strain relief.

Data Circuits

Data connections are made via the DB-25 female backplane connectors on the D/I MUX III, shown below in figure 3-18. An adapter cable is needed to connect the Data Terminal Equipment (DTE) to the D/I Mux III. The D/I Mux III end of the cable must have a male DB-25 connector. The opposite end of the cable must have the appropriate connector for matching user equipment. Please consult the appropriate data card manual for detailed cable pinouts/connections.

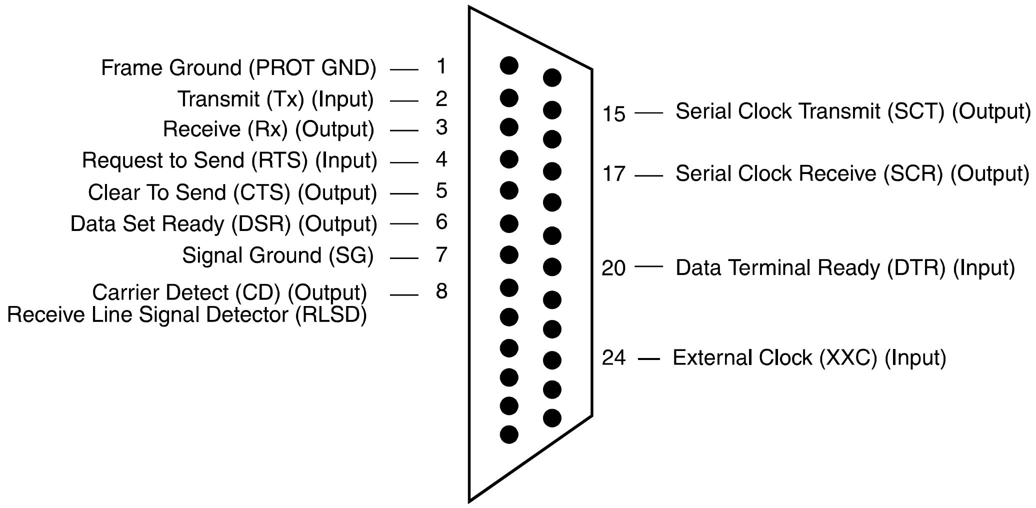


Figure 3-18. RS-232C Female Data Circuit (DCE)

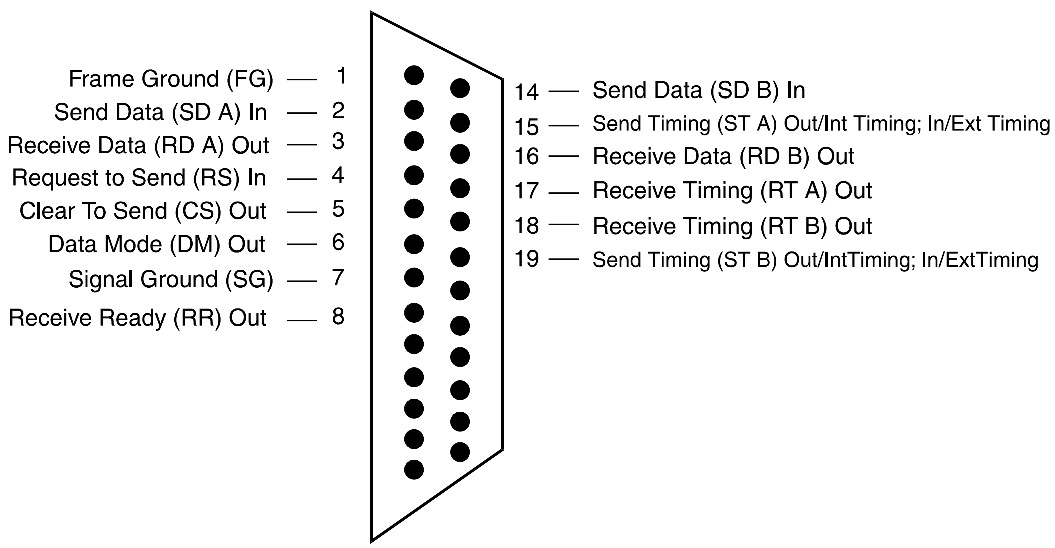


Figure 3-19. RS-449 Female Data Circuit

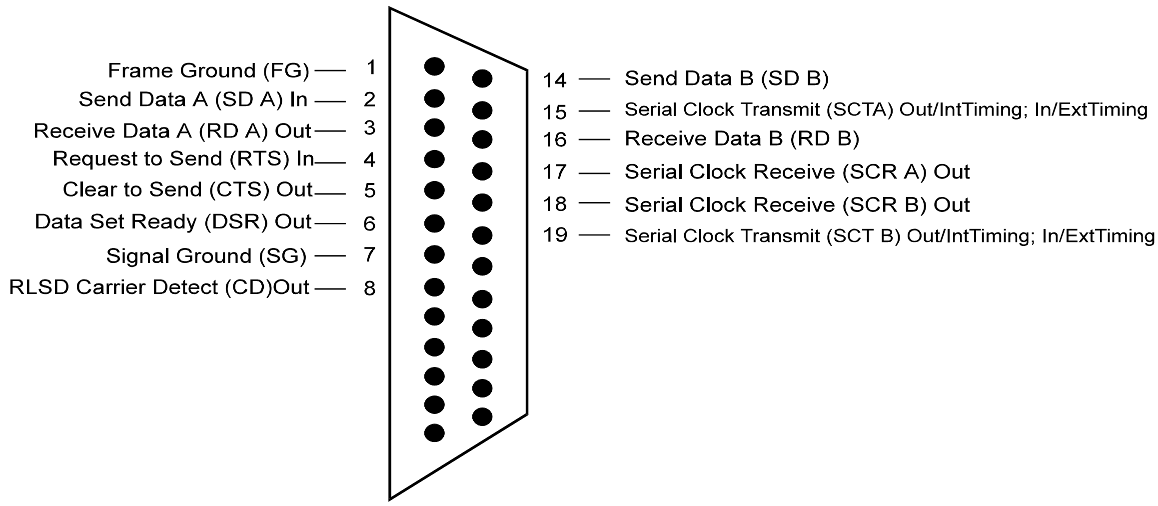


Figure 3-20. V.35 Female Data Circuit

Digital Program Channels

Digital Program Channels (DPCs) can use the 50-pin voice connectors or the DB-25 connectors. They connect to Tip and Ring for transmit, and Tip 1 and Ring 1 for receive.

Common Equipment and Line Card Installation

All common equipment and line cards are installed in the same manner. Common equipment units should be installed before line cards, and must be placed in the correct common equipment card slot, as designated on the static strip. Line cards can be placed in any line card slot of the multiplexer. See the D/I Mux III front view diagrams in Figures 3-15, 3-16 and 3-17 for the location of the various card slots, and follow the order given in this chapter for common equipment installation. (See *Appendix F. Shelf Supplement*, for details on older model shelves.)

> **Warning!**
>
> Power down the shelf when installing or replacing common equipment. Check the static strip in the shelf to ensure that the card being installed is the correct card for that slot, or damage can result.

Electrostatic Precautions

Precaution must be taken to prevent electrostatic damage to plug-in units. Electrostatic damage can cause semiconductors and other static-sensitive components to fail, resulting in unexplainable test failures and degraded performance.

Safety Precautions

Observe the following safety precautions when installing the D/I Mux III system.

- Never install telephone wiring during an electrical storm.1
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

Installing Cards in Shelf

1. Put on a grounded wrist strap. The wrist strap should touch the skin and be grounded through an approximately one-megohm resistor to the terminal block screw labeled GND on the D/I Mux III backplane.
2. With the line card still in its static-shielded bag, loosen the captive screw at the top of the line card front panel.
3. Pull forward the top of the front panel until it is at right angles from its former position.
4. Remove the plug-in card from the static-shielded bag.
5. Place jumpers in appropriate positions for each line card, as directed in specific line card user manuals.
6. Slide the unit as far as it will go into the correct card slot in the D/I Mux III shelf.
7. Return the front panel to its upright position so it locks into the shelf.
8. Push evenly and firmly on card front panel then apply firm pressure to lower part of front panel to ensure the card is securely seated in the shelf slot, and tighten the captive screw.

Removing Cards From Shelf

To remove cards from the shelf, reverse the installation procedure as follows.

1. Put on a grounded wrist strap. The wrist strap should touch the skin and be grounded through an approximately one-megohm resistor to the terminal block screw labeled GND on the D/I Mux III backplane.
2. Loosen the captive screw at the top of the line card front panel.
3. Pull forward the top of the front panel until it is at right angles from its former position.
4. Slide the unit out of the card slot in the D/I Mux III shelf.
5. Replace line card in a static-shielded bag.
6. Return the front panel to its upright position, and tighten the captive screw.

T1 I/F	UCOM (Opt)	LIU A or T1-2	LIU B or T1-1	CCU or AMCU	STROBE	CS1	CS2	CS3	CS4	CS5	CS6	CS7	CS8	DC PWR	AC/DC PWR

Figure 3-21. 8-Slot Shelves (Front View)
P/N 91620-308 and 91319-608

T1 I/F					DC PWR						AC/DC PWR					
UCOM (Opt)	LIU A or T1-2	LIU B or T1-1	CCU or AMCU	STROBE	CS1	CS2	CS3	CS4	CS5	CS6	CS7	CS8	CS9	CS10	CS11	CS12

Figure 3-22. 12-Slot Shelf (Front View)
P/N 91620-312

T1 I/F	DC PWR		AC/DC PWR	UPPER STROBE	CS 13	CS 14	CS 15	CS 16	CS 17	CS 18	CS 19	CS 20	CS 21	CS 22	CS 23	CS 24
UCOM	LIU A or T1-2	LIU B or T1-1	CCU or AMCU	LOWER STROBE	CS 1	CS 2	CS 3	CS 4	CS 5	CS 6	CS 7	CS 8	CS 9	CS 10	CS 11	CS 12

Figure 3-23. 24-Slot Shelf (Front View)
P/N 91620-324

Strobe Units

The Lower Strobe Unit (P/N 30307-104A) provides strobe timing information for 8-slot shelves, 12-slot shelves, and the lower 12 card slots in a 24-card slot shelf.

The Lower Strobe Unit has eight active option switches (Figure 3-18), any of which can be set for one of the eight preconfigured maps. (*See Appendix D. Preconfigured Maps*.) Select a preconfigured map if there is not a control terminal available for software configuration of the D/I Mux III.

The Upper Strobe Unit (P/N 30307-103) provides strobe timing information for the upper 12 card slots in a 24-slot shelf. The Upper Strobe switches are ignored. Refer to Figure 3-18 for depictions of the Upper and Lower Strobe Units.

In an emergency, an Upper Strobe unit can be converted to a Lower Strobe unit by removing the W1 jumper. A Lower Strobe can be converted into an Upper Strobe by adding the W1 jumper.

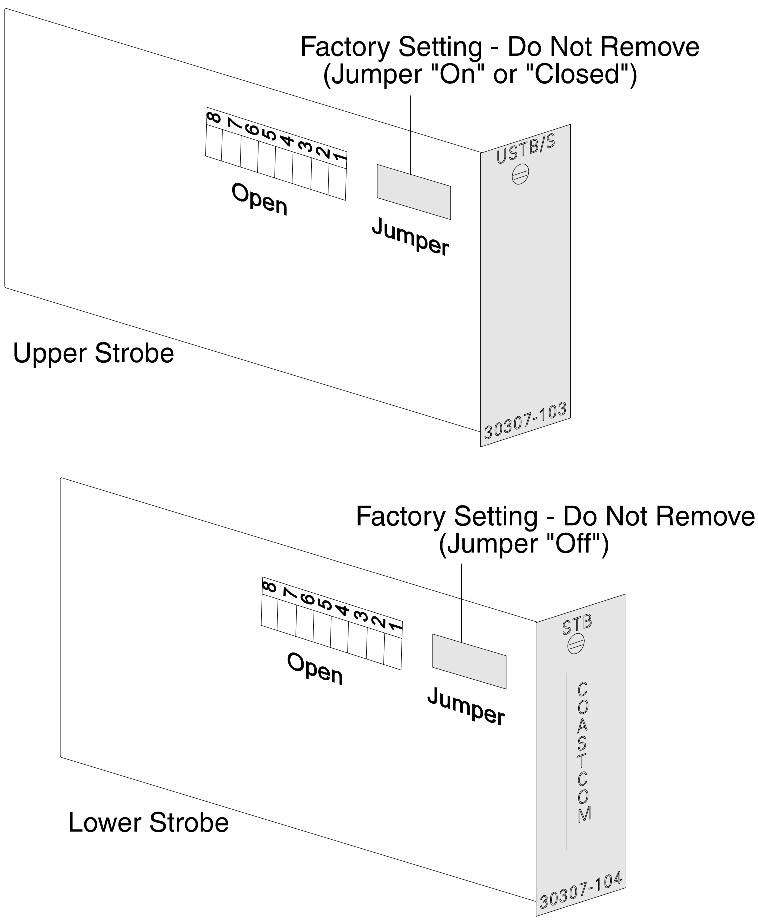


Figure 3-24. Strobe Units (Front and Side Views)
P/N 30307-103 and 30307-104A

Common Control Unit

The Common Control Unit (CCU) is the major logic control for the D/I Mux III system. The CCU directs the other common equipment, and is the link to the system control (COM) port. See Figure 3-19 for a front and side view of the CCU.

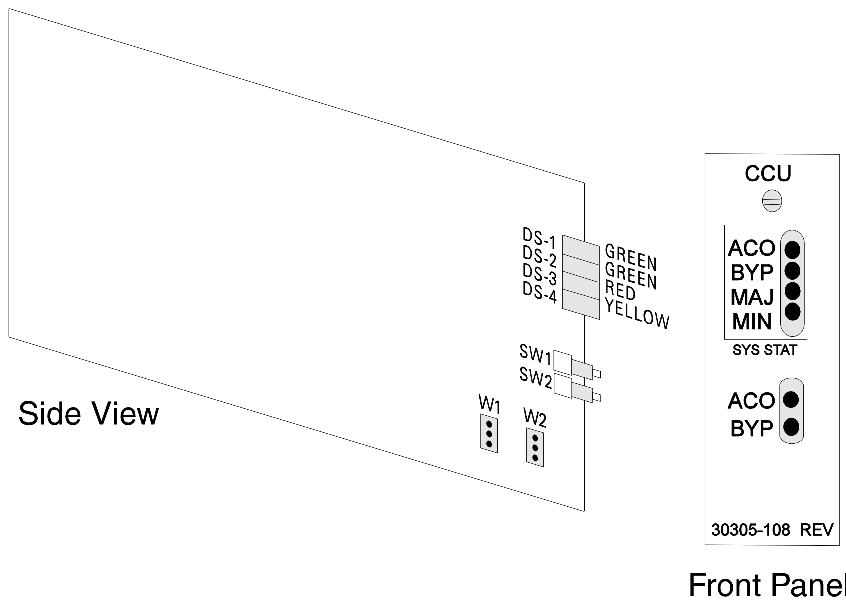


Figure 3-25. Common Control Unit - Front and Side View
(Part Number 30305-106, 30305-108, and 30305-110)

Control Terminal

The D/I Mux III is designed to be controlled with any asynchronous terminal or terminal emulation software. Configuration through the COM port offers many more options, and far greater flexibility, than working with option switches.

Setting the Data Rate and Communications Protocol

The control terminal or device should be set up with the following asynchronous communications protocol when the 1200 bps data rate is selected using jumper **W1**.

- 1200 bps data rate, 8 data bits, 1 stop bit, no parity.

When using Non-Volatile Random Access Memory (NVRAM) for data rate selection, the rate can be changed after communication has been established. It may be easiest to initiate communication at 1200 bps and then move jumper **W1** to the NVRAM position factory default. The same asynchronous communications protocol would be observed for the other data rates of: 300, 2400, 4800, 9600, 19200 bps. For example, to set the data rate to 9600 bps set the terminal to:

- 9600 bps data rate, 8 data bits, 1 stop bit, no parity.

The COM port data rate is stored in NVRAM. The (factory) default data rate in NVRAM is 1200 bps, with CCU jumper **W1** set for software control.

If the data rate is not set, select the bottom two pins of **W1** for software control of the data rate. Otherwise, with jumper **W1** set on the top two pins the data rate is set to a fixed 1200 bps.

Note: Be sure to set the system control terminal to the same data rate as the D/I Mux III.

Jumper **W2** on the CCU board selects which communications protocol is used by the D/I Mux III. With **W2** set to the bottom position, the D/I Mux III is controlled by standard terminals using ASCII code. With **W2** set to the top position the D/I Mux III is controlled with Coastcom proprietary language.

Front Panel LEDs

Front panel Light Emitting Diodes (LEDs) indicate the current status of the CCU. The control terminal of the D/I Mux III will also display the indicator status.

Table 3-5. CCU LED Indicators
(CCU P/N 30305-106, 30305-108, and 30305-110)

Front Panel Label	LED Color	Description
ACO	Green	Alarm Cut-off ON
BYP	Green	Bypass ENABLED
MAJOR	Red	Major Alarm Detected
MINOR	Yellow	Minor Alarm Detected

Advanced Multiplexer Control Unit (AMCU)

The Advanced Multiplexer Control Unit (AMCU) possesses all the functionality of the Common Control Unit (CCU) plus SNMP (Simple Network Management Protocol) network management capability. See Figure 3-20 for an illustration of the AMCU front panel.

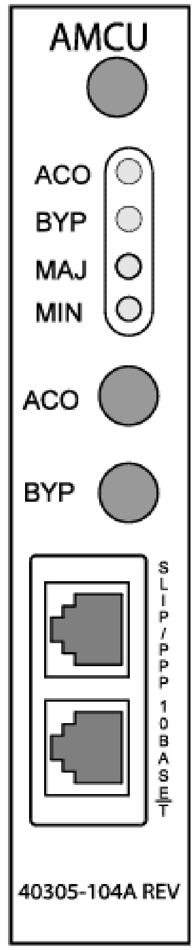


Figure 3-26. Advanced Multiplexer Control Unit - Front Panel

The AMCU is a two-card assembly comprised of a standard CCU board and a 32-bit processor sub-board. The sub-board is required for SNMP capability, and provides the interface between all line cards and the system operator.

LEDs

Four front panel Light Emitting Diodes (LEDs) indicate status during the CCU/AMCU initialization process. The control terminal of the D/I Mux III also displays the indicator status. See Table 3-6 for AMCU LED indications.

Table 3-6. AMCU Front Panel LED Indications

LED Action	Indication
ACO blinks fast	The CCU/AMCU is performing its startup checksum test. For CCU/AMCU code revision levels of 1.4 or higher, this takes approximately 25 seconds. (This checksum test is not run in Feature Group code levels of 8.4/9.4 or higher.)
ACO blinks slowly	When the ACO is blinking at a rate of about once per second, the CCU/AMCU is waiting for special instructions from the AMCU sub-board. In code levels of 8.4/9.4 or higher this LED state indicates that the EPROMs have not been programmed properly.
ACO blinks rapidly	The CCU/AMCU is erasing FLASH RAM.
ACO alternates with MAJ	The CCU/AMCU is downloading new code from the AMCU sub-board. The MAJOR LED is ON during the transfer of a section of code and the ACO LED is ON while FLASH RAM is being programmed.
MAJ blinks slowly	The CCU/AMCU is either uploading or downloading memory. After the memory transfer has completed, the MAJOR LED will return to its original state.
ACO solid on	Alarm Cut-Off has been activated either by the front panel button, or remotely through the user interface.
BYP solid on	The multiplexer is being bypassed.
MAJ solid on	There is a major alarm.
MIN solid on	There is a minor alarm.

Backplane

The AMCU backplane interface provides the physical connections for the RS-485 half-duplex provisioning bus and the control terminal asynchronous serial channels. Power for the AMCU is also delivered through the backplane.

> **Caution!**
>
> While the AMCU connects to the backplane via the standard 56-pin card edge connector, care must be taken to ensure that the MCU is inserted only into the slot marked "CCU or AMCU." If the AMCU is plugged into the wrong slot, or if a line card is inadvertently plugged into the "CCU or AMCU" slot, damage is likely to occur.

Provisioning Bus

The provisioning bus serial interface is used to provision and control all the cards in the shelf.

COM Port

The COM port is an RS-232 asynchronous interface capable of standard data rate speeds of between 1200 bps and 19200 bps. The port is used by the system operator to configure and control, or poll, status and alarms from any of the cards.

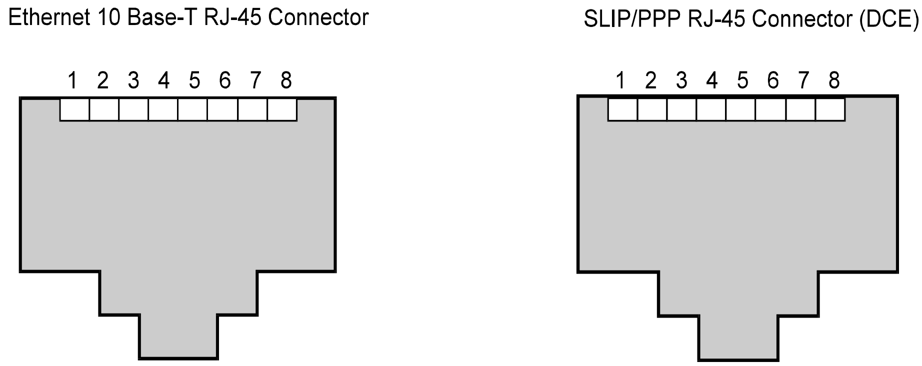
Ethernet 10Base-T Port

The high speed Ethernet 10Base-T port allows an SNMP manager, or Telnet connection (locally or via a router), to communicate with the D/I Mux III. (See also *Chapter 4. Configuration and Operation*, for more information.)

SLIP/PPP Port

The Serial Line Internet Protocol/Point-to-Point Protocol (SLIP/PPP) asynchronous connection provides the option of selecting either Ethernet or SLIP network messaging. As described in *Chapter 1. System Overview and Modes of Operation*, SLIP replaces the Ethernet where LANs are absent.

See Figure 3-21 for pin-out of Ethernet 10Base-T and SLIP/PPP ports.



Ethernet 10 Base-T	SLIP/PPP
1 - TD+	1 - RTS
2 - TD-	2 - DTR
3 - RD+	3 - TXD
4 - NC	4 - DSR
5 - NC	5 - RXD
6 - RD-	6 - GRD
7 - NC	7 - DCD
8 - NC	8 - CTS

Figure 3-27. Ethernet and SLIP/PPP Port Pin-Outs

Line Interface Units

The Line Interface Units (LIUs) give the D/I Mux III Channel Bank, Drop-and-Insert, and Dual Channel Bank (DCB) capabilities when used in conjunction with the CCU/AMCU. The LIUs select T1 line coding, framing, and alarm options. Select the options through software whenever possible. Use the LIU switches when a control terminal is not available.

See Tables 3-7 and 3-8 for lists of LIU front panel LED indicators and DIP switches.

Table 3-7. LIU LED Indicators
P/N 30309-104A and 30309-114A

Front Panel Label	LED Color	Description
LOC	Red	Local alarm, T1 framing or input signal lost
YEL	Yellow	Remote alarm, T1 remote alarm received
CGA	Yellow	Carrier Group Alarm, carrier taken off-line
FRM	Red	Receiving framing errors
B7	Green	Bit 7 stuffing selected
BPV	Yellow	Receiving excessive Bipolar Violations
0-DEN	Red	Receiving more than 32 consecutive zeros
AIS	Red	Receiving unframed all ones
RX	Red	Network loop code Received
TX	Yellow	Network loop code Transmitted

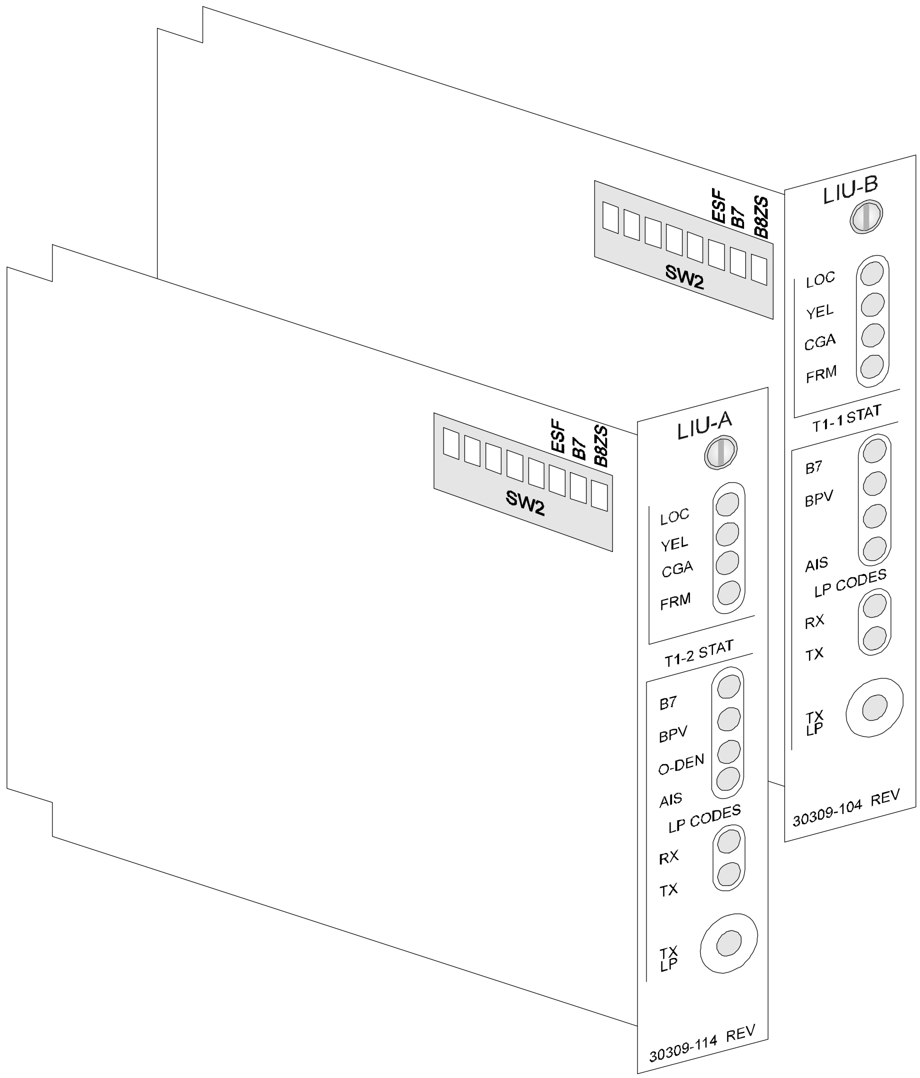


Figure 3-28. Line Interface Units (Front and Side Views)
P/N 30309-104A and 30309-114A

LIU Option Switches

On an option switch power-up, the D/I Mux III is configured from the option switches on LIU A. Use Figure 3-22 (above) and Table 3-8 (on the following page) to set operation with the option switches. (Coastcom recommends configuring both LIUs with the same settings.)

Table 3-8. LIU DIP Switch (SW2) Selections
P/N 30309-104A and 30309-114A

SW2 Switch Segment	Designation	Selection	Description
1	B8ZS	Open	B8ZS line coding
		Closed	Transparent line coding
2	B7	Open	B7 line coding
		Closed	Transparent line coding
3	ESF	Open	ESF framing
		Closed	SF framing
4*	TIM	Closed	Loop timing
Channel Bank, Dual Channel Bank, and ALPS modes		Open	Local timing
4*	TIM	Closed	Network timing from T1-2
Drop/Insert mode		Open	Network timing from T1-1
5	DCB	Open	Dual Channel Bank mode
		Closed	No effect
6	CHN	Open	Channel Bank mode
		Closed	Drop/ Insert mode
7	YEL	Open	Pass through yellow alarm
		Closed	Block yellow alarm
8	ALPS	Open	ALPS mode
		Closed	No effect

* Switch SW2-4 will perform a different function depending on the multiplexer mode selection as determined by switch segments 5, 6, and 7.

The D/I Mux III has Non-Volatile Random Access Memory (NVRAM) allowing the LIUs to be software-configured. System configuration on a power-up can be accomplished with the System Configuration (**SC)** command. Refer to *Chapter 4. Configuration and Operation* for more information on the **SC** command.

T1 Interfaces

The two types of T1 interface that can be used in a D/I Mux III system include the Dual DSX-1 Interface, which transmits and receives a basic DSX-1 signal, and the Dual CSU Interface which allows the D/I Mux III to perform the functions of a Channel Service Unit (CSU).

Dual Standard or Enhanced DSX-1 Interfaces (No CSU Function)

The Dual Standard DSX-1 Interface, Model 30118-101, or the Dual Enhanced DSX-1 Interface, Models 30118-102 and 30118-112, interconnect the incoming and outgoing T1 streams of the D/I Mux III. The units also provide signal conditioning to compensate for the variations in cable lengths between the D/I Mux III and the DSX-1 cross-connect point or T1 transmission equipment.

There are no switches for Model 30118-101; equalization is fixed for 150 ft or less.

On Models 30118-102 and 30118-122, switches SW1 and SW2 set equalization for the following cable lengths: 0 - 150 ft, 150 - 450 ft, 450 - 750 ft.

The Dual DSX-1 Interfaces are "hardware only" cards and cannot communicate with D/I Mux III control software. An installed Dual DSX-1 Interface will appear to the system software as an empty card slot.

> **Note**: Neither the standard nor the enhanced version of the DSX-1 Interface is designed to be connected to outside plant T1 span lines. Model 30118-122 is configured exclusively for use with the -24 V power supply possible damaging channel cards.

Select the cable equalization based on the distance to the DSX-1 cross-connect point, or T1 transmission equipment. See Figure 3-23 for more information on the switch selection.

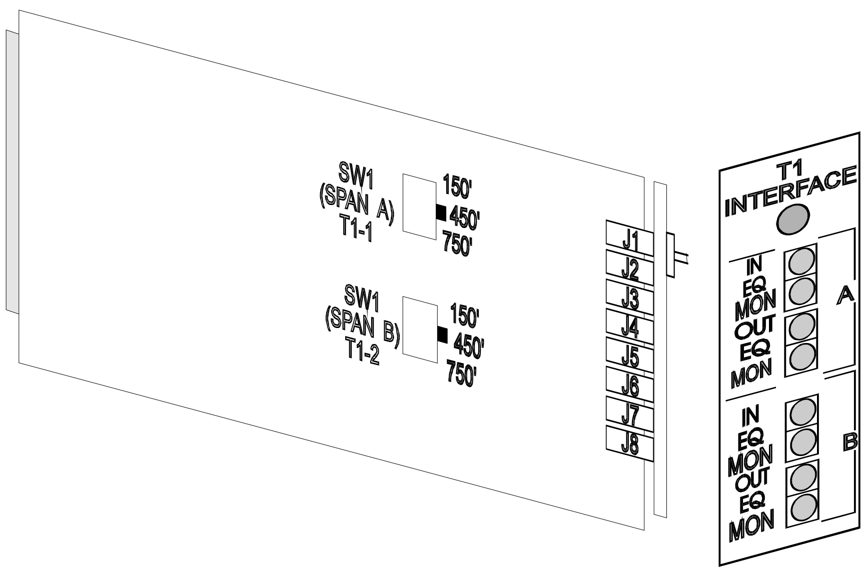


Figure 3-29. Dual Enhanced DSX-1 Interface (Front and Side Views)

Dual CSU Interface

The Dual CSU Interface offers a T1 interface, or a DSX-1 interface, with special test loopback capabilities between the T1 transmission line and the equipment. It is available in three versions.

- P/N 30318-101 with interface T1 (T1-1) and DSX-1 (T1-2)
- P/N 30318-102 with two DSX-1 interfaces
- P/N 30318-103 with two T1 interfaces

The Line Build-Out (LBO) for T1, and/or equalizer for DSX-1 circuits, maintains correct bipolar waveforms and levels on the transmit side. The T1 LBO settings are 0, -7.5, or -15 dB. The DSX-1 equalizer settings are 150 ft., 450 ft, or 750 ft.

Switch **SW1** (T1-1) on Model 30318-101 allows the unit to be adjusted to the length of cable between the Dual CSU Interface Unit and the next repeater. Switch **SW2** (T1-2) is used for equalizing the cable length to the local device termination.

Switches **SW1** (T1-1) and **SW2** (T1-2) on Model 30318-102 are used for equalizing the cable lengths to local device terminations.

Switches **SW1** (T1-1) and **SW2** (T1-2) on Model 30318-103 allow the unit to be adjusted to the length of cable between the Dual CSU Interface and the repeaters in both directions.

Jumpers **W1** and **W2** on the main circuit board will either loop span power back toward the span power source (when the jumpers are in the vertical position), or will bypass the span power around the D/I Mux III (when the jumpers are in the default, or horizontal, position).

WARNING!
Be sure to plug the Dual CSU Interface into its designated slot. Inadvertently plugging it into other than its own slot will damage the unit.

Install the Dual CSU Interface unit by performing the following steps in the order given.

1. To set the LBO attenuator for the proper T1 level, first contact the local carrier for line level requirements, then set the LBO switch accordingly, normally 0 dB. (Use -7.5 dB when connecting a T1 LBO interface to a local PBX that is closer than 500 feet.)
2. To set the DSX-1 EQL attenuator for the proper DS1 level, first determine the length of the connecting cable, then set the equalization switch accordingly.
3. To set jumpers **W1** and **W2** for span power loop mode (bypass mode is the default set by the factory), use needlenose pliers to position jumpers **W1** and **W2** vertically for *LOOP* mode. The span power will be looped back to the span power source. Otherwise, jumpers **W1** and **W2** are positioned horizontally for *BYPASS* mode; the span power will bypass the D/I Mux III.
4. Install the Dual CSU Interface.

CAUTION!

The Dual CSU Interface should not be unplugged after initial installation. Notify the local Telco before disconnecting this unit, or changing any switch settings. Refer to the *FCC* and *Telephone Company Requirements and Procedures* section, preceding the *Table of Contents* in this manual for further information.

Refer to Figure 3-24 for front and side views of the Dual CSU Interface Unit.

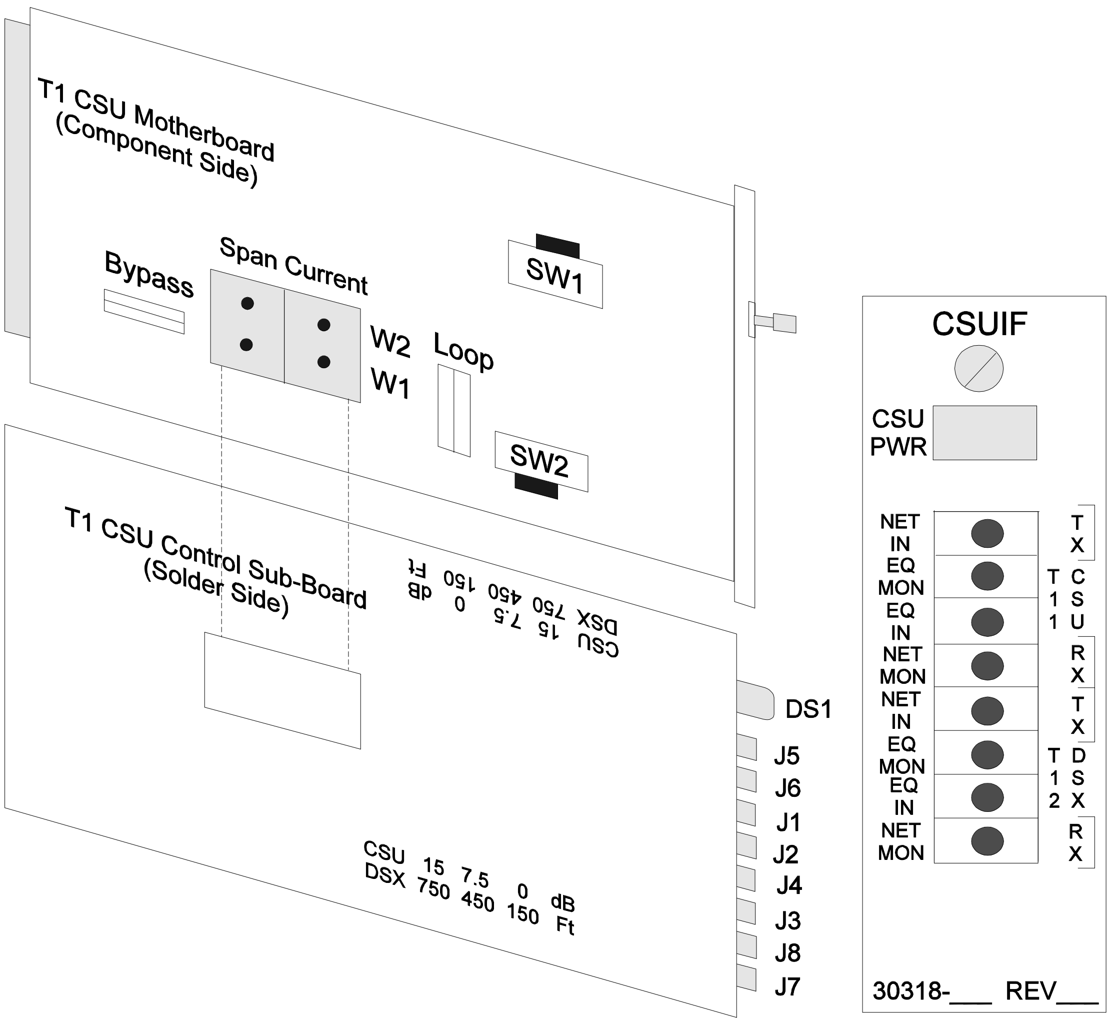


Figure 3-30. Dual CSU Interface (Front and Side Views)
P/N 30318-101/102/103

Power Supply

Power supplies should be the final common equipment items to be installed. This minimizes the occurrence of power surges, and the risk of powering up other common equipment incorrectly and prematurely. Line cards are less sensitive to power surges, and are usually installed after the system is powered, and the T1 is operating normally.

Tables 3-12, 3-13, and 3-14 summarize the power capabilities, and power consumption, of the D/I Mux III for the different power supplies available. Shown in the tables are examples of the maximum number of any particular type of line card that can be used with different power configurations. For systems with a combination of different cards, with one type of line card approaching its power limitations, contact Coastcom's Applications Engineering group for a power requirements evaluation.

Except where noted, the power matrix tables are for all D/I Mux III shelves in a nominal 0°- 50° C environment. Common equipment power consumption is taken into account. (See individual line card user manuals for specific information.)

Heat Considerations

AC and DC powered shelves should have one rack mount space clearance above and below AC/DC powered shelves. The shelves are air cooled and if the air flow is blocked, a component failure could occur.

Table 3-12. Maximum Data Line Cards Power Matrix for 24-Slot Shelf

Line Cards	110 V Smart AC Power Supply 30308-102	AC/DC Power Supplies 30315-105 & 30338-103	-48 V Redundant DC Power Supply 30338-102 1 Unit or 2 Redundant	-48 V Redundant DC Power Supply 30338-102 2 Non-Redundant	-24 V Redundant DC Power Supply 30314-101 1 Unit or 2 Redundant
SDCU with V.35 Interface, 30251-, 30252- and 30351-XX1 or XX3	8	18	24	24	24
SDCU with RS-422 Interface, 30251-, 30252-, and 30351-XX1 or XX3	24	18	24	24	24
DSDCU with V.35 Interface, 30451-101	8	8	24	24	24
DSDCU with RS-422 Interface, 30451-101	24	18	24	24	24
DSDCU with RS-232C Interface, 30451-101	18	18	18	24	18
SDM, *p*SDM 30355-XXX	12 (24 Opt*)	10 (20 Opt**)	12 (24 Opt*)	24	12 (24 Opt*)
OCUDP 30358-106/107/108	24	24	24	24	24
Async DCU 30011-1XX	24	18	24	24	24
Async DCU 30011-0XX	8	16	24	24	24
DSUDP 30358-101	8	18	24	24	24

- Full configuration for the SDM product is defined as operating with five fully utilized subrate channels per DS0 with all five RS-232C drivers active per subrate channel. This totals 25 RS-232C drivers active on an SDM line card. If an application is such that half as many (or less) RS-232C drivers are needed, then twice the number of SDM line cards can be powered, as shown in the parentheses as an "Optional" amount.

Table 3-13. Maximum Voice Line Cards Power Matrix for 24-Slot Shelf

Line cards	110 V Smart AC Power Supply 30308-102	AC/DC Power Supplies 30315-105 & 30338-103	-48 V Redundant DC Power Supply 30338-102 1 Unit or 2 Redundant	-48 V Redundant DC Power Supply 30338-102 2 Non-Redundant	-24 V Redundant DC Power Supply 30314-101 1 Unit or 2 Redundant
Dual 2W FXS 33242-XX4 (with cadenced ringing)	24	24	24*	24*	24*
Dual 2W FXO 33242-XX5	24	24	24	24	24
Dual 4W E/M 33245-XXX	24	24	24	24	24
DPC Transmit 32405-XXX	5	8	8	8	Not Available
DPC Receive 32406-XXX	8	8	8	8	Not Available
ADPCM 30245-1XX	16	12	16	24	16
Smart Omni-Orderwire 30313-XXX	24	24	24*	24*	24*
MXO 33243-105	24	18	24	24	24
MXS 33243-104	24	18	24	24	24

* DC power supplies do not have internal ringing generators. An external ringing generator is required for FXS and Smart Omni-Orderwire operation.

Table 3-14. Nominal/Maximum Power Consumption Matrix (W/BTUs)**

Chassis		Shelf Fully Outfitted (Nominal)			Shelf Fully Outfitted (Maximum)		
(Slot)	Voltage	A	W	BTU/Hr	A*	W	BTU/Hr
8	110 V AC	0.54	65	222	0.75	90	307
12	110 V AC	0.67	80	273	1.00	120	410
24	110 V AC	1.04	125	427	1.50	180	614
8	-48 V DC	1.25	60	205	1.77	85	290
12	-48 V DC	1.56	75	256	2.40	115	393
24	-48 V DC	2.50	120	410	4.16	200	683
8	-24 V DC	2.50	60	205	3.54	85	290
12	-24 V DC	3.12	75	256	4.80	115	393
24	-24 V DC	5.00	120	410	8.32	200	683

* *Fusing Considerations*: Fuse the main power to the selected shelf size at 150% of the maximum amperage indicated in the column labeled "A" above. To allow for inrush current, select a slow-blowing fuse.

** Total power consumption depends on card type used in channel unit slots. *Nominal* refers to a fully outfitted shelf with a typical combination of voice and data channel units. *Maximum* refers to a fully outfitted shelf with high consumption data channel units. Maximum quiescent current for DC powered shelves includes consumption of redundant power supplies.

-48 V DC Power Unit (P/N 30338-102 and 30338-902)

Two -48 V DC power supplies can be used to provide redundancy; the additional power supply plugs into a designated slot next to the first power supply. With redundancy, both power supplies share the load; if one fails, the other assumes the full load. Either power supply can be inserted or removed without interrupting service.

Test Points, Indicators, and Fuses

Front panel test points are available to monitor the various power input and output levels. Three fuses are included with the -48 V DC power supply: Primary Power (**-48 DC**), Signal Battery (**-48 SB**), and Alarm Battery (**-48 AB**). The **ON** LED indicator operates whenever -48 V DC is supplied to the unit regardless of fuse or failure conditions. The **FAIL** LED indicator illuminates when any power output is out of tolerance, or if a fuse is in overcurrent protection mode.

Table 3-15. Power Supply Fuses
(P/N 30338-102)

Fuse Designation	Amperage	Color	Power Supply Designation
GMT 1	1	Gray	-48 AB
GMT 3	3	Blue	-48 SB
GMT 4	4	White/Brown	-48 DC

-48 V DC Power Supply Installation (P/N 30338-902)

Note: Do **not** fully seat the power supply until wiring and other common equipment is in place.

Following is the procedure for installing the -48 V DC Power Unit.

1. Place one DC Power Unit into the appropriate card slot for the shelf being powered as follows:
   - **8-slot:** Card slot marked **DC PWR**, the second from the right card slot
   - **12-Slot:** Card slot marked **DC PWR**, the top middle horizontal slot, the bottom of the card toward the left of the shelf
   - **24-Slot:** Card slot marked **DC PWR**, second card slot from the left on the upper shelf
2. If a second DC Power Unit is to be used, place it in the second power supply card slot as follows:
   - **8-slot:** Card slot marked **AC/DC PWR**, the first from the right card slot
   - **12-Slot:** Card slot marked **AC/DC PWR**, the top right slot, the bottom of the card toward the left of the shelf
   - **24-Slot:** Card slot marked **AC/DC PWR**, first card slot from the left on the upper shelf

110 V AC Power Unit

Using the 30315-505 AC power supply simplifies installation of D/I Mux III at customer premises. This unit is a self-contained single-slot power supply that provides all of the voltages necessary to operate a D/I Mux III - except ringing voltage. When configured with FXS feature cards, order modular Ringing Generator 30333-101. Provides +/-12, +/-5, and -48. Can be used in 8, 12 and 24-slot shelves. Replaces a 30308-102A and the combination option of 30315-105A with 30338-103A. *Cannot be used in combination with any other power supply.*

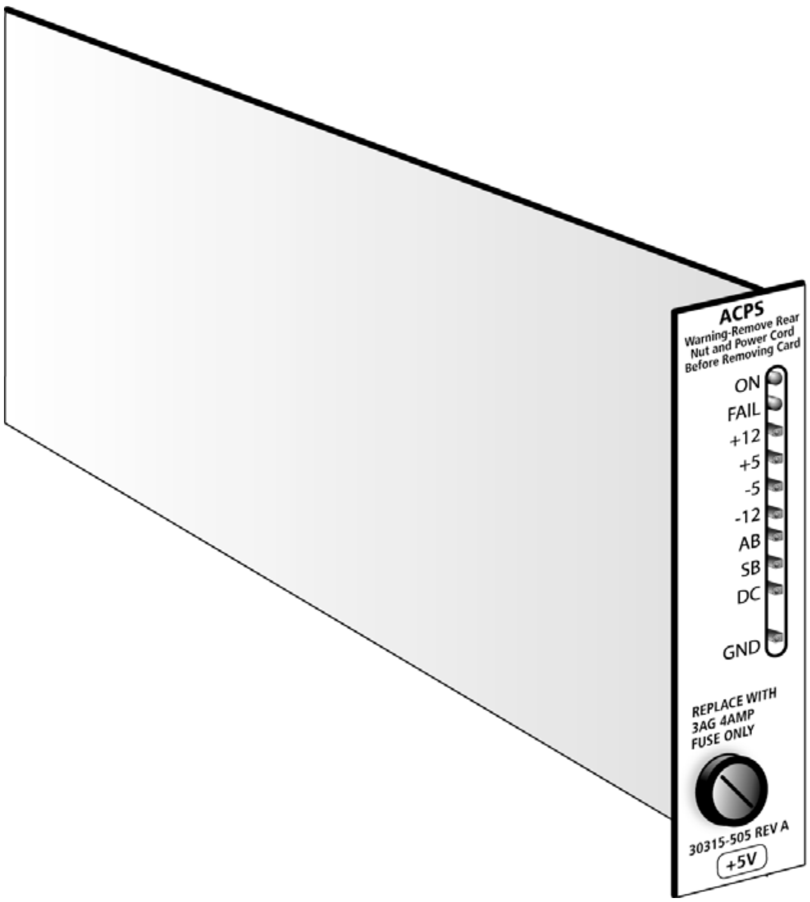


Figure 3-31. 110 V AC Power Supply (Front and Side Views)

110 V AC Power Supply Installation

Following is the procedure for installing the 110 V AC power supply. Follow the steps in the order given. Refer to Figure 3-25 for jumper locations on the power unit.

1. Remove any nut which may be attached to the back of the power supply, or on the grounding lug which may have been installed there for shipping purposes.
2. Slide the power supply into the AC/DC PWR slot until the card's edge firmly engages the connector fingers. The slot will have a rectangular opening for the cord to fasten through the backplane, and a hole for the grounding lug. Install the card as follows:

- **8-Slot:** Card slot marked AC/DC PWR, the first from the right card slot
- **12-Slot:** Card slot marked AC/DC PWR, the top right slot, the bottom of the card toward the left of the shelf
- **24-Slot:** Card slot marked AC/DC PWR, third card slot from the left on the upper shelf

3. Install the #10-32 ground nut previously removed in Step 2, or packed loosely on the lug at the rear of the system. Tighten the nut to secure grounding, but do not tighten excessively. Excessive tightening can damage the backplane, connector, and bracket on the supply.
4. Complete the common equipment installation and cabling before powering up the system.
5. The AC power is connected through the rear of the unit with a standard IEC line cord (supplied with the unit). Connect the line cord through the opening in the backplane to the supply.
6. Connect the plug end of the line cord to a 110 V AC, 50-60 Hz properly grounded source.
7. Ensure that the terminal block's protective covers are in place after installation. Voltages are marked on the terminal block’s terminals.
8. Observe that the green indicator is lit. If the red indicator is lit, the supply or the system has a fault which must be cleared.

Removal of the 110 V AC Power Supply

The following is the procedure for removing the 110 V AC Power Unit.

1. Remove the line cord plug from the 110 V AC source and unplug the cord from the back of the system.
2. Remove the grounding lug nut at the rear of the system near the rectangular opening for the line cord.
3. Gently tap or push the grounding stud at the rear of the system with a nut driver handle, malleable handle, or a piece of wood to remove the supply.
4. After removing the power supply from the slot, refasten the nut removed in Step 2 back onto the lug. Gently tighten the nut.
5. Place the power supply in a static-shielded bag.

Smart 110 V AC Power Supply (P/N 30308-102) (this product has been put on “end-of-life” status)

The older model 110 V AC Power Supply (P/N 30308-102) is a fully self-contained unit that provides all of the voltages necessary to operate any type of D/I Mux III configuration. It operates from 110 V commercial AC power. The Smart AC Power Supply has seven regulated voltage outputs. Each output will recover automatically from overload or short circuit conditions. It has a smart interface with the D/I Mux III CCU/AMCU, and can be monitored locally or remotely for performance parameters.

When installed, the Smart 110 V AC Power Supply occupies both vertical power supply slots of a D/I Mux III shelf. It cannot be used in a D/I Mux III 12-slot shelf because the physical layout requires two adjacent power supply card slots.

Test Points, Indicators and Fuses

The front panel has green LEDs to indicate the presence of primary power and ringing voltage, and a red LED to indicate unit failure.

Seven tip jack test points are accessible from the front panel to monitor the power supply outputs. Each test point is protected by a short circuit resistor. To obtain accurate voltage readings, use a high impedance AC/DC voltmeter.

The primary AC power is internally fused. The shelf's -48 V signalling battery supply is protected by a front panel user-replaceable 3AG type glass fuse.

Smart Interface

The 30308-102 Smart Interface consists of a microcontroller, a watchdog timer, a provisioning bus interface, an analog-to-digital converter with a companion voltage reference, and a programmable memory that retains unit identification information. Each power supply output is measured and reported to the CCU/MCU. The system operator can monitor each power supply output voltage from the system control terminal. This information, in conjunction with an alarm report from the D/I Mux III, can be used to isolate and correct system problems.

Power Supply Failure and Minor Alarm

An isolated, normally open pair of relay contacts on the rear of the multiplexer shelf, labeled as Minor Alarm connections, are controlled by the Smart Interface. These contacts can also be closed by a command from the CCU/MCU indicating a Minor Alarm condition. (The power supply illuminates the red Major LED, and closes these contacts when an output voltage is out of tolerance.) Power supply failure is also reported to the CCU/MCU. If the failure is not related to the supply voltages for the CCU/MCU, the Smart Interface will continue to display information.

To maintain compatibility with earlier D/I Mux III systems, the Smart Interface also responds to polling requests from CCUs/MCUs with earlier system control software. The same features are supported, except that earlier software does not support control terminal display of individual output voltages.

Smart 110V Power Supply Installation

Following is the procedure for installing the Smart 110 V AC power supply. Follow the steps in the order given. Refer to Figure 3-26 for jumper locations on the power unit.

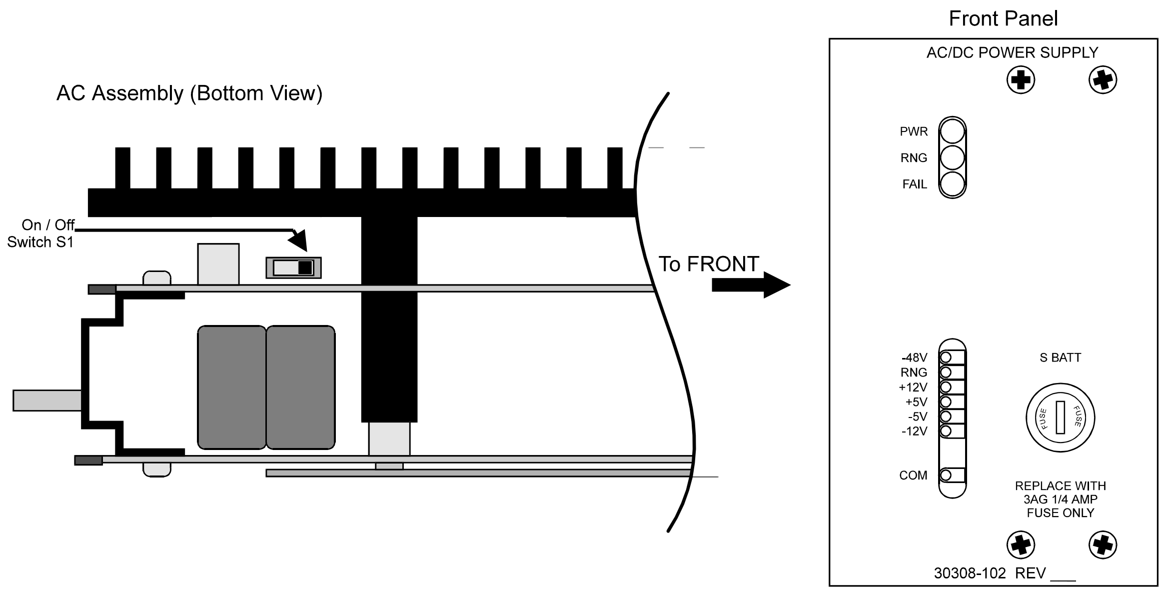


Figure 3-32. Smart 110 V AC Power Unit
(Front Panel and Bottom View)

1. Set Switch S1 to enable or disable the Ringing Generator as desired. The switch is located on the bottom of the assembly, as illustrated in Figure 3-26.
2. Remove any nut that may be attached to the back of the supply, or on the grounding lug, which may have been installed there for shipping purposes.
3. Slide the Smart 110V Power Supply (P/N 30308-102) into the power supply slots until the card's edge firmly engages the connector fingers. The slots have a rectangular opening for the cord to fasten through the backplane, and a hole for the grounding lug. The Smart 110V Power Supply occupies both power supply positions.
4. Install the #10-32 ground nut previously removed in step 2 above, or packed loosely on the lug at the rear of the system. Tighten the lug to secure grounding, but do not tighten excessively. Excessive tightening could damage the backplane, connector, and bracket on the supply.
5. Complete common equipment installation and cabling before powering up the system.
6. The AC power is connected through the rear of the unit with a standard IEC line cord (supplied with the unit). Connect the line cord to the power supply through the opening in the backplane.
7. Connect the plug end of the line cord to a 110 V AC, 50-60 Hz properly grounded source.

8. Ensure that the terminal block's protective covers are in place after installation. Voltages will be marked on the terminal blocks.

> **WARNING!**
>
> The ringer provides a constantly accessible 95 V AC on the backplane, so use caution whenever the system is powered.

9. Observe that the green indicator is lit. If the red indicator is lit, the supply or the system has a fault that must be cleared. In the event of a failure, examine the fuses.

Removal of the Smart 110 V AC Power Supply

The following is the procedure for removing the Smart 110 V Power Supply.

1. Remove the line cord plug from the 110 V AC source and unplug the cord from the back of the system.
2. Remove the nut from the back of the grounding lug at the rear of the system near the rectangular opening for the line cord.
3. Gently tap or push the grounding stud at the rear of the system with a nut driver handle, malleable handle, or a piece of wood to remove the supply.
4. After removing the supply from the slot, refasten the nut removed in step 2 onto the lug. Gently tighten the nut.
5. Replace the power supply in a static-shielded bag.

Transmission Connection

With all the cabling and common equipment installed, the system can now begin to operate in the T1 network. Work closely with the T1 carrier company at this point to make sure compatible line coding and framing methods are being used by all parties.

Cable

The control cable for the D/I Mux III is a standard RS-232C straight-through cable (pin 1 to pin 1, pin 2 to pin 2, refer to Figure 3-27 for details). Connect one side of the cable into the COM port of the D/I Mux III, and the other side into the control terminal. When using a personal computer and terminal emulation software package to control the D/I Mux III, the RS-232C cable connectors are both female.

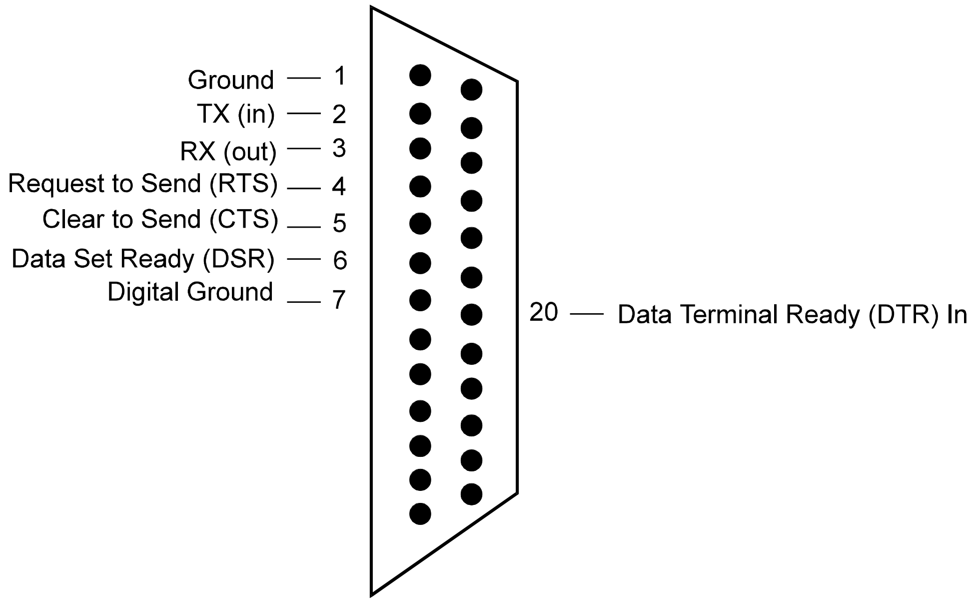


Figure 3-33. D/I Mux III RS-232C DCE Male COM Port

Line Card Installation

When all common equipment has been installed, and is operating normally, install line cards according to the appropriate individual line card user manuals.

System Power-Up and Initialization

After installing all common equipment and line cards as directed in this user's manual, and in applicable line card user manuals, apply power to the D/I Mux III shelf. Feature Group 8.4/9.4/1.4 includes a power-up cycle that features a 25-second self-test, and a 20-second initialization routine (including warm-up). During the self-test, the CCU/AMCU/MCU **ACO** LED flickers, and the **BYP** LED remains lit. Upon completion of self-test, the initialization routine begins, during which the LIU LEDs cycle on and off.

Note: Depressing the **BYP** button during power-up causes the CCU/MCU to "bypass" the checksum test.

Configuring the D/I Mux III System

Refer to *Chapter 4. Configuration and Operation* for information on D/I Mux III software configuration.

Chapter 4. CONFIGURATION AND OPERATION

This chapter describes how to configure the D/I Mux III after the hardware has been installed. The chapter is divided into three sections as follows:

- The Overall System Command Organization, with figure number references, is listed in Figure 4-1.
- The Setup and Programming Order lists the local and network commands in a functional sequence; figure numbers are referenced for detail on the various commands.
- A Command Index, listed alphabetically, includes actual screen, instructions as necessary, and a discussion of commands and resulting operation.

```
CCU System Access Screen - Figure 4-2
AC (Access CCU - D/I Mux III User Submenu) - Figure 4-6
│
├──Shelf Configuration
│      DC  (Display Shelf Configuration) - Figure 4-11
│      SC  (Set Shelf Configuration) - Figure 4-44
├──System Parameters
│      DV  (Display Smart AC PS if used) - Figure 4-21
│      SR  (Set Communications Rate) - Figure 4-61
│      SP  (Set System Parameters) - Figure 4-60
│      DP  (Display System Parameters) - Figure 4-18
├──Line Cards
│      DL  (Display Table) - Figure 4-14
│      CL  (Copy Line Card Configuration) - Figure 4-8
│      DD  (Display Line Card Configuration) - Figure 4-12
│      SL  (Set Line Card Configuration) - Figure 4-53
├──Map Matrix
│      DM  (Display Map Matrix) - Figure 4-15
│      SM  (Set/Edit Map Matrix) - Figure 4-54
│      CM  (Copy Map Matrix) - Figure 4-9
├──Map Table
│      DT  (Display Map Table) - Figure 4-20
│      ST  (Set/Edit Map Table) - Figure 4-64
│      DN  (Display Working Map) - Figure 4-17
│      SN  (Set Working Map) - Figure 4-58
├──Clock Source
│      DS  (Display Clock Source) - Figure 4-19
│      SS  (Set Clock Source) - Figure 4-62
├──Performance
│      PM  (FDL Monitor) - Figure 4-37
│      DH  (Display Alarm History) - Figure 4-13
│      SB  (Set Error Rate) - Figure 4-41
│      ZH  (Clear Alarm History) - Figure 4-71
├──Passwords
│      LO  (Logout—Returns to MCU Main Menu) - Figure 4-24
│      DW  (Display Passwords) - Figure 4-22
│      SW  (Set/Install Passwords) - Figure 4-65
│      EW  (Erase Passwords) - Figure 4-23
├──Alarms
│      DA  (Display Alarms) - Figure 4-10
│      ZA  (Clear Counts) - Figure 4-70
│      SO  (Set Communications Reports) - Figure 4-59
└──Diagnostics
                    OL  (Line Card) - Figure 4-34
                    OD  (T1-CSU) - Figure 4-33
MCU Main Menu - Figures 4-3, 4-4, 4-5
                    │
                    ├──Local Parameters
                    │      VR  (View Revision Levels) - Figure 4-69
                    │      MT  (Modify Keyboard Time-Out) - Figure 4-32
                    ├──Network Parameters
                    │      VN  (View Network Parameters) - Figure 4-67
                    │      MG  (Modify Default Gateway) - Figure 4-26
                    │      MI  (Modify IP Address) - Figure 4-27
                    │      MS  (Modify Subnet Mask) - Figure 4-31
                    │      ML  (Modify SLIP Parameters) Figure 4-28
                    ├───Code Download
                    │      MC  (Download CCU Program) - Figure 4-25
                    ├───Passwords
                    │      VP  (View Passwords) - Figure 4-68
                    │      MP  (Modify/Install Passwords) - Figure 4-30
                    │      RP  (Remove Passwords) - Figure 4-40
                    │      Q   (Quit/Disconnect) - Figure 4-38
                    ├─SNMP Manager Configuration
                    |      VM  (View Manager) - Figure 4-66
                    |      MM  (Modify/Install Managers) - Figure 4-29
                    |      RM  (Remove Manager) - Figure 4-39
```

Figure 4-1. Overall System Command Organization

Setup and Programming Order

This section lists the programming commands in the order recommended for configuration and operation of the network and local systems. The two letter commands, and appropriate reference figure numbers, are included.

If this is the first time the shelf is to be programmed, or if it needs to be reset to factory defaults, do an NVRAM clear.

To do an NVRAM clear, perform the following steps:

1. Power down the shelf.
2. Press both the Alarm Cut-Off (**ACO**) and Bypass (**BYP**) buttons (located on the CCU/MCU front panel).
3. Power-up the shelf while continuing to press the **ACO** and **BYP** buttons.
4. After 60 seconds, release the two buttons.

The shelf is now set to 1200 bps data rate and all the settings are factory default settings.

The logical programming order for the CCU is as follows.

1. Access CCU - D/I Mux III user submenu (**AC**) - Figure 4-6
2. Set communication Rate (**SR**) - Figure 4-61
3. Set shelf Configuration (**SC**) - Figure 4-44
4. Set system Parameters (**SP**) - Figure 4-60
5. Set Line card configuration (**SL**) - Figure 4-53
6. Set/edit a Map matrix (**SM**) - Figure 4-54
7. Set/edit a map Table (**ST**) - Figure 4-64
8. Set the New working map (**SN**) - Figure 4-58
9. Set clock Source (**SS**) - Figure 4-62
10. Select (Performance) operation options - if using a Facility Data Link Processor (FDLP) (**PM**) - Figure 4-37
11. Set the passWords (**SW**) - Figure 4-65
12. Set alarm report Options (**SO**) - Figure 4-59

For the MCU, the logical programming order for both the local and network parameters is as follows:

1. View Network parameters (**VN**) - Figure 4-67
2. Modify/set IP Address (**MI**) - Figure 4-27
3. Modify/set Subnet Mask (**MS**) - Figure 4-31
4. Modify/set Gateway IP Address (**MG**) - Figure 4-26
5. Modify/set SLIP parameters (**ML**) - Figure 4-28
6. Modify/set keyboard Time-out (**MT**) - Figure 4-32
7. View Manager configuration (**VM**) - Figure 4-66
8. Remove (erase) default Manager (if necessary) (**RM**) - Figure 4-39

9. Modify default Manager (**MM**) - Figure 4-29

Screen Display and Data Entry

Configure the system through use of an asynchronous ASCII terminal (or equivalent) connected to the D/I Mux III. Configuration settings are stored in Non-Volatile Random Access Memory (NVRAM) on the CCU, and may be used to reconfigure the system if there is power loss. The stored settings also allow replacement line cards plugged into the same slot as the card removed to be automatically configured upon installation.

Note:	On an NVRAM startup, all passwords, along with **ALL** other system configuration parameters are erased. While an NVRAM startup allows entry that a lost password might otherwise disallow, it is a last resort measure because of the complete erase feature! An NVRAM startup is accomplished by powering-up the CCU/MCU with both the Alarm Cut-Off (**ACO)** and the (**BYP**) Bypass buttons simultaneously depressed and held for 60 seconds.

Each system function is accessed by a two-letter command at either the CCU system access screen, or the MCU Main Menu screen for D/I Mux III parameters (**AC**). For the D/I Mux III system CCU, the first letter is usually **D** for display, or **S** for set or modify. For the MCU, the first letter is usually **V** for view, or **M** for modify or set, and **R** for remove. For example, the user can enter a **VN** or **DP** command to display current system parameter settings.

Commands to be entered are shown in **bold type**. A screen example follows each procedure description. Values shown in square brackets (**[ ]**) are default values. If something other than the default value is entered, the new value appears in the brackets the next time that parameter is edited. The enter key, indicated by **[Enter]** in the text, is pressed after each entry to select the default or new values. To make corrections, simply backspace and retype entries. To return to the prompt, press **[ESC]** from most functions. To quit, press **[Q]** when the option appears.

Items displayed in the CCU/MCU Main Menu may change depending upon password level. This chapter describes system operation from the standpoint of the System Administrator (Level 1 password). Lower level passwords are restricted from some options, and when accessing a user menu, certain restricted command options will not appear (e.g., as with IP address and password commands).

The Telnet server allows terminal emulation over LAN networks. This allows a Telnet user to log onto a D/I Mux III and operate it as if connected to a local terminal. To avoid having two simultaneous connections, a new log-in mechanism allows either interface—local terminal or Telnet terminal emulation—to lock the other out while updating the local configuration.

Warning:

Do Not enter a slash (**/**), a backslash (****), a colon (**:**), or **CTRL-P** while issuing commands. These are Coastcom's proprietary Machine Machine Language (MML) commands and, if used, will cause a system lockup. If there is such a lockup, press the **ENTER** key repeatedly, until the system responds, or cycle power on and then off again. System will respond upon re-power-up.

Obtaining System Access

The following procedure begins system configuration. After completing proper installation procedures, and applying power to the D/I Mux III shelf, turn on the control terminal to commence system access. The system will power up and, after a period of approximately 45 seconds, the password prompt appears. At initial startup, it is not necessary to enter a password. Press [**Enter**]. To access the Main Menu with a Common Control Unit (CCU), the screen in Figure 4-2 will appear. Type **?** and press [**Enter**].

```
                                   Coastcom
                              1141 Harbor Bay Parkway
                                Alameda, CA 94502

18:19:13  11/01/95
Access Level is: 1
Alarm Reporting is :  NO REPORTING

Type ? for Help
]?
08:42:57--------------------------[ Menu ]--------------------------11/28/95

ALARMS                             SYSTEM PARAMETERS
 DA  Display                        DP  Display
 ZA  Clr Cnts   SO  Set Comm. Rpts  SR  Set Comm. Rate  SP  Set

SHELF CONFIGURATION                LINE CARDS
 DC  Display                        DL  Display Table   DD  Disp Config
 SC  Set                            CL  Copy Config     SL  Set Config

MAP TABLE                          MAP MATRIX
 DT  Display    DN  Disp. Wrking    DM  Display
 ST  Edit       SN  Set Wrking      SM  Edit            CM  Copy

CLOCK SOURCE                       DIAGNOSTICS
 DS  Display    SS  Set             OL  Line Card       OD  T1-CSU

PASSWORDS                          PERFORMANCE
 LO  Logout     SW  Install         PM  FDL Monitor     SB  Set Error Rate
 DW  Display    EW  Erase           DH  Alarm History   ZH  Clr Alm History
```

Figure 4-2. CCU System Access Screen

To access the Main Menu with an Advanced Multiplexer Control Unit (AMCU), type **?** and **[Enter],** and the AMCU Main Menu will appear (depending upon the user password level), as shown in Figures 4-3, 4-4 and 4-5. For more information, see the password command sections included later in this chapter.

```
Welcome to the Coastcom D/I III Configuration System
Copyright 1995 - Coastcom, Alameda, California
13:15:23  06/08/95
Access Level is: 1

Type ? for Help
] ?

13:15:28 ---------------------[ AMCU Main Menu ]--------------------- 06/08/95

LOCAL PARAMETERS                       NETWORK PARAMETERS
 VR  View Revision Levels               VN  View Network Parameters
 MT  Modify Keyboard Time-out           MG  Modify Default Gateway
                                        MI  Modify IP Address
                                        MS  Modify Subnet Mask
                                        ML  Modify SLIP Parameters

D/I MUX III USER SCREEN                CODE DOWNLOAD
 AC  Access CCU User Submenu            MC  Download CCU Program

PASSWORDS                              SNMP MANAGER CONFIGURATION
 VP  View Passwords                     VM  View Managers
 MP  Modify/Install Password            MM  Modify/Install Manager
 RP  Remove Password                    RM  Remove Manager

 Q  Quit/Disconnect
-----------------------------------------------------------------------------
]
```

Figure 4-3. AMCU Main Menu - Access Level 1

```
Welcome to the Coastcom D/I Mux III Configuration System
Copyright 1995 - Coastcom, Alameda, California
13:15:52  06/08/95
Access Level is: 2
Type ? for Help
] ?
13:15:55--------------------[ AMCU Main Menu ]--------------------- 06/08/95

LOCAL PARAMETERS                       NETWORK PARAMETERS
 VR  View Revision Levels               VN  View Network Parameters
 MT  Modify Keyboard Time-out           MG  Modify Default Gateway
                                        MI  Modify IP Address
                                        MS  Modify Subnet Mask
                                        ML  Modify SLIP Parameters
D/I MUX III USER SCREEN                CODE DOWNLOAD
 AC  Access CCU User Submenu            MC  Download CCU Program
                                       SNMP MANAGER CONFIGURATION
                                        VM  View Managers
                                        MM  Modify/Install Manager
                                        RM  Remove Manager

 Q  Quit/Disconnect
----------------------------------------------------------------------------
]
```

Figure 4-4. AMCU Main Menu - Access Level 2

```
Welcome to the Coastcom D/I Mux III Configuration System
Copyright 1995 - Coastcom, Alameda, California

13:16:13  06/08/95
Access Level is: 3

Type ? for Help
] ?
13:16:16--------------------[ AMCU Main Menu ]--------------------- 06/08/95
LOCAL PARAMETERS                       NETWORK PARAMETERS
 VR  View Revision Levels               VN  View Network Parameters
 MT  Modify Keyboard Time-out

D/I MUX III USER SCREEN                        CODE DOWNLOAD
 AC  Access CCU User Submenu            MC  Download CCU Program

                                       SNMP MANAGER CONFIGURATION
                                        VM  View Managers
 Q  Quit/Disconnect
----------------------------------------------------------------------------
]
```

Figure 4-5. AMCU Main Menu - Access Level 3

AC - Accessing the CCU/D/I Mux III User Screen

To access the D/I Mux III CCU user sub-menu screen, from the AMCU Main Menu, type **AC** and press [**Enter**]. The screen shown in Figure 4-6 appears.

```
] ?
08:42:57 ----------------------[ Menu ]----------------------- 11/28/95

ALARMS                          SYSTEM PARAMETERS
 DA Display                      DP Display
 ZA Clr Cnts  SO Set Comm. Rpts  SR Set Comm. Rate  SP Set

SHELF CONFIGURATION             LINE CARDS
 DC Display                      DL Display Table   DD Disp Config
 SC Set                          CL Copy Config     SL Set Config

MAP TABLE                       MAP MATRIX
 DT Display   DN Disp. Wrking    DM Display
 ST Edit      SN Set Wrking      SM Edit            CM Copy

CLOCK SOURCE                    DIAGNOSTICS
 DS Display   SS Set             OL Line Card       OD T1-CSU

PASSWORDS                       PERFORMANCE
 LO Logout    SW Install         PM FDL Monitor     SB Set Error Rate
 DW Display   EW Erase           DH Alarm History   ZH Clr Alm History
```

Figure 4-6. Accessing the CCU/D/I Mux III User Submenu

Note:	This procedure only applies to D/I Mux III shelves containing AMCU cards.

AMCU Configuration

Prior to use of the SNMP function of the AMultiplexer Control Unit (AMCU), the AMCU must be configured via the local RS-232 port with an ANSI video display terminal (VDT), or a personal computer (PC). Connect the VDT, or PC, to the DB-25 COM port, located at the rear of the shelf. The VDT/PC should be set for 8 data bits, 1 stop bit, with no parity. Then complete the following steps.

1. Set the control terminal software speed to 1200 bps data rate for first time programming, or if the shelf data rate was programmed for 1200 bps.
2. Allow the AMCU to complete its self-check process when the system is first powered up. The self-test and initialization routines takes approximately 45 seconds.
3. Type **VM** to view the default SNMP manager.
4. Remove the default SNMP manager by typing **RM**, then press [**Enter**]. The system will then prompt for entry of the manager IP Address to be erased. Type the number **255.255.255.255**, and press [**Enter**]. This number is a global command, and will erase the default values.
5. The system will now accept all SNMP managers.
6. To configure the SNMP manager type **MM**, and press [**Enter**].

Selections are confirmed on most screens and menus through choice of the **Apply Changes** options. This is equivalent to the **SAVE** function in other system programming packages. Once a feature is selected, or a parameter is set, type **Y** (for yes) or **N** (for no), as applicable, and press [**Enter**] (see Figure 4-7).

```
Apply Changes
 Y) Yes
 N) No
[Y/N]
```

Figure 4-7. Apply Changes Prompt

CL - Copying Line Card Configuration

Use the **CL** command to copy a line card configuration to another line card of the same type, as depicted in Figure 4-8.

```
] CL

Copy Line Card Configuration

Source Slot Number
[1..12] 1

Destination:
Slot Range
 *) All Slots
[1..12] 2

Are You Sure?
 Y) Yes
 N) No
[Y/N]
```

Figure 4-8. Copying Line Card Configuration

In the example shown in Figure 4-8, the source slot number is the card configuration to be copied from (slot 1), and the destination slot number (slot 2) receives the copied line card configuration.

WARNING!

DO NOT copy a single card configuration to more than 12 line cards at once or all line cards will be configured to the same T1 channel. When configuring a 24-slot multiplexer, copy the configuration in two phases. Ensure that only cards assigned to T1-1 are copied to other cards being used on T1-1. This applies to T1-2 cards also. **DO NOT** mix T1-1 and T1-2 cards during the copy process.

Switching to another map, then returning to the working map, usually forces cards to resume normal communications.

CM - Copying the Map Matrix

This procedure assigns the transmission timeslots to the line card slots. Use the matrix map to plan the matrix configuration. If the planned map matrices have some common channel assignments, the Copy Map (**CM**) matrix procedure is a faster way to create a new map by copying an existing (complete) matrix to another matrix map, and then editing the data.

To copy the data from one map matrix to another, enter **CM** and press [**Enter**]. Enter the number of the source map ("1" is the source map to be copied in the example below). Enter the number of the destination map ("6" is the number of the map that will receive the copied map in the example below). Refer to Figure 4-9 for a depiction of the screen sequence.

To review the map, select **Yes**, otherwise, select **No** at the appropriate prompt. To apply changes, select **Yes** at the prompt and press [**Enter**]. If **No** is selected as the response to **Apply Changes**, the map will remain as it previously appeared.

```
] CM

Copy Map Matrix

Source Map Number
[1..7] 1

Destination Map Number
(1..7) 6

Please Stand By

** Map Copied **
```

Figure 4-9. Copying a Map Matrix

DA - Displaying Alarms

Enter **DA** to Display the T1 Alarm data (as depicted in Figure 4-10). The *Card Slot* column indicates which card generated the alarm. The *Alarm* column indicates the type of alarm it generated. The *Level* column shows *Major*, *Minor*, or *Info* alarms based on the severity of the alarm.

The *Status* column will display **Active** or **Clear**, based on the current status of the alarm. The *Count* keeps track of the number of times the alarm cycled between clear and active states. (Note that the count becomes incremental when the alarm goes to active status.)

```
] DA

10:48:55--------------- [ T1 Alarm Data ] ------------------03/08/95

Card Slot          Alarm             Level       Status         Count
------------       --------------    -----       ------         -----
LIU T1-2           RED Alarm         Major       Active             2
LIU T1-2           CGA               Info        Active             2
LIU T1-2           CLOCK Change      Info        Clear              1
LIU T1-2           RCVD Clk Loss     Major       Active             1
LIU T1-1           RED Alarm         Major       Active             2
LIU T1-1           CGA               Info        Active             2
LIU T1-1           CLOCK Change      Info        Clear              1
LIU T1-1           RCVD Clk Loss     Major       Active             2
--------------------------------------------------------------------
```

Figure 4-10. Displaying Alarm Data

DC - Displaying Shelf Configuration

The **DC** command Displays the shelf Configuration screen (Figure 4-11). The display will reflect the current shelf configuration. The revisions will vary depending on the release of the product purchased. If a Dual DSX-1 Interface is installed, or if a Facility Data Link Processor (FDLP) card is not installed, an empty card slot message will appear.

```
] DC

10:03:24--------------- [ Shelf Configuration ] ---------------03/08/95

Operation Mode     : Drop and Insert       T1 Interface      : Normal

Shelf Timing       : Loop          Working Map       : 1
Network Clk Src    : T1-2          Frame Mode        : 193S

Zero Suppression   : Transparent  Jitter Atten. UI   : 28
T1-1 REM Output    : T1-1         T1-1 FRM ERT       : 0E-0
T1-2 REM Output    : T1-2         T1-2 FRM ERT       : 0E-0

            ---Hardware ---   Serial            Software
Card Type   Part Number Rev   Number            Revision
----------------------------------------------------------------------
T1-CSU      30318-101   D     102572-0002       B      04/09/90
A-LIU T1-2  30309-115   E     A76558-0032       B      10/20/93
B-LIU T1-1  30309-105   E     A76557-0013       B      10/20/93
CCU         30305-108   C     123456-7890       1.0    02/24/95
STROBE 1    30307-001   E     212243-0057       F      08/23/91
FDLP        30325-101   A     190825-0018       A      12/07/94
AC/DC       30308-101   B     113611-0017       B      09/26/91
```

Figure 4-11. Displaying Shelf Configuration

DD - Displaying Line Card Data Configuration

Enter **DD** to Display the line card Data configuration screen (Figure 4-12). In the example below, the system displays the last card slot operated (which in the example is card slot 5). The current card under observation is in card slot 3, and it is an intelligent Dual 4-Wire channel card.

```
] DD

Slot Number
[5] 3

10:15:59---------------- [ Slot 3 : D4W ] ---------------03/08/95

Current Channel Status
      Ch. A: CGA
      Ch. B: Not Mapped

Direction        : T1-1            Loopback       : Not Active
Signalling Type  : E&M Type 1&3    CGA            : Type-3
Signalling Mode  : Normal E&M

Chan.   Label       Tx Level    Rx Level
-----   -----       --------    ----------
  A                 -16.0 dBm   +7.0 dBm
  B                 -16.0 dBm   +7.0 dBm

            ---Hardware---     Serial        Software
Card Type   Part Number  Rev   Number        Revision
---------------------------------------------------------------
D4W         33245-103     L    210710-0059   E  06/18/92
---------------------------------------------------------------
```

Figure 4-12. Displaying Line Card Data Screen

Note:	Screens will vary depending on the type of card configured. Refer to the appropriate line card user's manual, and its configuration chapter, for the specific configuration screen desired.

DH - Displaying Alarm History

Enter **DH** to Display the alarm History log (Figure 4-13). The alarm log lists the last 50 alarms, with the most recent listed in the number 1 position. Pertinent line card and alarm data are included.

```
] DH

10:39:38------------------- [ Alarm Log ] --------------------03/08/95

Log   Time      Date     Card Slot    Alarm             Level    Status
---   ----      -------  ---------    ----------------  -----    ------
1:    10:15     3/08/95  D4W   [ 3]   Card Added        Info
2:     9:54     3/08/95  LIU T1-1     RCVD Clk Loss     Major    Active
3:     9:54     3/08/95  LIU T1-2     RCVD Clk Loss     Major    Active
4:     9:54     3/08/95  LIU T1-1     CGA               Info     Active
5:     9:54     3/08/95  LIU T1-1     RED Alarm         Major    Active
6:     9:54     3/08/95  LIU T1-2     CGA               Info     Active
7:     9:54     3/08/95  LIU T1-2     RED Alarm         Major    Active
8:     9:54     3/08/95  * DA Screen  Reset *           Info     Active
```

Figure 4-13. Displaying Alarm History

DL - Displaying Line Card Table

Enter **DL** to Display the installed Line card table (Figure 4-14). Smart and non-intelligent cards specified through use of the Set Line card configuration (**SL**) command, are displayed. Active data rates are shown for all mapped cards.

```
] DL

Slot RANGE
*) All Slots
[1-12]

10:15:46---------------- [ Line Card Table ]----------------- 03/08/95

                        Power Up     Data Rate
Slot  Label  Card Type  Config.     (  T  R  )  # of DS0s    Direction
----------------------------------------------------------------------
3 A          D4W        Switch        0K  0K       1         T1-1
3 B          D4W        Switch        0K  0K       0
5            SDM        NV Ram       64K  64K      1         T1-1
7            OCUDP      Switch       56K  56K      1         T1-1
----------------------------------------------------------------------
```

Figure 4-14. Displaying Installed Line Card Table

DM - Displaying Map Matrix

Enter **DM** to Display a Map matrix. At the prompt, enter the number of the desired map. In the example below, map 1 has been selected. At the next prompt, enter **1** to display the Line Card Map. (Figure 4-15 shows the entire prompt sequence after **DM.**)

```
] DM

Display Map Number
[1]

Display
 1) Linecard Map
 2) DS0 Assignment Map
[1]

Slot RANGE
*) All Slots
[1-12] 5

17:17:14----------- [ WORKING Linecard Map 1 T1-1 ]----------- 06/25/92

    DS0:
SLOT 1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24
---------------------------------------------------------------------------
 5  TR
---------------------------------------------------------------------------
```

Figure 4-15. Displaying the Map Matrix

The **DM** command is also used to display the map matrix DS0 Assignment Map. At the **Display Map Number** prompt, enter the number of the desired map. In the example below, map 2 has been selected. At the *Display* prompt, enter **2** to display the DS0 Assignment Map. (Figure 4-16 shows the entire prompt sequence after **DM**.)

The DS0 Assignment Map does not allow strobe assignments to the line cards. Rather, it is used to assign signaling type or blocking. If no cards are assigned to a DS0, as shown in [Map 2: T1-2], nothing will be shown in the card slot row display, and Xs should appear on the data line.

```
] DM

Display Map Number
[2]

Display
 1) Linecard Map
 2) DS0 Assignment Map
[1] 2

10:31:46-------------------- [ Map 2 : T1-1 ]---------------------- 08/18/92

DS0    1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
-----------------------------------------------------------------------------
Voice TR TR    TR TR TR TR
Data        TR  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x
-----------------------------------------------------------------------------
Slot  15 15 18 20 20 22 22
       A  B     A  B  A  B

10:31:50-------------------- [ Map 2 : T1-2 ]---------------------- 08/18/92

DS0    1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
-----------------------------------------------------------------------------
Voice
Data   x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x
-----------------------------------------------------------------------------
Slot
```

Figure 4-16. Displaying the DSO Assignment Map Prompt Sequence

DN - Displaying the Current Working Map

Enter **DN** to display the current working map number (Figure 4-17).

```
] DN

Current Working Map: 1
```

Figure 4-17. Displaying the Current Working Map

DP - Displaying System Parameters

Enter **DP** to Display system Parameters, as shown in Figure 4-18.

```
] DP

09:55:03--------------- [ System Parameters ]----------------- 03/08/95

System Label      :              Day Of Week              : Wed
System ID         : 0            Alarm Report Mode        : REPORTING
Shelf Size        : 12           Alarm Report Bell        : OFF

Comm. Mode        : TERM         Data Rate  Jumper W1     : Disabled
Comm. Data Rate   : 19200        MML        Jumper W2     : Disabled

Modem Present     : NO           I960 MCU Present         : Yes
Port Exp. Present : NO           Mapping Restrictions     : Enabled

CGA Release Secs  : 5.0          REM Alarm                : Block
DCGA Delay Secs   : 2.5          TX REM Alarm Mode        : FDL

Jitter Atten. UI  : 28           Slip Buffer              : Disabled
```

Figure 4-18. Displaying System Parameters

DS - Displaying Clock Source

Enter **DS** to Display the clock Source, as depicted in Figure 4-19. Different alarms trigger various clock sources. Clock source is set with the Set clock Source (**SS**) command.

The example in Figure 4-19 shows the clock sources for *drop-and-insert* mode. The asterisk shows the present mode of operation, with a local alarm on T1-1.

The clock sources are listed under the *T1-1* and *T1-2 Clock* columns. The primary clock source, when the system is operating normally, is shown in the *No Alarm* row.

This screen will change depending upon mode of operation and timing source. It will also change if the user chooses an internal clock other than the default shown on the **SS** screen.

```
] DS

10:29:21------------- [ Transmit Clock Sources ]------------ 03/08/95

Drop/Insert        Loop Timing

Alarm Condition               T1-1 Clock              T1-2 Clock
---------------------------------------------------------------
No Alarm                      Rcvd T1-2               Rcvd T1-1
LOC T1-2                      Internal                Rcvd T1-1
LOC T1-1                      Rcvd T1-2               Rcvd T1-2
LOC T1-1/-2        *          Internal                Internal

                       * Current Alarm Condition
---------------------------------------------------------------
```

Figure 4-19. Displaying Transmit Clock Sources

DT - Displaying the Current Map Table

The map that currently controls the matrix is called the working map. Only maps that are enabled can be switched to a working map. The four types of maps include time-driven, event-driven, alarm-driven, and manual maps.

Time-driven maps respond at a user-defined time. Event-driven maps operate in response to an event map connection. Alarm-driven maps start in response to an alarm condition. “Manual” maps operate only when made the working map with the **SN** command, and they do not take precedence over time-driven or event-driven maps. When a time or event trigger occurs, the corresponding map type will be made the working map. For the manual map to work without interruption, the time and event maps must be disabled (see the **ST** command section).

Event-driven maps are started when an event map connection at the D/I Mux backplane is connected to shelf ground (refer to SYNC I/O connector information in *Chapter 3. Installation*, for connection details.) The event map takes precedence over both time and manual maps, and is enabled as long as ground is supplied to the event connection. When the event trigger is switched on, the event map becomes the working map; when the event trigger is switched off, the previous working map becomes the working map again.

Maps make it easy to change the network configuration. In Figure 4-20 below, the **DT** command Displays the various map Tables with their specific schedules. In the example, maps 3 and 4 operate every weekend because fewer voice circuits are required on the weekend, allowing an increase in data transfer. Note that time is displayed in a 24 hour clock format.

```
] DT

17:09:00---------------------[ Map Table ]--------------------06/25/92

     Label         Status        Type        Time/Cond.   Days of Week
----------------------------------------------------------------------
M      1           WORKING       Manual
A      2           Enabled       Event
P      3           Enabled       Time          18:00         Fri
       4           Enabled       Time          06:00         Sun
       5           Enabled       Manual
       6           Enabled       Manual
       7           Enabled       Manual
----------------------------------------------------------------------
```

Figure 4-20. Displaying the Current Map Table

DV - Displaying Smart AC Power Supply Parameters

Enter **DV** to Display the parameters of the 110 Volt Smart AC power supply (P/N 30308-102). Note that the option to select **DV** is only available when a Smart AC power supply is installed in the D/I Mux III system. Figure 4-21 depicts the **DV** screen.

```
] DV

10:03:19----------------- [ PS 1 : AC/DC ]----------------- 03/08/95

Minus 12V   : -12.1                 Plus 12V  : 12.0
Minus  5V   : - 5.0                 Plus  5V  :  5.0
Minus 48V   : -48.4

SB Fuse     : OK

Ringing Generator
-----------------
Voltage            : 266.8 V[p-p]
Trip Margin        : 83.0 V
Frequency          :  20 Hz
Minor Alarm        : Enabled

                  ---Hardware---          Serial            Software
Card Type         Part Number  Rev        Number            Revision
----------------------------------------------------------------------
AC/DC             30308-101     B         113611-0017       B  9/26/91
----------------------------------------------------------------------
```

Figure 4-21. Displaying the Smart AC Power Supply Parameters

DW - Displaying the Current Password

Enter **DW** to Display the current passWord (Figure 4-22).

```
] DW

10:48:42 ------------------ [ Passwords ]------------------- 03/08/95

            Level            Password
----------------------------------------------------------------------
 1          1                NetMan
 2          2                Tech1
 3
 4
 5
 6
 7
 8
----------------------------------------------------------------------
```

Figure 4-22. Displaying the Current Password

Note: Only a Level 1 password user will be able to display the passwords screen.

EW - Erasing Passwords

Enter **EW** to Erase passWords (Figure 4-23). In the event of a manual NVRAM reset startup, all configuration parameters, including passwords, are erased. There is no default password.

```
] EW

Enter Password to Erase: Tech1

** Password Erased **
```

Figure 4-23. Erasing Passwords

LO - Logging Off

Type **LO** to Log Off (Figure 4-24), and return to the Main Menu. This command may also be used to determine if there is a previous Level 1 password. The following example shows the response to a user without Level 1 password access.

```
] LO

** No Level 1 Password in Effect **
```

Figure 4-24. Log Off and Level 1 Password Status Screen

MC - Modifying the CCU - Downloading Code

From the AMCU Main Menu, to Modify/download Code to the CCU, use the **MC** command as shown in Figure 4-25.

```
] MC

Copy program from the PCMCIA Card to CCU Flash memory.

PCMCIA Card CCU program revision:   1.3
Current CCU program revision:       1.2

Are you sure? [N] Y

Erase CCU Flash Memory
Remaining blocks = 466 of 466
Remaining blocks = 465 of 466
Remaining blocks = 464 of 466
    .
    .
    .
Remaining blocks = 2 of 466
Remaining blocks = 1 of 466
Remaining blocks = 0 of 466

Transfer complete - rescanning code
Rescan complete - attempting to reinitialize

]
```

Figure 4-25. Modifying the CCU - Downloading Code

MG - Modifying/Setting the Gateway Address

From the AMCU Main Menu, use the **MG** command to Modify/set the Gateway address. The screen depicted in Figure 4-16 will appear. The Gateway Address must be on the same network, both by IP Address class and by Subnet Mask, as the current AMCU IP Address.

```
] MG

Changing the Gateway Address requires rebooting the unit.
Do you want to continue [N] y

Do you want to define a gateway? [N] y

Enter the Gateway IP Address [None]: 130.1.10.50

Stand by to reboot.  Confirm? [N] y

Password:

Welcome to Coastcom D/I Mux III Configuration System
Copyright (c) 1995 - Coastcom, Alameda, California

15:15:37  06/08/95
Access Level is: 1

Type ? for Help
]VN

15:15:42 ----------[ Network Parameters ]--------- 06/08/95

MAC Address:          00:A0:70:00:00:02
IP Address:           130.1.10.99
Subnet Mask:          255.255.255.0
Default Gateway:                 130.1.10.50
SLIP Parameters:
 Local IP Address:    130.1.10.98
 Peer IP Address:     130.1.10.97
 MTU:                 1006
 Data Rate:           9600
-----------------------------------------------------------
]
```

Figure 4-26. Modifying the Gateway Address

MI - Modifying/Setting the Local IP Address

From the AMCU Main Menu, use the **MI** command to Modify/set the local IP address. The screen depicted in Figure 4-27 will appear. This function may not be accomplished while working in a Telnet session. IP Address assignments should be discussed and coordinated with the local LAN administrator.

```
] MI

Changing the IP Address requires rebooting the unit.
Do you want to continue? [N] y

Enter Local IP Address [127.0.0.1]: 130.1.10.99

Stand by to reboot.  Confirm? [N] y

Password:

Welcome to Coastcom D/I Mux III Configuration System
Copyright (c) 1995 - Coastcom, Alameda, California

15:18:42  06/08/95
Access Level is: 1

Type ? for Help
] VN

15:18:46 ----------[ Network Parameters ]--------- 06/08/95

MAC Address:         00:A0:70:00:00:02
IP Address:          130.1.10.99
Subnet Mask:         255.255.255.0
Default Gateway:                None
-----------------------------------------------------------
]
```

Figure 4-27. Modifying the Local IP Address

ML - Modifying/Setting SLIP Parameters

From the AMCU Main Menu, use the **ML** command to set SLIP feature parameters, as depicted in Figure 4-28. Note that the SLIP and Ethernet ports should have different IP addresses. Consult the local LAN administrator for assistance with these address assignments.

```
] ML

Changing the SLIP parameters requires rebooting the unit.
Do you want to continue? [N] y

Enter SLIP Local IP Address [130.1.10.98]:

Enter SLIP Peer's IP Address [130.1.10.15]:

Enter SLIP MTU (Max Transmission Unit = 1006 Recommended) [1006]:

Enter SLIP Port Data Rate
  3) 300
 12) 1200
 24) 2400
 48) 4800
 96) 9600
[96]

Stand by to reboot.  Confirm? [N] y

Password:
]
```

Figure 4-28. Modifying SLIP Parameters

MM - Modifying/Installing the Manager

From the AMCU Main Menu, use the **MM** command to run the Modify/install Manager function, as shown in Figure 4-29. Refer to *Appendix G. SNMP* for access option definitions.

The configuration shown in the example below allows an SNMP manager installed on a workstation with an IP Address of 130.1.10.25 to have Set-and-Get access, and to receive Traps, all with a community string of “public”. By convention, the community string “public” is used when it is not desired that access be restricted. (The SNMP manager must then be configured to use “public”.) If 255.255.255.255 is entered as an IP Address, an SNMP manager at any IP Address is allowed the specified access.

```
] MM

Enter Manager IP Address : 130.1.10.25

Access
 1) ALL
 2) SET/GET
 3) GET
 4) TRAP
[1] 2

Enter Community String (Up to 15 characters): public

** Manager Set **
]
```

Figure 4-29. Modifying/Installing the Manager

MP - Modifying/Installing an AMCU Password

There are three levels of AMCU passwords that allow the user to either control or observe different operating system levels. Up to eight passwords may be assigned. (There is no default password.)

- Level 1 access is the highest level, allowing a user to configure and monitor the system, and install passwords. There can be more than one Level 1 password. The AMCU is shipped from the factory without a Level 1 password.
- Level 2 access allows the user to configure and monitor the system, but will not allow access to the **MP** (Modify/install Password) screen.
- Level 3 access permits only system monitoring. The main menu screen for a Level 3 user shows only the display options.

Once established, the Level 1 password takes precedence. Be careful not to lose this password. Write it down and place it in a secure location. It is required for maximum system control.

Note:	When creating passwords, the Level 1 password must be created **first.**

From the AMCU Main Menu, upon entering **MP** (to Modify, or install a Password), the following screen appears (Figure 4-30).

```
] MP

Install a Password

Enter Access Level (1-3): 1

Enter Password (up to 6 Characters):

Re-Enter Password:

**Password Set**
```

Figure 4-30. Modifying/Installing A Password

Note:	Passwords are not displayed while being entered. ***Upper case and lower case are considered different characters.***

MS - Modifying/Installing the Subnet Mask

From the AMCU Main Menu, type **MS** to Modify, or install, the Subnet mask. The screen shown in Figure 4-31 will appear. The Subnet Mask modifies which portion of the IP Address is interpreted as the network portion. Consult the local LAN administrator prior to setting the IP Address or Subnet Mask.

```
] MS

Changing Subnet Mask requires rebooting the unit.
Do you want to continue ? [N] y

Enter Subnet Mask [255.255.255.0]: 255.255.0.0

Stand by to reboot.  Confirm ? [N] y

Password:
]
```

Figure 4-31. Modifying the Subnet Mask

MT - Modifying Keyboard Time-Out

From the AMCU Main Menu, selecting the **MT** command from the AMCU Main Menu activates the Keyboard Time-Out function, as depicted in Figure 4-32. Use this screen to set how many minutes of keyboard inactivity may elapse before the work session will automatically end, allowing another session to be opened.

```
] MT

Keyboard Time-out

 1) No Time-out
 2) 5 Minutes
 3) 15 Minutes
 4) 30 Minutes
 5) 60 Minutes
[3]
```

Figure 4-32. Modifying Keyboard Time-out

Note:	The ***No Time-out*** selection should only be used for testing purposes when the MCU is locally accessible. If the keyboard time-out option is set to ***No Time-out***, and the communication link is severed during an active Telnet session to that MCU, the shelf must be powered down then back up, because further entry, or subsequent work sessions, will be ignored.

OD - Operate Diagnostics Menu

Use the **OD** command to access the Operate line card Diagnostics menu, as depicted in Figure 4-33. Depending upon the T1 interface, there may be different options presented for shelf control selections. Refer to *Chapter 5. Diagnostics,* for more detail.

```
] OD

12:07:47----------- [ Operate Diagnostics ]---------- 03/08/95

T1 Interface
  Normal
Shelf Controls
--------------
 C) Bypass            E) Reset Common/Line Cards
 D) Unbypass          F) Unloop Line Cards

 G) Shelf Restart     O) Acknowledge ACO
 H) Display Alarms

 Q) Quit
```

Figure 4-33. Operate Diagnostics Menu For Shelf With DSX Interface

OL - Operate Line Card Diagnostics Menu

Use the **OL** command to display the Operate Line card diagnostic menu, as depicted in Figure 4-34. Enter the slot number of the card selected for diagnostic testing. The menu will differ, depending upon the card being tested. In the following example, slot 7 contains a Dual 2-Wire FXS card. (See specific line card user manuals for more details on diagnostic options.)

```
] OL

Slot Number [7]

13:11:35---------[ Operate Slot 7 : D2W FXS ]---------05/20/94

Current Status
             Ch. A : Not Mapped
             Ch. B : Not Mapped

 1)  Disable channels on next idle
 2)  Disable channels immediately
 3)  Set/Clear digital loopback
 4)  Line Build-Out Cap. adjustment
 5)  Report signalling bits status
 6)  Enable channels
 7)  Ch A Transmit Override Status
 8)  Ch B Transmit Override Status

R)  Reset card
Q)  Quit
```

Figure 4-34. Operate Line Card Diagnostic Menu

Upon selection of one of the displayed options, the system prompts for an indication of whether the A or B channel is intended for modification. If option 5 is selected, the display in Figure 4-35 appears.

```
Current Status
      Ch. A : Disabled
      Ch. B : Disabled
---------------------------------------------------------------
         Rx Signalling  Implemented     Tx Signalling  Detected

           A bit  B bit  Condition *   A bit  B bit  Condition*
---------------------------------------------------------------
Channel A    0      0    Ringing        0      1     Idle
Channel B    0      0    Ringing        0      1     Idle
       * Based on signalling bits and card mode
---------------------------------------------------------------
** Press Enter to Continue **
```

Figure 4-35. Reporting Signaling Bit Status

Selecting options 7 or 8 on the Line Card Diagnostic Menu prompts the screen depicted in Figure 4-36 to appear.

```
Current Status
  Ch. A: Disabled
  Ch. B : Disabled
Transmit Override Status For Ch A:
  Set    Clear                  Card Status     Pending Status
  ---    -----         -------  -----------     --------------
  1) 2)  Ringback Tone    :     OFF             OFF
  3) 4)  LED              :     OFF             OFF
  5) 6)  Tx Sig.  Bit A   :     0               0

  7) 8)  Tx Sig.  Bit B   :     0               0

  9)     2 Wire Output    :     Tip Ground      Ringing

  E) D)  Override Status  :     Disabled

  Q) Quit
```

Figure 4-36. Viewing the Channel-A Transmit Override Status

PM - FDL Monitor

If a Facility Data Link Processor (FDLP) is included in the multiplexer, enter **PM** to begin Performance Monitoring, as shown in Figure 4-37. For more detail on this function, refer to the *FDLP User's Manual.*

```
] PM

10:40:23--------------- [ PERFORMANCE MONITOR ]--------------- 03/08/95

Select Direction        Select Side         AT&T/ANSI
 A) T1-1                 D) User             G) AT&T
 B) T1-2                 E) Network          H) ANSI
 C) Both                 F) Both             I) Both
[ T1-1 ]                [ User ]         [ AT&T/ANSI T1-1 & None T1-2 ]

Screen Reports          Clear Counters      Printer Reports
 0) Current Status       4) ESF Errors       6) ESF Error Counts
 1) 1 Hour               5) Others           7) 1 Hour
 2) 24 Hour                                  8) 24 Hour
 3) ANSI                                     9) ANSI

Logging of Network Messages          Network May Reset User Counters
 L) Disable                           P) Disable
 M) Enable With Data                  R) Enable
 N) Enable Without Data              [ T1-1 Enabled & T1-2 Enabled ]
[ T1-1 Disabled & T1-2 Disabled ]

 S) Serial Port Setup
 Q) Quit : Q
```

Figure 4-37. Performance Monitor

Q - Quit Command

To quit or disconnect from the system enter the Quit (**Q**) command as shown in Figure 4-41. The system will prompt for a new password prior to the re-appearance of the MCU Main Menu (refer to Figures 4-3, 4-4, and 4-5). To begin a new work session, enter an installed password. If no passwords are installed, simply press [**Enter**] to begin a new session.

```
] Q

Password:

Welcome to the Coastcom D/I Mux III Configuration System
Copyright 1995 - Coastcom, Alameda, California

08:41:54  11/28/94
Access Level is: 1

Type ? for Help
]
```

Figure 4-38. Quit Command

RM - Removing the Manager

To Remove an SNMP Manager, use the **RM** command as shown in Figure 4-39. When prompted, enter the IP Address of the manager to be removed.

```
] RM

Enter Manager IP to Remove: 130.1.10.25

** Manager Erased **
]
```

Figure 4-39. Removing the Manager

RP - Removing/Erasing Passwords

From the MCU Main Menu use the **RP** command to Remove a Password, as shown in Figure 4-40.

```
] RP

Enter Password to Erase: testla

** Password Erased **
```

]Figure 4-40. Removing/Erasing Passwords

SB - Setting the Error Rate

The Set Bit error rate (**SB)** command determines the alarm function by setting the Error Rate Test (ERT) Alarm. Frame coding sets the type of ERT alarm displayed. Extended Super Framing (ESF) supports Cyclic Redundancy Check (CRC) ERT alarms. D4/SF supports frame ERT alarms.

Figure 4-41 depicts the Frame ERT Alarm screen. (The CRC ERT alarms are configured exactly the same way, except that exponent ranges and resolution values differ.) Choose a menu option, and confirm the selection or port (outgoing, incoming, or both) for which the frame ERT alarm is to be set.

```
] SB

07:46:39----------- [ Set Frame ERT Alarm ]--------- 08/14/96
            ----------------Alarm-----------------
            ERT   Set Pt.     Resolution           Status
            ----  ---------------------------      -------
T1-1  :     0E-6  [9E-3]      [1E-6   2 Mins]      Disabled
T1-2  :     0E-6  [9E-3]      [1E-6   2 Mins]      Disabled

Frame ERT Alarm
 1) Set Pt.
 2) Resolution

 E) Enable
 D) Disable

 R) Reset ERT
 Q) Quit
```

Figure 4-41. Setting the Frame ERT Alarm

The set point is the value (the mantissa) raised to the specified power (exponent) at which alarms are generated. To change the ERT set point or threshold, enter 1 as shown in Figure 4-42.

```
T1-1 Alarm Set Pt.

Mantissa (1..9)
[9]

Exponent (3..6)
[3]
```

Figure 4-42. Setting Set Points

The resolution determines the size of the T1 signal sample. The higher the resolution, the longer it takes to complete sampling. To change the ERT resolution, enter a selection option as shown in Figure 4-43.

```
T1-1
Min. Resolution   Sample Time
 1) 1E-5          12.5 Secs
 2) 1E-6             2 Mins
 3) 1E-7            21 Mins
 4) 1E-8           3.5 Hrs
[2]
```

Figure 4-43. Setting ERT Resolution

SC - Setting Shelf Configuration

Shelf configuration consists of the following optional settings.

- Source of shelf settings after power-up
- Source of strobe settings after power-up
- Mode of operation
- Shelf timing
- Frame mode
- Zero suppression mode
- Remote alarm output
- *ALPS* protection option

Type **SC** to Set the shelf Configuration, as depicted in Figure 4-44. To use LIU A option switch settings on a power up, type **O** for the first entry. In order to set up shelf configuration from the terminal, the first entry for the LIU option switch must be **N**, otherwise the **SC** command terminates after the first two entries.

```
] SC

Enter Shelf Configuration Information

Source of Shelf Configuration Settings after Power Cycle
 N) NVRAM
 O) LIU-A Option Switches
[N]

Source of Strobe Card Configuration Settings after Power Cycle
 N) NVRAM
 O) Strobe Card Option Switches
[N]

Mode of Operation
 C) Channel Bank
 D) Drop/Insert
 S) Dual Channel Bank
 A) ALPS
[ ] A
```

Figure 4-44. Setting Shelf Configuration

If the *ALPS* (A) mode of operation is selected in the Shelf Configuration menu (as appears in the example in Figure 4-44), the following prompt appears. The *ALPS* protection option should remain disabled during the configuration process. **After configuring all other parameters**, if a 30309-105/115 LIU is installed in the D/I Mux shelf, and the *ALPS* feature is desired, select "**1) Enabled.**" Figure 4-45 depicts the ALPS option selection screen.

```
ALPS Protection
 1) Enabled
 2) Disabled
[ ]
```

Figure 4-45. Enabling ALPS Protection

The system next prompts for a choice of shelf timing and mode of operation (as depicted in Figure 4-46). The master site must be set to Local; all other sites must be set to Loop.

```
Shelf Timing
 L) Loop
 C) Local
[ ]
```

Figure 4-46. Shelf Timing Options

If the *drop-and-insert* mode is selected, the screen shown below will prompt for selection of the T1 port to which the network clock will be connected. The network clock source will be the primary timing source for the D/I Mux III. Figure 4-47 depicts the network clock source option screen.

```
Network Clock Connected to
 1) T1-1
 2) T1-2
[ ]
```

Figure 4-47. Selecting the Network Clock Port

If *single channel bank* or *dual channel bank* is selected, the system queries as to whether timing should be *loop* or *local shelf timing* (Figure 4-48).

```
Shelf Timing
L) Loop
C) Local
[ ]
```

Figure 4-48. Selecting Shelf Timing

When Loop timing is selected for *dual channel bank* mode, the system prompts with the following choices as shown in Figure 4-49.

```
Network Clock Connected to
 1) T1-1
 2) T1-2
 3) T1-1 and T1-2
[ ]
```

Figure 4-49. Selecting Network Clock with Loop Timing for Dual Channel Bank Operation

For all modes except *ALPS*, the system displays the screens below (Figures 4-50 and 4-51), in order to specify a frame mode, and zero suppression mode, compatible with the network.

```
Frame Mode
 S) D4/SF
 E) ESF
[ ]
```

Figure 4-50. Specifying Frame Mode

```
Zero Suppression Mode
 B) B8ZS
 7) Bit-7 Stuffing
 T) Transparent
[ ]
```

Figure 4-51. Specifying Zero Suppression Mode

Remote alarms (D/I Mux III sending yellow alarms) can be directed. In *channel bank* mode, the choices are T1-1 REM Alarm output, or none; in *dual channel bank* mode, the choices are T1-1, or none, and T1-2, or none. In *drop-and-insert* mode (as depicted in the example in Figure 4-50), select T1-1, T1-2, both, or none.

If using a Data Service Unit Data Port (DSUDP) line card, the direction and transmission port selection must be set, as is the case for all individual line cards. The direction is user-configurable unless the mode of operation dictates the direction of transmission.

Typically, use the T1-1 port when in channel bank mode. Use both ports when in dual channel bank and ALPS modes. For drop-and-insert mode, use both T1-1 and T1-2 ports.

Use the Set shelf Configuration (**SC)** command to configure the transmission direction, specifying mode of operation, port, and timing mode options.

```
T1-1 REM Alarm Output
 N) None
 1) T1-1
 2) T1-2
 B) Both
[1]

T1-2 REM Alarm Output
 N) None
 1) T1-1
 2) T1-2
 B) Both
[2]

Apply Changes
 Y) Yes
 N) No
[Y/N] Y
```

Figure 4-52. Directing REM Output

SL - Setting Line Card Configuration

All system line cards must be configured prior to use. The system identifies software-controlled line cards, progressing through a configuration menu for each specific line card.

The example in Figure 4-53 depicts the Set Line card configuration function for a hardware-configured Digital Program Channel (DPC). In the case of hardware-configured cards, only the card type may be designated. No other software commands will apply to those cards.

Enter **SL** for the Setting Line card configuration screen (Figure 4-53).

```
] SL

Enter Line Card Configuration Information

Slot Number
[1]

Label for Slot 1 (up to 10 Characters)
[]

Enter Card Type for Slot 1
 A) 4-Wire
 B) 2-Wire
 C) ADPCM
 D) DPC
 E) Low Speed Async
 F) Async TTY
 G) L. S. Sync
 H) Cellular 1
 J) Other
 0) Empty
[D]
```

Figure 4-53. Setting Line Card Configuration

SM - Setting/Editing a Map Matrix

Select the desired map number (1-7 of the available map-capable storage options), and enter the direction to be edited. *In channel bank* and *ALPS* modes, Edit Direction does not apply, and is not given as an option.

Enter **SM** to Set/edit a Map matrix (Figure 4-54).

```
] SM

Edit Map Matrix

Map Number
[4] 3

Direction To Edit
 1) T1-1
 2) T1-2
[1]

Edit
 1) Linecard Map
 2) DS0 Assignment Map
[1]
```

Figure 4-54. Setting/Editing a Map Matrix

Note:	When creating a new map, clear both directions when prompted for Direction To Edit.

Enter **Y** to clear the line card map and create a whole new map, or **N** to edit the map, as depicted in Figure 4-55.

```
** Editing Line Card Map 3 for Port Direction T1-1 **
Clear Linecard Map
 Y) Yes
 N) No
[N] Y
```

Figure 4-55. Clearing or Editing the Line Card Map

Some voice line cards that have more than one channel, as well as high speed data channels, can have several DS0s assigned to one line card. Dual channel voice cards can supply two voice channel DS0s; the channels are designated A and B. High speed data channels can have several DS0s assigned to one line card. With Quad channel voice cards, the channels are designated A, B, C, and D. DS0s for a hardware-controlled card or an empty card slot may also be assigned.

To edit a line card slot, first enter the slot number to be edited. The channel card will supply the card type and model information, which will be displayed on the screen, along with the existing line card map (if any). The next prompt will be to select either a particular DS0, or all DS0s to be edited, or to clear all DS0s. (To clear a range of DS0s, a quick way to designate the range is to enter the first and last DS0s to be cleared, separated by a hyphen, e.g., “2-10”, would be DS0s 2 and 10.) After the desired DS0(s) is entered, the system will prompt for entry of the type of function to be assigned to the DS0. The choices are **Transmit**, **Receive**, **Both**, and **Clear**. Except with intelligent channel cards, the prompt will ask next for whether the application is to be **Data** or **Voice**. After the application is entered, the line card map will then assign DS0s to the various channels of the line cards, all of which will be displayed.

The D/I Mux III allows up to seven (7) map configurations per line card. If, for example, more bandwidth is required for data transmission in the evening hours when voice traffic is minimal, a separate map can be configured for that time of day specifying data versus voice. Conversely, the daytime map can be configured to preclude data transmission. With a seven-map capability, each day of the week can be separately mapped, if necessary.

Having the capability of more than one map also facilitates map reconfiguration. An active working map cannot be modified. In order to change mapping parameters, it is necessary to first duplicate the working map. Changes can then be made to the copy, and the copy can then be made the new working map upon reconfiguration. The commands used during this process are Copy Map matrix (**CM**), Set/edit Map matrix (**SM**), Set the New working map (**SN**).

Figure 4-56 depicts the entire sequence included in editing a line card map.

```
Line Card Slot Number
 (1A..24D)
[Quit]  1A
Card Type              :SDCU
Card Model number      :30351-105
  DS0:
SLOT 1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
---------------------------------------------------------------------------
1A
---------------------------------------------------------------------------
DS0 Range
 (1-24)
 *) All DS0s
 C) Clear All DS0s
[Quit Slot] 1
Enter
 T) Transmit
 R) Receive
 B) Both
 C) Clear
[Quit DS0] B
Application
 D) Data
 V) Voice
[D] V
  DS0:
SLOT 1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
---------------------------------------------------------------------------
 1A  TR
---------------------------------------------------------------------------
Line Card Slot Number
(1A..24B)
[Quit] 2
Card Type : SDCU
   DS0:
SLOT 1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
---------------------------------------------------------------------------
 2
--------------------------------------------------------------------------
DS0 Range
(1-24)
 *) All DS0s
 C) Clear All DS0s
[Quit Slot] 2
Enter
 T) Transmit
 R) Receive
 B) Both
 C) Clear
[Quit DS0] B
    DS0:
SLOT 1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
---------------------------------------------------------------------------
  2    TR
---------------------------------------------------------------------------
Line Card Slot Number
(1A..24B)
[Quit]  Q
```

Figure 4-56. Editing a Line Card Slot

To "**Quit**" at the Line Card Slot Number prompt, simply press **[Enter]**. Figure 4-57 depicts the prompts that appear when quitting the line card assignments. The updated line card map and DS0 assignment map are shown, as a review of the information that has just been entered. In the DS0 assignment map, the *x* designates a *through DS0*. (Make sure the 'x' is on the data line. A misplaced 'x' may interfere with the through DS0.)

If more editing is desired, select **Yes** at the *Edit More* prompt. This allows corrections to be made as necessary, as well as editing the opposite T1 direction, and clearing maps. Once editing tasks are completed, press **No**. The map can then be reviewed, and work can be saved with a **Yes** response to the *Apply Changes* prompt.

```
10:33:38----------------- [ Linecard Map 3 : T1-1 ] -----------------08/18/96
  DS0:
SLOT   1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
-----------------------------------------------------------------------------
 1A   TR
  2     TR
-----------------------------------------------------------------------------
** Press Enter to Continue **

10:33:46---------- [ WORKING DS0 Assignment Map 4 : T1-1 ] ----------08/18/96

DS0    1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
-----------------------------------------------------------------------------
Voice TR
Data     TR  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x  x
-----------------------------------------------------------------------------
Slot  1 2

Edit More
 Y) Yes
 N) No
[Y/N] N

Review Map
 Y) Yes
 N) No
[Y/N] N

Apply Changes
 Y) Yes
 N) No
[Y/N] Y
```

Figure 4-57. Editing Line Card Assignments

SN - Setting the Working Map

Use the **SN** command to Set the New working map. Figure 4-58 depicts the screen prompts for the current and new working map numbers.

```
] SN

Current Working Map: 1

New Working Map Number
(1..7) 1

Are You Sure?
 Y) Yes
 N) No
[Y/N]
```

Figure 4-58. Setting the Working Map

SO - Setting the Communications Configuration

Applicable only to the CCU portion of the system, and not supported by the MCU, the **SO** command is used to display and set the communications configuration (Figure 4-59). When operating with the MCU, and in the SNMP mode, values displayed in the applicable communications modes should not be changed. For detailed information on communications configuration, refer to *Appendix J. Set Report Options*.

```
] SO

Current Mode
 TERM - DIALOUT ALARM REPORTING

Communication Configuration
 C)  COMM mode
 D)  Display Modem/Port expander Config.
 M)  Change Modem Config.
 P)  Change Port Expander Config.
 Q)  Quit
] Q
```

Figure 4-59. Displaying and Setting the Communications Configuration

SP - Setting System Operation Parameters

Use the **SP** command to Set the system operation Parameters. System parameters include the following.

Use of installed line cards to check map display - This allows a check on the bandwidth, based on the line cards in the shelf.

Shelf size - Number of slots

System Identification Number - This should remain at factory default setting of “0”.

System Label - Enter as desired.

System Date and Time - Initial entry of real-time clock data.

T1 Alarm Processing - Alarm routing to either T1-1 or T1-2; Carrier Group alarm release and delay time options; if **Yes** is selected further prompts allow selection of either **REM**(ote) alarm through either the Facility Data Link (FDL), or **Bit 2 = 0**.

Jitter Attenuation - Jitter is T1 signal distortion caused by noise or timing differences; attenuation reduces the amount of jitter.

Jitter Attenuation Depth - 28 Units per interval is the more stringent limit that can be set for attenuation.

REM Alarm - Choices differ depending upon mode of operation; selections displayed in the following figure apply to drop-and-insert operation, and would not appear for channel bank and dual channel bank modes.

Apply Changes - Save the system parameter settings.

Figure 4-60, following, depicts the entire System Operation Parameters edit sequence.

```
] SP

Enter System Operation Parameters

Use Installed Line Cards to Cross-check Map Display/Edit
 Y) Yes
 N) No
[Y] Y

Shelf Size
  8)
 12)
 24)
[24]

System ID
[0]

System Label
[ ]

Set System Date and Time
 Y) Yes
 N) No
[N]

Set T1 Alarm Processing
 Y) Yes
 N) No
[N]

Jitter Attenuator
 1) Enable
 2) Disable
Enter [2] for disable, unless known jitter is present.

Jitter Attenuator Depth
 1) 28 UI
 2) 120 UI
[1]

REM Alarm
 1) Pass Thru
 2) Block
[2]

Apply Changes
 Y) Yes
 N) No
[Y/N] N
]
```

Figure 4-60. Setting System Operation Parameters

SR - Setting the COM Port Data Rate

Use the **SR** command to Set the COM port data Rate, as depicted in Figure 4-61. Setting the data rate on the CCU motherboard will automatically change the data rate on the MCU sub-board to a matching rate. The default data rate for the CCU motherboard is 1200 bps after an NVRAM power-up.

In normal operation, the MCU sub-board will automatically match the rate set on the CCU. If the CCU malfunctions, or if the connection between the CCU and MCU sub-board is defective, the sub-board will revert to its 9600 bps default data rate. Any error messages that occur in such an event will be at 9600 bps.

Note: The warning screen indicates that after changing the data rate for the D/I Mux III, the terminal data rate has to be changed. The D/I Mux III and control terminal data rates must be the same to continue communications.

```
] SR

                           W A R N I N G

Changing the control port data rate may cause data rate mismatch.

Enter Control Port Data Rate
  3) 300
 12) 1200
 24) 2400
 48) 4800
 96) 9600
 19) 19200
 [24] 12

Are You Sure
 Y) Yes
 N) No
[Y/N] Y
```

Figure 4-61. Setting the COM Port Data Rate

SS - Setting the Clock Source

Enter **SS** to Set the clock Source (Figure 4-62). (Coastcom recommends leaving the internal clock set to factory defaults.) In drop-and-insert mode/normal operation (No Alarm), the system always uses the received T1 clocks for timing sources. A received clock, or internal clock, is available when a clock source fails. The internal clock is a Stratum IV clock within the D/I Mux III system.

```
] SS

Set Clock Source

10:29:25-----------[ Transmit Clock Sources ]----------03/08/96

Drop/Insert                  Loop Timing

Alarm Condition              T1-1 Clock       T1-2 Clock
---------------------------------------------------------------
No Alarm                     Rcvd T1-2        Rcvd T1-1
LOC T1-2                     Internal         Rcvd T1-1
                                              Rcvd T1-1
LOC T1-1                     Rcvd T1-2        Rcvd T1-2
                                              Internal
LOC T1-1/-2                  Internal         Internal
- Choices          *    Current Alarm Condition
---------------------------------------------------------------
T1-2 LOC Alarm Clock Source
 I) Internal
 1) Rcvd T1-1
[1]

T1-1 LOC Alarm Clock Source
 I) Internal
 2) Rcvd T1-2
[I]

Apply Changes
 Y) Yes
 N) No
[Y/N] Y
```

Figure 4-62. Setting the Clock Source

Since drop-and-insert operation does not use local timing, an example of Clock Source for channel bank mode in local timing is depicted in Figure
4-63. In local timing mode, several different timing sources are available.

Ext Slot-2 is the clock received from a line card in slot 2 of the D/I Mux III. **Ext DB-9** is a connector on the back of the D/I Mux III shelf (SYNC I/O) that will accept TTL, or differential signals, as a timing source. **The Ext Rcvd T1-2** clock is timing recovered from a T1, or T1 clock source, on the T1-2 port. The external clocks, Slot-2, Rcvd T1-2, and DB-9, must be in multiples of 1,600 Hz, from 8,000 - 1,544,000 Hz.

```
] SS

Set Clock Source

10:29:25---------- [ Transmit Clock Sources ] ---------03/08/96

Channel Bank            Local Timing

Alarm Condition         T1-1 Clock
---------------------------------------------------------------
No Alarm    *           Internal
LOC T1-2                -Slot-2
                        -DB-9
                        -Rcvd T1-2
LOC T1-1                Internal

- Choices   *     Current Alarm Condition
---------------------------------------------------------------
T1-2 LOC Alarm Clock Source
 I) Internal
 S) Ext Slot-2
 D) Ext DB-9
 2) Ext Rcvd T1-2
[I]

Apply Changes
 Y) Yes
 N) No
[Y/N] Y
```

Figure 4-63. Setting Clock Source in Single Channel Bank Local Timing

ST - Setting/Editing the Map Table

Enter **ST** to edit the map table, as represented in Figure 4-64.

```
] ST

Edit Map Table
Map Number
[3]
Map 3 Label (up to 10 Characters)
[Map 3]
Enter Type
 A) Alarm
 E) Event
 T) Time
 M) Manual
[T]
Enable Map
 Y) Yes
 N) No
[Y]
One Time Use
 Y) Yes
 N) No
[Y] N
Days of Week
  Currently : Mon
 1) Mon
 2) Tue
 3) Wed
 4) Thu
 5) Fri
 6) Sat
 7) Sun
 *) Everyday
[1]
Hours
 (0..23)
[10]
Minutes
 (0..59)
[50]
```

Figure 4-64. Setting/Editing the Map Table

SW - Setting/Installing CCU Passwords

Use the **SW** command to Set/install a CCU passWord, as shown in Figure 4-65. Actual password entries will not be visible upon entry.

There are three levels of passwords that allow the user to either control or observe different operating levels of the system. Up to eight passwords may be assigned.

- Level 1 access is the highest level, and allows a user to configure the system, monitor the system, and install passwords. There can be more than one Level 1 password.
- Level 2 access allows the user to configure and monitor the system, but will not give access to the install password screen.
- Level 3 access permits only system monitoring. The main menu screen for a Level 3 user only shows the display options.

> **Note:** Once established, the Level 1 password takes precedence. Be careful not to lose this password, write it down and place it in a secure location. It is required for maximum control of the system. (If the password is lost, the shelf must be reset to factory defaults by performing an NVRAM clear. Then, a new password can be selected.)
>
> When creating passwords, the Level 1 password must be created **first**.
>
> The password is not displayed as it is entered. **Upper and lower case are considered different characters.**

```
] SW

Install a Password

Enter Access Level (1-3): 1

Enter Password (up to 6 Characters)

Re-Enter Password:

** Password Set **
```

Figure 4-65. Setting/Installing a Password

VM - Viewing Manager Configuration

From the MCU Main Menu, use the **VM** command to View the network Manager configuration, as shown in Figure 4-66. The screen displays the manager's IP Address, the access level, and the type of community string applicable to the network.

```
] VM

15:32:33 -------------[ SNMP Managers ]--------------- 06/08/96

      Manager IP      Access          Community String
------------------------------------------------------
 1    130.1.10.98     3               public
 2
------------------------------------------------
```

Figure 4-66. Viewing Manager Configuration

VN - Viewing Network Parameters

From the MCU Main Menu, enter **VN** to View the Network parameters (as depicted in Figure 4-67), including MAC Address, IP Address and Subnet Mask.

- **MAC Address** (Media Access Control): This is the physical address of the line card (node), assigned by Coastcom during manufacture. The MAC Address serves as a unique line card identifier, even if no Internet protocol is assigned, or if differing protocols are attempting communication.

- **IP Address** (Internet Protocol): Initially set by Coastcom prior to shipment as a special loopback test address only, an IP Address change is required for network operation.

  If operating on a private network, a system administrator should assign the address as appropriate. The IP Address may not be set as all zeroes, nor may it be set as "255.255.255.255".

  If operating on the Internet, a registered IP Address is required. Consult the local LAN administrator to obtain this address.

- **Subnet Mask**: This feature allows a system administrator to divide the network into smaller segments. (See the **MS** command for further detail.)

```
] VN

15:14:36 ---------- [ Network Parameters ] ---------- 06/08/95

MAC Address:  00:A0:70:00:00:02
IP Address:                127.0.0.1
Subnet Mask:  255.255.255.0
Default Gateway:           None

SLIP Parameters:
 Local IP Address:  130.1.10.98
 Peer IP Address:   130.1.10.15
 MTU:               1006
 Data Rate:         9600
--------------------------------------------------------------
]
```

Figure 4-67. Viewing the Network Parameters

VP - Viewing Passwords

From the MCU Main Menu, use the **VP** command to View Passwords, as shown in Figure 4-68.

```
] VP

15:13:37 -------------- [ Passwords ] -------------- 06/08/95

      Level    Password
----------------------------------------
 1      1      test1
 2      3      test3
 3      2      test2
 4
 5
 6
 7
 8
----------------------------------------
```

Figure 4-68. Viewing Passwords

VR - Viewing Software Revision Status

From the MCU Main Menu, enter the **VR** command to View the Revision number of the current MCU operating system software,. The revision screen is then displayed as depicted in Figure 4-69. During this display process, the CCU may not be accessed until communication is re-established. Upon completion of the display, when the CCU Status message reads "**Executing program**", the system has returned to normal operation.

```
] VR

17:02:28 ----------- [ Revision Levels ] ------------ 06/08/96

MCU System Software:  Rev. 1.3
CCU Permanent Loader: Rev. 1.3

CCU Program (available to load):  Rev. 1.3
CCU Program (now loaded on CCU):  Rev. 1.3

CCU Status:  Initializing
--------------------------------------------------------------
] VR
17:02:44 -----------[ Revision Levels ]-------------- 06/08/95

MCU System Software:  Rev. 1.3
CCU Permanent Loader: Rev. 1.3

CCU Program (available to load):  Rev. 1.3
CCU Program (now loaded on CCU):  Rev. 1.3

CCU Status:  Executing program
```

Figure 4-69. Viewing the Software Revision Status

ZA - Clearing Alarm Count

Use the Zero Alarm (**ZA**) count command to clear the alarm records in the Display Alarm (**DA**) list that are no longer active (refer to Figure 4-10 for the **DA** screen). It also writes to the history file that alarms have been reset, as reflected in the Display Alarm History (**DH**) screen (Figure 4-13).

Figure 4-70 depicts the **ZA** sequence screen.

```
] ZA

Zero Alarm Counts
 Y) Yes
 N) No
[Y/N] Y
```

Figure 4-70. Clearing Alarm Counts

ZH - Clearing Alarm History

When finished with previous alarm log data, enter **ZH** to Zero/clear the alarm History of all alarms, as depicted in Figure 4-71.

```
] ZH

Clear Alarm History
 Y) Yes
 N) No
[Y/N] N
```

Figure 4-71. Clearing Alarm History

Chapter 5. DIAGNOSTICS

D/I Mux III system diagnostics include alarms, power-up sequences, test loopbacks, and individual circuit testing. The T1 alarms are the standard T1 Bell System alarms; local, remote, and Carrier Group Alarm (CGA).

Optioned with a Dual CSU Interface, the D/I Mux III can initiate a T1 bypass, T1 CSU loopback, and also respond to the network's T1 CSU loopback request.

To test the circuits of individual line cards, refer to the respective line card user manuals.

Software and hardware comprise the two types of diagnostics. Since the D/I Mux III is primarily a software-configurable device, software diagnostics should be the first approach to troubleshooting the system and network. However, an understanding of the various alarms, modes of operation, Dual DSX-1 Interfaces, and loopback capabilities is essential before any diagnostics can be performed.

Diagnostic capabilities change depending upon the type of T1 interface installed in the D/I Mux III. The basic and Dual Enhanced DSX-1 Interface units are primarily hardware devices which allow T1 testing with cables and loopback connectors. The Dual CSU Interface unit, with integrated Channel Service Unit (CSU) capabilities, is required to perform T1 software diagnostics.

Test Records

Keeping an accurate record of test results is important. Records of prior performance can be very helpful in troubleshooting. Also, the historical test data can be used to evaluate long-term system performance.

T1 Alarms

The primary T1 alarms of concern to the D/I Mux III are local, remote (Yellow), Carrier Group, Frame, Bipolar Violations, Bit 7 Zeros Suppression, 0-Density, and All Ones. These alarms are displayed on the Line Interface Unit (LIU) front panel Light Emitting Diodes (LEDs), and in the D/I Mux III system software. If one of these primary T1 alarms activates, an inspection of the T1 cable connections should be conducted, and the T1 carrier company should be called.

Local Alarm

The Local Alarm (**LOC)** LED illuminates upon detection of a loss of T1 framing, or signal, into the local D/I Mux III. This is often referred to as the "Red Alarm", and signifies a T1 failure. The failure could be the fault of the carrier, a broken cable connection between the carrier interface and the D/I Mux III, a faulty circuit card, or incorrect programming within the Dl/I Mux III system.

Yellow Alarm

The Yellow/Remote Alarm (**YEL**) LED illuminates if a failure is detected at the far-end T1 system. In such an event, the remote system sends a remote "Yellow" alarm signal to the local D/I Mux III. The received remote alarm signal also signifies a T1 failure, with potential causes as indicated above under “Local Alarm.”

Carrier Group Alarm

The Carrier Group Alarm (**CGA**) LED illuminates if a T1 failure is detected, and trunk conditioning is performed to allow circuits to be removed from operation in a controlled manner.

Frame Alarm

The Frame Alarm (**FRM**) LED illuminates whenever the LIUs lose synchronization (or “lock”) with the T1 frame. A frame failure can occur because the D/I Mux III has not been programmed for the same frame mode of operation for which the T1 span is set (ESF or D4). This type of failure can also occur if the LIUs have lost lock with the T1 carrier because of an external failure, or a D/I Mux III card failure.

B7 Alarm

The Bit 7 Zeros Suppression Alarm (**B7**) LED illuminates if the D/I Mux III has been programmed for bit seven zero suppression. While historic, this type of zero suppression is rarely used, and should not be used for data circuits.

BPV Alarm

The Bipolar Violations Alarm (**BPV**) LED illuminates whenever the LIUs detect a series of bipolar violations.

0-DEN Alarm

The 0-Density Alarm (**0-DEN**) LED illuminates if the LIUs detect that the T1 span has exceeded the maximum number of zeros allowed.

AIS Alarm

The Alarm Indication Signal (all ones alarm), also known as the Blue Alarm, (**AIS**) LED will illuminate whenever the LIUs detect all ones on the T1 span.

Loop Codes Alarms

There are two Loop Codes Alarm (**LP CODES**) LEDs included on the front panel. They are listed and described as follows.

RX

The Receive (**RX**) LED illuminates whenever the LIUs receive a loop code via the T1 span. This function only works if the D/I Mux III has a CSU (Model 30318-xxx) installed.

TX

The Transmit (**TX**) LED illuminates whenever the D/I Mux III sends a remote loop code from the LIUs. As with the RX Loop Code Alarm, this function only works when a CSU (Model 30318-xxx) is installed in the shelf.

Alarm Contacts

The alarm contacts at the back of the D/I Mux III shelf allow visual and audible alarm systems to be connected to the multiplexer. The contacts are isolated and normally open, and are controlled through the Common Control Unit/Multiplexer Control Unit (CCU/MCU). The major and minor alarm contacts close during corresponding alarm conditions as shown in Table 5-1. The audible alarm contacts can be opened manually by selecting Alarm Cut-Off (**ACO**) in the software, or by depressing the **ACO** push-button on the CCU/MCU front panel.

Table 5-1. Alarm Contacts and Alarm Cut-Off (ACO)

Alarm	Audible Contact	Visual Contact	Minor Contact
Major	Closed	Closed	Open
Major with ACO	Open	Closed	Open
Minor	Open	Open	Closed

Alarm Dialout

The D/I Mux III can report new alarm conditions to remote locations by dialing out through a port expander and a modem. At the other end of the connection, the alarms can be sent to a printer, or can be controlled and directed by any commercially available terminal emulation software product.

To set up the Alarm Dialout option, use the Set communications Options (**SO)** command.

CCU/AMCU Front Panel Switches

The CCU and AMCU front panel switches are momentary push-buttons which initiate a process. The switches have multiple functions depending on the set-up of the multiplexer and alarm condition.

ACO Button

The Alarm Cut-Off (ACO) button is used when the D/I Mux III is in major alarm to cut off the audible alarm, and to allow bypass operation initiation.

Bypass Button

The Bypass (BYP) button forces both T1-1 and T1-2 to bypass a D/I Mux III that is in the drop-and-insert mode, while in a major alarm, and following Alarm Cut-Off (ACO). Bypass permits the T1s to go through the system unaltered, as if the D/I Mux III were not in the T1 transmission path. The bypass function only operates in the drop-and-insert mode.

Bypass

Bypass can function only when the multiplexer is in an alarm condition, and the ACO button has previously been pushed, or if ACO has been initiated by software control. Remove the bypass operation by pressing the bypass switch a second time, or through software selection.

In **single channel bank** mode, the bypass relays will cause the Pulse Code Modulation (PCM) signal on the shelf backplane to be looped back to the Line Interface Units (LIUs). The local and remote alarms will clear in approximately 10 seconds when the LIUs have synchronized to the loop condition. If the local and remote alarms do not clear, there may be a problem with the LIUs. The multiplexer remains in Carrier Group Alarm (CGA) during the bypass operation, and the multiplexer transmits a framed T1 pattern while in bypass mode.

In **drop-and-insert** mode, the bypass relay passes T1 around the multiplexer without going through the primary multiplex circuitry. With Dual DSX-1 Interfaces, the signal passes only through line equalization. With the Dual CSU Interface, the repeaters and line equalization build-out are in the bypass path. Bypass also loops the PCM signal from the LIUs. The local alarm disappears when the LIUs have synchronized to the loop condition (approximately 10 seconds). If the local alarms do not clear, there may be a problem with the LIUs. The multiplexer remains in CGA during bypass operation.

In **dual channel bank** mode, bypass mode is not possible and the bypass switch is disabled.

Power-Up Sequence

The **normal power-up** sequence returns the system to the same operation status as before the power cycle. Upon initial power-up, the multiplexer defaults to LIU A and Strobe Unit option switches. After Non-Volatile Random Access Memory (NVRAM) has been selected through the Set shelf Configuration (**SC)** command, the power-up options default to NVRAM selections.

The front panel switches double as special power-up controls. The switches can be used to clear the system memory (NVRAM) and auto-configure. During an auto-configuration sequence the default data rate of the COM port is 1200 bps. Adjust the control terminal data rate accordingly.

Depressing the ACO button during power-up activates an **option switch power-up**. The system auto-configures from the LIU A, Strobe, and line card option switches. A matrix map is constructed from the line card switch options, and is placed in the Map 1 location. Map 1 is then made the (new) working map. Line cards are given bandwidth on a first-come-first-served basis, starting with card slot one. If a line card requests bandwidth that is not available, none is assigned. The Option Switch Power-up does not alter configuration on maps 2 through 7.

Note:	Depressing the **BYP** (Bypass) button during power-up causes the CCU/MCU to "bypass" the checksum test.

Depressing both the ACP and BYP buttons for 75 seconds activates a CCU/MCU **NVRAM power-up** on a shelf that has been powered down. The system operates the same as in an Option Switch Power-up, and all of the system map matrices are cleared. The NVRAM power-up clears all CCU/MCU memory, including passwords, and switches all options to default. An NVRAM power-up should be used only for drastic failure situations, or when placing the system in a new location and application.

CAUTION!

NVRAM power-up clears all shelf, line card, and password information.

Troubleshooting

When a fault is apparent within the D/I Mux III system, board-level troubleshooting procedures further isolate the problem. When the fault is isolated to one or more unit assemblies, replace each suspected unit with a known good spare until the fault clears. When replacement of a unit does not clear the fault, remove the spare and reinstall the original unit. Spare units should be stocked for this purpose. Refer to Table 5-2 for information on interpreting LEDs.

Table 5-2. LED INDICATIONS and PROBLEMS

LOC	YEL	CGA	FRM	B7	BPV	0-DEN	AIS	LPRX	LPTX	POSSIBLE PROBLEMS / SOLUTIONS
R		Y	R							T1 span is set to a different frame mode than the D/I Mux III. Access Set shelf Configuration (**SC**), and change frame mode. With a LOC alarm, for Models 30309-104/114, and 30309-105/115, the LED colors may be Red (R), Yellow (Y), Green (G), or slight variations on the LED color depending on version. Even though the colors are different, the function is the same.
R		Y	R		Y	R				LIUs have lost lock with T1 span; possible causes include: Telco is down, Smart Jack is faulty, cable between Smart Jack and D/I Mux III is faulty, CSU/T1-IF is faulty, LIU is faulty, or the wrong frame mode was selected in the D/I Mux III shelf configuration. To test: put a hard loopback on the T1 port. If the shelf locks up to itself, then the problem may be external, or the D/I Mux III and carrier may not be in frame sync.
R		Y	R			R				Same as above.
R	Y	Y	R			R				Same as above.
R	Y	Y	R		Y	R				Same as above.
R		Y	R				R			The T1 span is sending a “keep-alive” signal; alarms indicating unframed all ones. Possible causes include: a downstream problem with the carrier, the Smart Jack is in loopback, or carrier D/I Mux III is not transmitting a T1 signal out. To test: put a loop on the D/I Mux III T1 interface. If no problems are found, the problem is with the carrier.
R		Y	R				R	R		Carrier or far-end has initiated a remote loop, CSU is in loopback. To clear, access Operate Diagnostics (**OD**), and select “Clear loopback” option for the direction from which the loop is coming.
R		Y	R						Y	Local site has initiated a remote loop (to distant end CSU). To clear, press the **TX LP** button on the LIU, or access the **OD** screen and select “Clear all loopbacks”.
				G						B7 zero suppression coding has been selected in configuration, resulting in errors and lockup on FAX machines or modems used with voice cards; data circuits may be non-functional, or may evidence massive errors. Reconfigure, removing B7 coding.
					Y					If LED is flashing or on steady, may indicate Bipolar Violations, caused by T1 span being set for B8ZS with D/I Mux III being set for transparent or B7 zero suppression; may also result from T1 span or D/I Mux III problems. If D/I Mux is suspected, loop T1 interface back to itself. If BPV remains during loop test, problem may be with the CSU, or with the lit LIU.

LOC	YEL	CGA	FRM	B7	BPV	0-DEN	AIS	LPRX	LPTX	POSSIBLE PROBLEMS / SOLUTIONS
	Y	Y								Remote end detects problem; may be transmit failure. Put a loopback on T1 interface to clear alarms. If alarms clear, distant-end T1 span has a problem.

System-Level Troubleshooting

If a T1 failure occurs, loop the T1 at the backplane connector by performing the following steps. This will isolate the problem to either the D/I Mux III system, or to another part of the network.

1. Remove the T1 cable from the T1-1 connector.
2. Install the RJ-48 loopback plug (packed with the shelf in the bag kit) into the T1-1 RJ-48 connector. (Refer to Figure 5-1 or 5-2 for information on building a loopback plug.)
3. If the D/I Mux III system “times out” (if the alarm clears) within 20 seconds with the loopback connector installed, the failure is elsewhere in the network. (It may be necessary to place the shelf in local internal timing to force the shelf to acquire timing.)

Note: Placing the loopback plug in the T1-1 connector will affect the alarm lights on the T1-2 LIU. If optioned for drop-and-insert operation, the alarms do not clear.

4. Remove the second T1 cable from the T1-2 connector.
5. Move the loopback plug from T1-1 to the T1-2 connector, and note the readings on the T1-2 LIU.

If the D/I Mux III remains in alarm, go to "Board-Level Troubleshooting."

Board-Level Troubleshooting

Perform the following procedures after a failure has been isolated to the D/I Mux III system. Failures affecting all channels are usually in the common equipment units. Typical common equipment failures are indicated by the LIU front panel LEDs, and/or loss of data or signaling transmission on all channels in one or both directions. Failures affecting a single channel are usually caused by a faulty line card, or by a fault in the strobe board. Before replacing individual units, check the following.

1. Ensure that the common equipment and line cards are fully seated in the system backplane card edge connectors.
2. Ensure that all connector cables are fully seated.
3. Turn power to the shelf OFF then ON. This will re-initialize the D/I Mux III system configuration. See if this clears the problem.
4. Measure the -48 V DC on the D/I Mux III shelf at the terminal block, TB1 pin 1 (referenced to TB1 pin 2 battery ground). The D/I Mux III shelf operates from -44 V DC to -56 V DC.
5. If your system is -24 VDC then measure the -24 V DC on the D/I Mux III shelf at the terminal block, TB1 pin 1 (referenced to TB1 pin 2 battery ground). The D/I Mux III shelf operates from -22 V DC to -28 V DC.

6. If the red FAIL LED is illuminated on the power supply front panel, the power supply over/under voltage detectors or fuse failure alarm circuitry has activated. Check for an alarm indication on the fuse(s) by removing, inspecting, and replacing each fuse. If there is no alarm indication, proceed to step 8 below.
7. Measure the DC voltage at the test points indicated on the power supply front panel. These are approximately equal to the actual voltages on the backplane. Use a high-impedance (greater than 1 megohm) DC voltmeter for all measurements. Acceptable readings are within 10% of the marked voltages.
8. If a replacement power supply also shows a red LED failure and the DC voltage check indicates that one output is low, a possible cause is a shorted card elsewhere in the shelf. To check for this, systematically remove non-power supply cards from the shelf while observing the power supply failure light. Removal of the shorted card will allow the voltages to restore themselves and will extinguish the power supply FAIL LED.
9. Check the D/I Mux III system software programming using the Display line Card configuration (**DC),** Display system Parameters (**DP**), and related commands.

Common Equipment and Line Card Testing

The primary method of isolating trouble in the D/I Mux III line cards is by replacing the suspected module with a known good one.

Note:	When changing plug-in units, allow at least two minutes for the alarms to clear before continuing. If replacing common equipment, power down the shelf first, then swap cards as appropriate. Follow this procedure for replacement of the LIUs, CCU/MCU, strobes and power supplies.

1. Replace the suspected module.
2. Test the replacement module to verify normal operation.
3. If the replacement does not clear the trouble, remove it and verify all option settings, then re-install the original module.
4. Repeat steps 1 through 3 on the next suspected module.

Defective Units

DO NOT ATTEMPT TO REPAIR PLUG-IN UNITS. Return defective units per instructions in the D/I Mux III warranty.

Line Interface Units (LIUs)

This section contains illustrations of the Line Interface Unit (LIU) front panels (refer to Figure 5-1) and a description of the LIU Light Emitting Diode (LED) indications (see Table 5-3).

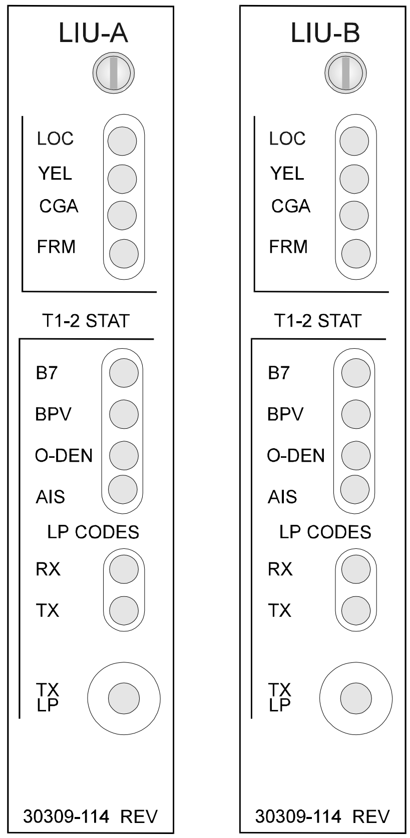


Figure 5-1. Line Interface Units Front Panels
P/N 30309-104A and 30309-114A

Table 5-3. LIU Front Panel

Legend	Indication	Classification
LOC	Loss of T1 framing for more than 450 milliseconds	Major
YEL	B2 = 0 for all received DS0s, or yellow alarm in FDL	Major
CGA	Trunk conditioning; activated 2.5 seconds after loss of frame	Informational
FRM	Framing errors on incoming T1	Major
B7	Bit 7 stuffing active	Informational
BPV	BPVs above threshold shown on ERT screen (refer to Chapter 4)	Minor
0-DEN	More than 32 consecutive zeros on incoming T1	Major
AIS	Receiving Alarm Indication Signal (unframed all ones)	Major
LP Codes	**Description**	**Classification**
RX	Network loop code being received	Informational
TX	Network loop code being transmitted	Informational
TX LP	**Description**	**Classification**
Push-button	Commands for GND loopback	N/A

T1 Transmission Tests

T1 Transmission Tests cover initial testing for channel bank, drop-and-insert, and dual channel bank operation. Testing with the Dual Standard DSX-1 Interface Unit, Dual Enhanced DSX-1 Interface Unit, and Dual CSU Interface are described for each mode of operation.

The initial testing of the D/I Mux III verifies the following system responses:

- Local Alarm
- Remote Alarm
- Carrier Group Alarm (CGA)
- Alarm Cut-Off (ACO)
- Bypass

T1 Interfaces

Diagnostic capabilities change depending upon the type of T1 Interface installed in the system.

The **Dual Enhanced DSX-1 Interface** (P/N 30118-102) includes a test jackfield. Local loopbacks can only be performed through the jackfield with bantam cables and dummy jacks, or at the DB-15 or RJ-48 T1 interface connectors. Test equipment can access and monitor signals through the jackfield. See Figure 5-4 for a jackfield explanation.

The **Dual CSU Interface Unit** (P/N 30318-10X) has the capability to perfomr local and remote software loopbacks without cables or loopback connectors. However, the Dual CSU Interface also has a jackfield which allows for hardware testing with bantam cables and plugs. To test Channel Service Unit (CSU) circuitry, loopbacks must be placed at either the DB-15, or the RJ-48, T1 interface connectors. Refer the Chapter 3 for more information on the Dual CSU Interface unit. See Figure 5-5 for a jackfield explanation.

The **Dual Standard DSX-1 Interface** (P/N 30118-101) has the fewest T1 diagnostics. It requires loopback connectors for T1 testing. A T1 loopback connector connects the T1 output to the T1 input. For the DB-15 connector, pin 1 connects to pin 3, and pin 9 connects to pin 11. For the RJ-48 connector, pin 1 connects to pin 4, and pin 2 connects to pin 5. (See Figures 5-2 and 5-3 for T1 loopback connector details.)

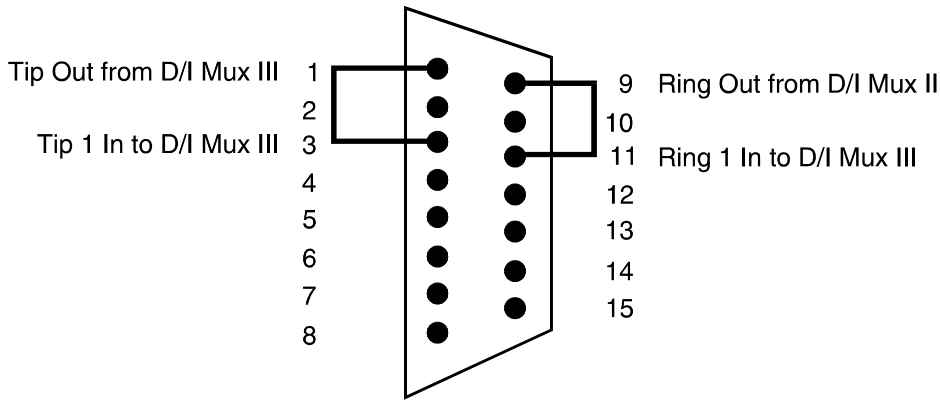


Figure 5-2. DB-15 Male T1 Loopback Connector

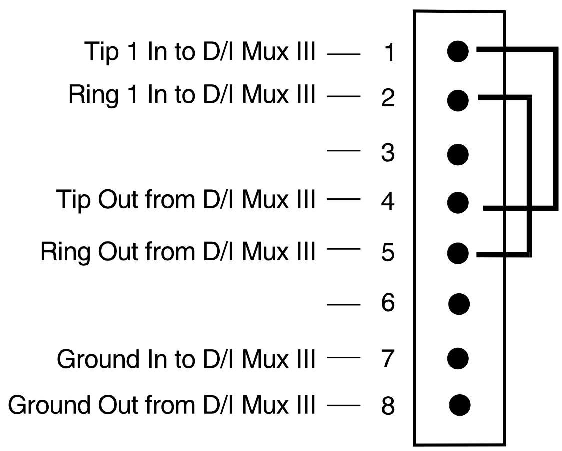


Figure 5-3. RJ-48 T1 Loopback Connector

An understanding of the jackfields on the Dual Enhanced DSX-1 Interface and Dual CSU Interface is helpful when performing T1 transmission testing. Refer to Figures 5-4 and 5-5 for details on the operation of the jackfields. T1 test equipment usually accesses the system and network through a jackfield.

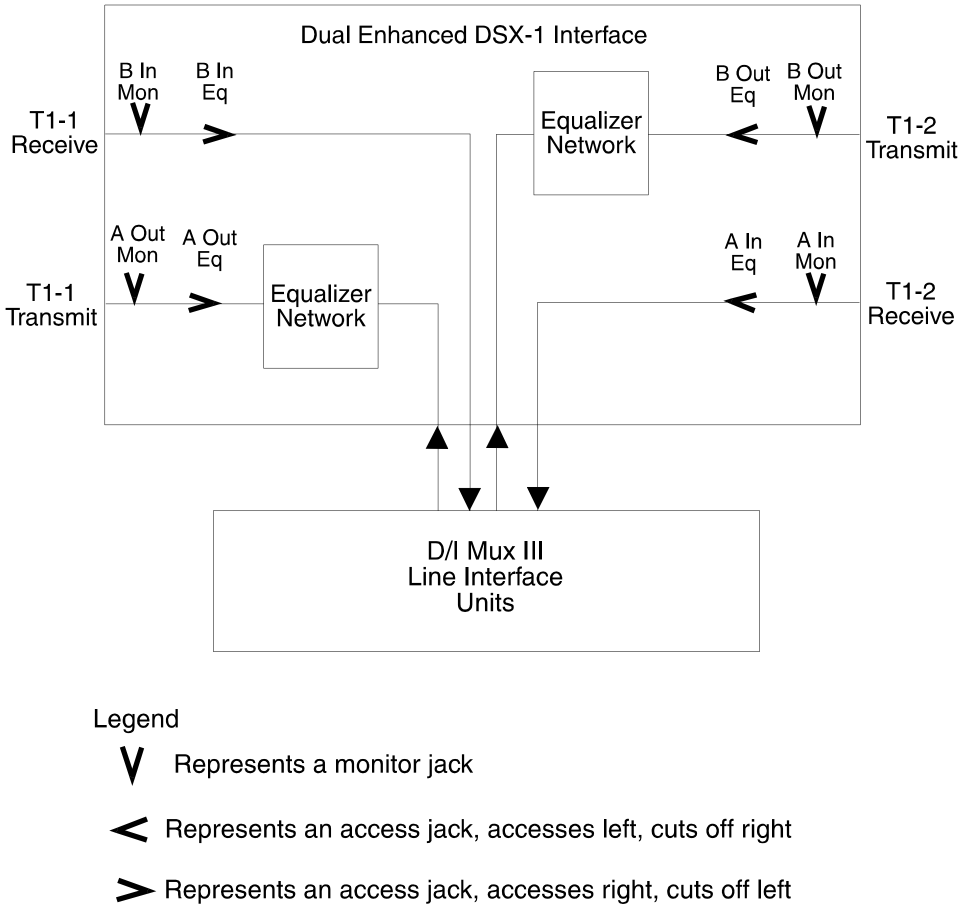


Figure 5-4. Dual Enhanced DSX-1 Interface - Jackfield Block Diagram (part number 30118-102)

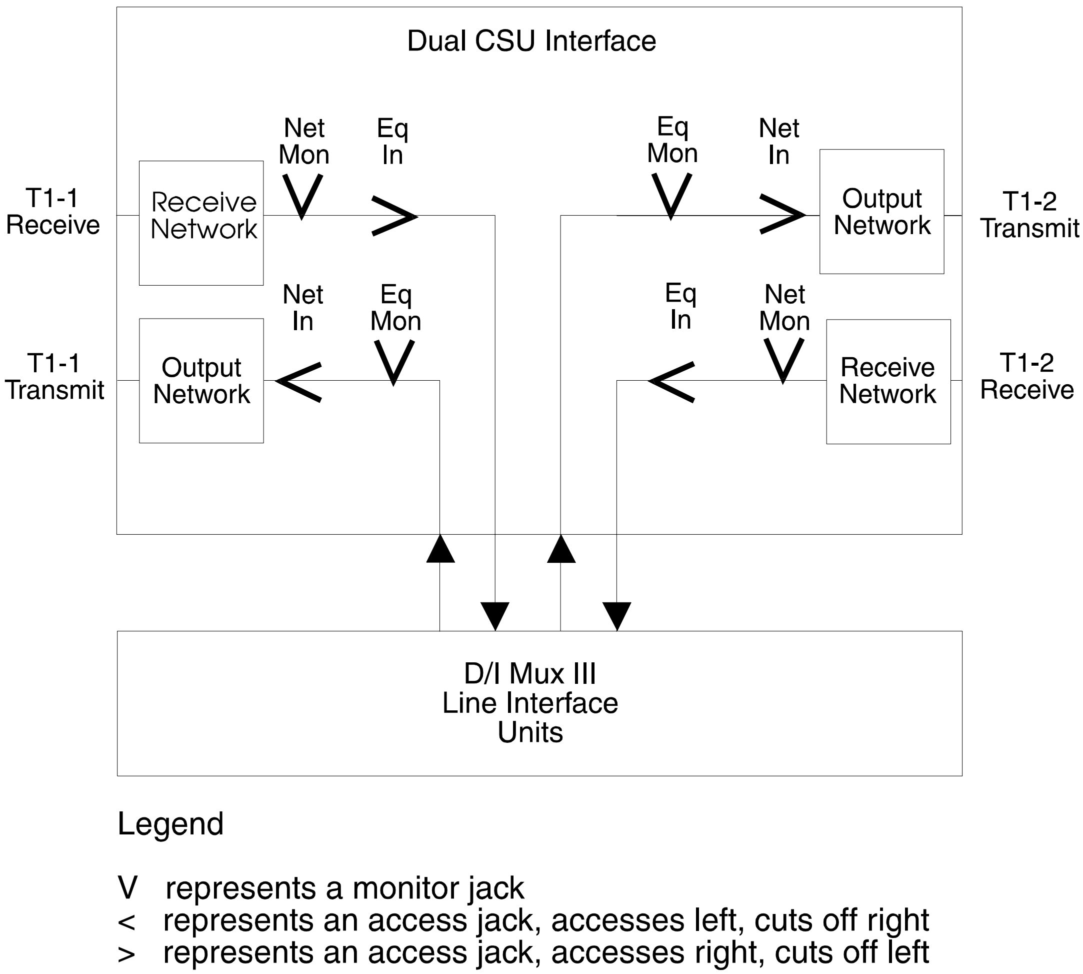


Figure 5-5. Dual CSU Interface - Jackfield Block Diagram (part numbers 30318-101, 30318-102, 30318-103)

Single Channel Bank Mode

Use the following procedures to test the D/I Mux III in channel bank mode (and not yet in the T1 network). Select single channel bank operation with local timing, as described in *Chapter 4. Configuration and Operation.* Refer to Figure 5-6 for the location of the various test jacks on the Dual Enhanced DSX-1 Interface and Dual CSU Interface.

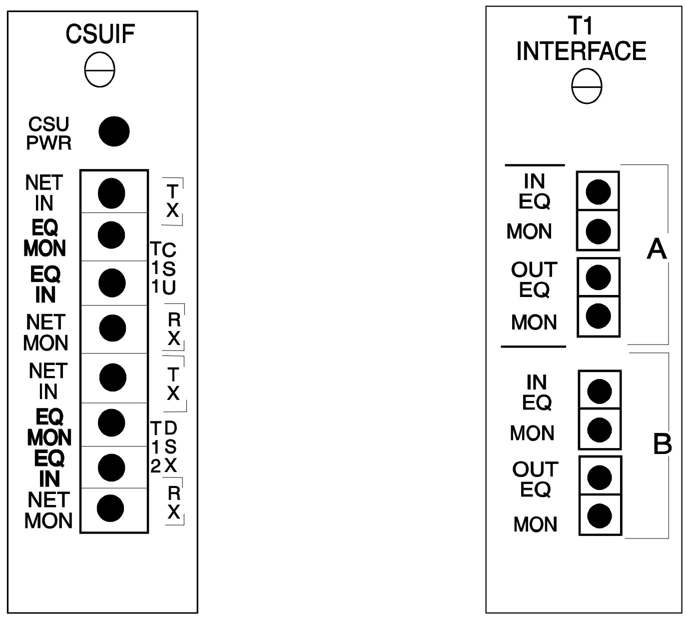


Figure 5-6. Test Jack Locations

Local and CGA Alarm Response

1. Loop the T1 output of the D/I Mux III T1-1 Transmit to T1-1 Receive with a bantam cable, or with a loopback connector on the shelf backplane connector (this is the recommended method for fully testing a shelf). (See Figures 3-8 through 3-11 *in Chapter 3. Installation* for backplane connector locations.) T1 is looped at the Dual Enhanced DSX-1 Interface (T1 interface) by connecting A OUT to B IN. T1 is looped on the Dual CSU Interface (CSUIF) by connecting EQ IN to EQ MON. All alarms should clear (time-out) in approximately 12.5 seconds. Alarms are timed out when all LEDs on the Line Interface Units (LIUs) are unlit. The alarms time-out when T1 timing and framing are synchronized and operating normally in the D/I Mux III.
2. Break the T1 line either by removing the loopback connector or by removing the patch cord from the jackfield. On LIU B, the FRM LED and the LOC LED glow red. After approximately 2.5 seconds, the CGA LED on LIU B illuminates. The system control terminal screen displays a message indicating Local T1-1 and CGA T1-1 are in alarm if terminal alarm reporting is turned on. (Other LEDs will also illuminate.)

ACO Switch and Response

1. Press the ACO switch on the Common Control Unit/Multiplexer Control Unit (CCU/MCU). The CCU/MCU front panel ACO LED illuminates.

Bypass Switch and Response

1. Press the BYP (bypass) switch on the CCU/AMCU. The BYP LED on the CCU/AMCU turns on, and the LOC LED on LIU B turns off. The CGA LED on LIU B remains lit. The ACO LED on the CCU/AMCU turns off. The FRM LED on LIU B turns off. The local T1-1 alarm indication clears on the system control terminal screen.
2. Press the BYP switch on the CCU/MCU. The BYP LED and the ACO LED on the CCU/AMCU turn off, the CGA LED on LIU B turns off, and the LOC LED and the FRM LED on LIU B illuminate. After approximately 2.5 seconds, the CGA LED on LIU B is again illuminated. The control terminal screen indicates a local T1-1 alarm, if alarm reporting is turned on.

CGA Timeout

Re-establish the T1 loopback by replacing the bantam cable or loopback connector. The LOC LED and the FRM LED on LIU B turn off. After the time-out, the CGA LED turns off. The control terminal local T1-1 alarm message clears immediately and the LIU B CGA alarm message clears after timing out.

Alarms in End-to-End Test

Note: This test requires a Dual Enhanced DSX-1 Interface or a Dual CSU Interface.

1. Connect two D/I Mux III systems together in a point-to-point network configuration. The T1 Transmit of one of the systems will go to the T1 Receive of the other. Both systems should be in channel bank mode with one system locally timed, and the other loop timed.
2. Break the T1 input path by placing a bantam plug in the Dual Enhanced DSX-1 Interface B IN EQ jack, or the Dual CSU Interface B EQ IN jack. On LIU B, the FRM LED illuminates after 60 milliseconds. At the same time, the LOC LED illuminates. After approximately 2.5 seconds, the CGA LED glows, generating the remote signal. The far-end unit should then indicate a remote alarm. Other LEDs will also illuminate.
3. Remove the bantam plug to re-establish the T1 output path. On LIU B, the FRM LED and the LOC LED turn off after 120 milliseconds. The CGA alarm times out, and the far-end unit remote alarm clears.

Drop-and-Insert Mode Tests

Use these procedures when installing the D/I Mux III multiplexer for drop-and-insert operation. D4 channel banks, or D/I Mux IIIs in channel bank mode, are required at both ends of the T1 links to perform these procedures. The alarm function tests require a jackfield.

Note: Single channel bank mode testing should be performed prior to drop-and-insert mode testing.

Bypass Relay Test

Perform the bypass relay test while the system is in drop-and-insert mode. The bypass relay test works only with the Dual DSX-1 Interface.

1. Ensure the D/I Mux III has valid T1 inputs for both T1-1 and T1-2.
2. Configure the D/I Mux III for drop-and-insert mode. Make certain the network has one timing master source, with one locally/internally timed and one channel bank loop timed.
3. Shut off the AC power supply. The two other channel banks or multiplexers in the link should not go into alarm, and communications should continue between the two. If an alarm condition arises, the Dual DSX-1 Interface should be replaced. (The slot card alarm LEDs may flicker on the channel banks while the drop-and-insert shelf goes into bypass.)
4. Turn the power back on. The CCU/MCU performs the initialization/restore sequence, then reinserts itself back into the T1 path. The channel banks at the other ends of the T1s will not operate momentarily, but will then restore themselves to normal operation.

Local Alarm Test

1. Break the T1 input path by placing a bantam plug in the Dual Enhanced DSX-1 Interface A IN EQ jack, or the Dual CSU Interface T1-2 EQ IN jack. The FRM LED and the LOC LED on LIU A light. After approximately 2.5 seconds, the CGA LED illuminates, generating a remote alarm. The FRM LED on LIU A clears. Remote channel banks go into various alarms, depending on the alarm path configuration. The T1 multiplexer connected to T1-2 should indicate a remote alarm. Other LEDs will also illuminate.
2. Remove the bantam plug. All alarms should time-out and clear.

Remote Alarm Test

1. Place the bantam plug in the B OUT EQ jack on the Dual Enhanced DSX-1 Interface, or T1-2 NET IN jack on the Dual CSU Interface. The T1 multiplexer connected to T1-2 indicates a local alarm, and sends out a remote (yellow) alarm. The D/I Mux III REM LED and CGA LED on LIU A lights up, indicating a remote alarm.
2. Remove the bantam plug. All alarms should time-out and clear.

Software Controlled Loopback Tests

Software controlled loopback tests require a Dual CSU Interface. The three software controlled loopbacks that are available are remote, line, and payload.

Each software controlled loopback is available in every mode:
- Single channel bank
- Drop-and-insert
- Dual channel bank.

Remote and line loopbacks test the transmission lines from the local D/I Mux III to the far end. Payload loopback tests some of the internal functions of the D/I Mux III.

In single channel bank operation, remote loopback from the local D/I Mux III is initiated either by entering a *Set Remote Loop-up* command with the software, or by pressing the network loop push-button switch on LIU B, which sends a network *set code* to the far end. The following sequence then occurs.

1. The Tx LP LED on LIU B flashes on and off for 5 seconds, then stays lit continuously.
2. The far end remains looped, and all traffic is terminated until the network loop switch on LIU B is depressed again, or until the remote loop down command is issued, at which time a remote loop reset code is initiated.
3. The Tx LP LED on LIU B flashes on and off for 5 seconds while the reset code is transmitted.
4. After the 5 second interval, the far end detects the reset code and then unloops. The Tx LP LED turns off, and all traffic resumes.

Conversely, if the line loopback code is received for 5 seconds, the Rx LP LED on LIU B turns on and the shelf goes into line loopback. The line reset code must be received for 5 seconds to unloop the shelf. At this point, the Rx LP LED turns off.

This same sequence is identical for drop-and-insert and dual channel bank, and can also be performed on LIU A. The payload, or test loop, is used to check the common equipment by looping the equipment locally to the network through the LIUs.

Loopback Tests

The following sections describe, and depict, the various D/I Mux III system loopbacks. Refer to the software diagnostics portion of this chapter for instructions on how to initiate and remove these loopbacks.

Channel Bank: Normal Operation

In normal channel bank operation, only the T1-1 connection to the D/I Mux III shelf is used. The Dual CSU Interface routes incoming Pulse Code Modulation (PCM) from span B to the input of LIU B, and sends PCM from the output of LIU A to the output of span A. Channel cards can transmit and receive on selected DS0 channels. Normal operation is represented in Figure 5-7.

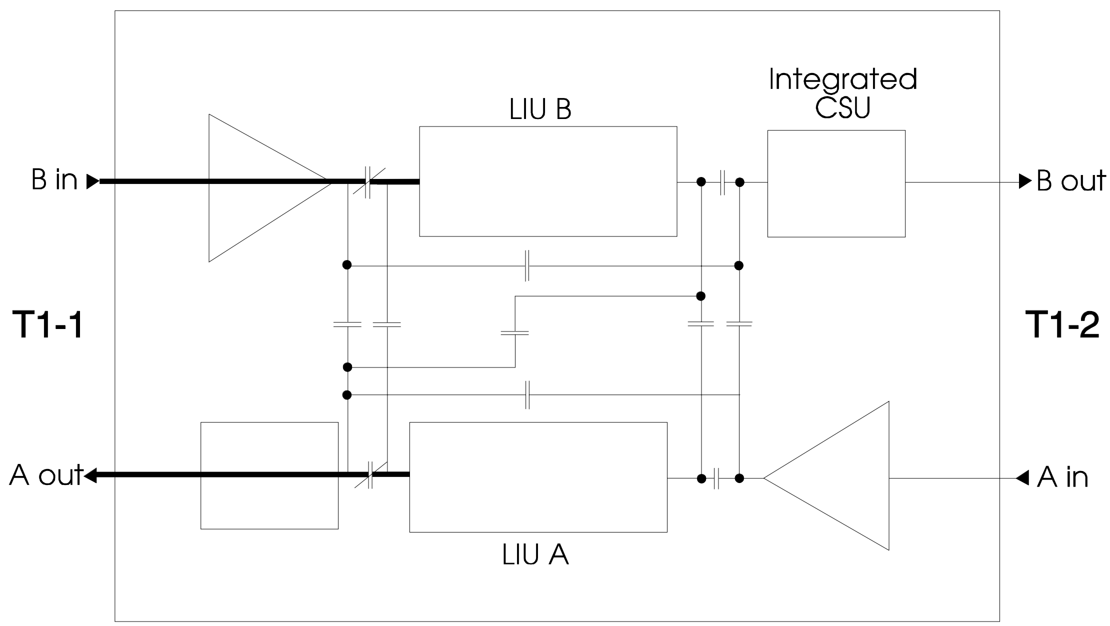


Figure 5-7. Channel Bank: Normal Operation

Channel Bank: Bypass

In channel bank bypass mode, the PCM span B input path to LIU B is broken, and replaced with the output from LIU A. From the output of LIU B, an Alarm Indication Signal (AIS) is sent to the output of span A. The bypass operation is represented in Figure 5-8.

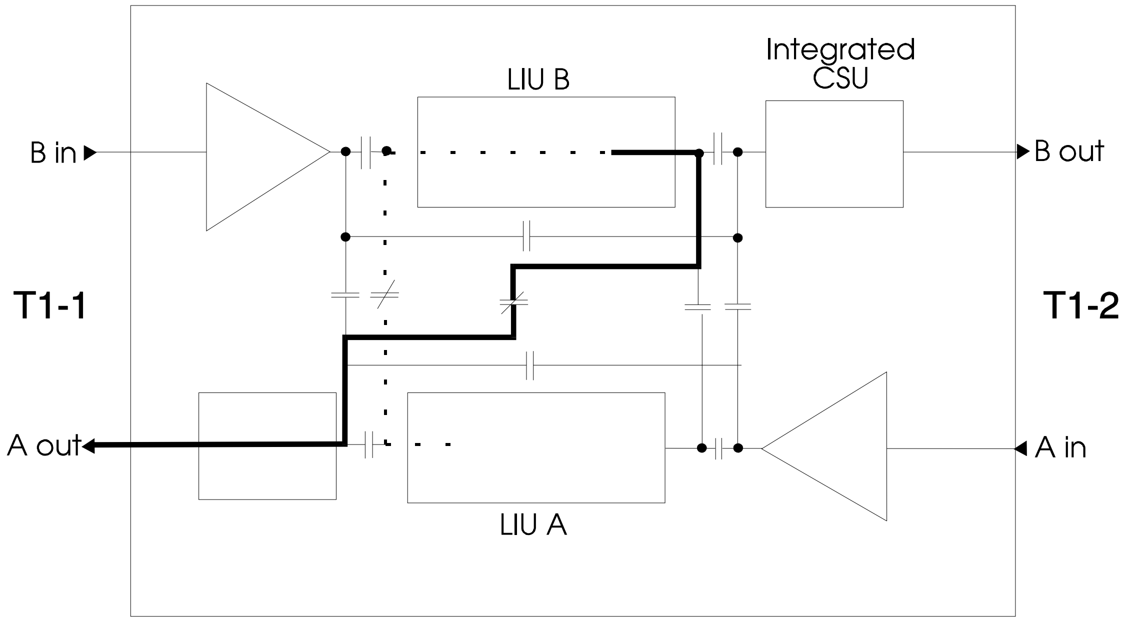


Figure 5-8. Channel Bank: Bypass Operation

Channel Bank: Line Loopback

Line loopback is set in response to receiving the “Line Loop Set” code on a span's input, or via software. Pulse Code Modulation (PCM) arriving at the input is looped back to the opposite span's output. Figure 5-9 illustrates PCM looping back from span A’s output, as a result of a Line Loop Set code received by span B’s input. PCM is also passed on to the LIU B input, even though the LIUs are not in the PCM path. T1 line receivers and line buildouts are kept in the PCM loop to maintain the proper T1 line levels. Figure 5-9 shows the path of the line loopback signal.

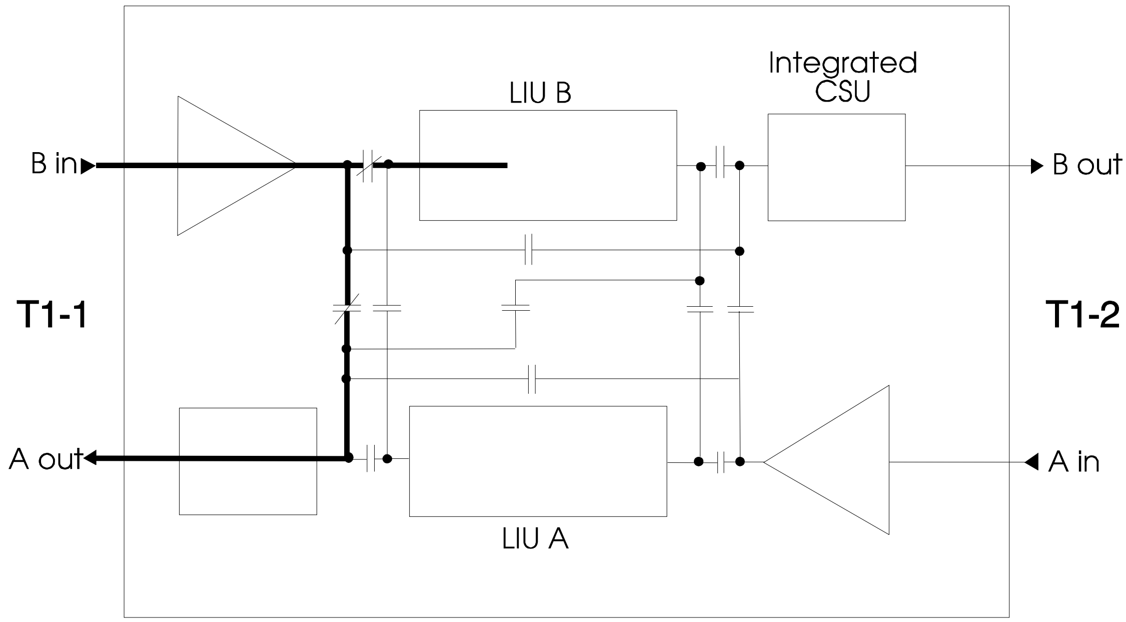


Figure 5-9. Channel Bank: Line Loopback

Channel Bank: Payload Loopback

Payload loopback is initiated from the D/I Mux III software interface. In payload loopback, the LIUs are included in the data path.

Incoming PCM from span B is sent to the input of LIU B, then from the output of LIU B to the input of LIU A, and finally from the output of LIU A to the output of span A, as depicted in Figure 5-10. PCM from the output of LIU B is blocked.

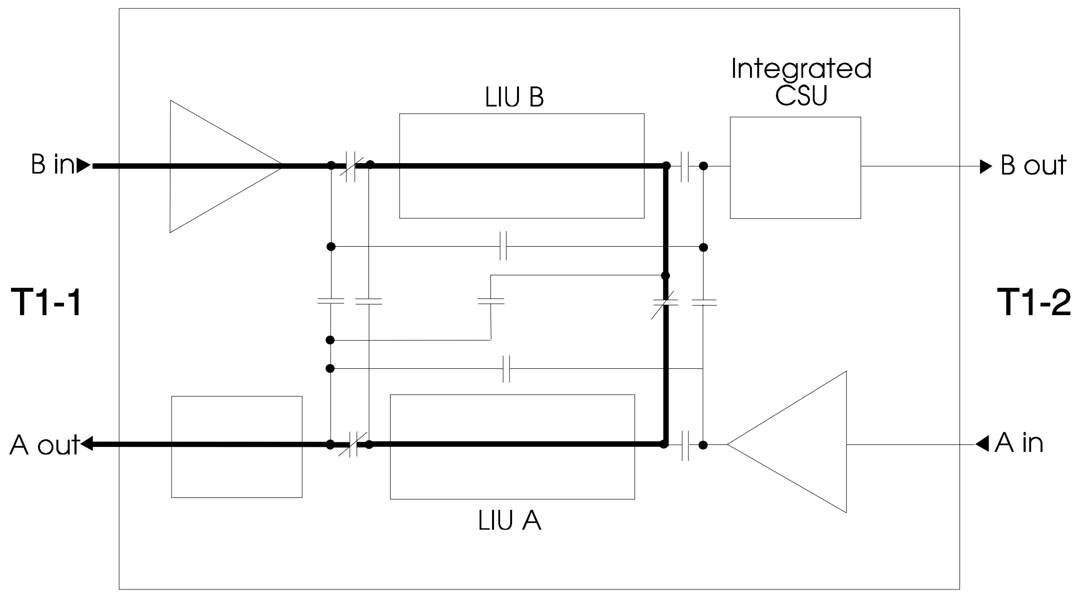


Figure 5-10. Channel Bank: Payload Loopback

Drop-and-Insert: Normal Operation

Under normal drop-and-insert operation, the Dual CSU Interface routes incoming PCM from span B to the input of LIU B, and sends PCM from the output of LIU B to the output of span B. Incoming PCM from span A is sent to the input of LIU A, and PCM from the output of LIU A is sent to the output of span A. That is, PCM coming in on span A is sent out on span A, and PCM coming in on span B is sent out on span B. Channels from either span can be dropped (received) or inserted (sent) on the appropriate line card of the D/I Mux III. D/I Mux III circuits can be inserted into either T1 span. Drop-and-insert in normal operation is illustrated in Figure 5-11.

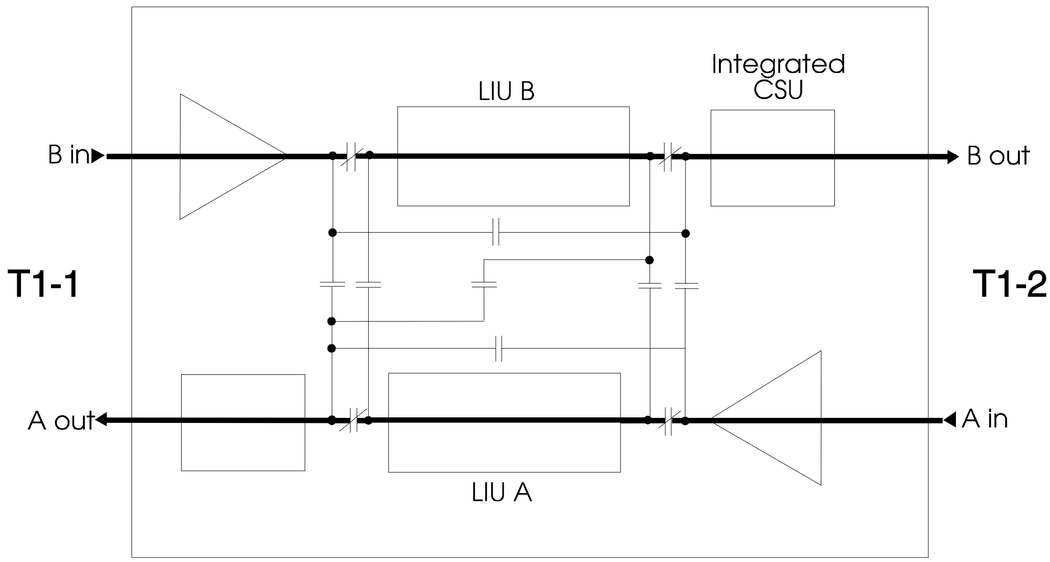


Figure 5-11. Drop-and-Insert: Normal Operation

Drop-and-Insert: Bypass

Bypass mode removes the D/I Mux III from the T1 line by bypassing the incoming T1 PCM around the LIUs. The Dual CSU Interface receivers and line buildouts are left in line to provide the correct levels on the T1 line. Within the D/I Mux III shelf, the output of LIU B is connected to the input of LIU A, and the output of LIU A is connected to the input of LIU B, as illustrated in Figure 5-12. This allows the D/I Mux III to frame on itself, providing an internal operational check.

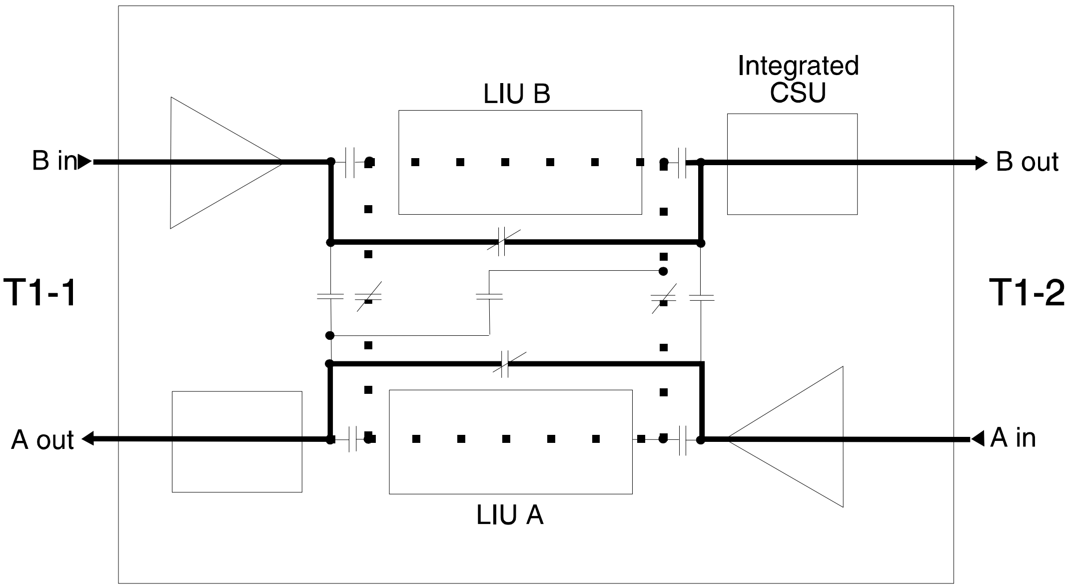


Figure 5-12. Drop and Insert: Bypass

Drop-and-Insert: Line Loopback

Line loopback is set in response to receiving the “Line Loop Set” code on a span's input. PCM arriving at the input is looped back to the opposite span's output. The LIUs are not in the PCM path. T1 line receivers and line build outs are kept in the PCM loop to maintain the proper T1 line levels. In line loopback, the PCM is looped before reaching the LIUs

Drop-and-Insert: T1-1 Line Loopback

Line Loop Set code received on the input of span B causes span B input PCM to be looped back out span A before reaching the LIUs, as well as passing it on to the input of LIU B. Output PCM from LIU B is sent to the output of span B. PCM from the input of span A is unaffected, as depicted in Figure 5-13. The output of LIU A is blocked.

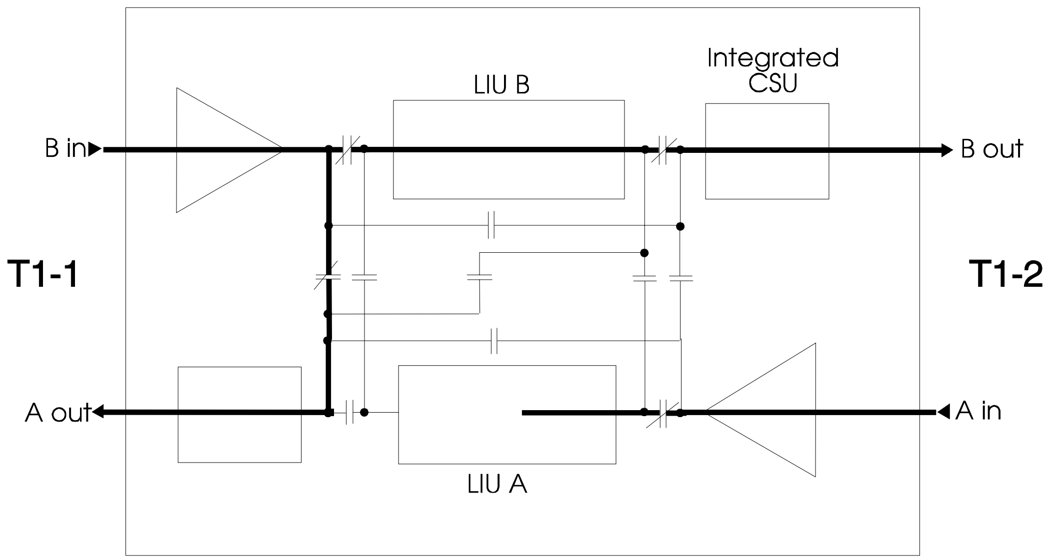


Figure 5-13. Drop-and-Insert: T1-1 Line Loopback

Drop-and-Insert: T1-2 Line Loopback

Line Loop Set code received on the input of span A causes span A input PCM to be looped back out span B before reaching the LIUs, as well as passing it on to the input of LIU A. Output PCM from LIU A is sent to the output of span A. PCM from the input of span B is unaffected, as shown in Figure 5-14. The output of LIU B is blocked.

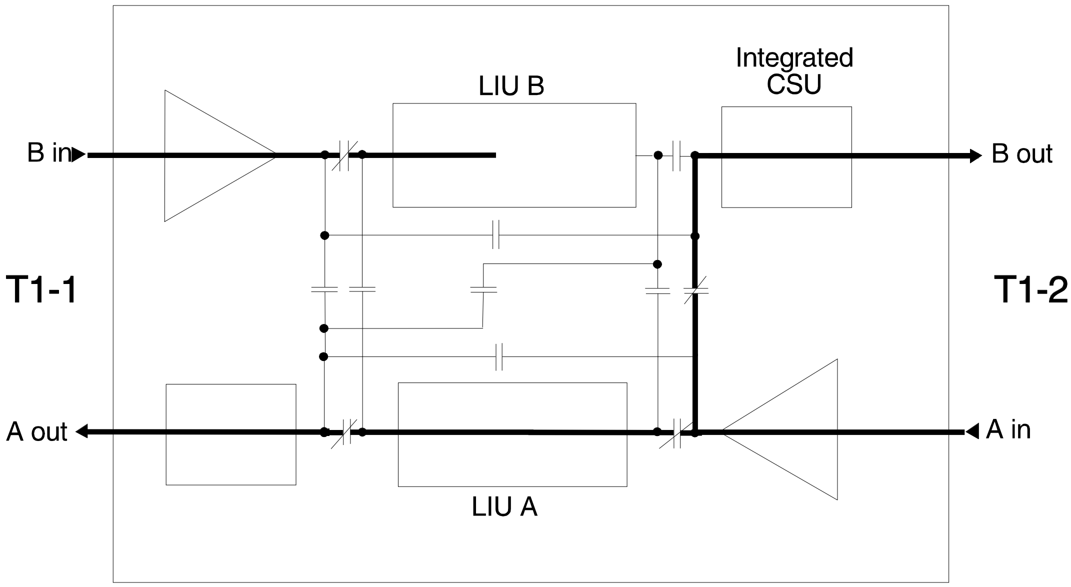


Figure 5-14. Drop-and-Insert: T1-2 Line Loopback

Drop-and-Insert: T1-1 and T1-2 Line Loopback

Line Loop Set code received on span B input causes PCM to be looped back out span A's output, as well as being passed on to the input of LIU B. The PCM from the output of the LIU A is blocked. Line Loop Set code received on span A input causes PCM to be looped back out span B's output, as well as being passed on to the input of LIU A. The PCM from the output of LIU B is blocked, as illustrated in Figure 5-15.

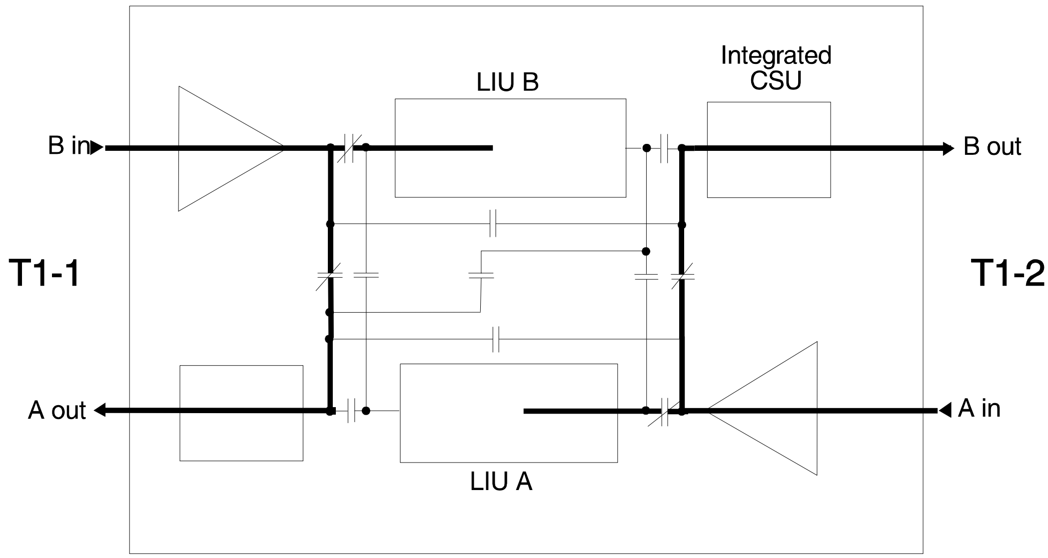


Figure 5-15. Drop-and-Insert: T1-1 and T1-2 Line Loopback

Drop-and-Insert: Payload Loopback

Payload loopback is initiated from the D/I Mux III software interface. In payload loopback, the LIUs are included in the data path; line loopback does not include the LIUs. In payload loopback, the loopback occurs after rather than before the LIUs.

Drop-and-Insert: T1-1 Payload Loopback

Incoming PCM from span B is sent to the input of LIU B, then from the output of LIU B to the input of LIU A, and finally from the output of LIU A to the output of span A. PCM from the output of LIU B is also sent to the output of span B. Detail is depicted in Figure 5-16.

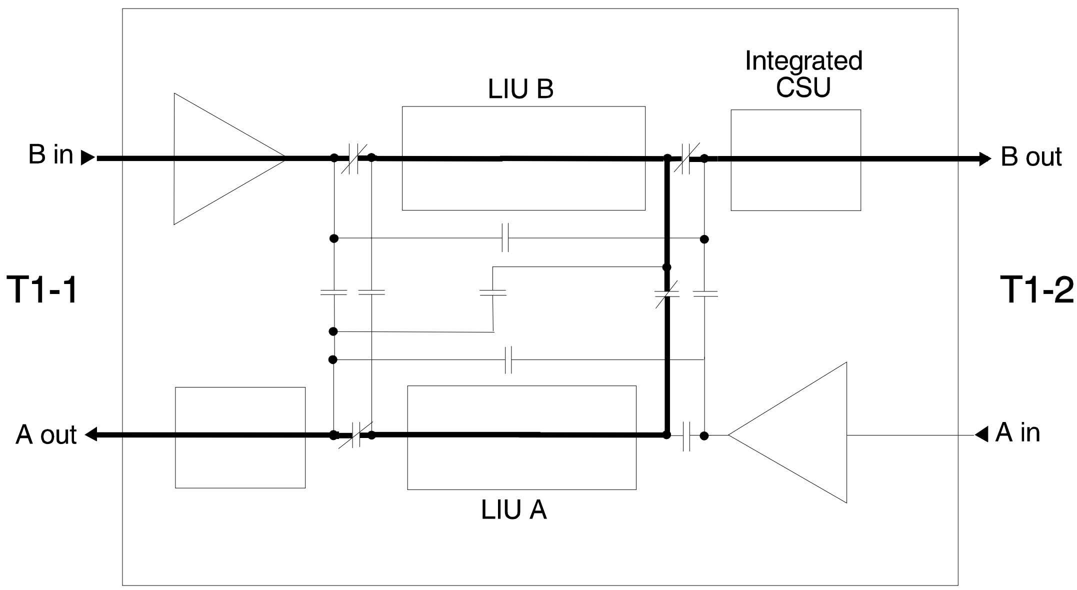


Figure 5-16. Drop-and-Insert: T1-1 Payload Loopback

Drop-and-Insert: T1-2 Payload Loopback

Incoming PCM from span A is sent to the input of LIU A, then from the output of LIU A to the input of LIU B, and finally from the output of LIU B to the output of span B. PCM from the output of LIU A is also sent to the output of span A. Reference Figure 5-17.

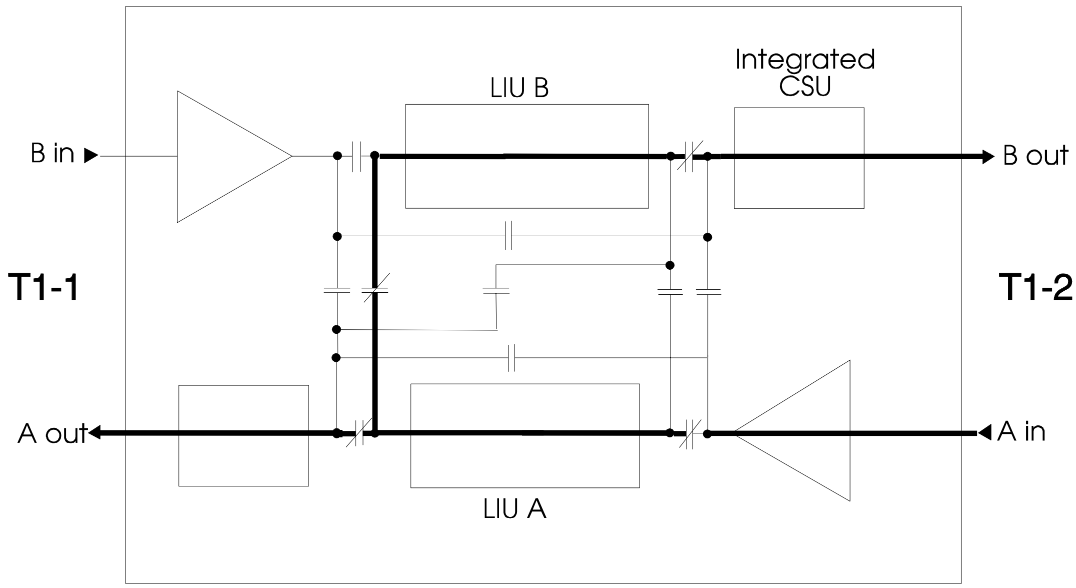


Figure 5-17. Drop-and-Insert: T1-2 Payload Loopback

Dual Channel Bank: Normal Operation

In Dual Channel Bank operation, the D/I Mux III acts as two separate channel banks, one looking to T1-1, and the other looking to T1-2. The Dual CSU Interface routes incoming PCM from span B to the input of LIU B, and sends PCM from the output of LIU B to the output of span B. Incoming PCM from span A is sent to the input of LIU A, and PCM from the output of LIU A is sent to the output of span A. The paths through both LIUs are blocked so information cannot pass through the system. See detail in Figure 5-18.

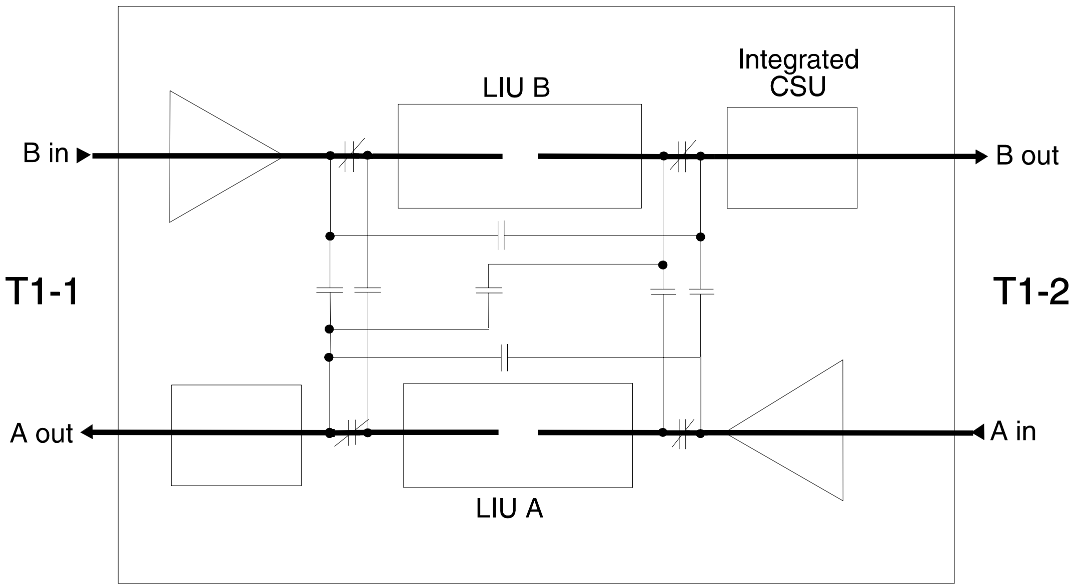


Figure 5-18. Dual Channel Bank: Normal Operation

Dual Channel Bank: Bypass

Bypass mode is not allowed in Dual Channel Bank mode.

Dual Channel Bank: Line Loopback

Line loopback is set in response to receiving a Line Loop Set code on a span's input. PCM arriving at the input is looped back to the opposite span's output. The LIUs are not in the PCM path. T1 line receivers and line buildouts are kept in the PCM loop to maintain the proper T1 line levels. In line loopback, the PCM is looped before reaching the LIUs

Dual Channel Bank: T1-1 Line Loopback

Line Loop Set code received on the input of span B causes PCM to be looped back out the output of span A. Output PCM from LIU B is sent to the output of span B. PCM from the input of span A and the output of LIU A are blocked. See Figure 5-19 for detail.

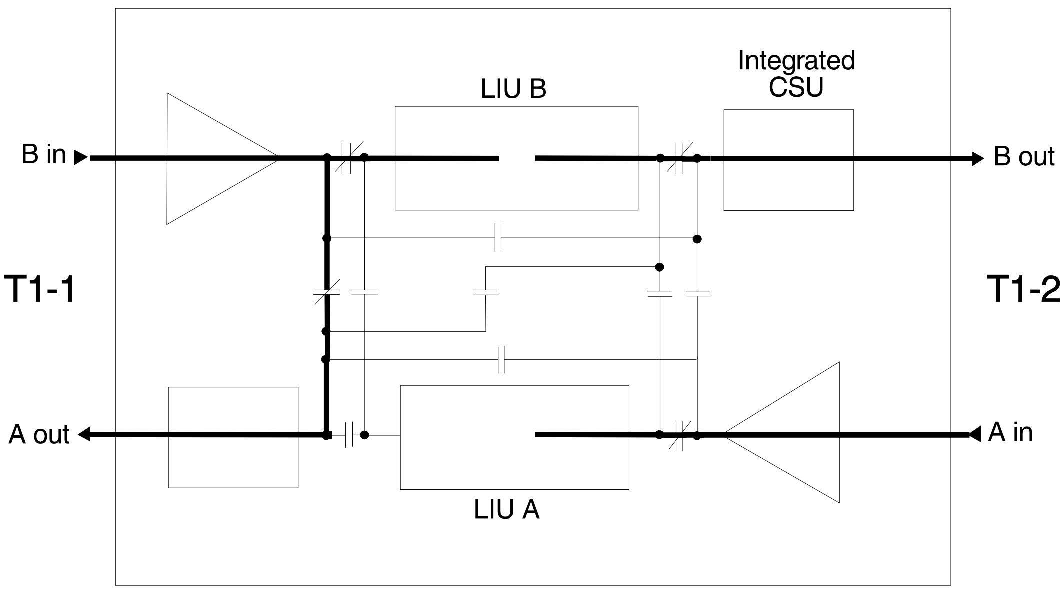


Figure 5-19. Dual Channel Bank: T1-1 Line Loopback

Dual Channel Bank: T1-2 Line Loopback

Line Loop Set code received on the input of span A causes PCM to be looped back out the output of span B. Output PCM from LIU A is sent to the output of span A. PCM from the input of span B and the output of LIU B are blocked. Reference Figure 5-20.

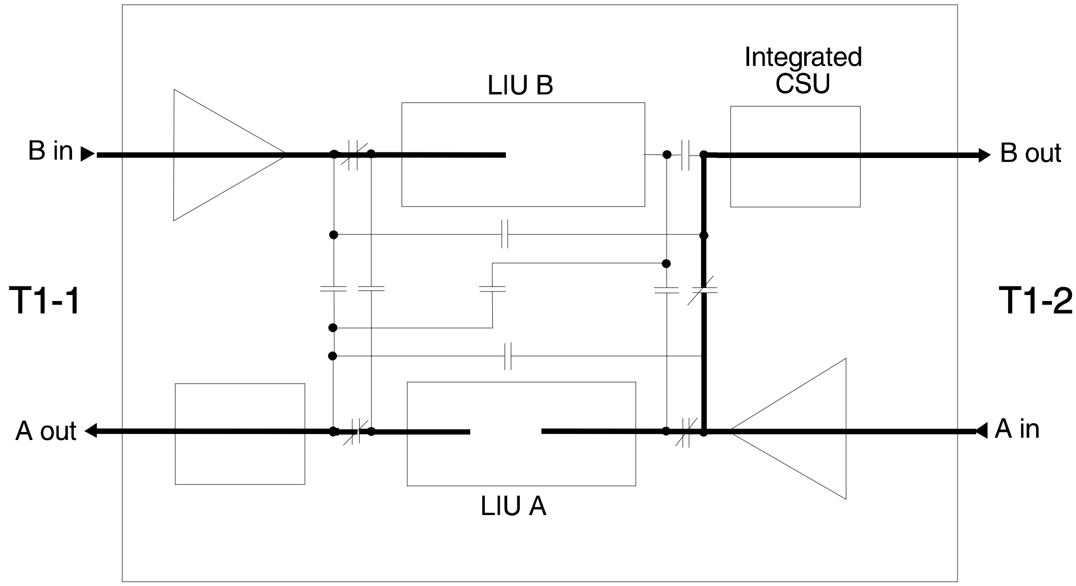


Figure 5-20. Dual Channel Bank: T1-2 Line Loopback

Dual Channel Bank: T1-1 and T1-2 Line Loopback

Line Loop Set code received on span B input causes PCM to be looped back out span A's output before reaching the LIUs, as well as being passed on to the input of LIU B. The PCM from the output of LIU B is blocked. Line Loop Set code received on span A input causes PCM to be looped back out span B's output before the LIUs, as well as being passed on to the input of LIU A. The PCM from the output of the LIU A is blocked. See Figure 5-21 for details.

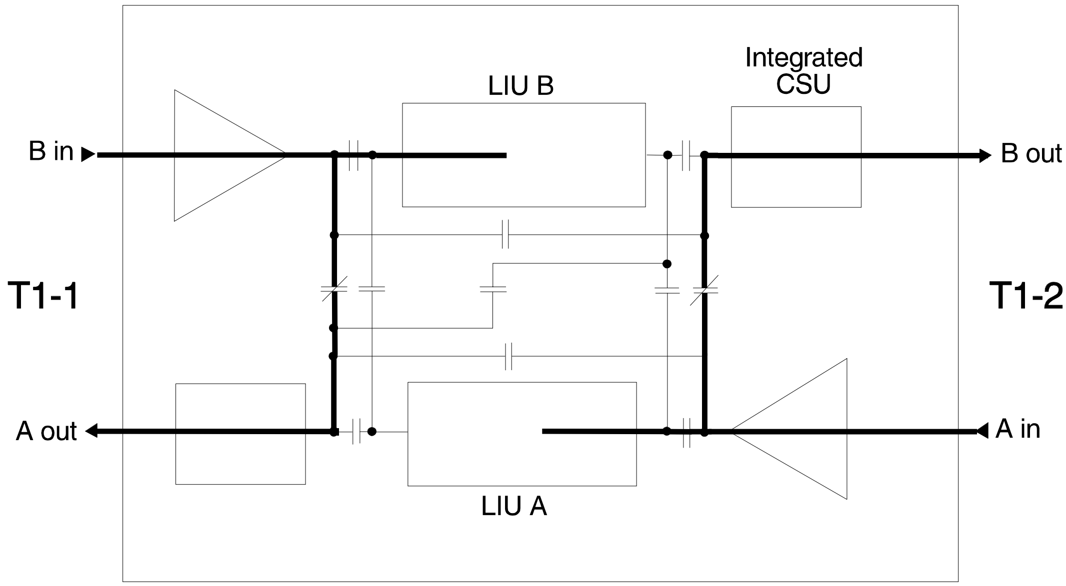


Figure 5-21. Dual Channel Bank: T1-1 and T1-2 Line Loopback

Dual Channel Bank: Payload Loopback

Payload loopback is initiated from the D/I Mux III software interface. In payload loopback, the LIUs are included in the data path; line loopback does not include the LIUs. In payload loopback, the loopback occurs after rather than before the LIUs.

Dual Channel Bank: T1-1 Payload Loopback

PCM from span B (T1-1) is sent to the input of LIU B. The output of LIU B is looped to the input of LIU A. The output of LIU A is sent out on span A (T1-1). The input from span A (T1-2) is blocked, as is the output path to span B (T1-2). In other words, the T1-2 side of the D/I Mux III is now disconnected from the network. The LIUs are configured to allow data input on span B (T1-1) to be output on span A (T1-1). The data input on span B (T1-1) will be dropped to both T1-1 and T1-2 line cards. See detail in Figure 5-22.

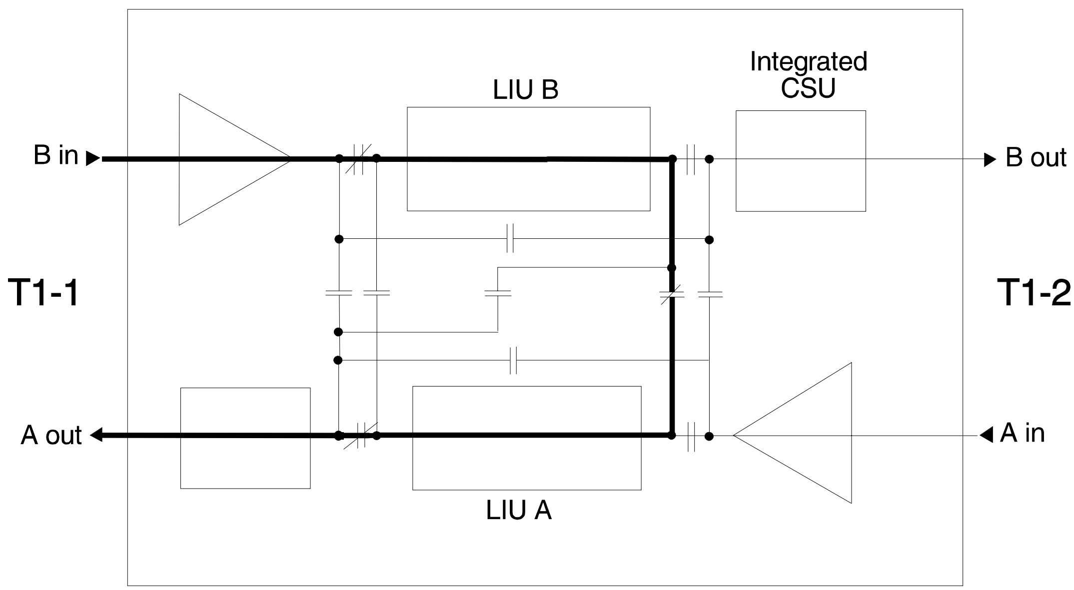


Figure 5-22. Dual Channel Bank: T1-1 Payload Loopback

Dual Channel Bank: T1-2 Payload Loopback

PCM from span A (T1-2) is sent to the input of LIU A. The output of LIU A is looped to the input of LIU B. The output of LIU B is sent out on span B (T1-2). The input from span B (T1-1) is blocked, as is the output path to span A (T1-1). In other words, the T1-1 side of the D/I Mux III is now disconnected from the network. The LIUs are configured to allow data input on span A (T1-2) to be output on span B (T1-2). The data input on span A (T1-2) will be dropped to both T1-1 and T1-2 line cards. See Figure 5-23 for details.

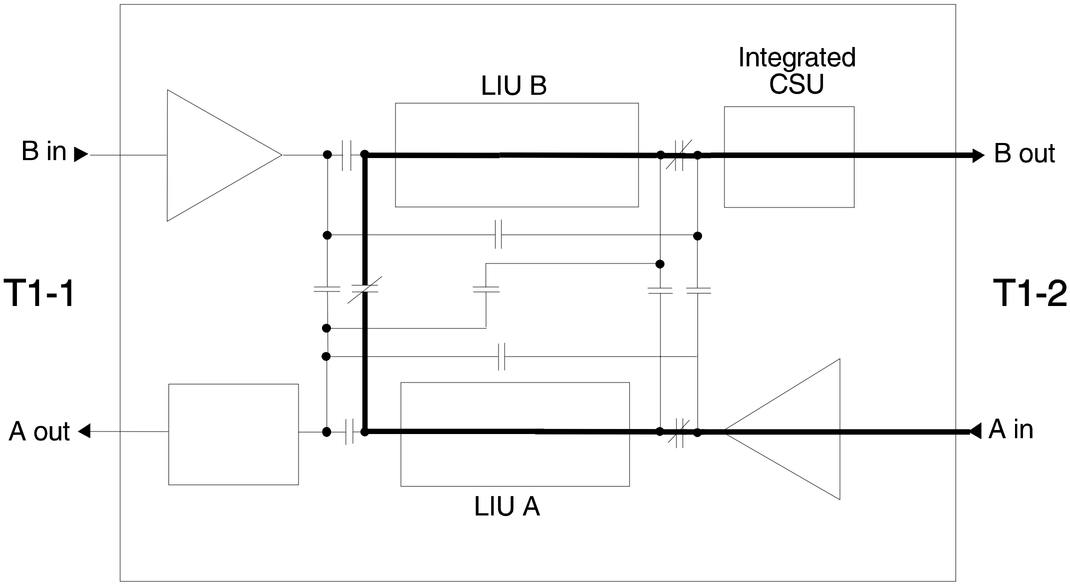


Figure 5-23. Dual Channel Bank: T1-2 Payload Loopback

Software Diagnostics

The following section illustrates and describes the various screens and processes for performing software diagnostics on the D/I Mux III system. Examples are included for diagnostics and performance monitoring.

OL - Operate Line Card Diagnostics

Enter **OL** to display the Operate Line card diagnostics screen on a specific line card, as depicted in Figure 5-24. Refer to the related line card user manual for the specific options on individual line cards.

```
] OL

Slot Number
[1]

** Slot 1 Is Empty **
```

Figure 5-24. Operating Line Card Diagnostics Screen

OD - Operate Diagnostics

Enter **OD** to access the Operate Diagnostics screen as depicted below. The example in Figure 5-25 is of a Dual CSU Interface (Integrated CSU) card in channel bank mode.

```
] OD

17:19:37----------- [ Operate Diagnostics ] ----------02/01/96

CSU Loopback
  Normal

T1-1
----
 0) Clear Loopback
 2) Set PAYLOAD Loopback
 4) Set LINE Loopback
 6) Send REM Loop-up
 8) Send REM Loop-down

Shelf Controls
--------------
 C) Bypass                    E) Reset Common/Line Cards
 D) Unbypass                  F) Unloop Line Cards

 G) Shelf Restart             O) Acknowledge ACO
 H) Display Alarms

 Q) Quit

** Warning: Ensure that a network clock source is
   provided for the T1 port under test.

Are You Sure?
 Y) Yes
 N) No
[Y/N]
```

Figure 5-25. Channel Bank Mode Operate Diagnostics Screen

Figure 5-26 displays diagnostics options in drop-and-insert and dual channel bank modes, with a Dual CSU Interface. Choose the desired T1 port loopback as listed under the T1-1 or T1-2 column.

```
] OD

17:22:12 --------- [ Operate Diagnostics ] ---------- 02/01/96

CSU Loopback
  Normal

T1-1         T1-2
-----        -----
 0)          1) Clear Loopback
 2)          3) Set PAYLOAD Loopback
 4)          5) Set LINE Loopback
 6)          7) Send REM Loop-up
 8)          9) Send REM Loop-down

Shelf Controls
--------------
 C) Bypass                E) Reset Common/Line Cards
 D) Unbypass              F) Unloop Line Cards

 G) Shelf Restart         O) Acknowledge ACO
 H) Display Alarms

 Q) Quit

** Warning: Ensure that a network clock source is
   provided for the T1 port under test.

Are You Sure?
 Y) Yes
 N) No
[Y/N] Y
```

Figure 5-26. Dual Channel Bank and Drop-and-Insert Modes Operate Diagnostics Screen

When using a Dual DSX-1 Interface the available diagnostics options are limited to the selections shown in Figure 5-27.

```
] OD

17:24:18---------- [ Operate Diagnostics ]-------- 06/25/96

T1 Interface
 Normal

Shelf Controls
--------------
 C) Bypass                  E) Reset Common/Line Cards
 D) Unbypass                F) Unloop Line Cards

 G) Shelf Restart           O) Acknowledge ACO
 H) Display Alarms

 Q) Quit

** Warning: Ensure that a network clock source is
   provided for the T1 port under test.

Are You Sure?
 Y) Yes
 N) No
[Y/N] Y
```

Figure 5-27. Dual DSX-1 Interface Mode Operate Diagnostics Screen

Performance

Enter **PM** to begin the Performance Monitoring sequence. This screen will only appear if a Facilities Data Link Processor (FDLP) is installed in the multiplexer. Consult the *FDLP User's Manual* for the various options of the Performance Monitor screen, as depicted in Figure 5-28.

```
] PM

10:40:23---------- [ PERFORMANCE MONITOR ]----------- 03/08/96

Select Direction              Select Side    AT&T/ANSI
 A) T1-1             D) User        G) AT&T
 B) T1-2             E) Network     H) ANSI
 C) Both             F) Both        I) Both
[ T1-1 ]            [ User ]       [ AT&T/ANSI T1-1 & None T1-2 ]

Screen Reports      Clear Counters  Printer Reports
 0) Current Status   4) ESF Errors   6) ESF Error Counts
 1) 1 Hour           5) Others       7) 1 Hour
 2) 24 Hour                          8) 24 Hour
 3) ANSI                             9) ANSI

Logging of Network Messages     Network May Reset User Counters
 L) Disable                      P) Disable
 M) Enable With Data             R) Enable
 N) Enable Without Data         [ T1-1 Enabled & T1-2 Enabled ]
[ T1-1 Disabled & T1-2 Disabled ]

 S) Serial Port Setup

 Q) Quit
```

Figure 5-28. Performance Monitor Screen

SB - Set Bit Error Rate Options

Enter **SB** to access the Set Bit error rate options screens. These include the Set Frame Error Rate Test (ERT) Alarm screen, and the Cyclic Redundancy Check (CRC) ERT Alarm screen. When the D/I Mux III system is configured for D4 operation, the **SB** command displays the Set Frame ERT Alarm screen. When the D/I Mux III is configured for Extended Super Frame (ESF) operation the **SB** command shows the Set CRC ERT Alarm screen. The **SB** alarm screen is available with all D/I Mux III systems. Framing error and CRC error detection are performed on the Line Interface Units (LIUs).

The error rate test gives an ongoing evaluation of the T1 line. If an error threshold is passed, a minor alarm occurs to warn the user of degradation in transmission. The alarm can be used to initiate a change in the network through system or network software. The alarm feature can be disabled.

Figure 5-29 illustrates a Set CRC ERT Alarm screen. Refer to *Chapter 4. Configuration and Operation* for further detail on setting the bit error rate.

```
] SB

17:20:41 ---------- [ Set CRC ERT Alarm ]----------- 06/25/92

     ------------------------ Alarm ------------------------
       ERT   Set Pt.   Resolution       Status
       ---   -------   --------------   ------
T1-1 : 0E-4   [9E-1]   [1E-4  3 Secs]   Disabled
T1-2 : 0E-4   [9E-1]   [1E-4  3 Secs]   Disabled

CRC ERT Alarm
 1) Set Pt.
 2) Resolution

 E) Enable
 D) Disable

 R) Reset ERT
 Q) Quit Q

Clear Alarm History
 Y) Yes
 N) No
[Y/N]
```

Figure 5-29. Set Bit Error Rate Options Screen Alarm

Technical Assistance

After software diagnostics and hardware diagnostics have been performed, the next step in troubleshooting the system is to follow a systematic replacement of suspected failed units. This requires spares on hand, or a call to Coastcom to expedite a replacement unit. Before a replacement unit is shipped, it must be confirmed as a failure by a Coastcom Technical Support Engineer. Call Technical Support Services at 1-800-385-4689.

D/I Mux III Messages

Table 5-4 lists all of the D/I Mux III error and status messages. Messages appear within the table in alphabetical order.

Table 5-4. D/I Mux III Messages (Page 1 of 3)

Error Message	Cause	Solution
Card Removed	Card not in slot.	Replace card.
Clock Sources Fixed In ALPS Loop Mode	The clock source cannot be changed when in ALPS loop mode with loop shelf timing; it can only be changed with local shelf timing.	Informational message only; no action required.
Clock Sources Fixed In Channel Bank/Loop Mode	The clock source cannot be changed when in channel bank mode with loop shelf timing; it can only be changed with local shelf timing.	Informational message only; no action required.
Command Not Processed	No acknowledgment of the command being processed by the system	Check that the command requested matches the installed equipment.
First Unbypass Shelf	The loopback command entered cannot be performed until the shelf is out of bypass mode.	Take the shelf out of bypass mode, then enter the loopback command again.
Invalid Command for Password	This level password excludes use of the entered command.	Log out, then enter the correct-level password that allows use of the entered command. See *Chapter 4. Configuration and Operation*, for a description of password levels, and the commands allowed at each level.
Invalid DS0 Range (1-24)	Either the DS0 range was outside the range of 1 to 24, or the first number of the range was greater than the second number.	Check the range, then enter the numbers again.
Invalid Entry	The entry is not a valid value for this command, e.g., a letter was entered instead of a number, a number was entered instead of a letter, etc.	Enter a valid value for this command.
Invalid Map Number (1..7)	The map number entered was not a number between 1 and 7.	Enter a map number between 1 and 7.
Invalid Password	The password entered while logging in was incorrect.	Verify that the password is correct, then enter the password again.
Invalid Slot Number (1..N)	The slot number entered was not a number between 1 and 8 for the 8-slot shelf; or not a number between 1 and 12 for the 12-slot shelf; or not a number between 1 and 24 for the 24-slot shelf.	Check the slot number, then enter the number again. Check for proper shelf size selection, using **SP** command.

Error Message	Cause	Solution
Invalid Slot Range (1-N)	Slot range entered was not a number between 1 and 8 for the 8-slot shelf; or not a number between 1 and 12 for the 12-slot shelf; or not a number between 1 and 24 for the 24-slot shelf; or the first number of the range was greater than the second number.	Check the range, then enter the numbers again. (To check for proper shelf size, use the **SP** command.)
LIU B Slot is Empty	Self explanatory.	Informational message only; no action required.
LIU A Slot is Empty	Self explanatory.	Informational message only; no action required.
Lower Strobe Card Not Installed	Self explanatory.	Informational message only; no action required.
Lower Strobe Error	Self explanatory.	Check the lower strobe card and retry operation.
Map is Working	This map is the working map and its status cannot be modified or changed while it is the working map.	Make another map the working map (copy the working map), or choose another map to modify.
Map Not Enabled	A disabled map cannot be made the working map.	Change the status of the map to *Enabled* before making it the working map.
Original Alarm Map Working	Only one alarm map can be enabled at a time. Another alarm map is already enabled and its status cannot be changed because it is currently the working map. Normally, when a second alarm map is enabled, the first alarm map is disabled, unless it is the working map.	Change the first alarm map so that it is not the working map. Then try again to change the status of the second alarm map to *Enabled*.
Original Event Map Working	Only one event map can be enabled at a time. Another event map is already enabled and its status cannot be changed because it is currently the working map. Normally, when a second event map is enabled, the first event map is disabled, unless it is the working map.	Change the first event map so that it is not the working map. Then try again to change the status of the second event map to *Enabled*.
Original Time Map Working	Only one time map can be enabled at a time. Another time map is already enabled and its status cannot be changed because it is currently the working map. Normally, when a second time map is enabled, the first time map is disabled, unless it is the working map.	Change the first time map so that it is not the working map. Then try again to change the status of the second time map to *Enabled*.
Password Already Used	Duplicate passwords are not allowed.	Select and enter another password.
Password Table Full	A maximum of eight passwords are allowed, and eight are already entered.	Delete an already-defined password, then enter the new password.
Request is Not Allowed	Self explanatory.	Make corrections and retry. If appropriate, respond to system prompts to correct the problem.

Error Message	Cause	Solution
Reinstall Line Card Error	Power-up sequence of the line card is not correct.	Install line card again, perhaps with power off.
Switch to Normal Mode	Self explanatory.	Informational message only; no action required.
That Slot Appears Unoccupied	Operation cannot be performed because there is no card in the slot, or because that card is not responding.	Check to see if a card is in the slot. Reseat the card, then re-enter the command. If the message continues to be received, replace the card.
This Selection Has No Meaning For D4W Card	Self explanatory.	Informational message for dual-four wire cards. Make corrections and retry.
Two Alarm Map Types Not Allowed	Self explanatory.	Informational message. Make corrections and retry.
Two Event Maps Cannot Be Enabled	Only one event map can be enabled at a time. When a second event map is enabled, the first event map's status is changed from *Enabled* to *Disabled*.	Informational message. Make corrections and retry.
Two Time Maps Cannot Be Enabled	Only one time map can be enabled at a time. When a second map is enabled, the first map's status is changed from *Enabled* to *Disabled*.	Informational message. Make corrections and retry.
Two Time Maps With The Same Time Not Allowed	Self explanatory.	Informational message. Make corrections and retry.
Try Again	Self explanatory.	Informational message. Make corrections and retry.
Unsupported Loop Code	Self explanatory.	Informational message only; no action required.
Upper Strobe Card Not Installed	Self explanatory.	Informational message only; no action required.
Upper Strobe Error	Self explanatory.	Check the upper strobe card and retry the operation.
Working Map Type Cannot Be Modified	The map is currently the working map and cannot be modified while it is the working map.	Select another map to modify, or make another map the working map. When the map is no longer the working map, its type can be changed.

Alarm Reporting

Table 5-5 describes the various D/I Mux III alarms. Each is grouped as Major, Minor, or Info as applicable.

Table 5-5. Alarm Reporting (Page 1 of 2)

Alarm	Severity	Report to NCC	Log into History	Description
Card Added/Removed	Major	Yes	Yes	Major alarm if either of the LIUs or the Strobe card is removed, otherwise it is an informational alarm.
RED Alarm	Major	Yes	Yes	Loss of T1 framing for > 450 ms.
YELLOW Alarm	Major	Yes	Yes	Bit 2 equals Zero for all 24 DS0s received or yellow alarm in FDL of ESF.
Rly V Alarm	Major	Yes	Yes	-48 V supply relay failed.
RCVD Clk Loss	Major	Yes	Yes	Recovered T1 clock lost.
INT Clk Fail	Major	Yes	Yes	Internal clock failed.
ALPS T1-1 Loop	Major	Yes	Yes	Data rerouted from T1-1 to T1-2 as a result of a span failure.
ALPS T1-2 Loop	Major	Yes	Yes	Data rerouted from T1-2 to T1-1 as a result of a span failure.
ALPS Pass Thru	Minor	Yes	Yes	Both spans in use as a result of a span failure elsewhere in the network.
T1-1 BER Alarm	Minor	Yes	Yes	Bit Error Rate on a T1-1 span exceeds threshold.
T1-2 BER Alarm	Minor	Yes	Yes	Bit Error Rate on a T1-2 span exceeds threshold.
PS1 ALARM	Minor	Yes	Yes	Power Supply (PS1 card slot) failed.
PS2 ALARM	Minor	Yes	Yes	Power Supply (PS2 card slot) failed.
+5V Fail	Minor	Yes	Yes	Plus 5-V failed.
+12V Fail	Minor	Yes	Yes	Plus 12-V failed.
-12V Fail	Minor	Yes	Yes	Minus 12-V failed.
-5V Fail	Minor	Yes	Yes	Minus 5-V failed.
-48V Fail	Minor	Yes	Yes	Minus 48-V failed.
Sig Bat Fail	Minor	Yes	Yes	Signal Battery failed.
Rng Gen +V Err	Minor	Yes	Yes	Ringing Generator failed.
Rng Gen -V Err	Minor	Yes	Yes	Ringing Generator failed.
Rng Gen Freq Err	Minor	Yes	Yes	Ringing Generator failed.

Alarm	Severity	Report to NCC	Log into History	Description
Prov Bus Err	Info	No	Yes	Tx and/or Rx failed over the provisioning bus.
Diagnostics Err	Info	No	No	Card diagnostics failed.
LINE T1-1 LPBK	Info	Yes	Yes	The T1-1 span is looped back towards the network. Message at the looped end.
LINE T1-2 LPBK	Info	Yes	Yes	The T1-2 span is looped back towards the network. Message at the looped end.
PAYLOAD T1-1 LPBK	Info	Yes	Yes	The T1-1 span is looped back towards the network. Message at the looped end.
PAYLOAD T1-2 LPBK	Info	Yes	Yes	The T1-2 span is looped back towards the network. Message at the looped end.
CGA	Info	Yes	Yes	Carrier Group Alarm signal produced 2.5 s after loss of T1 framing. Has a 10-s minimum release time.
DCGA	Info	No	No	Delayed Carrier Group Alarm signal is produced 0-20 seconds after CGA is set.
Req Remote LLB	Info	No	Yes	Loop initiated from the local LIU.
REMOTE Loop	Info	No	No	T1 span is looped back towards the network. Message at the looped end.
CLOCK Change	Info	No	Yes	Reports a clock change event.
RCVD Clk Freq Err	Info	No	Yes	The recovered clock shifted from the Stratum 4 clock specifications.
INT Clk Freq Err	Info	No	Yes	The internal clock shifted from the Stratum 4 clock specifications.
EXT2 Clk Freq Err	Info	No	Yes	Slot-2 clock shifted from the Stratum 4 clock specs.
EXT9 Clk Freq Err	Info	No	Yes	DB-9 clock shifted from the Stratum 4 clock specs.
EXT CLK Fail	Info	Yes	Yes	External clock failed. (DB-9, Slot-2, etc.)
Event Trigger	Info	Yes	Yes	Event input is grounded. Event map is on.
Event Map Sw	Info	No	Yes	Switched to an event map.
Time Map Sw	Info	No	Yes	Switched to a time map.
Alarm Map Sw	Info	No	Yes	Switched to an alarm map.
Task error	Info	No	Yes	Task switching error.
Man. Map Sw	Info	No	Yes	Switched to a manual map.
TTU Red Alarm	Info	No	Yes	Loss of frame reported by Tandem T1 Channel Unit (TTU).
TTU Yellow Alarm	Info	No	Yes	Bit 2 = Zero for all 24 DS0s received or yellow alarm in FDL of ESF on Tandem T1 Channel Unit (TTU).

APPENDIX A.

D/I MUX III SPECIFICATIONS

Appendix A. D/I MUX III SPECIFICATIONS

The following tables list the various D/I Mux III system specifications.

DS1 Signal	
Line Rate	2 x 1.544 Mbps ± 200 bps
Format	D4 Mode 3, or ESF
Framing	24 DS0 64 Kbps channels; 8 Kbps framing overhead (per AT&T Pub 62411)
Line Code	AMI
Zero Suppression Mode	B7, B8ZS, or Transparent
Clear Channel	B8ZS
Transmit Signal	DSX-1, CSU (optional)
Receive Signal	DSX-1 to -22.5 dB
Input/Output Impedance	100 ohms balanced ± 10 ohms
T1 Connections	DB-15F; RJ-48 (Network)
Transmit Equalization (DSX)	1 - 150 feet (Standard); 0 - 750 feet (Option)
Transmit Line Build-Out (CSU)	0.0 dB; -7.5 dB; -15.0 dB
Network Compatibility	AT&T Accunet T1.5
Maximum Bandwidth	1.344 Mbps (56 Kbps/DS0); 1.536 Mbps (64 Kbps/DS0)
Data Port Interfaces	
8, 12, or 24 Data Ports	V.35; RS-422; RS-232C; Switch-selectable EIA control lines; Compatible with DEC DMR11 (V.54) interface
Voice Connections	
Number	3; 6
Type	50-pin Amphenol style
Data Connections	
Number	8; 12; 24
Type	25-pin DB-25F
Dual CSU Interface (Integrated CSU) Jacks	
Access (Bantam)	Break-and-test signal monitors for transmit and receive
Monitor (Bantam)	Non-interruptive signal monitors for transmit and receive

Configuration and Control	
Software Controlled	With use of an ASCII terminal, Telnet, SNMP
User Test Functions	
Test Loopback	Loops towards user's equipment to test CSU and user's equipment (software control)
Network Loopback	Transmits and receives network loop codes with software or front panel switches
Alarms	
Contacts	2 Amp, dry contacts, make during alarm; one set each for audible, visual, and minor alarms
LIU Alarm Indicators	Local alarm (LOC); Remote alarm (YEL); Carrier Group Alarm (CGA); Receive framing errors (FRM); Bit 7 stuffing selected (B7); Receiving excessive bipolar violations (BPV); Receiving more than 32 consecutive zeros (0-DEN); Alarm indication signal (AIS); Network loop code received (RX); Network loop code transmitted (TX)
Power	
DC Power Supply	
-48 V Voltage Input	-44 to -56 Volts DC
Current	2.5 to 4 Amps- Nominal to Maximum shelf load
-24V Voltage Input	-22 to -28 VDC
Current	5 to 8 A Nominal to Maximum shelf load
AC Power Supply	
Voltage Input	110 Volts AC +/- 10%
Current	1.0 to 1.5 Amps - Nominal to maximum

Data Line Cards	
SDM - Subrate Data Multiplexer	SDM: 1.2 - 19.2 Kbps; 5-Port DS0B, Sync/Async 1-Port DS0A, Sync/Async *p*SDM: Point-to-Point & Multipoint; 0 - 19.2 Kbps Async MSDM: Multipoint; 12 - 19.2 Kbps; 5-Port Async, RS-232
SDCU - Synchronous Data Channel Unit	56/64 Kbps; 56/64 x N Kbps
OCUDP - Office Channel Unit Data Port	2.4, 4.8, 9.6, 56 Kbps; 4-Wire DDS; Switched 56 Kbps
Voice Line Cards	
4-Wire	E&M; PLR Signaling; ADPCM; TO;SCG
2-Wire	FXS; FXO; PLAR; TO; Megacom 800; DPO; DPT
Special Service Cards	
SOS - Smart Omni-orderwire Station	Voice Service Channel
DPC - Digital Program Channel	High Fidelity Audio Channel
MXS; MXO	FXS & FXO for Northern Telecom Meridian Switchboard
TTU - Tandem T1 Unit	T1 Access Channel Card

Dimensions and Weight			
	8-Slot	**12-Slot**	**24-Slot**
Shipping Weight (fully equipped)	17 Pounds	31 Pounds	45 Pounds
Width	17.00 Inches	17.00 Inches	17.00 Inches
Depth	11.75 Inches	11.75 Inches	11.75 Inches
Height	5.25 Inches	7.00 Inches	10.50 Inches
Environmental			
Voice Only	0°C to +55°C	0°C to +50°C	0°C to +55°C
Data	0°C to +50°C	0°C to +45°C	0°C to +50°C
Storage	-20°C to +60°C	-20°C to +60°C	-20°C to +60°C
Humidity	Up to 95% non-condensing		
Altitude	15,000 Feet (4.5 km) above sea level		
Approvals	FCC Part 15, Subpart B, Class A FCC Part 68 Complies with applicable sections of AT&T Publications 43801, 54018, 62310, 54075 Complies with applicable sections of ANSI Publications T1.403, T1.107 UL/CSA Standards, CSA-Certified for U.S. and Canada		

APPENDIX B.

-24 VOLT SYSTEMS

Appendix B. -24 VOLT SYSTEMS

The following cards are specific to a -24 Volt DC system.

Common Equipment

30118-121	T1 Interface (Requires -24 V for alarm relays)
30118-122	Enhanced T1 Interface (Requires -24 V for alarm relays)

Voice Cards

33242-124	2-Wire FXS (requires -24 Volt for Talk Battery); also requires a -24 V External Ringing Generator. Coastcom does not include a -24 V External Ringing Generator in its product list. Tellabs' model 8102 has a -24/48 V option switch. Contact Tellabs directly at (708) 969-8800.
The 2-Wire FXS	(650 ohm maximum) has a limited distance range when used in -24 V systems. Allow for one-half the cabling distance.
30058-001	C1SDCU - The C1DCU Control Unit will work in a –24 V system. However, a +24 V system will require an isolated ground. Coastcom does not provide an isolated ground.

APPENDIX C.

ACCESSORIES INSTALLATION

Appendix C. - ACCESSORIES INSTALLATION

Coastcom provides various accessories that can be used with D/I Mux III multiplexers for troubleshooting and maintenance purposes as well as for special applications. The following sections list and describe these optional accessories, and include procedures for their installation.

- Card Extender
- External AC Power Supply
- External Ringing Generator

Card Extender

The card extender (P/N 30316-001) can be used in any common equipment or channel card slot. All channel and common equipment cards will operate normally on the extender, and will allow switch and test point access.

The internal AC power supply should not be placed on the card extender without additional support.

Warning!
Using the card extender exposes the backplane supply voltages, including 100 volts from the ringer, at a point near the front edge of the D/I Mux III shelf.

External AC Power Supply

The External AC Power Supply (P/N 0400-0035) can supply up to ten (10) Amps of current at -48 V DC. The External AC Power Supply has protection circuitry; a short or surge on the output will cause the supply to shut down. Add a fuse panel if several multiplexers are to be supplied with -48 V DC. This provides individually fused power circuits to each multiplexer, which protects the overall system in the event of a single multiplexer failure.

Installing the External AC Power Supply

Connect the External AC Power Supply with power **Off**. The External AC Power Supply does not have a power ON/OFF switch. To ensure safety, verify that the AC power cord is not plugged in before beginning installation.

1. Connect pin 1 (chassis ground) on the power supply to pin 2 (positive voltage +) on the power supply.
2. Connect pin 2 on the power supply to the ground TB1-1 ground on the D/I Mux III multiplexer backplane.
3. Connect pin 3 on the power supply to the battery TB1-1 on the D/I Mux III multiplexer backplane.
4. Plug in the External AC Power Supply power cord, providing power to the unit.

Ringing Generator

The Ringing Generator (P/N 30034-003) is used to supply ringing voltage for applications with more than 20 Megacom, or heavily used FXS circuits. An external Ringing Generator used with FXS circuits may require -48 V DC. For more information on FXS circuits, refer to the FXS user's manual.

Installing the Ringing Generator

Warning!

Ringer voltage is hazardous! Make all connections with power **Off!**

1. Connect pin 1 on the ring generator to chassis ground on the D/I Mux III multiplexer backplane.
2. Connect pin 2 on the ring generator to positive ground on the D/I Mux III multiplexer backplane.
3. Connect pin 3 on the ring generator to -48 V DC (battery) on the D/I Mux III backplane.
4. Connect pin 4 to pin 3 (both on the ring generator), to bias the ringer with -48 V DC.
5. Connect pin 5 on the ring generator to the ringer input of the D/I Mux III backplane.
6. Apply power.

Figure C-1 depicts a typical ring generator.

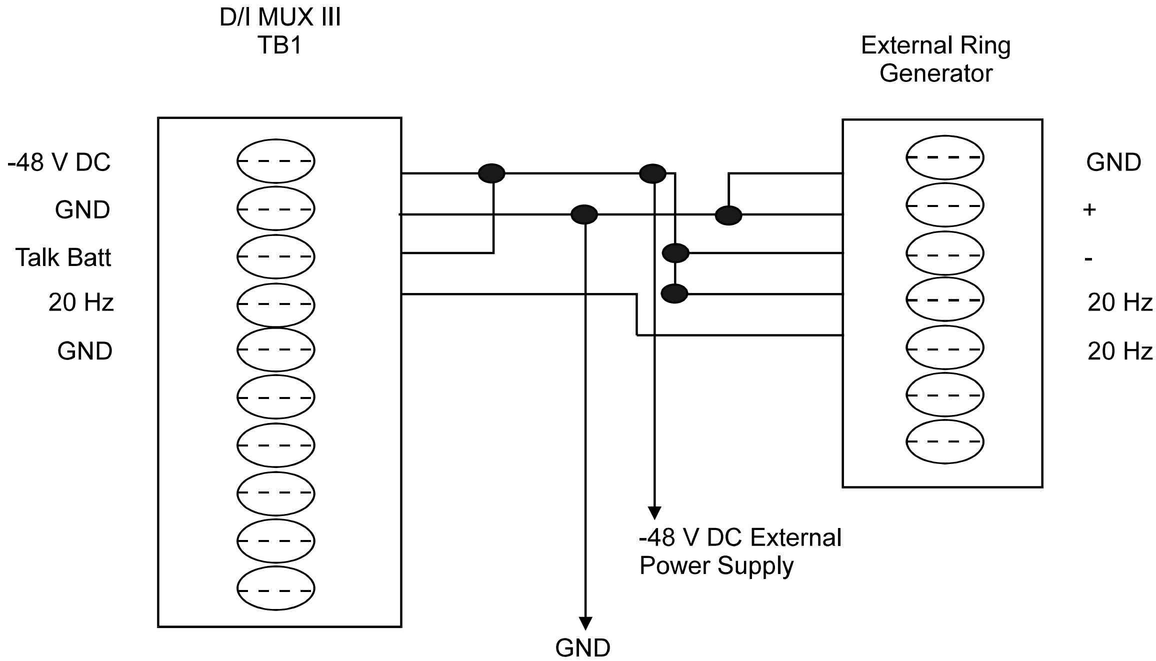


Figure C-1. Typical Ring Generator Circuit Diagram

APPENDIX D.

PRECONFIGURED MAPS

Appendix D. PRECONFIGURED MAPS

Eight pre-configured maps are available on the Strobe unit, and are described in this appendix. Select a map to match the desired application from the maps described in this appendix. If a map is required which differs from those supplied here, use the Set/edit Map matrix (**SM**) command to configure a custom map.

Use the Lower Strobe unit's option switches for map selection (see Figure 3-18), if software configuration is not available. If a control terminal is available for system software configuration, activate the map by selecting the Strobe card option switches in the Set shelf Configuration (**SC**) screen.

When given the choice of either a Nonvolatile Random Access Memory (NVRAM) or Strobe card option shelf configuration, select the Strobe option by typing **SC**, then select **O** for Strobe Card Option Switches, as depicted in Figure D-1.

```
SC

Enter Shelf Configuration Setting after Power Cycle

 N) NVRAM
 O) Strobe Card Option Switches

[N] O
```

Figure D-1. Strobe Option Switch Selection Screen

Review the Set/Edit Shelf Configuration section in *Chapter 4. Configuration and Operation* for details on menu selections available with the **SC** command. Following selection of either NVRAM or Option switch configuration, the next selections to be made are Mode of Operation, Shelf Timing, Frame Mode, Zero Suppression Mode, T1 REM Alarm Output and, finally, Apply Changes (save settings).

Following are the eight preconfigured maps available through use of the strobe switches.

Strobe Option Switch #1 - 24-Card Slots: 64 Kbps per Slot

Rows represent card slots and columns represent timeslots.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	TR																							
2		TR																						
3			TR																					
4				TR																				
5					TR																			
6						TR																		
7							TR																	
8								TR																
9									TR															
10										TR														
11											TR													
12												TR												
13													TR											
14														TR										
15															TR									
16																TR								
17																	TR							
18																		TR						
19																			TR					
20																				TR				
21																					TR			
22																						TR		
23																							TR	
24																								TR

Strobe Option Switch #2 - 12-Card Slots:
Two 64 Kbps per Slot

Rows represent card slots and columns represent timeslots.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1 A	TR																							
1 B		TR																						
2 A			TR																					
2 B				TR																				
3 A					TR																			
3 B						TR																		
4 A							TR																	
4 B								TR																
5 A									TR															
5 B										TR														
6 A											TR													
6 B												TR												
7 A													TR											
7 B														TR										
8 A															TR									
8 B																TR								
9 A																	TR							
9 B																		TR						
10 A																			TR					
10 B																				TR				
11 A																					TR			
11 B																						TR		
12 A																							TR	
12 B																								TR

Strobe Option Switch #3 - 12-Card Slots: 128 Kbps per Slot

Rows represent card slots and columns represent timeslots.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	TR	TR																						
2			TR	TR																				
3					TR	TR																		
4							TR	TR																
5									TR	TR														
6											TR	TR												
7													TR	TR										
8															TR	TR								
9																	TR	TR						
10																			TR	TR				
11																					TR	TR		
12																							TR	TR

Strobe Option Switch: #4 - 8-Card Slots: 192 Kbps per Slot

Rows represent card slots and columns represent timeslots.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	TR	TR	TR																					
2				TR	TR	TR																		
3							TR	TR	TR															
4										TR	TR	TR												
5													TR	TR	TR									
6																TR	TR	TR						
7																			TR	TR	TR			
8																						TR	TR	TR

Strobe Option Switch #5 - 6-Card Slots: 256 Kbps per Slot

Rows represent card slots and columns represent timeslots.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	TR	TR	TR	TR																				
2					TR	TR	TR	TR																
3									TR	TR	TR	TR												
4													TR	TR	TR	TR								
5																	TR	TR	TR	TR				
6																					TR	TR	TR	TR

Strobe Option Switch #6 - 4-Card Slots: 384 Kbps per Slot

Rows represent card slots and columns represent timeslots.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	TR	TR	TR	TR	TR	TR																		
2							TR	TR	TR	TR	TR	TR												
3													TR	TR	TR	TR	TR	TR						
4																			TR	TR	TR	TR	TR	TR

Strobe Option Switch #7 - 3-Card Slots: 512 Kbps per Slot

Rows represent card slots and columns represent timeslots.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	TR	TR	TR	TR	TR	TR	TR	TR																
2									TR	TR	TR	TR	TR	TR	TR	TR								
3																	TR	TR	TR	TR	TR	TR	TR	TR

Strobe Option Switch #8 - 1-Card Slot: 1.536 Kbps per Slot

Card slot 2 is used so the Slot 2 Sync function can be activated.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
2	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR	TR

APPENDIX E.

SNMP

Appendix E. SNMP

Simple Network Management Protocol (SNMP) is a protocol for, as well as a method of describing, the configuration and status values used to manage simple network devices. SNMP is transported either over Ethernet 10Base-T, or token ring, using the TCP/IP protocol stack, or communication interface. Coastcom's Advanced Multiplexer Control Units (AMCUs) use only the 10Base-T protocol. SNMP allows both the SNMP manager and the managed device (the agent) to send packets to multiple destinations without first negotiating a connection through use of User Datagram Protocol (UDP) over IP. UDP transmits requests (or packets) in a connectionless transfer. However, since SNMP does not acknowledge receipt of such packets, this method can be somewhat unreliable. Most data managers compensate for this by offering time-outs or retry options, called *TRAPs.*

Configuration and status values are called *objects* in SNMP. These objects are described in a formal document called a Management Information Base (MIB). General MIBs are published as Requests For Comments (RFCs), and stored at various locations on the Internet. Companies commonly write their own private MIBs specific to their applications. Such privately written MIBs are known as Enterprise MIBS, and each company decides whether or not to release them for use by other companies. MIBs are basic commands, built into SNMP language, that travel through the network, functioning much like other basic computer programming commands, allowing SNMP to function.

The formal method for writing a MIB is called ASN.1, and has been published by the CCITT. SNMP uses two primary ASN.1 constructs -- octet strings, and integers or whole numbers. Octet strings are used to form ASCII text, while integers are used for SNMP V1. These integers are further broken down into special cases of integers, gauges, counters, and time ticks. Integers are whole numbers, gauges indicate constants, or maximums, counters are used for statistical purposes and increase until they reach their maximum value and then return to zero, and time ticks indicate the time in 1/100ths of a second. All objects are part of a single object tree (described numerically and by name mnemonics, indicating the path through the tree to reach that particular object).

A function in SNMP called *GET* is used to retrieve a single value in the tree. A *GET-NEXT* command is used to retrieve the next available object value. Since each object has a numerical position in the tree, the software increases the number used to describe the object until an object with an associated value is found. By using the *GET-NEXT* command, every value of every object supported by an agent can be retrieved, even in dynamic tables, by using the object name/number and comparing it to the MIBs the manager supports. The *GET-NEXT* function can then output the value with a mnemonic description of the object.

SETs are used to change the value of octet strings, integers, and some gauges. Counters, however, are not normally writable.

TRAPs are originated by the agent or managed device, and indicate a change in the operating environment, such as an alarm or an event message. *TRAPs*, unfortunately, are not retrievable.

APPENDIX F.

MIB II AND DS1 MIB GROUP

NAMES AND OBJECTS

Appendix F. MIB II AND DS1 MIB GROUP NAMES AND OBJECTS

Managed objects are accessed via a virtual information store, called the Management Information Base, or *MIB*. Objects in the MIB are defined using the subset of Abstract Syntax Notation One (ASN.1) [8] defined in the Structure of Management Information (SMI). SMI is the set of formatting and rules used to define, access and augment the Internet MIB. Each object is encoded, and has a name, and a syntax. The name is an object identifier, an administratively assigned name that specifies an object type. The object type, together with an object instance, serves to uniquely identify a specific use of the object. For convenience, a text string called an OBJECT DESCRIPTOR is often used to refer to the object type.

The syntax of an object type defines the abstract data structure corresponding to that object type. The ASN.1 language is used for this purpose. However, the SMI [12] purposely restricts the ASN.1 constructs that may be used. These restrictions are made for simplicity.

The encoding of an object type is simply how that object type is represented, using the object type's syntax. The object type's syntax and encoding indicates how the object type is represented when transmitted on the network. MIBs are assigned Request For Comment (RFC) numbers, and are stored in a central location, such as the Internet's *venera.isi.edu*.

MIB II consists of the following RFC 1213 groups:

- System
- Interfaces
- IP - Internet Protocol
- ICMP - Internet Control Message Protocol
- TCP - Transmission Control Protocol
- UDP - User Datagram Protocol
- EGP - External Gateway Protocol
- Transmission - Transmission Group is a placeholder in the SNMP tree configuration, containing other groups, including DS1, DS3, Serial, and Ethernet.
- SNMP - Simple Network Management Protocol

Table F-1. MIB-II (RFC 1213) Groups and Objects

Group/Object Name	Description
System Group	
sysDescr	A textual description of the entity.
sysObjectID	The vendor's authoritative identification of the network management subsystem contained in the entity.
sysUpTime	The time (in hundredths of a second) since the network management portion of the system was last re-initialized
sysContact	The textual identification of the contact person for this managed node, together with information on how to contact this person
sysName	An administratively-assigned name for this managed node; by convention, the node's fully-qualified domain name
sysLocation	The physical location of this node (e.g., telephone closet, 3rd floor).
sysServices	A value which indicates the set of services that this entity primarily offers.
Interface Group	
ifNumber	The number of network interfaces (regardless of their current state) present on this system
IfTable	A list of interface entries. The number of entries is given by the value of ifNumber.
ifIndex	A unique value for each interface.
ifDescr	A textual string containing information about the interface.
ifType	The type of interface, distinguished according to the physical/link protocol(s) immediately `below' the network layer in the protocol stack.
ifMtu	The size of the largest datagram which can be sent/received on the interface, specified in octets.
ifSpeed	An estimate of the interface's current bandwidth in bits per second.
ifPhysAddress	The interface's address at the protocol layer immediately `below' the network layer in the protocol stack.
ifAdminStatus	The desired state of the interface.

Table F-1. MIB-II Groups and Objects (Continued)

Group/Object Name	Description
ifOperStatus	The current operational state of the interface.
ifLastChange	The value of sysUpTime at the time the interface entered its current operational state.
ifInOctets	The total number of octets received on the interface, including framing characters.
ifInUcastPkts	The number of subnetwork-unicast packets delivered to a higher-layer protocol.
ifInNUcastPkts	The number of non-unicast (i.e., subnetwork-broadcast or subnetwork-multicast) packets delivered to a higher-layer protocol.
ifInDiscards	The number of inbound packets which were chosen to be discarded, even though no errors had been detected, to prevent their being deliverable to a higher-layer protocol.
ifInErrors	The number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol.
ifInUnknownProtos	The number of packets received via the interface which were discarded because of an unknown or unsupported protocol.
ifOutOctets	The total number of octets transmitted out of the interface, including framing characters.
ifOutUcastPkts	The total number of packets that higher-level protocols requested be transmitted to a subnetwork-unicast address, including those that were discarded or not sent.
ifOutDiscards	The number of outbound packets which were chosen to be discarded, even though no errors had been detected, to prevent their transmission.
ifOutErrors	The number of outbound packets that could not be transmitted because of errors.
ifOutQLen	The length of the output packet queue (in packets).
ifSpecific	A reference to MIB definitions specific to the particular media being used to realize the interface.

Table F-1. MIB-II Groups and Objects (Continued)

IP Group	
Group/Object Name	**Description**
ipForwarding	The indication of whether this entity is acting as an IP gateway for the forwarding of datagrams received by, but not addressed to, this entity.
ipDefaultTTL	The default value inserted into the Time-To-Live field of the IP header of datagrams originated at this entity, whenever a TTL value is not supplied by the transport layer protocol.
ipInReceives	The total number of input datagrams received from interfaces, including those received in error.
ipInHdrErrors	The number of input datagrams discarded due to errors in their IP headers, including bad checksums, version number mismatch, other format errors, TTL exceeded, errors discovered in processing IP options, etc.
ipInAddrErrors	The number of input datagrams discarded because the IP address in their IP header's destination field was not a valid address to be received at this entity.
ipForwDatagrams	The number of input datagrams for which this entity was not their final IP destination, as a result of which an attempt was made to find a route to forward them to that final destination.
ipInUnknownProtos	The number of locally-addressed datagrams received successfully but discarded because of an unknown or unsupported protocol.
ipInDiscards	The number of input IP datagrams that awere discarded, but for which no problems were encountered to prevent their continued processing (e.g., lack of buffer space, etc.).
ipInDelivers	The total number of input datagrams successfully delivered to IP user-protocols (including ICMP).
ipOutRequests	The total number of IP datagrams which local IP user-protocols (including ICMP) supplied to IP in requests for transmission.
ipOutDiscards	The number of output IP datagrams that were discarded, but for which no problem was encountered preventing their transmission to their destination (e.g., lack of buffer space, etc.).
ipOutNoRoutes	The number of IP datagrams discarded because no route could be found to transmit them to their destination.

Table F-1. MIB-II Groups and Objects (Continued)

Group/Object Name	Description
ipReasmTimeout	The maximum number of seconds which received fragments are held while they are awaiting reassembly at this entity.
ipReasmReqds	The number of IP fragments received that required reassembly at this entity.
ipReasmOKs	The number of IP datagrams successfully reassembled.
ipReasmFails	The number of failures detected by the IP reassembly algorithm (for any reason: timed out, errors, etc.).
ipFragOKs	The number of IP datagrams successfully fragmented at this entity.
ipFragFails	The number of IP datagrams discarded because they needed to be fragmented at this entity, but could not be (e.g., because their Don't Fragment flag was set).
ipFragCreates	The number of IP datagram fragments generated as a result of fragmentation at this entity.
ipAddrTable	The table of addressing information relevant to this entity's IP addresses.
ipAddrEntry	The addressing information for one of this entity's IP addresses.
ipAdEntAddr	The IP address to which this entry's addressing information pertains.
ipAdEntIfIndex	The index value which uniquely identifies the interface to which this entry is applicable.
ipAdEntNetMask	The subnet mask associated with the IP address of this entry.
ipAdEntBcastAddr	The value of the least-significant bit in the IP broadcast address used for sending datagrams on the (logical) interface associated with the IPaddress of this entry.
ipAdEntReasmMaxSize	The size of the largest IP datagram which this entity can reassemble from incoming IP fragmented datagrams received on this interface.
ipRouteTable	This entity's IP Routing table.
ipRouteDest	The destination IP address of this route.

Table F-1. MIB-II Groups and Objects (Continued)

Group/Object Name	Description
ipRouteIfIndex	The index value that uniquely identifies the local interface through which the next hop of this route should be reached.
ipRouteMetric1	The primary routing metric for this route.
ipRouteMetric2	An alternate routing metric for this route.
ipRouteMetric3	An alternate routing metric for this route (the semantics of this metric are determined in ipRouteProto value).
ipRouteMetric4	An alternate routing metric for this route (the semantics of this metric are determined in ipRouteProto value).
ipRouteNextHop	The IP address of the next hop of this route.
ipRouteType	The type of route.
ipRouteProto	The routing mechanism through which this route was learned.
ipRouteAge	The number of seconds since this route was last updated or otherwise determined to be correct.
ipRouteMask	Indicate the mask to be logical-ANDed with the destination address before being compared to the value in the ipRouteDest field.
ipRouteMetric5	An alternate routing metric for this route.
ipRouteInfo	A reference to MIB definitions specific to the particular routing protocol which is responsible for this route, as determined by the value specified in the route's ipRouteProto value.
ipNetToMediaTable	The IP Address Translation table used for mapping from IP addresses to physical addresses.
ipNetToMediaEntry	Each entry contains one IpAddress to 'physical' address equivalent.
ipNetToMediaIfIndex	The interface on which this entry's equivalence is effective.
ipNetToMediaPhysAddress	The media-dependent 'physical' address.
ipNetToMediaNetAddress	The IpAddress corresponding to the media-dependent 'physical' address.
ipNetToMediaType	The type of mapping.
ipRoutingDiscards	The number of routing entries which were chosen to be discarded even though they are valid.

Table F-1. MIB-II Groups and Objects (Continued)

Group/Object Name	Description
ICMP Group	
icmpInMsgs	The total number of ICMP messages which the entity received.
icmpInErrors	The number of ICMP messages which the entity received but determined as having ICMP-specific errors (bad ICMP checksums, bad length, etc.).
icmpInDestUnreachs	The number of ICMP Destination Unreachable messages received.
icmpInTimeExcds	The number of ICMP Time Exceeded messages received.
icmpInParmProbs	The number of ICMP Parameter Problem messages received.
icmpInSrcQuenchs	The number of ICMP Source Quench messages received.
icmpInRedirects	The number of ICMP Redirect messages received.
icmpInEchos	The number of ICMP Echo (request) messages received.
icmpInEchoReps	The number of ICMP Echo Reply messages received.
icmpInTimestamps	The number of ICMP Timestamp (request) messages received.
icmpInTimestampReps	The number of ICMP Timestamp Reply messages received.
icmpInAddrMasks	The number of ICMP Address Mask Request messages received.
icmpInAddrMaskReps	The number of ICMP Address Mask Reply messages received.
icmpOutMsgs	The total number of ICMP messages which this entity attempted to send.
icmpOutErrors	The number of ICMP messages which this entity did not send due to problems discovered within ICMP (such as a lack of buffers, etc.).
icmpOutDestUnreachs	The number of ICMP Destination Unreachable messages sent.
icmpOutTimeExcds	The number of ICMP Time Exceeded messages sent.
icmpOutParmProbs	The number of ICMP Parameter Problem messages sent.

Table F-1. MIB-II Groups and Objects (Continued)

Group/Object Name	Description
icmpOutSrcQuenchs	The number of ICMP Source Quench messages sent.
icmpOutRedirects	The number of ICMP Redirect messages sent.
icmpOutEchos	The number of ICMP Echo (request) messages sent.
icmpOutEchoReps	The number of ICMP Echo Reply messages sent.
icmpOutTimestamps	The number of ICMP Timestamp (request) messages sent.
icmpOutTimestampReps	The number of ICMP Timestamp Reply messages sent.
icmpOutAddrMasks	The number of ICMP Address Mask Request messages sent.
icmpOutAddrMaskReps	The number of ICMP Address Mask Reply messages sent
TCP Group	
tcpRtoAlgorithm	The timeout value algorithm used to retransmit unacknowledged octets.
tcpRtoMin	The minimum value permitted by a TCP implementation for the retransmission timeout (measured in milliseconds).
tcpRtoMax	The maximum value permitted by a TCP implementation for the retransmission timeout (measured in milliseconds).
tcpMaxConn	The limit on the total number of TCP connections the entity can support.
tcpActiveOpens	The number of times TCP connections have made a direct transition to the SYN-SENT state from the CLOSED state.
tcpPassiveOpens	The number of times TCP connections have made a direct transition to the SYN-RCVD state from the LISTEN state.
tcpAttemptFails	The number of times TCP connections have made a direct transition to the CLOSED state from either the SYN-SENT state or the SYN-RCVD state, plus the number of times TCP connections have made a direct transition to the LISTEN state from the SYN-RCVD state.

Table F-1. MIB-II Groups and Objects (Continued)

Group/Object Name	Description
tcpEstabResets	The number of times TCP connections have made a direct transition to the CLOSED state from either the ESTABLISHED or the CLOSE-WAIT state.
tcpCurrEstab	The number of TCP connections for which the current state is either ESTABLISHED or CLOSE-WAIT.
tcpInSegs	The total number of segments received, including those received in error.
tcpOutSegs	The total number of segments sent, including those on current connections but excluding those containing only retransmitted octets.
tcpRetransSegs	The total number of segments retransmitted, (i.e., the number of TCP segments transmitted that contain one or more previously transmitted octets).
tcpConnTable	A table containing TCP connection-specific information.
tcpConnEntry	Information about a particular current TCP connection.
tcpConnState	The only value which may be set by a management station is deleteTCB (12).
tcpConnLocalAddress	The local IP address for this TCP connection.
tcpConnLocalPort	The local port number for this TCP connection.
tcpConnRemAddress	The remote IP address for this TCP connection.
tcpConnRemPort	The remote port number for this TCP connection.
tcpInErrs	The total number of segments received in error (e.g., bad TCP checksums).
tcpOutRsts	Number of TCP segments sent containing RST flag
UDP Group	
udpInDatagrams	The total number of UDP datagrams delivered to UDP users.
udpNoPorts	The total number of received UDP datagrams for which there was no application at the destination port.
udpInErrors	The number of received UDP datagrams that could not be delivered for reasons other than the lack of an application at the destination port.

Table F-1. MIB-II Groups and Objects (Continued)

Group/Object Name	Description
udpOutDatagrams	The total number of UDP datagrams sent from this entity.
udpTable	A table containing UDP listener information.
udpEntry	Information about a particular current UDP listener.
udpLocalAddress	The local IP address for this UDP listener.
dpLocalPort	The local port number for this UDP listener.
Transmission Group **This group is provided by the DS1 MIB. See Table H-2.**	
SNMP Group	
snmpInPkts	The total number of Messages delivered to the SNMP entity from the transport service.
snmpOutPkts	The total number of SNMP Messages passed from the SNMP protocol entity to the transport service.
snmpInBadVersions	The total number of SNMP Messages delivered to the SNMP protocol entity, and that were for an unsupported SNMP version.
snmpInBadCommunityNames	The total number of SNMP Messages delivered to the SNMP protocol entity which used an SNMP community name not known to said entity.
snmpInBadCommunityUses	The total number of SNMP Messages delivered to the SNMP protocol entity that represented an SNMP operation not allowed by the SNMP community named in the Message.
snmpInASNParseErrs	The total number of ASN.1 or BER errors encountered by the SNMP protocol entity when decoding received SNMP Messages.
snmpInTooBigs	The total number of SNMP PDUs which were delivered to the SNMP protocol entity, and for which the value of the error-status field is 'tooBig'.
snmpInNoSuchNames	The total number of SNMP PDUs delivered to the SNMP protocol entity, and for which the value of the error-status field is 'noSuchName'.
snmpInBadValues	The total number of SNMP PDUs delivered to the SNMP protocol entity, and for which the value of the error-status field is 'badValue'.
snmpInReadOnlys	The total number valid SNMP PDUs delivered to the SNMP protocol entity, and for which the value of the error-status field is 'readOnly'.

Table F-1. MIB-II Groups and Objects (Continued)

Group/Object Name	Description
snmpInGenErrs	The total number of SNMP PDUs delivered to the SNMP protocol entity, and for which the value of the error-status field is 'genErr'.
snmpInTotalReqVars	The total number of MIB objects retrieved successfully by the SNMP protocol entity as the result of receiving valid SNMP Get-Request and Get-Next PDUs.
snmpInTotalSetVars	The total number of MIB objects altered successfully by the SNMP protocol entity as the result of receiving valid SNMP Set-Request PDUs.
snmpInGetRequests	The total number of SNMP Get-Request PDUs accepted and processed by the SNMP protocol entity.
snmpInGetNexts	The total number of SNMP Get-Next PDUs accepted and processed by the SNMP protocol entity.
snmpInSetRequest	The total number of SNMP Set-Request PDUs accepted and processed by the SNMP protocol entity.
snmpInGetResponses	The total number of SNMP Get-Response PDUs accepted and processed by the SNMP protocol entity.
snmpInTraps	The total number of SNMP Trap PDUs accepted and processed by the SNMP protocol entity.
snmpOutTooBigs	The total number of SNMP PDUs generated by the SNMP protocol entity, and for which the value of the error-status field is 'tooBig'.
snmpOutNoSuchNames	The total number of SNMP PDUs generated by the SNMP protocol entity, and for which the value of the error-status is 'noSuchName'.
snmpOutBadValues	The total number of SNMP PDUs generated by the SNMP protocol entity, and for which the value of the error-status field is 'badValue'.
snmpOutGenErrs	The total number of SNMP PDUs generated by the SNMP protocol entity, and for which the value of the error-status field is 'genErr'.
snmpOutGetRequests	The total number of SNMP Get-Request PDUs generated by the SNMP protocol entity.
snmpOutGetNexts	The total number of SNMP Get-Next PDUs generated by the SNMP protocol entity.

Table F-1. MIB-II Groups and Objects (Continued)

Group/Object Name	Description
snmpOutSetRequests	The total number of SNMP Set-Request PDUs generated by the SNMP protocol entity.
snmpOutGetResponses	Total number of SNMP Get-Response PDUs generated by the SNMP protocol entity.
snmpOutTraps	The total number of SNMP Trap PDUs generated by the SNMP protocol entity.
snmpEnableAuthenTrap	Indicates whether the SNMP agent process is permitted to generate authentication-failure traps.

Table F-2. DS1 MIB (RFC 1406) Groups and Objects

Group/Object	Description
DS1 Near End Group	
dsx1ConfigTable	The DS1 Configuration table.
dsx1ConfigEntry	An entry in the DS1 Configuration table.
dsx1LineIndex	This object is the identifier of a DS1 Interface on a managed device.
dsx1IfIndex	This object's value is equal to the value of ifIndex from the MIB II Interface table (RFC 1213).
dsx1TimeElapsed	The number of seconds that have elapsed since the beginning of the current error-measurement period.
dsx1ValidIntervals	The number of previous intervals for which valid data was collected.
dsx1LineType	This variable indicates the variety of DS1 Line implementing this circuit.
dsx1LineCoding	This variable describes the variety of Zero Code Suppression used on the link, which in turn affects a number of its characteristics.
dsx1SendCode	This variable indicates what type of code is being sent across the DS1 interface by the device.
dsx1CircuitIdentifier	This variable contains the transmission vendor's circuit identifier, to facilitate troubleshooting.
dsx1LoopbackConfig	This variable represents the DS1 interface loopback configuration.
dsx1LineStatus	This variable indicates the interface Line Status.
dsx1SignalMode	'None' indicates that no bits are reserved for signaling on this channel. 'RobbedBit' indicates that T1 Robbed Bit Signaling is in use. 'Bit-Oriented' indicates that E1 Channel Associated Signaling is in use. 'MessageOriented' indicates that Common Channel Signaling is in use either on channel 16 of an E1 link or channel 24 of a T1.
dsx1TransmitClockSource	The source of Transmit Clock.
dsx1Fdl	This is the facilities data link, and is the sum of the capabilities. 'Other' indicates that a protocol other than one following is used.
dsx1CurrentTable	The DS1 Current table.
dsx1CurrentEntry	An entry in the DS1 Current table.

Table F-2. DS1 MIB (RFC 1406) Groups and Objects

Group/Object	Description
dsx1CurrentIndex	The index value which uniquely identifies the DS1 interface to which this entry is applicable.
dsx1CurrentESs	The number of Errored Seconds encountered by a DS1 interface in the current 15-minute interval.
dsx1CurrentSESs	The number of Severely Errored Seconds encountered by a DS1 interface in the current 15-minute interval.
dsx1CurrentSEFSs	The number of Severely Errored Framing Seconds encountered by a DS1 interface in the current 15-minute interval.
dsx1CurrentUASs	The number of Unavailable Seconds encountered by a DS1 interface in the current 15-minute interval.
dsx1CurrentCSSs	The number of Controlled Slip Seconds encountered by a DS1 interface in the current 15-minute interval.
dsx1CurrentPCVs	The number of Path Coding Violations encountered by a DS1 interface in the current 15-minute interval.
dsx1CurrentLESs	The number of Line Errored Seconds encountered by a DS1 interface in the current 15-minute interval.
dsx1CurrentBESs	The number of Bursty Errored Seconds (BESs) encountered by a DS1 interface in the current 15-minute interval.
dsx1CurrentDMs	The number of Degraded Minutes (DMs) encountered by a DS1 interface in the current 15-minute interval.
dsx1CurrentLCVs	The number of Line Code Violations (LCVs) encountered by a DS1 interface in the current 15-minute interval.
dsx1IntervalTable	The DS1 Interval table.
dsx1IntervalEntry	An entry in the DS1 Interval table.
dsx1IntervalIndex	The index value which uniquely identifies the DS1 interface to which this entry is applicable.
dsx1IntervalNumber	A number between 1 and 96, where 1 is the most recently completed 15-minute interval and 96 is the least recently completed 15-minute interval (assuming that all 96 intervals are valid).

Table F-2. DS1 MIB (RFC 1406) Groups and Objects

Group/Object	Description
dsx1IntervalESs	The number of Errored Seconds encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.
dsx1IntervalSESs	The number of Severely Errored Seconds encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.
dsx1IntervalSEFSs	The number of Severely Errored Framing Seconds encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.
dsx1IntervalUAS	The number of Unavailable Seconds encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.
dsx1IntervalCSSs	The number of Controlled Slip Seconds encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.
dsx1IntervalPCVs	The number of Path Coding Violations encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.
dsx1IntervalLESs	The number of Line Errored Seconds encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.
dsx1IntervalBESs	The number of Bursty Errored Seconds (BESs) encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.
dsx1IntervalDMs	The number of Degraded Minutes (DMs) encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.
dsx1IntervalLCVs	The number of Line Code Violations (LCVs) encountered by a DS1 interface in the current 15-minute interval.
dsx1TotalTable	The DS1 Total table.
dsx1TotalEntry	An entry in the DS1 Total table.
dsx1TotalIndex	The index value which uniquely identifies the DS1 interface to which this entry is applicable.
dsx1TotalESs	The number of Errored Seconds encountered by a DS1 interface in the previous 24-hour interval.
dsx1TotalSESs	The number of Severely Errored Seconds encountered by a DS1 interface in the previous 24-hour interval.

Table F-2. DS1 MIB (RFC 1406) Groups and Objects

Group/Object	Description
dsx1TotalSEFSs	The number of Severely Errored Framing Seconds encountered by a DS1 interface in the previous 24-hour interval.
dsx1TotalUASs	The number of Unavailable Seconds encountered by a DS1 interface in the previous 24-hour interval.
dsx1TotalCSSs	Number of Path Coding Violations encountered by DS1 interface in the previous 24-hour interval.
dsx1TotalLESs	The number of Line Errored Seconds encountered by a DS1 interface in the previous 24-hour interval.
dsx1TotalBESs	The number of Bursty Errored Seconds (BES) encountered by a DS1 interface in the previous 24-hour interval.
dsx1TotalDMs	The number of Degraded Minutes (DM) encountered by a DS1 interface in the previous 24-hour interval.
dsx1TotalLCVs	The number of Line Code Violations (LCV) encountered by a DS1 interface in the current 15-minute interval.
DS1 Far End Group **NOTE: Group unsupported at this time. Noted here as a place holder only.**	
dsx1FarEndCurrentTable	The DS1 Far End Current table.
dsx1FarEndCurrentEntry	An entry in the DS1 Far End Current table.
dsx1FarEndCurrentIndex	The index value which uniquely identifies the DS1 interface to which this entry is applicable.
dsx1FarEndTimeElapsed	The number of seconds that have elapsed since the beginning of the far end current error-measurement period.
dsx1FarEndValidInterval	The number of previous far end intervals for which valid data was collected.
dsx1FarEndCurrentESs	The number of Far End Errored Seconds encountered by a DS1 interface in the current 15-minute interval.
dsx1FarEndCurrentSESs	The number of Far End Severely Errored Seconds encountered by a DS1 interface in the current 15-minute interval.
dsx1FarEndCurrentSEFSs	The number of Far End Severely Errored Framing Seconds encountered by a DS1 interface in the current 15-minute interval.

Table F-2. DS1 MIB (RFC 1406) Groups and Objects

Group/Object	Description
dsx1FarEndCurrentUASs	The number of Unavailable Seconds encountered by a DS1 interface in the current 15-minute interval.
dsx1FarEndCurrentCSSs	The number of Far End Controlled Slip Seconds encountered by a DS1 interface in the current 15-minute interval.
dsx1FarEndCurrentLESs	The number of Far End Line Errored Seconds encountered by a DS1 interface in the current 15-minute interval.
dsx1FarEndCurrentPCVs	The number of Far End Path Coding Violations reported via the far end block error count encountered by a DS1 interface in the current 15-minute interval.
dsx1FarEndCurrentBESs	The number of Bursty Errored Seconds (BES) encountered by a DS1 interface in the current 15- minute interval.
dsx1FarEndCurrentDMs	The number of Degraded Minutes (DMs) encountered by a DS1 interface in the current 15-minute interval.
DS1 Far End Interval Table **NOTE: Group unsupported at this time. Noted here as a place holder only.**	
dsx1FarEndIntervalTable	The DS1 Far End Interval table.
dsx1FarEndIntervalEntry	An entry in the DS1 Far End Interval table.
dsx1FarEndIntervalIndex	The index value which uniquely identifies the DS1 interface to which this entry is applicable.
dsx1FarEndIntervalNumber	A number between 1 and 96 where 1 is the most recently completed 15-minute interval and 96 is the least recently completed 15-minutes interval (assuming that all 96 intervals are valid).
dsx1FarEndIntervalESs	The number of Far End Errored Seconds encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.
dsx1FarEndIntervalSESs	The number of Far End Severely Errored Seconds encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.
dsx1FarEndIntervalSEFSs	The number of Far End Severely Errored Framing Seconds encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.

Table F-2. DS1 MIB (RFC 1406) Groups and Objects

Group/Object	Description
dsx1FarEndIntervalUASs	The number of Unavailable Seconds encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.
dsx1FarEndIntervalCSSs	The number of Far End Controlled Slip Seconds encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.
dsx1FarEndIntervalLESs	The number of Far End Line Errored Seconds encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.
dsx1FarEndIntervalPCVs	The number of Far End Path Coding Violations reported through the far end block error count encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.
dsx1FarEndIntervalBESs	The number of Bursty Errored Seconds (BESs) encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.
dsx1FarEndIntervalDMs	The number of Degraded Minutes (DMs) encountered by a DS1 interface in one of the previous 96 individual 15-minute intervals.
DS1 Far End Total Table **NOTE: Group unsupported at this time. Noted here as a place holder only.**	
dsx1FarEndTotalTable	The DS1 Far End Total table.
dsx1FarEndTotalEntry	An entry in the DS1 Far End Total table.
dsx1FarEndTotalIndex	The index value which uniquely identifies the DS1 interface to which this entry is applicable.
dsx1FarEndTotalESs	The number of Far End Errored Seconds encountered by a DS1 interface in the previous 24-hour interval.
dsx1FarEndTotalSESs	The number of Far End Severely Errored Seconds encountered by a DS1 interface in the previous 24-hour interval.
dsx1FarEndTotalSEFSs	The number of Far End Severely Errored Framing Seconds encountered by a DS1 interface in the previous 24-hour interval.
dsx1FarEndTotalUASs	The number of Unavailable Seconds encountered by a DS1 interface in the previous 24-hour interval.
dsx1FarEndTotalCSSs	The number of Far End Controlled Slip Seconds encountered by a DS1 interface in the previous 24 hour interval.

Table F-2. DS1 MIB (RFC 1406) Groups and Objects

Group/Object	Description
dsx1FarEndTotalLESs	The number of Far End Line Errored Seconds encountered by a DS1 interface in the previous 24-hour interval.
dsx1FarEndTotalPCVs	The number of Far End Path Coding Violations reported via the far end block error count encountered by a DS1 interface in the previous 24-hour interval.
dsx1FarEndTotalBESs	The number of Bursty Errored Seconds (BES) encountered by a DS1 interface in the previous 24-hour interval.
dsx1FarEndTotalDMs	The number of Degraded Minutes (DM) encountered by a DS1 interface in the previous 24-hour interval.
DS1 Fractional Group **NOTE: Group unsupported at this time. Noted here as a place holder only.**	
dsx1FracTable	The DS1 Fractional table.
dsx1FracEntry	An entry in the DS1 Fractional table.
dsx1FracIndex	The index value which uniquely identifies the DS1 interface to which this entry is applicable.
dsx1FracNumber	The channel number for this entry.
dsx1FracIfIndex	An index value that uniquely identifies an interface.

APPENDIX G.

MODEM INTERFACES

Appendix G. MODEM INTERFACES

An analog modem (**mo**dulator-**dem**odulator) modulates a signal (called the *Carrier*) with data, and sends it over the telephone system. The receiving end demodulates the carrier, and converts the analog representation of the data back to digital form for the receiving computer. Coastcom uses modems that are compatible with the Hayes Command Set for modems.

Modems are available which transfer data at rates from 300 bps through 56,000 bps. Two standard compression algorithms are available. The previous, traditional standard is Microcom Networking Protocol (MNP) Level 5. The newer standard is CCITT V.42bis.

General Modem Operation

A Hayes compatible modem has two states: *Command* and *on-line*. In the command state, the modem interprets all locally received characters as commands. Unrecognized text between each carriage return is ignored. In the on-line state, the modem passes all locally received characters, with one exception, through to the remote system. The exception is the *escape sequence* that places the modem back into the command state.

A modem must be configured (initialized) before it can be used. After configuring the modem, it can be made to answer an incoming call, or to originate a call.

Hayes Command Set

The Hayes Command Set is an ASCII interface used to control and configure the modem. This command set is also known as the **AT** command set since the two characters, "**AT**" are used to get the modem's attention. Commands to the modem are prefixed with the attention string and are followed by a carriage return.

Special Coastcom Characters

Special Coastcom programs incorporate several additional characters, and character sequences, for modem control The special characters and command string examples are listed and described below.

NCC Characters

Coastcom's Network Communication Control (NCC) program set is used to configure the modem control strings. The NCC program family includes *NCC2.EXE*, *NCC5.EXE*, *NCC6.EXE* and *CTERM.EXE*. Using these programs, the phone number, dialing, and attention strings can be changed from the default settings. Most modems require the strings to be followed by a carriage return [**CR**]. But since there may be a device which does not require the carriage return, the Coastcom programs do not automatically insert a carriage return at the end of each command sequence.

! - The exclamation point is a special character used to terminate a character sequence with a carriage return [**CR**]. The exclamation point also allows multiple inputs in a single string.

\b or **\B** - Some devices require a **BREAK** signal to be used. To cause a **BREAK** signal to be sent, type a *backslash* followed by the letter *B* in either lower case or upper case at the appropriate location in the command string.

~ - To cause a one-second delay in the character sequence being sent to the modem, type the *tilde* character at the appropriate location in the command string.

D/I Mux III Characters

The firmware in the D/I Mux III allows modem control strings to be configured as desired with special characters.

\$. - To insert a **BREAK** signal, type a *backslash*, followed by a *dollar sign*, followed by a *period*, at the appropriate location in the command string.

DXC II Characters

The firmware in Coastcom's DXC II system also allows modem control strings to be configured as desired with special characters, except that the DXC II does not insert **BREAK** signals.

Table I-1 gives various command set examples using the special characters noted above.

Table H-1. Command Examples

Process	Command String (Description)	Possible Result Strings
Setup/Initialization	**AT E0 S0=1 Q1 V1 X4 &C0 &D0!** (Attention, Echo Off, Answer on First Ring, Results Off, Verbose, Extended Result Codes, Carrier Tracking Off, Ignore DTR)	OK
Hang up	**~~~+++~~~ATH!** (3 Second Pause, "+++", 3 Second Pause) (Hang up)	OK OK
Dial	**AT Q0 DT 1-234-567-1234** (Set Results ON, then Tone Dial Phone Number)	CONNECT xxxx BUSY ERROR NO DIAL TONE NO CARRIER

Table I-2 lists and describes the Hayes Smartmodem 300 commands.

Table H-2. Hayes Smartmodem 300 Command Set

Command	Description
AT	Attention prefix; precedes all commands, except *escape sequence* and the *repeat command* (**A/**).
A/	Repeat last command.
+++	Escape sequence: *Go to* command state if in on-line state. The escape character is stored in S-register 2. It is '+' (ASCII value 0x2B) by default.
A	Go to answer mode. Attempt to go into on-line state. The modem powers up in *originate mode* (i.e., ready to place a call). The modem can also operate in *answer mode* by entering **ATA**.
C0	Carrier signal off until **C1** or **Z** is issued.
C1	Carrier signal on; restores automatic carrier signal on/off switching; carrier signal remains on when modem originates or answers a call, or is connected to another modem. The modem controls the carrier by default (state C1). This command was discontinued with the Smartmodem 2400 and **C1** factory set.
E0	Disable character echo in command state.
E1	Enable character echo in command state. The default state is **E1** but the state of this setting is set by a switch. Software should set the value of this parameter during modem initialization.
D	Go into *originate mode*; dial number that follows to go on-line. This is one of the most frequently used modem commands. A typical command sequence to make the modem dial might be **ATDT-123-4567**. This command sequence makes use of one of the dial modifiers available with the dial command, and indicates that hyphens (0x2D) and spaces (0x20) are legal and ignored in the dialing sequence. The dial modifiers permitted are listed below.
0-9#*ABCD	Digits/characters for display.
P	Pulse dial.
T	Tone dial.
,	Delay processing of next character. Delay value is stored in S-register 8 and calibrated in seconds. Default is 2 seconds. The main use of this feature is to impose delays required by PBX systems.
R	Reverse mode (to originate a call in answer mode); This command causes the modem to use answer tones when a call is originated, enabling the modem to establish a link with a modem that cannot use answer tones.
;	Return to command state after dialing. This feature allows the modem to send number tones without attempting to establish a link (e.g. in response to voice mail requests or as a password to access an on-line service).
F0	Enable character echo in on-line state.
F1	Disable character echo in on-line state.
	Similar to the preceding command but applies when the modem is on-line. The default is **F1**. Under most conditions, transmitted characters are expected to be echoed by the remote system, and F1 is the desired setting . Software should explicitly set the value of this parameter during modem initialization.

Table H-2. Hayes Smartmodem 300 Command Set (Continued)

Command	Description
H0 **H1** **H2**	Go on hook (hang up). Line and auxiliary relays off hook. Line relay only off hook. The Hayes Smartmodem contains an additional relay that can be used to control equipment, independent of the telephone line relay.
O0	Go to on-line state. This command returns the modem on-line, and is primarily for issue after going off-line with the *escape sequence* **+++**.
M0 **M1** **M2**	Speaker off. Speaker on until carrier is detected. Speaker always on. The modem loudspeaker is often the primary indicator of the progress of a call, from dialing to establishing a connection. For this reason, the default setting is *speaker on* until carrier is detected. However, the speaker can be left on for troubleshooting, or turned off completely as desired. This command **does not** permit speaker volume control. Some Hayes-compatible modems provide an external speaker volume knob for this. In the later 1200 model, Hayes implemented basic software control of the speaker volume with the *L* command.
Q0 **Q1**	Modem returns result codes. Modem does not return result codes. Normally, software depends on the modem to return command result codes, so Q0 must be set. This Hayes command set option is provided for those rare occasions when *echo* must be off.
Sr **Sr=n** **Sr?**	Set pointer to address of register "r". Set register "r" to value "n". Display value stored in register "r". To assign a value to one of the Smartmodem's S-registers (e.g., to increase dialing speed to its maximum) issue the command **ATS11=50**. To read the new value in S11, issue the command **ATS11?**. Many registers have ranges of acceptable values. However, the modem does not ignore invalid assignments and instead, can set the modem to an invalid value. Hayes-compatible modems respond in various ways to invalid values. Hayes S-register definitions follow this command listing.
V0 **V1**	Display result codes in numeric form. Display result codes in verbose form (as words). Numeric codes are easier for software to interpret, whereas word responses are easier for people to interpret. Word responses are also less susceptible to software misinterpretation due to line noise.
Z	Reset modem, and recall factory configuration. On the Smartmodem 300, this is equivalent to turning the modem off and back on. On later modems, EPROMs and command set extensions can store a default configuration different from that set at the factory, and the effect of this command varies across products.

Hayes 1200 and 1200B Command Sets

The Smartmodem 1200/1200B commands and dial modifiers are super sets of the Smartmodem 300 commands. They are listed and described in Table I-3.

Table H-3. Hayes 1200 and 1200B Command Sets

Command	Feature
B0	Select CCITT V.22 as communications standard.
B1	Select Bell 103/212A communications standard
	This command sets the communications protocol. Many European and other countries subscribe to CCITT standards, whereas the US (for low-speed modems) subscribes to Bell standards. For speeds above 2400 bps, CCITT standards are universal in asynchronous, dial-up communications.
!	Hook flash.
@	Wait for quiet answer (no dial tone transmitted).
W	Wait for dial tone.
I0	Request product identification code.
I1	Perform checksum on firmware ROM; return checksum.
I2	Perform checksum on firmware ROM; return OK or ERROR result codes.
	This command assists in permitting software to determine the modem type. However, there is no agreement among manufacturers of Hayes-compatible modems concerning product code determination criteria. Most modems rated at or below 2400 bps return the first two digits of the maximum supported speed as the first two digits of a three-digit product ID code (e.g., a 2400 bps modem returns 245). At higher speeds there is more divergence (e.g., the UDS 3225 V.32 modem returns 901). While not completely reliable, this method is most commonly used to determine the maximum supported speed. Allow the user to override the software default determination.
L0	Low speaker volume.
L1	Medium speaker volume.
L2	High speaker volume.
	This allows basic software speaker volume control.
O1	Turn off the remote digital loop back test function, and return the modem on-line.
O2	Request remote digital loop back test, and return modem on-line.
XO	Enable features represented by result codes 0-4.
X1	Enable features represented by result codes 0-5.
X2	Enable features represented by result codes 0-6.
X3	Enable features represented by result codes 0-5, and 7.
X4	Enable features represented by result codes 0-7.
	With the Smartmodem 1220, Hayes has expanded the result code set from dialing operations to reflect the enhanced features of new modems. Other manufacturers have also added their own dialing result codes, creating differences in meaning between all the codes. Note that there is no standardization in any of the possible result codes used when an MNP connection is made.
Y0	Disable long space disconnect.
Y1	Enable long space disconnect.
	This command controls how the modem behaves if a BREAK (defined arbitrarily as a SPACE condition for 1.6 seconds) is sent from the remote system. When enabled, the modem disconnects when a BREAK is received. Furthermore, when the hang-up command (H0) is received from the local system, the modem sends a 4-second SPACE to the remote system.

Smartmodem 2400/2400B Command Set

The Smartmodem 2400 and the Smartmodem 2400B command sets are super sets of the Smartmodem 1200 command set with some exceptions, and are listed and described in Table I-4. The following commands are no longer available:

- C0 : Preset to C1
- F0 : Preset to F1
- H2 : No longer available

Table H-4. Smartmodem 2400/2400B Command Set

Command	Description
B0	Select CCITT V.22 or V.22bis as communication standard.
B1	Select Bell 212A communication standard.
M3	Speaker on until carrier is detected, except during dialing.
O0	Go to on-line state, and initiate equalizer retrain.
X0	Enable features represented by result codes 0-4.
X1	Enable features represented by result codes 0-5, 10.
X2	Enable features represented by result codes 0-6, 10.
X3	Enable features represented by result codes 0-5, 7, 10.
X4	Enable features represented by result codes 0-7, 10.
	(See section below for description of result codes.)
Z0	Reset modem, and recall user profile 0.
Z1	Reset modem, and recall user profile 1.
	These commands accommodate the ability to store telephone numbers in an onboard dialing directory.
S=n	Dial number stored in location "n".

Table H-4. Smartmodem 2400/2400B Command Set (Continued)

The following commands are used with newer model 2400 bps modems.

Command	Description
&C0 **&C1**	Assume data carrier always present (DCD signal). Track presence of data carrier. This command (found on a large number of clones) causes the most problems when moving to a 2400 bps modem from a slower speed. The default state is **&C0**, which causes the software to react as though a lost carrier is present. When initializing a 2400 bps modem, always use **&C1** as part of the initialization.
&D0 **&D1** **&D2** **&D3**	Ignore DTR signal. Assume command state when an on-to-off transition of DTR occurs. Hang up and assume command state when an on-to-off transition of DTR occurs. Reset when an on-to-off transition of DTR occurs. As with the **&C0** command, the factory default (**&D0**) is not the most logical choice, and most software expects that lowering DTR hangs up the line. Be sure to use **&D2** as part of the modem initialization sequence to avoid problems.
&F	Recall factory settings as active configuration.
&G0 **&G1** **&G2**	No guard tone. 550 Hz guard tone. 1800 Hz guard tone. Some telephone systems require other than the default **&G0** for guard tone.
&J0 **&J1**	RJ-11/RJ-41S/RJ-45S telephone company jack (intended for single-line phone systems). RJ-12/RJ-13 telephone company jack (intended for multi-line systems).
&M0 **&M1** **&M2** **&M3**	Asynchronous mode. Synchronous mode 1. Synchronous mode 2. Synchronous mode 3.
&P0 **&P1**	Pulse dial make/break ratio = 39/61. Pulse dial make/break ratio = 61/39. These options are provided for different national phone systems.
&Q0 **&Q1** **&Q2** **&Q3** **&Q4**	Asynchronous mode. Synchronous mode 1. Synchronous mode 2. Synchronous mode 3. Synchronous mode 4. These commands are alternatives to the **&Mx** commands listed above.

Table H-4. Smartmodem 2400/2400B Command Set (Continued)

Command	Description
&R0 **&R1**	Track CTS according to RTS. Ignore RTS; always assume presence of CTS. In the default state (**&RI**), CTS is forced on. In **&R1**, CTS follows RTS with the value specified in register S26.
&S0 **&S1**	Assume presence of DSR signal. Track presence of DSR signal. In the default state, DSR remains high when the modem is on. In the alternate state, an off-to-on transition occurs after the answer tone is received (treating the modem as a "dumb" modem". This command is a CCITT V.22 recommendation.
&T0 **&T1** **&T3** **&T4** **&T5** **&T6** **&T7** **&T8**	Terminate test in progress. Initiate local analog loop back. Initiate digital loop back. Grant request from remote modem for RDL. Deny request from remote modem for RDL. Initiate remote digital loop back. Initiate remote digital loop back with self-test. Initiate local analog loop back with self-test. This set of commands provides a test suite of the local and remote connection.
&V	View active configuration, user-defined profiles, and stored numbers. This command allows viewing of the information stored in the modem's EEPROM.
&W0 **&W1**	Save storable parameters of active configuration as user profile 0. Save storable parameters of active configuration as user profile 1. The modem permits two active configurations, each of which can be stored in the EEPROM for future use.
&X0 **&X1** **&X2**	Modem provides transmit clock signal. Data terminal provides transmit clock signal. Receive carrier provides transmit clock signal. This command set provides flexibility for clock source signal in synchronous communications.
&Y0 **&Y1**	Recall user profile 0 on power-up. Recall user profile 1 on power-up. Either of the two stored two user profiles can be selected as the default for future communication sessions.

V-Series Commands

Additional commands were introduced with the Hayes V-series modems. They are listed and described in Table I-5.

Table H-5. V-Series Modem Commands

Command	Description
N0 **N1**	Speed control.
Q2	Result code control.
W0 **W1**	Negotiation result control.
X0 **X1** **X2** **X3** **X4**	Result code control (see below).
&K0 **&K1** **&K2** **&K3**	Flow control.
&L0 **&L1**	Dial-up line operation. Conditioned lease-line operation.
&Q5	Error-control mode.

Table I-6 lists and describes the result codes, with associated control, included with the V-series *Xn* commands (refer to Table I-5 above).

Table H-6. Result Codes Based On Xn Commands

		Commands						
Code	**Verbose**	**X0**	**X1**	**X2**	**X3**	**X4**	**X5**	**X6**
0	OK	X	X	X	X	X	X	X
1	CONNECT	X	X	X	X	X	X	X
2	RING	X	X	X	X	X	X	X
3	NO CARRIER	X	X	X	X	X	X	X
4	ERROR	X	X	X	X	X	X	X
5	CONNECT 1200		X	X	X	X	X	X
6	NO DIAL TONE			X		X		X
7	BUSY				X	X	X	X
8	NO ANSWER (Requires @; replaces *NO CARRIER*)				X	X	X	X
9	Reserved							
10	CONNECT 2400		X	X	X	X	X	X
11	RINGING						X	X
12	VOICE						X	X
FUNCTIONS								
Adaptive Dialing				X	X	X	X	X
Wait for 2nd Dial Tone (W)					X	X	X	X
Wait for Answer (@)					X	X	X	X
Fast Dial				X		X		X

The Smartmodems also include S-Registers, permitting selection of rings before answering. Table I-7 lists and describes the S-Register options.

Table H-7. Smartmodem S-Registers

S- Register	Description
S0=*n* **S0=*0***	Auto-answer mode where *n* = the number of rings before the modem answers, OR *0* = do not answer. For other S-registers refer to the particular modem's user manual.

Modem Considerations

There are a number of considerations to be taken into account when planning modem installation. Among the problems that might be encountered are line noise, timing discrepancies, sequencing difficulty, and control signalling errors. Each is described below.

Line Noise

Noise on the telephone line can inject data errors, can cause loss of carrier, and can and terminate the connection. If the connection is dropped, and the result code has been enabled, the modem will return a *NO CARRIER* message.

Command Timing

Certain modem commands and functions can take several moments to activate and complete. Generally, however, the initialization response should occur in less than a half second, and entering the auto-answer mode should take less than a half second.

Dialing time varies with the length of the number to be dialed, and any pauses in the dialing string. For most telephone numbers, dialing should take less than 5 seconds. However, the modem will not return a result until after either a preset time-out has occurred, or a complete connection has been established with the called modem. Allow 30 seconds to elapse, prior to connection, if the called modem has been configured to answer on the first ring.

A modem answers on the first detected ring. Due to central telephone office timing cycles, however, an extra ringing cycle often occurs before the called modem actually sees ringing. This additional time can be as long as 10 to 15 seconds. After answering the call, and going off hook, the two modems attempt to establish a carrier signal. Various modulations will be tried until they either match, or until the calling modem gives up.

If, during one of the longer time periods, either modem receives a character from its controlling port, the current command is terminated, especially for the dial-out process mentioned above. The modem immediately advances its time out period, and returns a *NO CARRIER* status.

Modem-To-Modem Sequencing

If two modems attempt to call each other at the same time, neither will be able to complete the connection since each modem is attempting to originate the connection. (This is rare, but can occur.)

Modem Control Lines

Modems track any changes in the Data Terminal Ready (DTR) and Ready To Send (RTS) signals coming from a terminal. Not all modems permit changing the response DTR signalling (refer to the **&D*n*** command set in Table I-4 above for details).

Any fluctuations of the DTR signal can cause the modem to drop a connection. In early model equipment (with older communications libraries), this was a problem. The older libraries disabled DTR when a controlling program invoked and shelled to a child program. Even though the child program re-enabled the DTR line, the modem would see the fluctuation and hang up.

The RTS signals the modem that the terminal wants to send data. The modem responds by enabling the Clear To Send (CTS) signal. The CTS signal enables the terminal to send data.

Dial-Out Call Processing

The basic sequence for modem call processing is listed below. More specific steps are listed in the following section for connecting and terminating modems when using the D/I Mux III system, the Digital Cross Connect II (DXC II) system, and the Network Communications Controller (NCC) system.

1. Acquire and initialize the serial port.
2. For each device in the connect path, initialize and connect the device.
3. Exchange data with the remote unit.
4. For each device in the connect path, disconnect the device (in reverse order).
5. Release the serial port.

Note: In all cases it is the responsibility of the calling unit, or node, to properly disconnect the call.

Modems and the NCC System

When the NCC program attempts to make or break a connection the activity sequence includes making connection, processing messages, and terminating the connection. This is the case for all versions of the NCC software product family.

Making Connection

Each of the components involved in the data transfer must be connected. The sequence of those connections are listed below.

Port

Coastcom's *NCC5* program will first request the serial port from the system. If the port is not available within several seconds, the connection attempt will be aborted. The *NCC5* program will then initialize the port to the configuration in the program.

The *NCC2* and *NCC6* programs will save the original serial interrupt vector, and install their own interrupt routines. These programs will then initialize the port to the configuration in the program.

Modem

If a modem has been configured into the network follow the steps below, otherwise proceed to the next section.

1. To ensure that the modem is not in an off-hook state, hang up the modem using the following recommended hang-up string: **~~~+++~~~ATH0!**
2. Wait 2-3 seconds.
3. Send the *escape* sequence: **+++**
4. Wait for an *OK* response (which should appear within 3 seconds), and continue as follows.
5. Send the *hang-up* command: **ATH!**
6. Wait for an *OK* response (which should appear within 3 seconds), and continue.

7. Send the *initialization* command to the modem using the following recommended *initialization* string: **AT E0 Q1 S0=1 V1 X4 &C0 &D0!**
8. Wait for an *OK* response (which should appear within 3 seconds), and continue.
9. Send the *dial* command to the modem using the following recommended dial string is: **AT Q0 DT 1-234-567-1234**
10. Wait for a *CONNECT* response (which should appear within 45 to 90 seconds), and continue. If there is no response, or if there is a *NO CARRIER*, or *BUSY*, or *NO DIALTONE* response, then terminate the connection (refer to the Terminate Connection/Modem section below).

Port Expander

If a port expander has been configured into the network, follow the steps listed below, otherwise proceed to the next section.

1. Send the *link* command to the port expander, using the following recommended link string: **0t.r.o.PL0*x***
2. Wait for a *LINK ESTABLISHED* response (which should appear within 3 seconds). If the *LINK ESTABLISHED* response is received, continue with the next section.
3. If there is no response after sending the *link* command, terminate the connection (refer to the Terminating Connection/Modem section below).
4. If there is a *LINK UNAVAILABLE* response, clear all possible connections using the following recommended command strings:

   0t.r.o.PU01
   0t.r.o.PU02
   ...
   0t.r.o.PU08
5. Wait for a response for each unlink command.
6. If a response of *UNLINK DONE* is received, repeat step 1 in this section.
7. If a response of *LINK UNAVAILABLE* is received, continue clearing all possible connections.
8. If all possible connections have been cleared, repeat step 1 in this section.

Processing Messages

Proceed with message transmissions. Alarm mode switching during message processing is controlled by Coastcom's *NCC5* and *NCC6* programs when communicating with the D/I Mux III system (the *NCC2* program does not switch alarm modes). The program sends a Machine Machine Language (MML) command to disable alarm reporting, thus allowing ASCII or MML data transmission/reception to occur. At the conclusion of message processing, the program sends another MML command to re-enable alarm reporting.

When all transmissions are complete, or after a configurable period of time without any data being transferred, proceed to Terminating Connection below.

Terminating Connection

At the conclusion of transmission, the connection must be terminated. Follow the steps listed below for terminating connection with each device listed.

Port Expander

If a port expander, or other black box device, has been configured into the network follow the steps listed below, otherwise proceed to the next section.

1. Send the *unlink* command to the port expander, using the following recommended command string: **0t.r.o.PU0*x***
2. Wait for an *UNLINK DONE* response (which should appear within 3 seconds).
3. If the *UNLINK DONE* response is received, proceed to the next section.
4. If there is no response, proceed to the next section.
5. If there is a *LINK UNAVAILABLE* response, clear all possible connections using the following recommended command strings:

   0t.r.o.PU01
   0t.r.o.PU02
   ...
   0t.r.o.PU08

6. Wait for a response for each unlink command.
7. If a response of *UNLINK DONE* is received, proceed to the next section.
8. If a response of *LINK UNAVAILABLE* is received, continue clearing all possible connections as indicated above.
9. When all possible connections have been cleared, proceed to the next section.

Modem

If a modem has been configured into the network, follow the steps listed below, otherwise proceed to the next section.

1. To ensure that the modem is not in an off-hook state; hang up the modem using the following recommended *hang-up* command string: **~~~+++~~~ATH0!**
2. Wait 2-3 seconds.
3. Send the *escape* sequence using the following command string: **+++**
4. Wait for an *OK* response (which should appear within 3 seconds), and continue.
5. Send the following *hang-up* command: **ATH!**
6. Wait for an *OK* response (which should appear within 3 seconds), and continue.

7. Send the *initialization* string to the modem, using the following recommended command string:

   AT E0 Q1 S0=1 V1 X4 &C0 &D0!

8. Wait for an *OK* response (which should appear within 3 seconds), and continue.

Port

Coastcom's *NCC5* program will release the serial port back to the system.

The *NCC2* and *NCC6* programs will release the port by restoring the original serial interrupt vector.

Modems and D/I Mux III or DXC II Systems

When either the D/I Mux III or DXC II systems attempt to make or break a connection the activity sequence includes making connection, processing messages, and terminating the connection. Each activity is described below.

Making Connection

Each of the components involved in the data transfer must be connected. The sequence of those connections are listed as follows.

Port

Because the D/I Mux III and DXC II ports are dedicated ports, no special connections need be made.

Port Expander

If a port expander, or other black box device, has been configured into the network follow the steps listed below, otherwise proceed to the next section.

1. Send the *link* string to the port expander, using the following recommended string command: **0t.r.o.PL0*x***
2. Wait for a *LINK ESTABLISHED* response (should appear within 3 seconds).
3. If the no response is received or if a *LINK UNAVAILABLE* response is received, proceed to the Terminating Connection section below.

Modem

If a modem has been configured into the network follow the steps listed below, otherwise proceed to the next section.

1. To ensure that the modem is not in an off-hook state, hang up the modem using the following recommended hang-up string: **~~~+++~~~ATH0!**
2. Wait 2-3 seconds.
3. Send the *escape* sequence, using the following command string: +++
4. Wait for an *OK* response (should appear within 3 seconds), and continue.

5. Send the *hang-up* command, using the following command string: **ATH!**
6. Wait for an *OK* response (should appear within 3 seconds), and continue.
7. Send the *initialization* command to the modem, using the following recommended command string:

   AT E0 Q1 S0=1 V1 X4 &C0 &D0!
8. Wait for an *OK* response (should appear within 3 seconds), and continue.
9. Send the *dial* command to the modem, using the following recommended command string (this command string includes the phone number): **AT Q0 DT 1-234-567-1234**
10. Wait for a *CONNECT* response (this should appear within 45 to 90 seconds), and continue.
11. If there is no response, or if there is a *NO CARRIER*, or *BUSY*, or *NO DIALTONE* response, terminate the connection and proceed to the Terminating Connection/Modem section).

Connection Stabilization

A two second delay after a connection is established allows all elements of the data path to stabilize. This quiet time gives slower modems, and connections which utilize a slower data rate, a chance to complete the connection process.

Processing Messages

Proceed with message transmissions. Alarm mode switching during message processing is controlled by Coastcom's *NCC5* and *NCC6* programs when communicating with the D/I Mux III system (the *NCC2* program does not switch alarm modes). The program sends a Machine Machine Language (MML) command to disable alarm reporting, thus allowing ASCII or MML data transmission/reception to occur. At the conclusion of message processing, the program sends another MML command to re-enable alarm reporting. If this message is missed by the D/I Mux III firmware, the D/I Mux III automatically terminates the connection after a preconfigured period of time (a range of 3 to 127 seconds).

When all transmissions are complete, or after a configurable period of time without any data being transferred, proceed to Terminating Connection below.

Terminating Connection

At the conclusion of transmission, the connection must be terminated. Follow the steps listed below for terminating connection with each device listed.

Modem

If a modem has been configured into the network follow the steps listed below, otherwise proceed to the next section.

1. To ensure that the modem is not in an off-hook state, hang up the modem by using the following recommended hang-up string: **~~~+++~~~ATH0!**
2. Wait 2-3 seconds.
3. Send the *escape* sequence, using the following command string: **+++**
4. Wait for an *OK* response (should appear within 3 seconds), and continue.

5. Send the *hang-up* command, using the following command string: **ATH!**
6. Wait for an *OK* response (should appear within 3 seconds), and continue.
7. Send the *initialization* command to the modem using the following recommended command string: **AT E0 Q1 S0=1 V1 X4 &C0 &D0!**
8. Wait for an *OK* response (should appear within 3 seconds), and continue.

Port Expander

If a port expander, or other black box device, has been configured into the network follow the steps listed below, otherwise proceed to the next section.

1. Send the *unlink* command to the port expander, using the following recommended command string: **0t.r.o.PU0*x***
2. Wait for any response (should appear within 3 seconds), then proceed to the next section.

Port

Because the ports on the D/I Mux III and the DXC II are dedicated, nothing special need be done to terminate the port connection.

APPENDIX H.

SET REPORT OPTIONS

Appendix H. SET REPORT OPTIONS

The Set report Options (**SO**) command allows viewing and selection of various communications modes and devices. This appendix depicts and describes **SO** command screens for Feature Groups 6.4 through 9.0. Minor screen or command differences for Feature Groups prior to 6.4 are noted in the text accompanying the figures.

The figures in this Appendix depict various configurable report options available through use of the **SO** command screens. After typing **SO**, and [**Enter**], the current operating mode appears, followed by communications configuration selection options. The options include the following.

- **COMM mode:** Selects the desired communications mode; options are either basic terminal control, or Machine Machine Language (MML) control when Coastcom's Network Communications Controller (NCC) software product is used.

- **Display Modem/Port expander configuration:** Displays the current modem and port expander set up.

- **Change Modem Configuration:** Allows connection to a modem, and use of the modem for control and alarm reporting.

- **Change Port Expander Configuration:** Allows control and alarm reporting through a port expander connection. Port expanders are useful when there are several network elements at one site; they allow all of the devices connected to the port expander to share one control channel.

- **Quit**: Allows exiting the command screen at this time.

Setting Communications in Terminal Mode With Inaudible Terminal Alarm Reporting

Figure J-1 depicts the Set report Options (**SO**) command sequence screen, resulting in communications in terminal mode with inaudible terminal alarm reporting.

Selecting option **C** under Communication Configuration sets the communications mode. Then, selecting option **T** specifies that communications will be controlled by a terminal versus MML. The next options to appear are the Alarm Reporting Mode and choice of whether or not to activate an audible alarm.

The choices for alarm reporting mode include **T) Terminal Alarm Reporting**, **E) Enable Modem Dial-out**, or **O) Off**. Option **T** permits alarms to be reported to the terminal, and disables dial-out reporting, as indicated on the screen. An alarm condition will interrupt, and report to, the Common Control Unit (CCU) control screens. If the multiplexer is operating in a channel card screen at the time of the event, the alarm will only be reported when a CCU alarm reporting screen is accessed. If a Sound Bell is selected (with a **Y** entry), the terminal will beep during an alarm condition. To prevent the terminal from beeping in alarm, select **N**.

Once all selections are made, **Current Mode** displays again, reflecting the selection.

Feature Group 6.0/6.2 Screen Changes

The 6.0/6.2 Feature Group Set report Options (**SO**) screen signifies alarm reporting only in **Current Mode**. In **TERM** mode, the alarm is reported to the terminal.

The 6.0/6.2 Feature Group COMM Mode selections were labeled
1) Terminal and *2) MML*. Options, however, were the same as found in current Feature Group.

The 6.0/6.2 Feature Group Alarm Reporting Mode selections were limited to *T) Terminal*, and *O) Off***,** and did not allow alarm dial-out in terminal communications mode.

```
SO

Current Mode
 TERM - NO ALARM REPORTING

Communication Configuration
 C) COMM mode
 D) Display Modem/Port expander conf.
 M) Change Modem Conf.
 P) Change Port Expander Conf.
 Q) Quit C

COMM mode:
 T) Terminal
 M) MML
[TERM] T

Alarm Reporting Mode:
 T) Terminal Alarm Reporting
 E) Enable Modem Dial-out
 O) Off
[TERM - DIALOUT DISABLED] t

Sound Bell
 Y) Yes
 N) No
[N] n

Current Mode
 TERM - ALARM REPORTING
```

Figure I-1. Setting Communications in Terminal Mode With Inaudible Terminal Alarm Reporting Screen

Setting Communications in Terminal Mode With Modem Dial-Out

Figure J-2 depicts the Set report Options (**SO**) command sequence screen, resulting in communications in terminal mode with modem dial-out enabled.

Selecting option **C** under Communication Configuration sets the communications mode. Then, selecting option **T** specifies that communications will be controlled by a terminal versus MML. The next option to appear is the Alarm Reporting Mode.

The choices for alarm reporting mode include **T) Terminal Alarm Reporting**, **E) Enable Modem Dial-out**, or **O) Off**. Option **E** enables modem dial-out. An alarm condition will interrupt, and report to, the Common Control Unit (CCU) control screens.

Once all selections are made, **Current Mode** displays again, reflecting the selection. Note that the modem requires configuration. This is accomplished by returning to the **SO** command menu and selecting **D) Display Modem/Port expander configuration** (see later instructions for detail).

Feature Group 6.0/6.2 Screen Changes

The 6.0/6.2 Feature Group COMM Mode selections were labeled
1) Terminal and *2) MML*. Options, however, were the same as found in current Feature Group.

The 6.0/6.2 Feature Group Alarm Reporting Mode selections were limited to *T) Terminal*, and *O) Off***,** and did not allow alarm dial-out in terminal communications mode.

```
SO

Current Mode
 TERM - NO ALARM REPORTING

Communication Configuration
 C) COMM mode
 D) Display Modem/Port expander conf.
 M) Change Modem Conf.
 P) Change Port Expander Conf.
 Q) Quit C

COMM mode:
 T) Terminal
 M) MML
[TERM] T

Alarm Reporting Mode:
 T) Terminal Alarm Reporting
 E) Enable Modem Dial-out
 O) Off
[TERM - DIALOUT DISABLED] e
Current Mode
 TERM - DIALOUT ALARM
REPORTING
(Modem Requires Configuration)
```

Figure I-2. Setting Communications in Terminal Mode With Modem Dial-Out

Setting Communications in Terminal Mode With Alarm Reporting Off

Figure J-3 depicts the Set report Options (**SO**) command sequence screen, resulting in communications in terminal mode with alarm reporting turned off.

Selecting option **C** under Communication Configuration sets the communications mode. Then, selecting option **T** specifies that communications will be controlled by a terminal versus MML. The next option to appear is the Alarm Reporting Mode.

The choices for alarm reporting mode include **T) Terminal Alarm Reporting**, **E) Enable Modem Dial-out**, or **O) Off**. Option **O** turns off alarm reporting. The terminal will still detect and record alarms, but will not interrupt the operation of the Common Control Unit (CCU).

Once all selections are made, **Current Mode** displays again, reflecting the selection.

Feature Group 6.0/6.2 Screen Changes

The 6.0/6.2 Feature Group COMM Mode selections were labeled
1) Terminal and *2) MML*. Options, however, were the same as found in current Feature Group.

The 6.0/6.2 Feature Group Alarm Reporting Mode selections were limited to *T) Terminal*, and *O) Off*, and did not allow alarm dial-out in terminal communications mode.

The 6.0/6.2 Feature Group Current Mode with no alarm reporting was labeled simply *OFF*.

```
SO

Current Mode
 TERM - NO ALARM REPORTING

Communication Configuration
 C) COMM mode
 D) Display Modem/Port expander conf.
 M) Change Modem Conf.
 P) Change Port Expander Conf.
 Q) Quit C

COMM mode:
 T) Terminal
 M) MML
[TERM] T

Alarm Reporting Mode:
 T) Terminal Alarm Reporting
 E) Enable Modem Dial-out
 O) Off
[TERM - DIALOUT ENABLED] o
Current Mode
 TERM - NO ALARM REPORTING
```

Figure I-3. Setting Communications in Terminal Mode With Alarm Reporting Turned Off

Setting Communications in MML Mode With Modem Dial-Out Enabled

Figure J-4 depicts the Set report Options (**SO**) command sequence screen, resulting in communications in Machine Machine Language (MML) mode with alarm reporting modem dial-out enabled. MML is the language used by Coastcom's Network Communications Controller (NCC) software product. If still connected to a terminal when entering this option, extra characters will appear on the terminal screen.

Selecting option **C** under Communication Configuration sets the communications mode. Then, selecting option **M** specifies that communications will be controlled by MML versus a terminal. The next option to appear is the Alarm Reporting Mode.

The choices for alarm reporting mode include **E) Enable Modem Dial-out**, or **D) Disable Modem Dial-out**. Option **E** enables modem dial-out, causing an alarm condition to interrupt, and report to, the Common Control Unit (CCU) control screens.

Once all selections are made, **Current Mode** displays again, reflecting the selection. Note that the modem requires configuration. This is accomplished by returning to the **SO** command menu and selecting **D) Display Modem/Port expander configuration** (see later instructions for detail).

Feature Group 6.0/6.2 Screen Changes

The 6.0/6.2 Feature Group COMM Mode selections were labeled
1) Terminal and *2) MML*. Options, however, were the same as found in current Feature Group.

The 6.0/6.2 Feature Group Alarm Reporting Mode selections in MML mode were labeled *E) Modem Dial-out Enabled*, and *D) Modem Dial-out Disabled*, with a warning that read *[MML NO ALERT].*

```
SO

Current Mode
 TERM - NO ALARM REPORTING

Communication Configuration
 C) COMM mode
 D) Display Modem/Port expander conf.
 M) Change Modem Conf.
 P) Change Port Expander Conf.
 Q) Quit C

COMM mode:
 T) Terminal
 M) MML
[TERM] m

Alarm Reporting Mode:
 E) Enable Model Dial-out
 D) Disable Modem Dial-out
[MML - DIALOUT DISABLED] e

Current Mode
 MML - DIALOUT ALARM
REPORTING
(Modem Requires Configuration)
```

Figure I-4. Setting Communications in MML Mode With Modem Dial-Out Enabled

Setting Communications in MML Mode
With Modem Dial-Out Disabled

Figure J-5 depicts the Set report Options (**SO**) command sequence screen, resulting in communications in Machine Machine Language (MML) mode with alarm reporting modem dial-out disabled. MML is the language used by Coastcom's Network Communications Controller (NCC) software product. If still connected to a terminal when entering this option, extra characters will appear on the terminal screen.

Selecting option **C** under Communication Configuration sets the communications mode. Then, selecting option **M** specifies that communications will be controlled by MML versus a terminal. The next option to appear is the Alarm Reporting Mode.

The choices for alarm reporting mode include **E) Enable Modem Dial-out**, or **D) Disable Modem Dial-out**. Option **D** disables modem dial-out, preventing an alarm condition from interrupting, or reporting to, the Common Control Unit (CCU).

Once all selections are made, **Current Mode** displays again, reflecting the selection.

Feature Group 6.0/6.2 Screen Changes

The 6.0/6.2 Feature Group COMM Mode selections were labeled
1) Terminal and *2) MML*. Options, however, were the same as found in current Feature Group.

The 6.0/6.2 Feature Group Alarm Reporting Mode selections in MML mode were labeled *E) Modem Dial-out Enabled*, and *D) Modem Dial-out Disabled*, with a warning that read *[MML ALERT* or *MML - NO ALERT].*

The 6.0/6.2 Feature Group did not display modem status, and Current Mode status was labeled *MML NO ALERT*.

```
SO

Current Mode
 TERM - NO ALARM REPORTING

Communication Configuration
 C) COMM mode
 D) Display Modem/Port expander conf.
 M) Change Modem Conf.
 P) Change Port Expander Conf.
 Q) Quit C

COMM mode:
 T) Terminal
 M) MML
[TERM] m

Alarm Reporting Mode:
 E) Enable Model Dial-out
 D) Disable Modem Dial-out
[MML - DIALOUT DISABLED] d

Current Mode
 MML - NO ALARM REPORTING
```

Figure I-5. Setting Communications in MML Mode With Modem Dial-Out Enabled

Displaying Modem and Port Expander Information

Figure J-7 depicts the Set report Options (**SO**) command sequence screen, permitting selection of the **D) Display Modem/Port Expander Configuration** option.

```
SO

Current Mode
 TERM - NO ALARM REPORTING

Communication Configuration
 C) COMM mode
 D) Display Modem/Port expander conf.
 M) Change Modem Conf.
 P) Change Port Expander Conf.
 Q) Quit d
```

Figure I-7. Display Modem and Port Expander Configuration Screen

The Display Modem and Port Expander Configuration screen appears, listing all current alarm dial-out configuration data. Figure J-8 depicts a modem and port expander configuration screen.

```
16:49:16 -------------[ Alarm Dial Out ]------------- 07/09/92

Interval Between Calls : 3 mins  Last Message Time Out : 20 secs

Port Expander Present  : No
 NCC Port              : 0
 Port                  : 1
 Attention String      : 1t.r.o.P
 Link String           : L
 Link Response         : LINK ESTABLISHED
 Unlink String         : U
 Unlink Response       : UNLINK DONE

Modem Present          : No
 Phone Number          :
 Attention String      : ~~~+++~~~ATH!
 Init. String          : ATE0S0=1Q1V1X4&C0&D0!

** Press Enter to Continue **

Current Mode
TERM - NO ALARM REPORTING
```

Figure I--8. Display Modem and Port Expander Configuration Screen

Feature Group 6.0/6.2 Screen Changes

The 6.0/6.2 Feature Group Current Mode status was not labeled. It simply indicated alarm reporting, but did not specify reporting to the terminal.

Configuring the Modem

To configure the modem, access the **SO** screen, and select **M) Change Modem Configuration** from the options screen.

Next, select the number of desired interval minutes between call attempts to the control site. This option is allows the control site modem to be busy communicating with another part of the network, and still be alerted promptly to an alarm event. The number of **minutes** may be any number between 3 and 127

After establishing the interval between call attempts, the next selection to be made is the number of seconds to elapse prior to hanging up the modem after the last message is sent. This time period is called the "time out". The number of **seconds** selected may be any number between 3 and 127.

The next selection in modem configuration is to inform the system of modem status ("do you have a modem"). Respond either **Y** (**Yes**) or **N** (**No**), as appropriate. At the next, prompt enter the modem phone number.

The next four entries call for the Attention String, the Dial String, the Modem Hang-up String, and the Modem Initiation String. In each case, the default string command appears in the prompt brackets. Coastcom recommends use of these default commands.

Figure J-9 on the following page depicts the modem configuration sequence as described here.

```
]SO

Communication Configuration
 C) COMM mode
 D) Display Modem/Port expander conf.
 M) Change Modem Conf.
 P) Change Port Expander Conf.
 Q) Quit m

Intervals Between Call Attempts In Minutes
(3..127)
[3]

Last Message Time Out In Seconds
(3..127)
[20]

Do You Have A Modem
 Y) Yes
 N) No  y

Phone Number
[] 501-555-1234

Modem Attention String
[AT]

Modem Dial String
[Q0DT]

Modem Hang-up String
(Use ~ For delay = 1/2 second)
(Use ! For Return Key)
[~~~+++~~~ATH!]

Modem Init. String
(Use ! For Return Key)
[ATE0S0=1Q1V1X4&C0&D0!]
```

Figure I-9. Modem and Port Expander Configuration Option Screen

Displaying New Modem Configuration

After all modem configuration options are selected, the Alarm Dial Out screen displays automatically. Each of the options set during configuration are reflected on the terminal screen, with the **Apply Changes** "save" option included. If the displayed options are those desired, press **Y** and [**Enter**] to save all configuration settings. If other changes are desired, press **N** and [**Enter**], and all settings will remain as previously set. After saving the settings, the screen prompts to "Press Enter to Continue", after which the Current Mode (for alarm reporting) will again display.

Figure J-10 depicts the modem configuration settings display screen.

```
16:49:27 ------------[ Alarm Dial Out ]--------------- 11/30/96

Interval Between Calls : 3 mins  Last Message Time Out : 20 secs

Modem Present          : Yes
 Phone Number          :
 Attention String      : AT
 Dial String           : Q0DT
 Hang-up String        : ~~~+++~~~ATH!
 Init. String          : ATE0S0=1Q1V1X4&C0&D0!

Apply Changes
 Y) Yes
 N) No
[Y/N] Y

** Press Enter to Continue **

Current Mode
 TERM - NO ALARM REPORTING
```

Figure I-10. Modem Configuration Settings Display Screen

Feature Group 6.0/6.2 Screen Changes

The 6.0/6.2 Feature Group Current Mode status was labeled simply *OFF*.

Configuring the Port Expander

To configure the port expander, access the **SO** screen, and select **P) Change Port Expander Configuration** from the options screen. The screen will ask "Do you have a port expander". Respond **Y** (**Yes**), or **N** (**No**), as appropriate.

The screen will then prompt for entry of the applicable Network Communications Controller (NCC) control port connection, followed by the applicable port expander port number.

The next five entries specify the Port Expander Attention String, the Port Expander Link String, the Port Expander Link Response, the Port Expander Unlink String, and the Port Expander Unlink Response String. In each case, the default string command appears in the prompt brackets. Coastcom recommends use of these default commands.

Figure J-11, on the following page, depicts the port expander configuration options screen.

```
SO

Communication Configuration
 C) COMM mode
 D) Display Modem/Port expander conf.
 M) Change Modem Conf.
 P) Change Port Expander Conf.
 Q) Quit p

Do You Have A Port Expander
 Y) Yes
 N) No
[N] y

NCC Port
 (0..9)
[0]

Port Expander Port
 (0..16)
 [1]

Port Expander Attention String
 [lt.r.o.P]

Port Expander Link String
 [L]

Port Expander Link Response
 [LINK ESTABLISHED]

Port Expander Unlink String
 [U]

Port Expander Unlink Response String
 [UNLINK DONE]
```

Figure I-11. Port Expander Configuration Options Screen

Displaying New Port Expander Configuration

After all port expander configuration options are selected, the Alarm Dial Out screen displays automatically. Each of the options set during configuration are reflected on the terminal screen, with the **Apply Changes** "save" option included. If the displayed options are those desired, press **Y** and [**Enter**] to save all configuration settings. If other changes are desired, press **N** and [**Enter**], and all settings will remain as previously set.

Figure J-12 depicts the port expander configuration settings display screen.

```
16:49:38 ------------[ Alarm Dial Out ]---------- 11/30/96

Port Expander Present    : Yes
 NCC Port                : 0
 Port                    : 1
 Attention String        : 1t.r.o.P
 Link String             : L
 Link Response           : LINK ESTABLISHED
 Unlink String           : U
 Unlink Response         : UNLINK DONE

Apply Changes
 Y) Yes
 N) No
[Y/N] y


** Press Enter to Continue **
```

Figure I-12. Port Expander Configuration Settings Display Screen

Quitting Alarm Reporting Configuration

After saving all configuration settings, the screen prompts to "Press Enter to Continue", after which the Communication Configuration menu will again display. The option to **Quit** is available whenever this menu displays. To quit, simply press **Q** and [**Enter**]. After quitting, the D/I Mux III main menu may be accessed by pressing **M** and [**Enter**].

Figure J-13 depicts the quit/return to D/I Mux III main menu sequence.

```
** Press Enter to Continue **

Communication Configuration
 C) COMM mode
 D) Display Modem/Port expander conf.
 M) Change Modem Conf.
 P) Change Port Expander Conf.
 Q) Quit q

] m
```

Figure I-13. Quitting Alarm Reporting Configuration and Returning to D/I Mux III Main Menu Screen

APPENDIX I.

TRAPS AND MODEM DIAL OUT CONFIGURATION

Appendix I. Traps and Modem Dial Out Configuration

AMCU New Screens

Three new commands are now available on the AMCU. Two commands (**M**odify **D**ial Out Parameters, and **V**iew **D**ial Out parameters) are for viewing and/or modifying the Modem Dialout Parameters. The other command (**M**odify **A**larm Trap) is used to determine what type of alarm conditions will be used to determine if a link is down.

AMCU Main Menu

The new AMCU Main Menu with Modem Dial Out Configuration commands

08:50:32 ---------------------[AMCU Main Menu]---------------------- 06/11/97

LOCAL PARAMETERS	NETWORK PARAMETERS
VR View Revision Levels	VN View Network Parameters
MT Modify Keyboard Timeout	MG Modify Default Gateway
	MI Modify IP Address
MODEM DIALOUT CONFIGURATION	MS Modify Subnet Mask
VD View Dial Out Parameters	ML Modify SLIP Parameters
MD Modify Dial Out Parameters	
MA Modify Alarm trap	
D/I Mux III User Screen	CODE DOWNLOAD
AC Access CCU User Submenu	MC Download CCU Program
PASSWORDS	SNMP MANAGER CONFIGURATION
VP View Passwords	VM View Managers
MP Modify/Install Password	MM Modify/Install Manager
RP Remove Password	RM Remove Manager
Q Quit/Disconnect	

Figure J-1 AMCU Main Menu

TRAPS

The normal communication path in an SNMP system is from the manager(s) to a specific node (the agent). Usually the manager initiates communication by sending a request (**set, get, get-next**) and the agent (**AMCU**) responds.

A **Trap** is used to indicate a change in the operating environment, such as an alarm or an event message. Traps are unsolicited messages from the agent to the manager.

The 5 traps as defined in RFC 1157 and used in this implementation are:

1) **coldStart Trap:** Signifies that the agent is reinitializing itself and that some or all of the configuration information may be changed.

2) **warmStart Trap:** Signifies that the agent is doing a warm boot and that the configuration information has not changed.

3) **linkDown Trap:** Signifies that the agent recognizes that one of its communication links has failed.

4) **linkUp Trap:** Signifies that the agent recognizes that one of its communication links is back in service.

5) **authenticationFailure Trap:** Signifies that the agent has the correct IP address but the community string is not recognized.

When an SMNP manager receives a trap message, it can be displayed on a terminal screen, or into a log file, etc. depending on how the manager site is configured. At this point the manager site can request further information from the agent (using **get**, **get-next**) or, reroute traffic, or reconfigure the agent (using **set**) as is necessary to keep the network running.

MODIFY ALARMS

MA

The **MA** command allows the user to specify what type of alarms will be used as the criteria for determining if a link has failed, triggering a **linkDown Trap.** When all of the specified alarms have cleared a **linkUp Trap** will be sent.

The MA screens shown are for Channel Bank Mode. In Dual Channel Bank or Drop and Insert mode, T1-2 would be offered as a choice.

] **ma**

Modify T1 Alarm Trap Conditions

----

1 Modify T1 line one criteria

Q Quit

Select: [Q] **1**

15:43:37 --------[Set T1 Line Trap Criteria - T1 One]-------- 06/19/97

If any alarm marked Check is present, the T1 line will be considered down. Unmarked alarms are ignored.

0: Receive Far End LOF (Yellow) ..... [ ]

1: Transmit Far End LOF (Yellow) .... [ ]

2: Receive AIS (Blue) .... [ ]

3: Transmit AIS (Blue) .... [ ]

4: Near End Loss Of Frame (Red) ..... [ ]

5: Near End Loss Of Signal .... [ ]

6: Loopback .... [ ]

7: Bypass .... [ ]

8: Carrier Group Alarm .... [ ]

9: Delayed Carrier Group Alarm ...... [ ]

A: Any Alarm

N: None

Q: Quit

Chose a number to change the state of that alarm, or chose a letter for

the specified action: [Q] **8**.

Figure J-2 Modify alarm Screen

SELECT TRAP CRITERIA

By selecting option 8 the **AMCU** is now told that if a **CGA** (**C**arrier **G**roup **A**larm) occurs to send a **linkDown** Trap to the SNMP Manager.

```
15:43:53 --------[ Set T1 Line Trap Criteria - T1 One ]-------- 06/19/97


 If any alarm marked Check is present, the T1 line will be considered

 down.  Unmarked alarms are ignored.

---------------------------------------------------------------------

    0:  Receive Far End LOF (Yellow) ..... [     ]

    1:  Transmit Far End LOF (Yellow) .... [     ]

    2:  Receive AIS (Blue) ............... [     ]

    3:  Transmit AIS (Blue) .............. [     ]

    4:  Near End Loss Of Frame (Red) ..... [     ]

    5:  Near End Loss Of Signal .......... [     ]

    6:  Loopback ......................... [     ]

    7:  Bypass ........................... [     ]

    8:  Carrier Group Alarm .............. [Check]

    9:  Delayed Carrier Group Alarm ...... [     ]


    A:  Any Alarm

    N:  None

    Q:  Quit

---------------------------------------------------------------------

Chose a number to change the state of that alarm, or chose a letter for

the specified action:  [Q]
```

Figure J-3 Trap Criteria Selected

EXIT MODIFY ALARM TRAP

The site operator has now set the criteria which the **AMCU** will use in determining if a link has failed and will end this session with "**Q**". The operator then chooses to keep the changes and exit with "**D**".

Modify T1 Alarm Trap Conditions

----

1 Modify T1 line one criteria

Q Quit

Select: **[Q]**

Exit from Set Alarm Trap Criteria

D Done: Save changes

C Cancel: Discard changes

R Return to set screen

[R] **D**

Figure J-4 Quit Modify Alarm

The path for this system is: D/I Mux III with an AMCU, to an external modem (using a cable with an RJ-45 connector on the AMCU end and a DB-9 connector on the modem end) to a phone line to the Network, from the network to a modem to the SNMP manager Mux. .

MODEM DIAL OUT

MD **M**odify **D**ial Out Parameters

If the AMCU is appropriately configured, a trap can cause the AMCU to dial out on a customer supplied modem to reach an SMNP manager. This command allows the user, via menu selections to do the following:

- Configure the SLIP port of the AMCU for modem or no modem
- Set the length of inactivity (Timeout) before the modem hangs up.
- Input a Modem Initialization String.
- Add, Change the ordered list, or Delete dial out numbers.
- View the configuration of the site with the new parameters
- Apply the changes

MODIFY DIAL OUT

After inputting the "**MD**" command, the first menu selection lets the user tell the system whether or not to configure the SLIP port for a modem

] **md**

Modify Dial Out Parameters

M Modem present?

T Timeout

I Modem initialization string

N Dail out numbers

V View dial out parameters

Q Quit

Select parameter to set or modify [Q] **m**

Figure J-5 Select Modify Dial Out

MODEM PRESENT?

After choosing the **M** option the user now selects **Y** for "yes configure the SLIP port for a modem. **N** says "no don't configure this SLIP port for a modem.

Modem Connected to SLIP port: **Yes**

Y Configure for modem

N configure for no modem

Q Quit

[Q]

Figure J-6 Connect Modem to SLIP Port

SET TIMEOUT

Selecting menu option "**T**" the user sets the number of inactive minutes allowed before the modem hangs up. Minimum is approximately 15-20 seconds but is rounded to zero minutes. Sending or receiving a SLIP packet restarts the timer.

```
Modify Dial Out Parameters

-------------------------------

M  Modem present?

T  Timeout

I  Modem initialization string

N  Dail out numbers

V  View dial out parameters

Q  Quit

Select parameter to set or modify [Q]  T


Modem Inactivity Timeout:      1 Min.

0.  Minimum

1.  1 Minute

2.  5 Minutes

3. 10 Minutes

4. 30 Minutes

Q. Quit

[Q]
```

Figure J-6 Set Timeout

INPUT MODEM INITIALIZATION STRING

Menu option **I** allows the user to input a modem initialization string

Modify Dial Out Parameters

M Modem present?

T Timeout

I Modem initialization string

N Dail out numbers

V View dial out parameters

Q Quit

Select parameter to set or modify [Q] **i**

Modem Initialization String: **ATZV1&D2&C1E0**

Do you want to enter a new string (Y or N)? [N] **y**

Please enter a new value (zero to 32 characters). End the entry with a

carriage return (Enter key).

ATZV1&D2&C1E0

Figure J-8 Input Modem Initialization String

ANALYSIS OF DEFAULT INITIALIZATION STRING

Note: This is a breakdown analysis of the default initialization string.

ATZV1&D2&C1E0

AT is the attention prefix—this precedes all commands except for *escape sequence* or the *repeat command.*

Z means reset the modem and recall the factory configuration.

V1 displays the result code(s) in the form of words.

&D2 assume the command state when an **on-to-off** transition of **DTR** occurs.

&C1 Track the presence of a data carrier.

Use **&D2&C1** because software convention assumes that when **DTR** goes low the modem will hang up. Using the factory default **&D0&C0** will not hang up when **DTR** goes low.

E0 Disable character echo in command state.

INPUT DIAL OUT NUMBERS

The **N** option of the menu allows the user to input the numbers the modem will use to dial out to. The "**atdt**" string is a command string for the modem to go into dial out mode (any command to a Hays or Hays comparable modem must start with "**at**" , which is the attention prefix, followed by, in this case, "**dt**", meaning **d**ial **t**one, or "**dp**" for **d**ial **p**ulse).

For example: **atdt5239417**

See the example on the previous page for a breakdown of the string**.** There are many other options available for a particular modem. Please consult your modem manual for further information.

```
Modify Dial Out Parameters

------------------------------

M  Modem present?

T  Timeout

I  Modem initialization string

N  Dail out numbers

V  View dial out parameters

Q  Quit

Select parameter to set or modify [Q] n


  Dial Out Number Command Strings

  -------------------------------------------------------------------

   1  atdt5239417

   2

   3

   4

   5

---------------------------------------------------------------------
```

Figure J-9 Input Dial Out Numbers

ADD A NUMBER

After choosing the **N** option the user selects **a** from the sub menu to add a number to the dial out list. .

```
Edit Dial Out Numbers

A  Add a number

C  Change a number

D  Delete a number

Q  Quit

[Q] a


 Dial Out Number Command Strings

 ------------------------------------------------------------------

  1  atdt5239417

  2

  3

  4

  5

--------------------------------------------------------------------
```

Figure J-10 Add a Number

INSERT OR ADD A NUMBER

Now the operator can choose where in the list to put the new number.

```
Add a new dial out number:

 B  Insert at the beginning of the list.

 1  Add a new number after number #1.

 Q  Quit

Please enter one of B, 1, or Q [1]  1


Please enter a new value (zero to 32 characters).  End the entry with a

carriage return (Enter key).

atdt5105236000


  Dial Out Number Command Strings

  ---------------------------------------------------------------------

   1  atdt5239417

   2  atdt5105236000

   3

   4

   5

---------------------------------------------------------------------
```

Figure J-11 Put Number In the List

The user has added a new phone number to the list. This number was added after the first number, but could have been added before it, depending on what order the operator wants the modem to dial the numbers.

Up to 5 numbers can be listed. The modem will begin the dial out sequence with the first number in the list. If the first number is busy, the modem will automatically dial out the next number in the list. The modem will cease dialing after it has tried and not connected with all 5 numbers. (This scenario is extremely unlikely)

CHANGE A NUMBER

If, for any reason the dial out number needs to be changed the user can correct the error with the **C** command

```
Edit Dial Out Numbers

A  Add a number

C  Change a number

D  Delete a number

Q  Quit

[Q]  C

Dial Out Number Command Strings

  ------------------------------------------------------------------

   1  atdt5239417

   2  atdt5105236000

   3

   4

   5

--------------------------------------------------------------------
```

Figure J-12 Change a Number

SELECT NUMBER TO CHANGE

This sub menu then asks the operator which number he wishes to change.

```
Change a dial out number:
 1  Change number #1.
 2  Change number #2.
 Q  Quit

Please enter one of 1 through 2, or Q [Q] 2

Please enter a new value (zero to 32 characters).  End the entry with a
carriage return (Enter key).
atdt15105236000
  Dial Out Number Command Strings
  ------------------------------------------------------------------
   1  atdt5239417
   2  atdt15105236000
   3
   4
   5
--------------------------------------------------------------------
```

Figure J-13 Select Number to Change

DELETE A NUMBER

If, for some reason, a dial out number is no longer of any use it can be deleted by the **D** command.

```
Edit Dial Out Numbers

A  Add a number

C  Change a number

D  Delete a number

Q  Quit

[Q]  d


  Dial Out Number Command Strings

  ----------------------------------------------------------------------

   1  atdt5239417

   2  atdt15105236000

   3

   4

   5

------------------------------------------------------------------------
```

Figure J-14 Delete a Number

CHOOSE THE NUMBER TO DELETE

This sub menu allows the operator chooses which number to delete.

```
Delete a dial out number:
 1  Delete number #1.
 2  Delete number #2.
 Q  Quit

Please enter one of 1 through 2, or Q [Q]  2

  Dial Out Number Command Strings
  ----------------------------------------------------------------------
   1  atdt5239417
   2
   3
   4
   5
------------------------------------------------------------------------
```

Figure J-15 The Number Deleted

Dial Out number 2 in the list has been deleted

VIEW PARAMETERS

The **V** command allows the user to view the modem parameters he has set.

Modify Dial Out Parameters

M Modem present?

T Timeout

I Modem initialization string

N Dail out numbers

V View dial out parameters

Q Quit

Select parameter to set or modify [Q] **V**

15:43:11 ----------------[Dialer Parameters]----------------- 06/19/97

Modem Connected to SLIP port: **Yes**

Modem Inactivity Timeout**:**   **1 Min**.

Modem Initialization String: **ATZV1&D2&C1E0**

Dial Out Number Command Strings

----

1 **atdt5239417**

2

3

4

5

Figure J-16 View Parameters

QUIT MODEM DIAL OUT

All of the changes need have been made and now the user can exit the configuration program with the **Q** command.

```
Modify Dial Out Parameters

-------------------------------

M  Modem present?

T  Timeout

I  Modem initialization string

N  Dail out numbers

V  View dial out parameters

Q  Quit

Select parameter to set or modify [Q]

(The default command Q is used here)


Exit from Set Dial Out Parameters

D  Done:    Save changes

C  Cancel:  Discard changes

R  Return to set screen

[R] D
```

Figure J-17 Quit

The operator then chooses to save the changes made, discard the changes, or to return to set screen.

VD View **D**ial Out Parameters

This command allows the operator to view the current configuration, or a new configuration after a session with the **MD** command.

VD

15:43:11 ----------------[Dialer Parameters]----------------- 06/19/97

Modem Connected to SLIP port: **Yes**

Modem Inactivity Timeout**:** **1 Min**.

Modem Initialization String: **ATZV1&D2&C1E0**

Dial Out Number Command Strings

----

1 **atdt5239417**

2

3

4

5

Figure J-18 VD Command

MODEM CABLE PINOUTS

The table and diagram below show the pinouts for the cable that connects the AMCU with the modem. The Modem end of the cable is a dB-9 connector, while the AMCU end is an RJ-45 connector (again this is for a Hays modem, if the DB connector on your modem is different please consult your modem manual)..

Modem end of cable **AMCU end of cable**

(Male dB-9) **(Male RJ-45)**

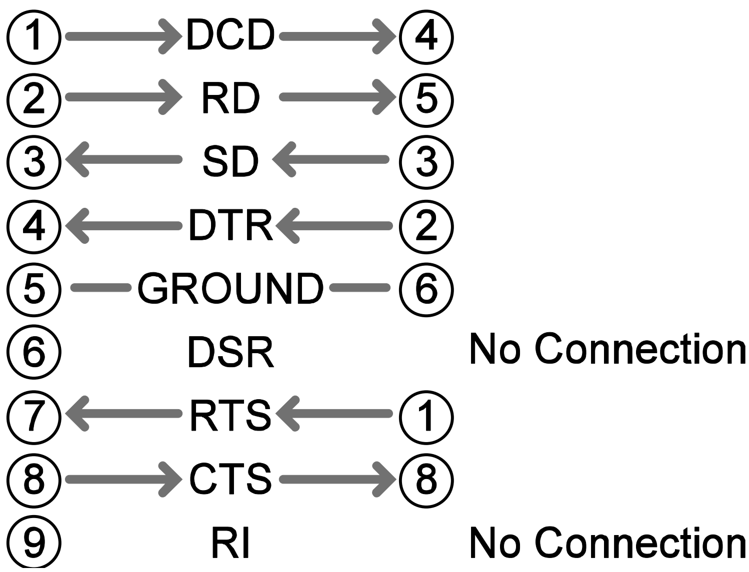
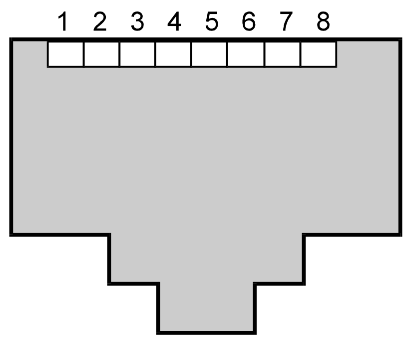


Figure J-19 Cable Pin Outs



1 - Tip 1 In to D/I Mux III
2 - Ring 1 In to D/I Mux III
3 -
4 - Tip Out from D/I Mux III
5 - Ring Out from D/I Mux III
6 -
7 - Ground In to D/I Mux III
8 - Ground Out from D/I Mux III

Figure J-20 RJ-48 pin out

Note:

The two levels of passwords (AMCU and CCU) have been eliminated. One password is used (level 1, 2, or 3) in logging on. This affects access to commands on the AMCU and CCU screens appropriately, i.e., according to the status level when logging on. However, note that in a telnet session there is a difference in the commands available in level 1. In a telnet session a user does not have access to MI, MS, or ML commands as would be the case in terminal mode. This is a safeguard so the user cannot change any network parameters and get locked out while in a telnet session. Also, all commands are available in the CCU screens with level 1 access.

WARNING. . .If the user sets the keyboard time-out, via the **MT** command (refer to your *D/I MUX III WITH SNMP* manual for further information), to **No Time-Out** and the communication link to the AMCU is severed the user will be locked out of both Telnet and terminal mode permanently. To restore communication with the AMCU, the AMCU must be powered down and brought up again.

Thus it is **strongly** recommended that the user **not use** the **No Time-Out** option with the **MT** command.

There are two time outs. The first one **MT** refers to a Telnet, RS-232, etc. session. The second time-out **MD.T** (this is the **M**odify **D**ial-out Parameters sub screen **T**) refers to the amount of time set before the modem times out.

Hardware Warranty and 90-Day Support Agreement

Coastcom warrants that hardware products of its own manufacture shall, at date of shipment and for 24* months from said date, be free from defect in materials. These products will perform substantially as described in applicable Coastcom written materials and support services shall be substantially as described in applicable Coastcom written materials.

*Please note the following exceptions:

- Any product that reaches end of life (is no longer being manufactured) shall be subject to a 90-day warranty period.
- Any product, part or assembly not manufactured by Coastcom is subject to such warranty of the original manufacturer as negotiated by Coastcom.

If any Coastcom product shall be determined by Coastcom to be defective in material or workmanship under normal intended usage and maintenance during the warranty period, then Coastcom shall repair or replace, with substantially equivalent product, at Coastcom's sole discretion, such defective product. Such replacement shall not include the cost of labor by Buyer's own employees, agents or contractors in identifying, removing or replacing the defective product. Coastcom's liability for breach of any and all warranties hereunder is expressly limited to the repair or replacement of defective products as set forth in this section. In no event shall Coastcom be liable for special, incidental or consequential damages by reason of any breach of warranty or defect in material or workmanship. Coastcom shall not be responsible for the repair or replacement of products which have been subjected to neglect, accident or improper use or installation, acts of God, or which have been altered by other than authorized Coastcom personnel. This warranty is not transferable.

Coastcom's Technical Support Department will provide phone assistance for a period of **90 days** from the day of product shipment from Coastcom. Coastcom will provide product upgrades free of charge only as such upgrades fall within that 90-day period. After 90 days, Coastcom will provide telephone consultation and other customer services per a **written service agreement** providing such agreement has been executed and authorized by the customer.

Return Policy: An item may only be returned with prior written approval of an authorized Coastcom representative. Any such approval shall reference a return material authorization number issued by said Coastcom representative. Shipping costs, if any, incurred in connection with the return of a defective item to Coastcom will be paid by Customer. Any shipping costs incurred in connection with the return of a repaired or replaced item shall be the responsibility of Coastcom. However, such costs shall be the responsibility of the Customer if Coastcom determines that the item is NOT defective. If Coastcom determines, at its sole discretion, that the allegedly defective item is not covered by the terms of the warranty provided hereunder or that the warranty claim is made after the warranty period, the cost of repair at Coastcom's option, including all shipping expenses, shall be reimbursed by the customer. If the returned material is improperly packaged for shipment thereby resulting in further damage the Customer is responsible for the additional repair cost. Coastcom will have no liability with respect to any data contained in any system returned to Coastcom. Coastcom will make every reasonable effort to repair or replace and ship replacement products in warranty within thirty (30) calendar days. Coastcom will make every reasonable effort to repair or replace out of warranty products.

THIS EXPRESS WARRANTY SHALL EXTEND TO THE BUYER AND ITS END-USER CUSTOMER ONLY, AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED INCLUDING IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY. THERE ARE NO OTHER WARRANTIES EXCEPT AS APPEAR ON THE FACE HERE OF.

If you require further information or assistance, contact Coastcom:
1141 Harbor Bay Parkway
Alameda, California 94502
Telephone: (800) 433-3433
(510) 523-6000
Fax: (510) 523-6150
info@coastcom.com
www.coastcom.com