GDC 076R100-000
Issue 3 - May 1997

Installation and Operation

SpectraComm 5001

T1 Line Terminating Unit

General DataComm

Warning

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to CISPR 22 which is designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference. The user is cautioned that any changes or modifications not expressly approved by General DataComm void the user's authority to operate the equipment.

This digital apparatus does not exceed Class A limits for radio noise emissions from digital apparatus described in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

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Figures

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Preface

Scope

This manual describes how to install and configure a General DataComm SC 5001 Line Terminating Unit.

Revision History

This is Issue 3 of the manual. It has been revised to include instructions for the use of the terminal interface.

Issue 2 of the manual was revised to include references to the RLN system application and to cover the addition of the AT command set.

Organization

This manual has seven chapters and two appendices. The information is arranged as follows:

- *Chapter 1 - Introduction* briefly describes the SC 5001 Line Terminating Unit and its features.
- *Chapter 2 - Installation* describes how to install and connect the LTU.
- *Chapter 3 - Operation* explains the functions of the controls and indicators on the LTU front panel, and provides procedures for using the AT command set and the terminal interface.
- *Chapter 4 - Configuration Parameters* lists the LTU's configuration options and the settings available for each. Each option description identifies the corresponding AT command and terminal interface selection.
- *Chapter 5 - Timing* explains the various transmit timing sources that are available to the LTU.
- *Chapter 6 -Diagnostics* describes the test functions built into the LTU.
- *Chapter 7 - Alarms and Status History* describes the alarms that the LTU can generate in response to various operating conditions and events.
- *Appendix A - Technical Characteristics*
- *Appendix B - MIB Support* lists and describes the individual Management Information Base (MIB) objects that an SNMP controller can use to interact with the LTU.

Document Conventions

Level 1 paragraph headers introduce major topics.

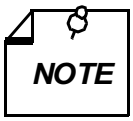
Level 2 paragraph headers introduce subsections of major topics.

Level 3 paragraph headers introduce subsections of secondary topics.

`This typewriter font shows output that is displayed on the screen.`

`This bold font shows specific input that you type at the keyboard.`

`This bold italicized font shows variable input that you type at the keyboard.`



Notes present special instructions, helpful hints or general rules.

Related Publications

The following documents have additional information that may be helpful when using this product:

- *SC 5000 System Overview* GDC 076R104-000
- *SpectraComm Manager Card Installation and Operation* GDC 058R075-000
- *SC 5520 Data Set Emulator Installation and Operation* GDC 076R102-000

GDC publication numbers (e.g., *GDC 032R163-000*) are used to track and order technical manuals. Publication numbers use the following format:

GDC NNNRnnn-000 or GDC NNNRnnn-Vnnn

- NNN identifies the product family (e.g. APEX)
- R denotes a technical publication
- nnn a number assigned by Technical Publications
- 000 identifies a hardware product and does not change
- Vnnn the software version associated with a product may be updated periodically

The Issue Number on the title page only changes when a hardware manual is revised or when a manual is reprinted for some other reason; it does not automatically change when the software is updated. A new Software Version is always Issue 1. Other specialized publications such as Release Notes or Addenda may be available depending on the product.

Service and Support

General DataComm is committed to providing the service and support needed to install, manage, and maintain your equipment. For information about service programs or for assistance with your support requirements, contact your local Sales Representative or call General DataComm Service at the 24-hour toll free number listed below.

- in the U.S. dial 1-800-243-1030
- outside the U.S. dial 1-203-598-7526

Be ready with the site name and phone number, and a description of the problem. The next available support representative will promptly return your call.

Hands-on training courses are provided by GDC Educational Services. Courses range from basic data communications, modems and multiplexers, to complex network and ATM systems. They are taught in Connecticut or at a customer location. Call 1-800-243-1030 and follow the menu instructions to discuss educational services or to receive a course schedule.

Safety Instructions

Antistatic Precautions

Electrostatic discharge (ESD) results from the buildup of static electricity and can cause computer components to fail. Electrostatic discharge occurs when a person whose body contains a static buildup touches a computer component.

The equipment may contain static-sensitive devices that are easily damaged and proper handling and grounding is essential. Use ESD precautionary measures when installing parts or cards and keep the parts and cards in antistatic packaging when not in use. If possible, use antistatic floor pads and workbench pads.

When handling components, or when setting switch options, always use an antistatic wrist strap connected to a grounded equipment frame or chassis. *If a wrist strap is not available, periodically touch an unpainted metal surface on the equipment.* Never use a conductive tool, such as a screwdriver or a paper clip, to set switches.

Safety Guidelines

The following symbols are used in this manual to draw your attention to potential hazards. A Caution indicates a hazard to equipment or data. A Warning indicates a hazard to personnel.

Caution statements identify conditions or practices that can result in damage to the equipment or in loss of data.

Warning statements identify conditions or practices that can result in personal injury or loss of life.

Always use caution and common sense. *To reduce the risk of electrical shock, do not operate any equipment with the cover removed.* Repairs must be performed by qualified service personnel only.

- Never install telephone jacks in a wet location unless the jack is designed for that location.
- Never touch uninsulated telephone wires or terminals unless the telephone line is disconnected at the network interface.
- Use caution when installing telephone lines and never install telephone wiring during an electrical storm.

Regulatory Notices

FCC Part 68 Compliance

Connection of data communications equipment to the public telephone network is regulated by FCC Rules and Regulations. This equipment complies with Part 68 of these regulations which require all of the following:

All connections to the telephone network must be made using standard plugs and telephone company provided jacks or equivalent. Connection of this equipment to party lines and coin telephones is prohibited. A label on the back of the front panel of data communications equipment and on the underside or rear panel of other equipment provides the FCC Registration number and the Ringer Equivalence Number (REN) for the unit. If requested, give this information to the telephone company.

To connect the SC 5001 LTU to the Public Telephone Network you are required to give the following information to the Telephone Company:

FCC Registration Number:AG6USA-22608-DD-N

FIC (Facility Interface Code):04DU9-DN, 04DU9-BN, 04DU9-1KN, 04DU9-1SN

SOC (Service Order Code):6.0Y

Telephone Company jack type:RJ48C

The telephone company may discontinue your service temporarily if the unit causes harm to the telephone network. If possible, you will be notified of such an action in advance. If advance notice is not practical, you will be notified as soon as possible and will be advised of your right to file a complaint with the FCC. The telephone company may change its communication facilities, equipment, operations and procedures where reasonably required for operation. If so, the telephone company will notify you in writing. You must notify the telephone company before disconnecting equipment from 1.544 Mbps digital service. All repairs or modifications to the equipment must be performed by General DataComm. Any other repair or modification by a user voids the FCC registration and the warranty.

Canada DOC Notification

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. *Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.*

Bundesrepublik Deutschland

Installieren Sie nie die Telefonleitungen wahrend eines Gewitters. Installieren Sie nie die Telefonbuchsen in einem feuchten Raum es sei denn die Buchs ist spezielle für Feuchträume vorgesheen. Berühren sie nie unisoliete Telefonleitungen oder Einrichtungen es sei denn die Leitungen sind vom Telefonnetz getrennt. Vorsicht bei der Installierung oder Änderung von Telefonleitungen. *Achtung*: Es sind keine durch denn Anwender zu wartende Teils im Gerät. Warting darf nur durch qualifizietes Personal erfolgen. Vor Wartung vom Stromnetz trennen.

Glossary of Terms

Backplane Data Highway

High speed bus built into the SpectraComm Shelf backplane to support the exchange of data and timing signals between a line terminating unit and up to 24 data set emulators. The backplane contains four data highways. Two backplanes, and their data highways, can be connected by daisy-chain cables so that a total of 32 shelf slots are supported.

Data Set Emulator (DSE)

Term for the units in the SpectraComm 5000 system that provide DTE interface functions. Each DSE is designed to be compatible with a GDC device that can be installed as a standalone unit at a remote site. An SC 5520 DSE, for example, is compatible with a remote NMS 520 DSU.

Line Terminating Unit

Term for the unit in the SpectraComm 5000 system that provides T1 network interface functions.

Concentrator Mode

Term used in this manual to describe the LTU's mode of operation when it is transmitting and receiving T1 network data for the DSEs that are linked to it by the SpectraComm Shelf backplane.

1 Introduction

Overview

This manual contains instructions for installing the SC 5001 LTU and placing it into service. *Chapter 1* describes the LTU, including the options that are available for it, and lists the cables required for its installation.

The SC 5001 LTU is part of General DataComm's SpectraComm family of products. Depending on the application for which it is installed, it can be configured and controlled by means of an SNMP controller, its built-in terminal interface functions, or AT (Attention) commands.

When using the LTU in an SNMP environment consult the controller documentation for more extensive operation and testing instructions. This manual fully describes the terminal interface and the AT command set for the LTU.

SC 5001 LTU Features

General DataComm's SpectraComm 5001 Line Termination Unit (LTU) is a highly efficient means of transmitting and receiving digital data over a T1 line leased from a telephone company (Telco) or other service provider.

The SC 5001 LTU:

- Is, essentially, a compact and space-efficient channel service unit (CSU) for connection to T1 line service
    - when used in CSU mode, its DSX-1 Cascade Port acts as the Equipment Port for all local data interface
    - provides a standard, point to point link in which the entire T1 is directed to a single remote site
- Can operate in Concentrator mode, in which it performs channel grooming and provides network interface functions for a group of up to 24 data set emulators (DSEs)
    - in Concentrator mode operation, line provisioning is arranged with the Telco so that DS0s are directed from the switching office, individually or in groups, to multiple remote locations.
    - DSEs perform DTE interface functions and exchange data with the LTU by means of a Data Highway incorporated into the backplane of the SpectraComm shelf
    - Data on the backplane highway is organized in "timeslots" that correspond to DS0s on the T1 line
    - T1 DS0s that are not required for DSE data traffic are available to the Cascade Port
- Acts as a Concentrator to perform Central Termination functions. It can terminate one T1 signal containing channelized 56 Kbps or 64 Kbps DDS signals at individual DSEs configured for N X 56 Kbps or N X 64 Kbps operation.

- Can function fully under Simple Network Management Protocol (SNMP) network management. Local communication with an SNMP controller takes place through a shelf-resident SpectraComm Manager (SCM) card.
- Provides terminal interface control functions accessible through an SCM by an ASCII terminal or a computer running the Telnet protocol
- Can be configured by means of AT commands sent to it from a terminal or by the server that coordinates DTE-side data traffic
- Includes a built-in T1 Cascade port that accepts a channelized T1-rate signal. Up to three LTUs can be cascaded.
- Allows the linking of FT1 services with traditional Dataphone Digital Service (DDS) and generic digital services at 56 Kbps and 64 Kbps.
- Permits configuration of network transmitter timing from a variety of sources:

  Network (Loop) timing

  Shelf timing

  Cascade (Through) timing

  Internal (Local) clock

  Station timing
- Provides configurable Auto Framing option that automatically adapts the LTU's network and cascade interfaces to Extended Superframe Format (ESF) or D4 Superframe Format.
- Supports both Alternate Mark Inversion (AMI) and Bipolar with 8 Zero Substitution (B8ZS) line codes, and allows a variety of options for ones density in the data stream.
- Supports both AT&T PUB 54016 and Bellcore TR-TSY-000194 (ANSI) performance reporting.
- Provides independent user and network register sets for performance data — the user set is unaffected when the Central Office clears the network set.
- Provides T1 and DS0 testing for extensive diagnostic capabilities.
- Supports redundant installation (two LTUs in shelf), with switching between primary and secondary (backup) LTU controlled by the SNMP controller.

Description

The SC 5001 Line Terminating Unit is a T1 channel service unit (CSU) for installation in a GDC SpectraComm shelf. When you configure it for CSU mode it can serve the network interfacing and protection functions for any traditional CSU application.

It is uniquely suited for the applications that combine it with GDC data set emulators (DSEs): the SpectraComm 5000 system and the Remote LAN Node system. In each of those systems the LTU provides network interface to the T1 line, and the DSEs co-located with it in its SpectraComm shelf (or pair of shelves) provide DTE interface functions. The LTU and its DSEs exchange data over one of four "data highways" incorporated in the backplane of the SpectraComm shelf.

When it operates in conjunction with an SNMP controller the SC 5001 LTU supports comprehensive, nonintrusive network management capabilities. The LTU is software controllable so that an operator at a central site can configure its options, including network address, by means of SNMP. Diagnostic testing and system restoral performed through SNMP require no intervention by personnel at remote sites.

The SC 5001 LTU's integral diagnostic design enables it to overlay an “in-band” Diagnostic

Communication Channel (DCC) onto the communication link. The DCC provides a communication path to remote sites for the controller and enables continuous monitoring of performance, unit status, and alarms.

The SC 5001 LTU also supports an AT command set for configuration and limited maintenance functions. This command set enables a terminal server to configure the LTU by sending it a command string. This capability is used principally when the LTU is installed as part of an RLN system.

The SC 5001 LTU is a 7-inch by 9.5-inch (178 mm by 241 mm) printed circuit (pc) card. It features GDC's unique SpectraComm packaging concept, which allows a variety of data communications products to be mounted in the same high-density shelf. Each 16-slot shelf can hold 16 single-card devices.

Channel Grooming

The SC 5001 LTU can groom the T1 DS-1 signal in a wide variety of ways, cross-connecting bundles of DS0s between its interfaces as required by system design. The LTU has six interfaces over which it can direct bundles: network, cascade, and four backplane data highways. The LTU can cross-connect DS0s between any of those interfaces. A bundle can consist of as little as one DS0 operating at 56 Kbps, or as many as 24 DS0s each operating at 64 Kbps (1.536 Mbps total).

More detailed information on bandwidth grooming (fractionalization) can be found in the *SpectraComm 5000 System Manual* (076R104-000).

LTU Applications

CSU

When used in CSU mode, the SC 5001 LTU performs all local interface functions through its DSX-1 Cascade Port, which serves as the Business Equipment interface. Control and configuration functions for this application can be performed by means of SNMP, by the terminal interface, or by AT commands.

SNMP and terminal interface control each require that there be an SCM card installed in the shelf (or pair of shelves) with the LTU. To use AT commands you must connect a VT100-compatible terminal to the back panel Zone 3 DB-25 connector for the LTU's slot.

SC 5000 System

When the SC 5001 LTU is part of a SpectraComm 5000 system, it operates in Concentrator mode. It can support a mix of data traffic from the data highways in the shelf backplane and from its cascade port. You can perform control and configuration for this application either by means of an SNMP controller software application or by means of the terminal interface.

The GDC TEAM family of software includes specialized SNMP applications for each SC 5000 component, and a core application that provides coordination and shelf functions. The application for the SC 5001 LTU is TEAM 5001.

RLN System

When the SC 5001 LTU is part of a SpectraComm Remote LAN Node (RLN) system, it operates in Concentrator mode. The LTU occupies slot 16 in the SpectraComm RLN shelf, which also contains SC 5034 DSEs in slots 2 through 13. The system supports simultaneous switched network connections between an RLN Access Server connected to the LAN at the shelf site and up to 24 remote V.34 modems. Each SC 5034 DSE provides the functionality to support two dial-up connections.

You perform configuration and control functions for the RLN system by means of AT (Attention)

commands. You send the commands to the LTU and DSEs from the Attachmate software package that controls the server.

Consult RLN documentation for more detailed information on the system.

Table 1-1 Equipment List

Description	GDC Part No.
GDC SC 5001 LTU	076P001-001
Shelves	
Description	**GDC Part No.**
SpectraComm Shelf MS-2 Model 1 (100/120 V ac) Includes two 8-slot, dual RJ48 Zone 1 connector panels	010M054-001
SpectraComm Shelf MS-2 Model 2 (-48 V dc) Includes two 8-slot, dual RJ48 Zone 1 connector panels	010M055-001
SpectraComm Shelf MS-2 Model 10 (-48 V dc, with redundant power supplies) Includes two 8-slot, dual RJ48 Zone 1 connector panels	010M070-001
Unless otherwise stated, systems include one base shelf, one power supply and one power supply blank front panel, Zone 1 connector panels as stated, one 16-slot DB25 Zone 3 connector panel, two standard mounting brackets (19-/23-inch) and assorted mounting hardware.	
Connector Panels	
Description	**GDC Part No.**
Kit, Zone 1, 8-slot Blank Rear Panel (Z1-S-B)	010K341-001
Kit, Zone 1, 8-slot dual RJ45 connector panel (Z1-S-16DRJ45)	010K342-001
Kit, Zone 3, 16-slot DB25 connector panel (Z3-S-16DB25)	010K339-001
Cables	
Description	**GDC Part No.**
Interface cable, RJ48C plug-to-plug (LTU network or cascade port to T1 line), 10 to 50 ft. lengths	022H024-xxx
Interface cable, RJ48C plug to15-pin male (LTU network or cascade port to T1 line for Canadian installations), 10 to 50 ft. lengths	022H022-xxx
Interface cable, RJ48C plug to15-pin female (LTU network or cascade port to T1 line for Canadian installations only), 10 to 125 ft. lengths	022H020-xxx
Front panel access test jack patch cable, male-to-male, 24 to 60 in lengths	830-005-xxx
Front panel access test jack patch cable, Bantam to WECO, 4 ft. length	830-021S001
Bantam to WECO adapter plug	209-026S001
Manuals	
Description	**GDC Part No.**
SC 5000 System Overview	076R104-000
Operating and Installation Instructions for SpectraComm Shelf	010R302-000
Operating and Installation Instructions for SpectraComm Manager Card	048R303-000

2 Installation

Overview

This chapter describes the installation of the SC 5001 LTU.

The SC 5001 LTU is shipped pre-assembled, tested, and ready to use. The normal procedure after unpacking the unit is to insert it in its intended shelf slot and perform the Preoperational Check described in this chapter. When the test is successfully completed you may proceed to make the LTU's cable connections.

The SC 5001 LTU should be installed in a ventilated area where the ambient temperature does not exceed 122°F (50°C). Do not install the LTU above other equipment that generates large amounts of heat (e.g., power supplies).

Chapter 4, Configuration Parameters, defines the configuration option selections for the SC 5001 LTU.

SpectraComm Shelf

A rack-mountable SpectraComm Shelf can house up to 16 plug-ins. It fits into 19- and 23-inch wide equipment racks. The backplanes of two shelves can be linked by cables so that a total of 32 card slots function as though connected to the same backplane. The SC 5001 LTU can be installed in any card slot.

The shelf's backplane is made up of four separate "data highways" and a management bus. Each data highway supports the transfer of data between an LTU and its DSEs, so there can be up to four LTU/DSE functional groupings in a shelf (or pair of shelves). The management bus supports the transfer of management data between a SpectraComm Manager (SCM) card and the shelf's LTUs and DSEs. The SCM card functions as an SNMP agent for the control of compatible devices, such as the LTU and DSE, in the shelf. The SpectraComm Shelf can contain a single SCM card, or two SCM cards installed as a primary and a backup.

An LTU/DSE functional group can consist of one or two LTUs (one primary and one backup) and up to 24 DSE cards. The application determines the exact selection of pc cards to be installed in a shelf. An LTU can be combined with 24 DSE channels only when each channel requires just a single DS0. The number of DSE cards the LTU can support is reduced when channels employ N X 56 Kbps or N X 64 Kbps rates. For example, the LTU can support no more than 12 DSE cards when each DSE is providing a 128 Kbps channel.

Two SC 5001 LTUs can be installed in a primary/secondary arrangement. If the primary LTU malfunctions, the SNMP controller can command the secondary LTU to take over.

Figure 2-1 shows the shelf's back panel. In Zone 1 the back panel provides two RJ48 connectors for each shelf slot. An SC 5001 LTU employs the upper RJ48 connector for its slot as the network (DS-1) interface by which it can be connected to a Telco-supplied T1 line. The lower RJ48 connector serves as the LTU's cascade (DSX-1) interface, for the transfer of T1 signals over shorter distances.

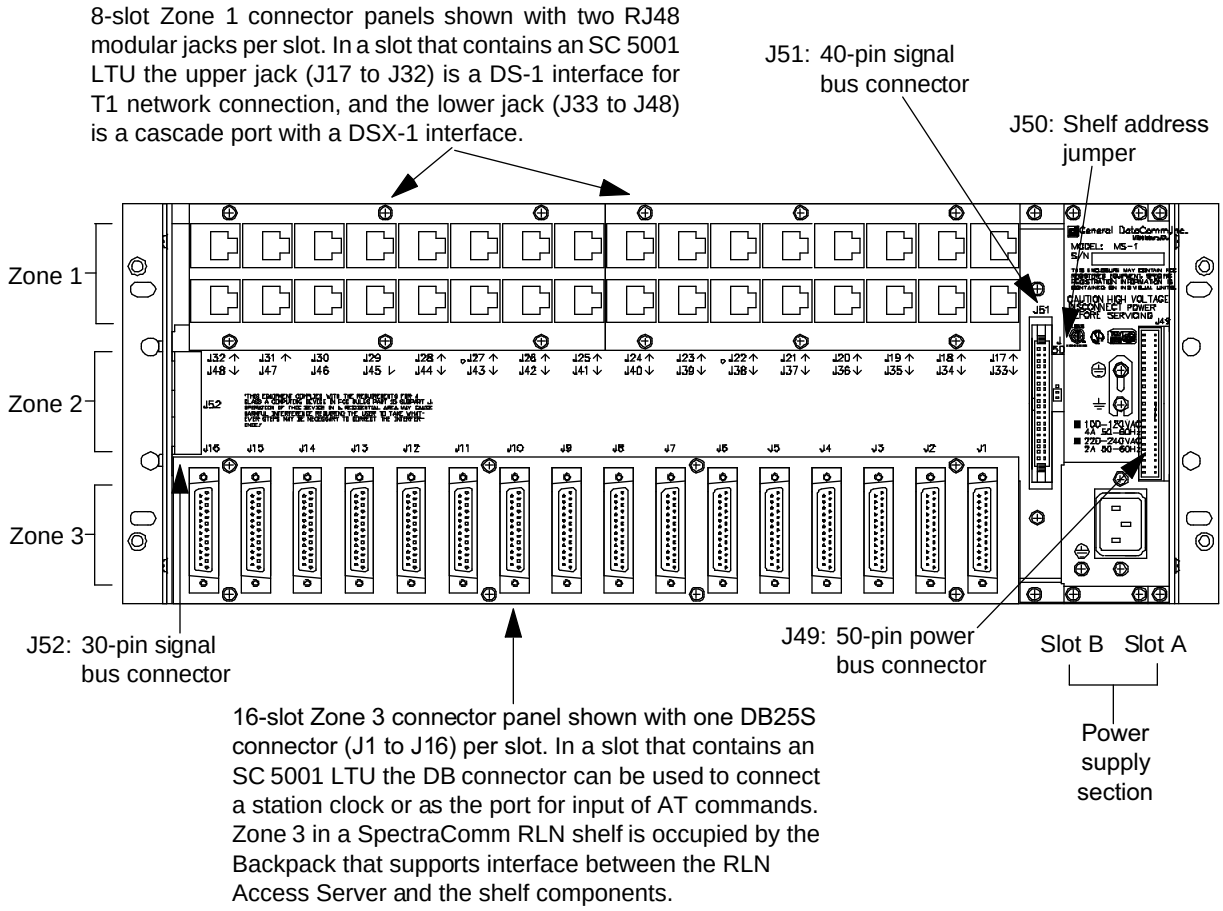


Figure 2-1 SpectraComm Shelf Back Panel

When the LTU is configured for timing from a station clock, that clock must be connected to the LTU at the DB25 connector for its slot, located in Zone 3.

The DB25 connector can also serve as the port for input of AT commands. The most frequently used AT command application, though, is the RLN system in which Zone 3 of the shelf back panel is replaced by the RLN backpack. The backpack accommodates the AT command interface function for the LTU.

Unpacking and Handling

The SC 5001 LTU is shipped in packing material that is enclosed in a corrugated box. Inspect the SC 5001 LTU when you receive it. If you observe any damage, notify the shipper immediately.

Do not discard the box and packing material. Save them for use if it is ever necessary to reship the SC 5001 LTU.

Preoperational Check

Before you connect the SC 5001 LTU to the network and *before you change any factory-set options,* you should give it a preoperational check to verify normal operation. First check to be sure the options are set as shown in *Figure 2-2,* then perform a Local Test with Self-Test by means of the front panel. Refer to *Chapter 4* for instructions on performing the test.

If the SC 5001 LTU does not check out properly, replace it with a spare, if available, and repeat the test. Do not attempt to repair the SC 5001 LTU. For assistance, contact General DataComm Service.

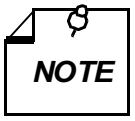
If the SC 5001 LTU passes the test, but subsequently fails to perform in data communications operation, it may not be at fault; some error may have been made in the installation or option selection, or there may be other faulty devices or connections. Recheck the connections and option selections, and if necessary perform the Fault Isolation Procedure in *Chapter 4* to isolate the fault. Also verify that the customer equipment and remote unit are compatible (that is, operating at the same rate).

Connections

Network Connection

The back panel of the SpectraComm Shelf has 16 RJ48C jacks, labeled **J17** through **J32**, for connections to a Telco's T1 network (DS-1 interface). J17 corresponds to shelf slot 1 and J32 corresponds to shelf slot 16, as shown in *Figure 2-1*.

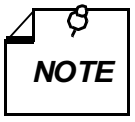
Connect the SC 5001 LTU to the network by means of the jack for its slot as described below. Refer to *Table 1-1* and *Figure 2-3* for the appropriate interface cable.



The Telco may continuously monitor the T1 link and the equipment connected to it. Notify the Telco before connecting the SC 5001 LTU to the network. The SC 5001 LTU must remain continuously powered on and connected to the T1 service. FCC Part 68 rules require the user to notify the service provider if the LTU is removed from service or turned off.

For most installations use GDC cable P/N 022H024-XXX (RJ48C plug-to-plug) to connect the T1 line to the LTU. The cable's ends are labeled NETWORK and CSU to indicate where each is used.

*If you connect two LTUs back-to-back (a direct cable connection), automatic Line Build-Out must not be enabled for both. It may be enabled in **one** of the units, if so desired.*



a. *This installation procedure must be followed for compliance with FCC Part 15, Subpart J, Class A requirements.*

b. *For Canadian installations only, a special cable is required for the network port connection. Use GDC cable P/N 022H020-XXX (RJ48C plug to 15-pin female) or GDC cable P/N 022H022-XXX (RJ48C plug to 15-pin male) to connect the network port to the T1 line.*

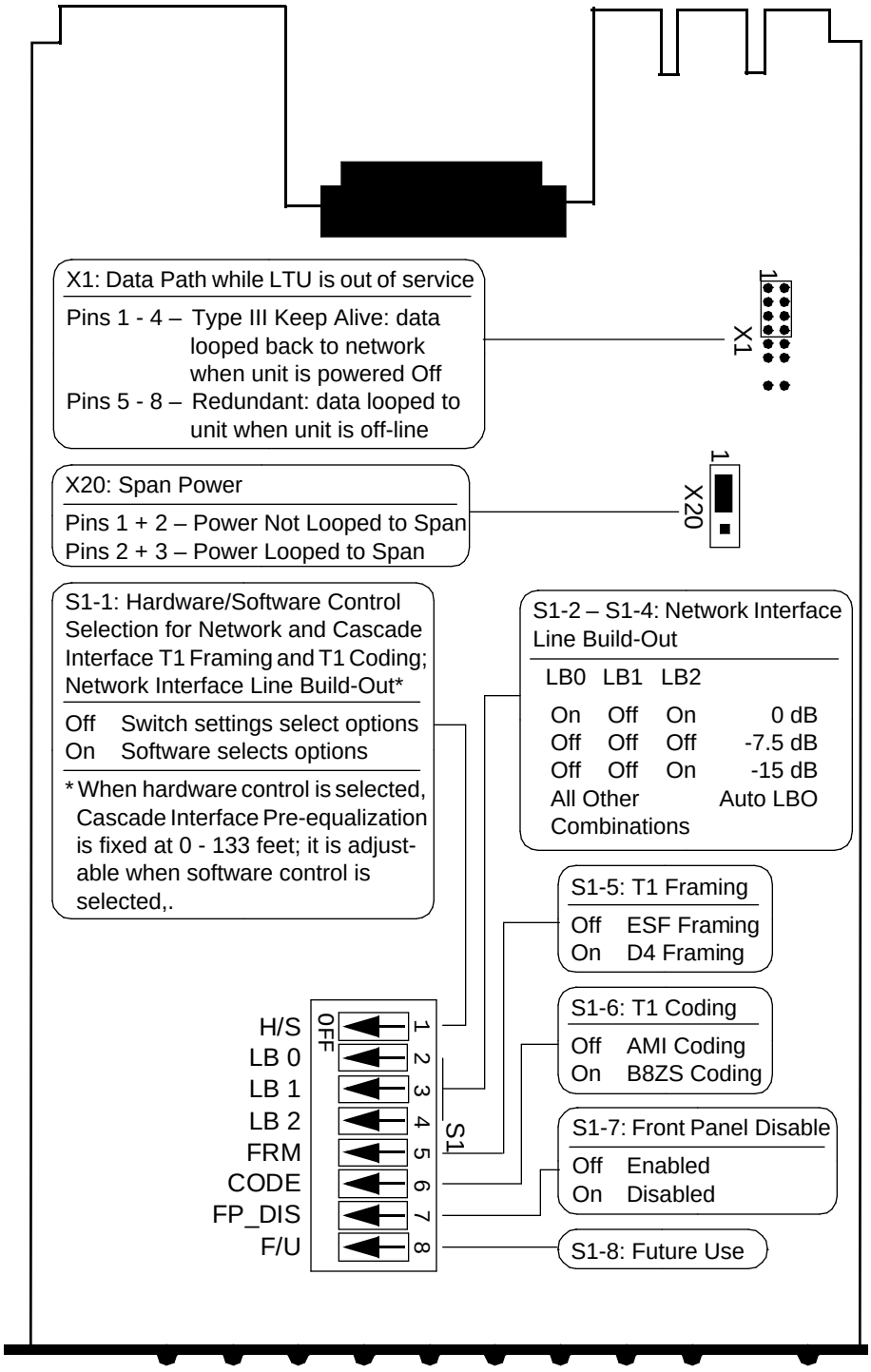


Figure 2-2 SC 5001 PC Card, with Option Settings

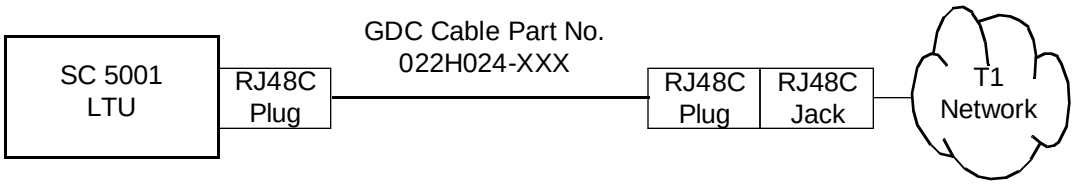


Figure 2-3 Network Cable

Pinouts for the network end of the network interface cables are listed below:

Function	Direction	Pin No.
Receive Data (Ring)	To LTU	1
Receive Data (Tip)	To LTU	2
Send Data (Ring)	From LTU	4
Send Data (Tip)	From LTU	5
Shield (Frame Gnd.)	n/a	7
Note: The remaining leads are not used.		

Cascade Port (DSX-1 Interface) Connection

The back panel of the SpectraComm Shelf has 16 RJ48C jacks, labeled **J33** through **J48**, for connection to a short haul T1 line (DSX-1 interface). J33 corresponds to shelf slot 1 and J48 corresponds to shelf slot 16, as shown in *Figure 2*-1.

Make connection to the SC 5001 LTU's cascade port by means of the jack for its slot. The cables that can be used for this purpose are listed in *Table 1*-1. They are the same as those described above for network connection.

Station Clock Connection

When the LTU is to receive its transmit timing from a station clock, the clock must be connected to the Zone 3 DB25 connector for the LTU's shelf slot. The station clock interface employs the following pin signals:

Pin No.	Function	Direction
2	Test Port, In	To LTU
3	Test Port, Out	From LTU
7	Signal Ground	n/a
11	Station Clock, Negative	To LTU
14	Station Clock, Positive	To LTU
Note: All other pins are unused.		

Option Selection

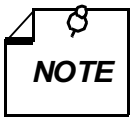
Most options on the SC 5001 LTU are soft options that can be set either through an SNMP controller or by means of AT commands. Options adapt the LTU to a variety of configurations, as well as enabling and disabling certain features and tests. Option selections are stored in non-volatile memory. *Chapter 4* lists and describes the LTU's soft-configurable options. Consult it before you select any options, to determine which options should be selected for your application.

a. If the Auto Framing option is to be used, enable it at only one of the two units that make up a link.

b. If you connect two units back-to-back (direct cable connection) and automatic Line Build-Out is to be used, enable it in only one of the units.

Addressing

The LTU communicates with an SNMP controller through a SpectraComm Manager (SCM) card installed with it in the SpectraComm Shelf. The controller and the SCM employ a slot-line-drop method of addressing to identify the system devices being controlled. Slot address is determined by the unit's position in the SpectraComm Shelf. The SNMP operator assigns each LTU's line and drop addresses, selecting appropriate addresses based on the serial numbers of the SNMP products in the system.



The LTU's serial number must be reported to the system controller operator when the unit is initially installed and configured. The serial number is located on the back of the front panel.

If the firmware is ever changed on the SC 5001 LTU, the EEPROM containing the unit's configuration will be automatically erased and the unit will have to be re-assigned using the new serial number.

Timing Options

Timing options determine the clock source for the data the SC 5001 LTU transmits to the network. The default timing option for the LTU is Network timing, in which the LTU derives its transmit timing from the signal it is receiving from the T1 network.

Although the network's clock is the preferred timing source, the SC 5001 LTU provides other timing options for use in applications where a network clock is either not available or not applicable. Refer to *Chapter 5* for details of the SC 5001 LTU's timing options.

3 Operation

Overview

This chapter describes the functions of the SC 5001 LTU front panel. Front panel functions include indicator displays, limited test functions, and provision for connection of external test equipment.

This chapter also provides instructions concerning two forms of control that can be used for configuring and commanding the LTU:

- Terminal interface – access takes place through a SpectraComm Manager (SCM) card installed in the SpectraComm shelf that houses the LTU. The SCM card supports two types of connection for terminal interface functions:
    - connection of a VT100-compatible terminal via the Craft port on the SCM front panel
    - Telnet connection via the SCM LAN port located on the back panel of the shelf

    There are small differences between the two types of connection.
- AT commands – can be input to the LTU from a VT100-compatible terminal connected to the LTU at the Zone 3 DB25 connector for its shelf slot. More often they are used when the LTU is installed as part of an RLN system, and directed to the unit through the RLN Access Server, using the Attachmate RLN Server software. Full instructions for using the AT (Attention) command set appear in *Chapter 4, Configuration*, because that is the purpose of most commands in the set; this chapter does contain instructions for the use of AT commands that function as maintenance commands.

The information concerning the front panel applies to the LTU in any of its applications. AT commands are used most often in the RLN system application and are, for the most part, involved in unit configuration. The maintenance AT commands that are described in this chapter perform control (as opposed to configuration) functions.

A Simple Network Management Protocol (SNMP) controller or the terminal interface can be used for configuration and operation of the SC 5001 LTU when it is installed in a SpectraComm 5000 system. An SNMP controller provides capabilities for:

- Alarm management
- Configuration
- Control
- Diagnostics
- Report generation

The terminal interface does not support Report Generation. If you are using an SNMP controller, consult its manual for detailed instructions on its use. This manual provides information specific to the SC 5001 LTU and its built in functionality.

Chapter 4, Configuration Parameters, details the option selections available in the LTU, including instructions for setting options by means of the AT command set.

Chapter 5, Timing Options, discusses how timing arrangements affect network performance.

Chapter 6, Diagnostics, describes LTU test procedures.

LTU Controls and Indicators

Figures 3-1 and 3-2 illustrate the SC 5001 LTU front panel and explain the function of each indicator and switch. *Figure 3-3* explains the function of the front panel jacks.

Rack-Mount Shelf Controls and Indicators

Refer to the manual supplied with the SpectraComm rack-mount shelf for information on the shelf's front panel controls, indicators, and fuses. In this manual, the shelf's rear panel is illustrated in *Chapter 2, Figure 2-1*.

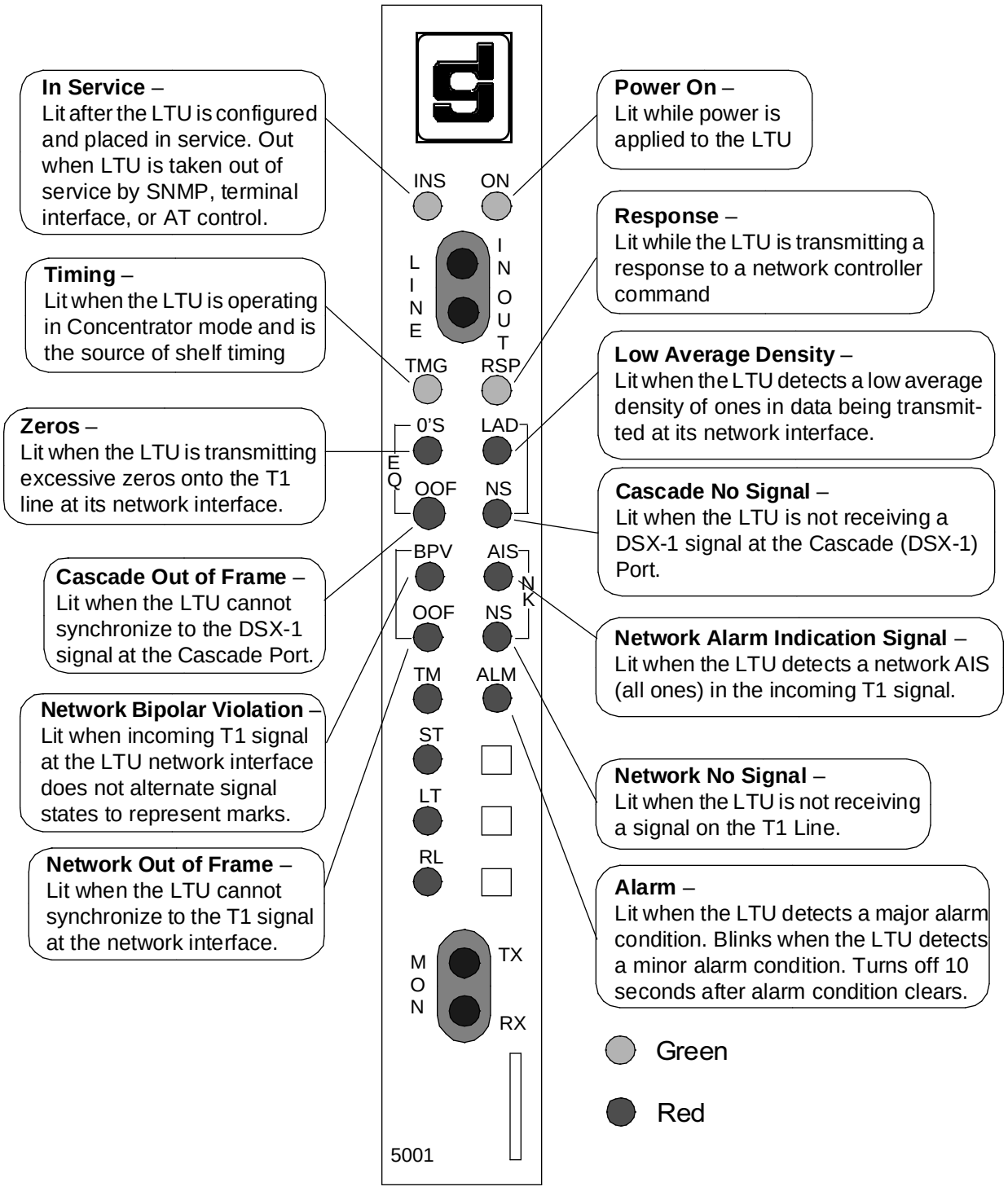


Figure 3-1 SC 5001 Front Panel Indicators

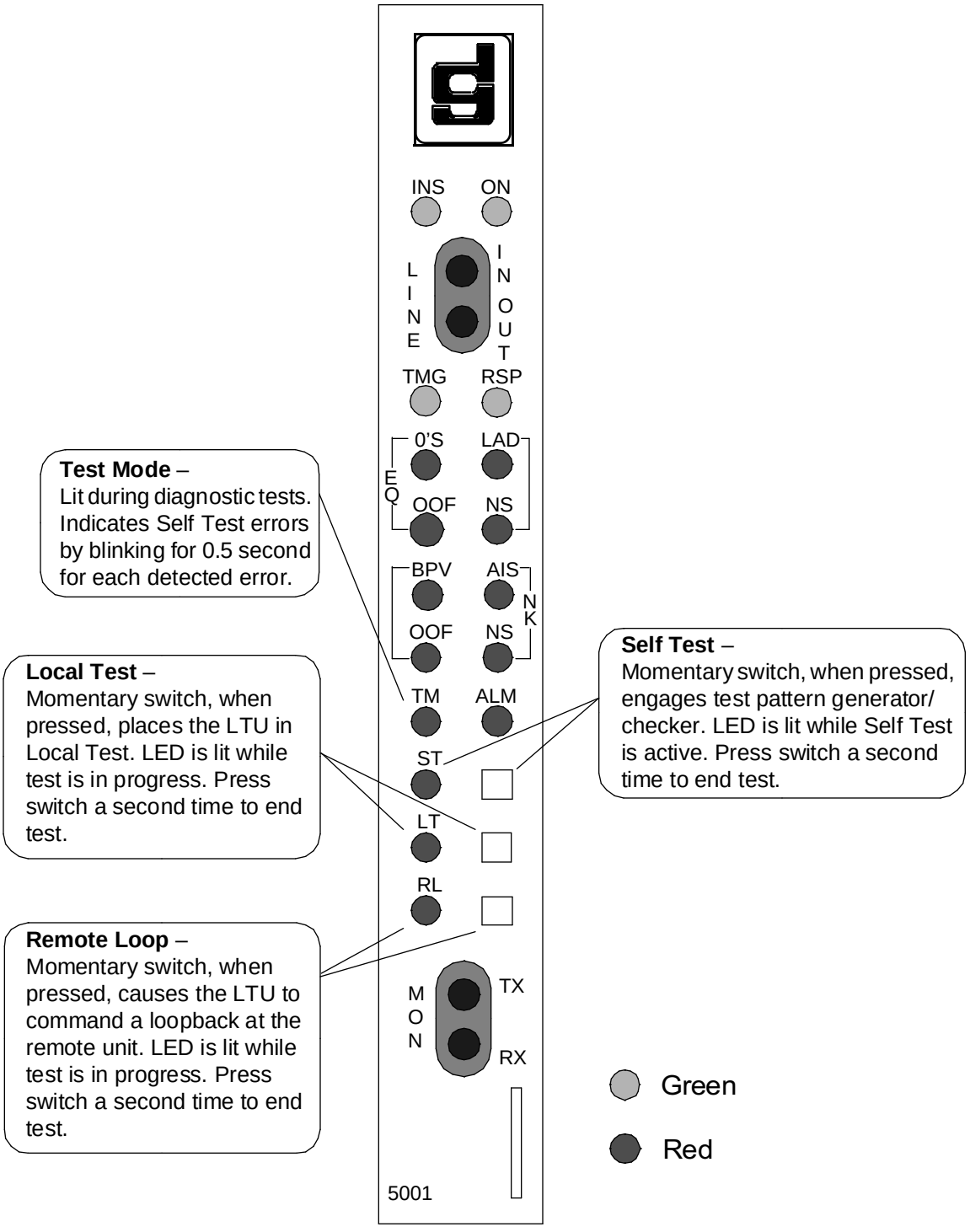


Figure 3-2 SC 5001 Front Panel Test Switches and Indicators

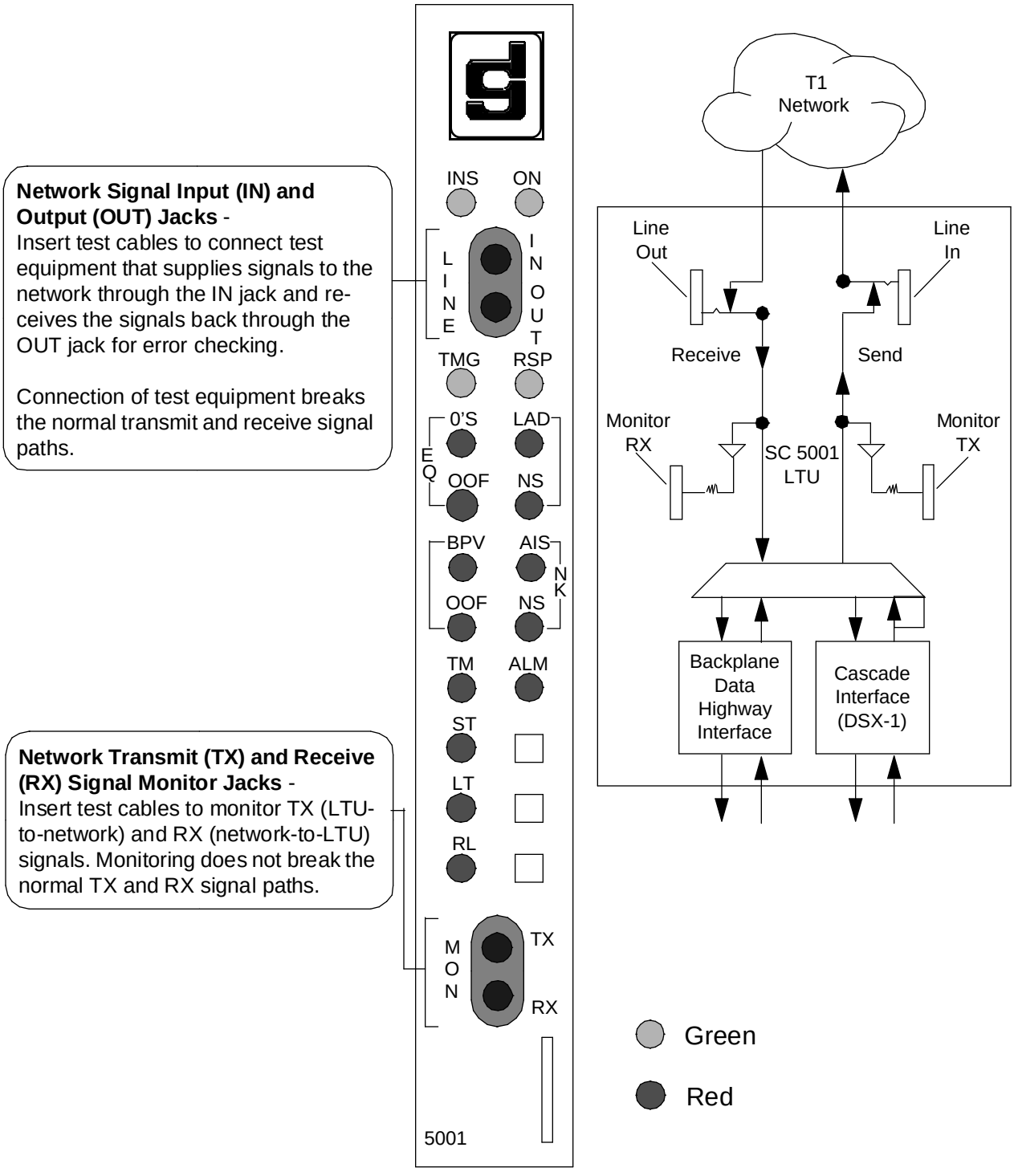


Figure 3-3 SC 5001 Front Panel Test Jacks

AT Commands for Control Functions

Instructions for using the AT (Attention) command set appear in *Chapter 4, Configuration*, because that is the purpose of most commands in the set. The two AT commands described here perform operational control (as opposed to configuration) functions:

DS0 Maintenance – #S*nnx*

LTU Operational Status – #A*n*

DS0 Maintenance

The AT command DS0 Maintenance, **#S**, enables you to specify the function of a selected DS0 in the network interface. It takes two parameters in the format:

#S*nnx*

where*nn* is a two-digit DS0 number from 01 to 24

x is a letter, A – F, that specifies the assigned function of the DS0:

A = carries data for the corresponding timeslot in Data Highway 1

B = carries data for the corresponding timeslot in Data Highway 2

C = carries data for the corresponding timeslot in Data Highway 3

D = carries data for the corresponding timeslot in Data Highway 4

E = carries data for the corresponding DS0 in the Cascade Port interface

F = Busy Out

G = Disable

When you need to remove an SC 5034 DSE from the SpectraComm RLN shelf, use this command first to Busy Out its assigned DS0s. Use the command again to place the re-installed or replacement DSE into service.

LTU Operational Status

The AT command LTU Operational Status, **#A**, enables you to command the LTU in and out of service. It accepts either of two values:

#A0 = LTU out of service

#A1 = LTU in service

Terminal Interface

Access to the SC 5001 LTU terminal interface takes place through the SCM card, which provides this functionality for compatible units installed with it in a SpectraComm shelf (or pair of shelves connected by daisy chain cables). One SCM supports interface functions for up to 15 units in a single shelf or up to 31 units in a pair of shelves.

The SC 5001 LTU requires firmware revision level H- or higher to support the terminal interface functionality.

Initiating a Terminal Interface Session

The first portion of a terminal interface session varies depending on whether you're using a VT100-compatible terminal connected directly to the SCM front panel or a computer with a Telnet connection to the SCM LAN port.

VT100-compatible Terminal

When you connect a terminal to the SCM front panel, the following screen is the first to appear

```
Main Menu
1. IP Address
2. Security
3. Element Access
4. Test
Next Selection:
```

Type 3 and press the Enter key. The screen then displays the Shelf Inventory screen that appears below.

The other selections in this menu all relate to SCM functionality. They are discussed in the *SpectraComm Manager Card Installation and Operation Manual*, GDC Publication Number 048R303-000.

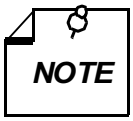
Telnet Connection

The *SpectraComm Manager Card Installation and Operation Manual*, GDC Publication Number 048R303-000 explains how to establish a Telnet connection to the SCM LAN port. When you do so, the following screen is the first to appear

```
Copyright (c) 1993-1997 General DataComm Industries Inc.
All rights reserved
SCM Application Version 2.81E

login:
```

After you enter the login password the screen displays the Shelf Inventory screen that appears below.



There is a 10-minute timeout on the terminal interface. If you allow 10 minutes to pass with no activity, that is without pressing any key on the keyboard, the LTU terminates the session. At that point the display returns to the SCM Main Menu if you are using a terminal connected to the SCM front panel, or to the SCM login screen if you are using a Telnet connection.

Selecting the LTU (Shelf Inventory Screen)

From this point, procedures are the same for both types of connection. The Shelf Inventory screen below is for a two-shelf installation in which each shelf contains an SC 5001 LTU and a group of SC 5553 DSEs. The two columns for Slots 17 through 32 do not appear when there is only one shelf.

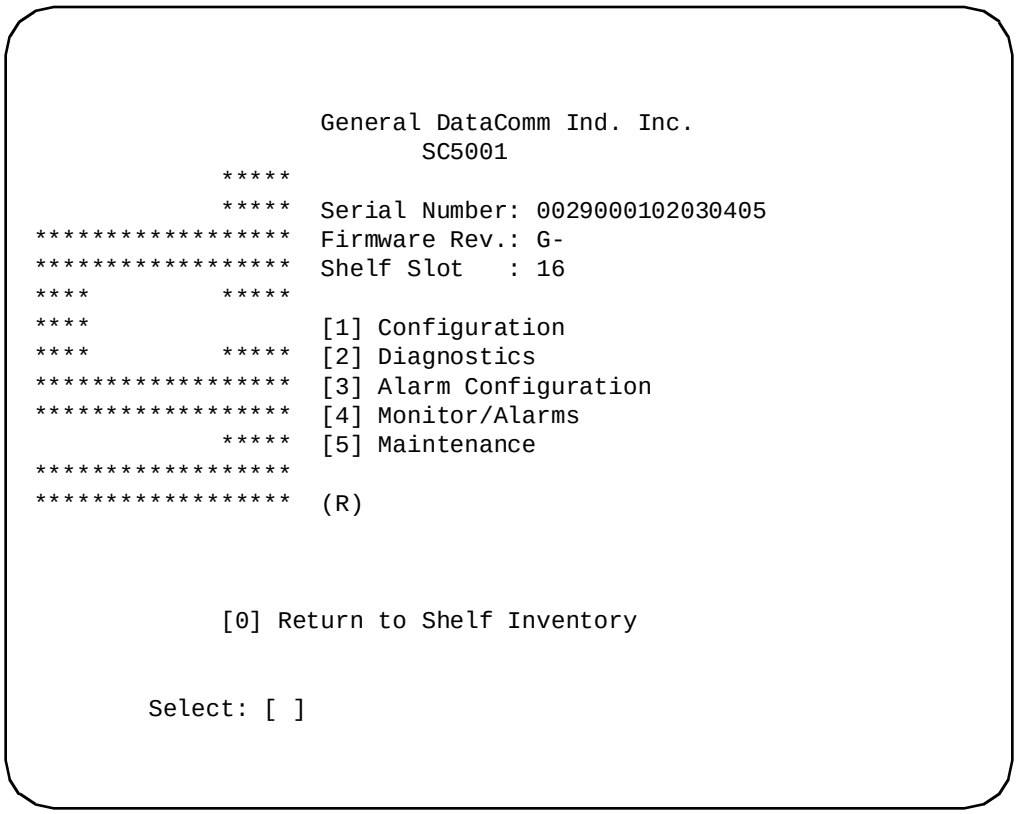
```
   SHELF INVENTORY
  Slot  Card           Slot  Card
-------------------------------------------------
  [1]SCM               [17]SC5001
  [2]SC5001            [18]SC5553
  [3]SC5553            [19]SC5553
  [4]SC5553            [20]SC5553
  [5]SC5553            [21]SC5553
  [6]SC5553            [22]SC5553
  [7]SC5553            [23]SC5553
  [8]SC5553            [24]SC5553
  [9]SC5553            [25]SC5553
 [10]SC5553            [26]SC5553
 [11]SC5553            [27]SC5553
 [12]SC5553            [28]SC5553
 [13]SC5553            [29]SC5553
 [14]SC5553            [30]SC5553
 [15]SC5553 (alarm)    [31]SC5553
 [16]SC5553            [32]SC5553

  [0]Close Session

Enter slot number:  [  ]
```

The Shelf Inventory displays the word "alarm" in parentheses next to the name of any unit that currently has an active alarm condition.

Type the slot number of the unit you intend to work with, and press the Enter key. The LTU responds by displaying the SC 5001 Main Menu as shown below.



Type the number that corresponds to the function with which you intend to work.

Configuration

The Configuration function presents a screen of configuration options. Each option is identified by a selection number or letter, and displays its current setting.

```
                        SC 5001 Configuration

                          CSU Configuration
[1] Operational Status : Down            [2] CSU Mode        : CSU
[3] Front Panel        : Enable          [4] Signal Mode     : None
[5] Loopback Config.   : Payload Loopback [6] AIS Loopdown    : Inhibit
[7] D-Channel Signaling: Normal

                          Network Configuration
[8]  Frame Type        : ESF             [9] Line Code       : AMI
[A] Interface Type     : DS-1            [B] Pre-Equalization: 0-130ft
[C] Line Build-Out     : Manual, -7.5dB  [D] Ones Density    : Inhibit
[E] FDL Mode           : ATT-54016       [F] RCV Range       : Auto
[G] Redundancy         : Keep Alive

                          Cascade Configuration
[H] Frame Type         : ESF             [I] Line Code       : AMI
[J] Pre-Equalization   : 0-130ft         [K] Redundancy      : Off-line


[0] Return to Main Menu     [S] Save & Update Unit

      Select: [ ]
```

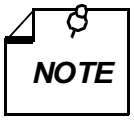
Figure 3-4 Configuration Screen, with Default Settings

The procedure for changing configuration option settings involves the following steps:

1. Type the selection number or letter of the option you intend to change, and press the Enter key. Highlighting appears on the current setting field for the corresponding option.
2. Use the arrow keys to toggle the highlighted field through its potential settings.
3. When the field displays the desired setting, press the Enter key again. The highlight returns to the Select field.
4. Repeat steps 1 through 3 for each option you need to change.
5. After you've made all required changes and you are certain they are correct, type selection S, `Save & Update Unit` and press the Enter key. This selection puts the changed configuration into effect in the LTU.

   If you decide not to put your changes into effect, go to step 6 without selecting `Save & Update Unit`.
6. To dismiss the Configuration screen, type selection 0, `Return to Main Menu,` and press the Enter key.

Chapter 4, Configuration, contains a complete listing of the configuration options and their settings. It identifies selection numbers for those that appear on the terminal interface display.



*Operational Status, selection 1 on the Configuration screen, is equivalent to the AT command #A*n*, described on* page 3-6.

Diagnostics

Figure 3-5 illustrates the SC 5001 Diagnostics screen which enables you to run a variety of tests on the LTU. Instructions for using the screen to perform tests and display their results appear in *Chapter 6, Tests*, together with descriptions of the diagnostic functions.

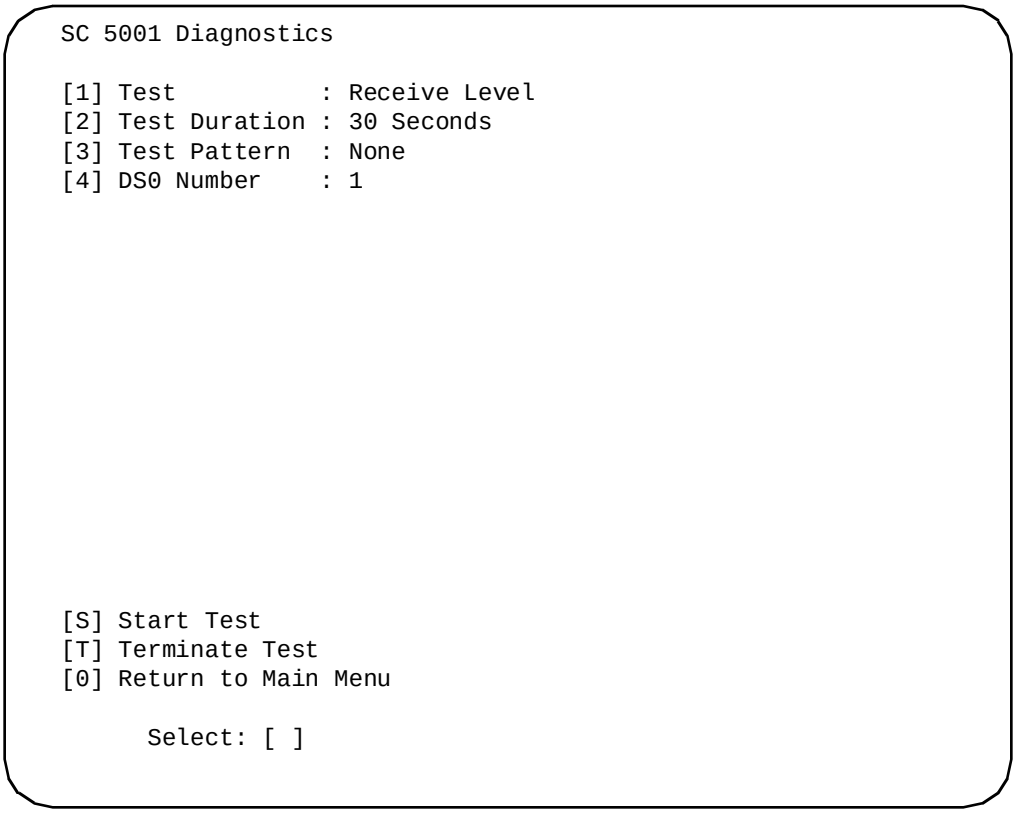


Figure 3-5 Diagnostics Screen

Alarm Configuration

The Alarm Configuration function determines which alarms the LTU is to report and the conditions under which they are to be reported. The function is divided into three screens.

The first screen that appears when you select Alarm Configuration from the Main Menu is a menu screen with three selections:

```
[1] Alarm Mask
[2] Alarm Threshold
[0] Return to Main Menu
```

Selection 1, Alarm Mask, presents a screen of configuration options that determine which alarms the LTU is to report. Alarms can be individually designated either to be reported when they occur or to masked (not reported). For definitions of the alarm conditions consult *Chapter 7, Alarms.*

Selection 2, Alarm Threshold, presents a screen of configuration options by which you can set intervals and thresholds for the reporting of Network and Cascade Bipolar Violations and CRC Errors alarms. The configured interval is the length of time during which a configured number of events (the threshold) must occur in order to cause an alarm. Alarm Threshold configuration has no effect on alarms configured as Masked.

```
                    SC 5001 Alarm Configuration

                          CSU Alarm
[1] Timing Loss        : Masked   [2] Unsolicited Test   : Masked
[3] Fallback Active    : Masked

                        Network Alarm
[4] Loss of Signal(LOS): Masked   [5] Out of Frame(OOF)  : Masked
[6] Low Average Density: Masked   [7] AIS                : Masked
[8] Bipolar Violations : Masked   [9] Received Yellow    : Masked
[A] CRC Errors         : Masked   [B] Excessive Zeros    : Masked
[C] Controlled Slips   : Masked   [D] Unavailable Signal : Masked

                        Cascade Alarm
[E] Loss of Signal(LOS): Masked   [F] Bipolar Violations : Masked
[G] Out of Frame(OOF)  : Masked   [H] Unavailable Signal : Masked
[I] AIS                : Masked   [J] CRC Errors         : Masked
[K] Received Yellow    : Masked

[L] All Alarms Control : Masked


[0] Return to Main Menu     [S] Save & Update Unit
      Select: [ ]
```

Figure 3-6 Alarm Mask Configuration Screen (default: all masked)

```
                    SC 5001 Alarm Configuration


      Network              Interval         Threshold

Bipolar Violations :    [1] Disabled     [5] >10
CRC Errors         :    [2] Disabled     [6] >10


      Cascade

Bipolar Violations :    [3] Disabled     [7] >10
CRC Errors         :    [4] Disabled     [8] >10









[0] Return to Main Menu     [S] Save & Update Unit
      Select: [ ]
```

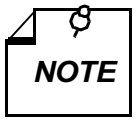
Figure 3-7 Alarm Interval/Threshold Configuration Screen

The procedure for changing Alarm Configuration option settings involves the following steps:

1. Type selection 1 and press the Enter key to access the Alarm Mask configuration screen.
2. Type the selection number or letter of the option you intend to change and press the Enter key. Highlighting appears on the current setting field for the corresponding option.

   You may want to begin with a uniform setting for all alarms, either all Masked or all Reported. Selection L, `All Alarms Control`, enables you to set all selections on the screen uniformly with one command.
3. Use the arrow keys to toggle the highlighted field between the Masked and Reported settings.
4. When the field displays the desired setting, press the Enter key. The highlight returns to the Select field.

   If you are setting selection L, `All Alarms Control`, all selections on the screen assume the new setting. Go to step 6 if you don't need to change any of the individual alarm options.
5. Repeat steps 1 through 3 for each option you need to change.



The value displayed for selection L, All Alarms Control, is Mixed whenever the alarms do not all have the same setting, either Masked or Reported. Mixed is a display setting that the LTU itself puts on-screen automatically as soon as any alarm is changed from the uniform setting.

6. After you've made all required changes and you are certain they are correct, type selection S, `Save & Update Unit` and press the Enter key. This selection puts the changed configuration into effect in the LTU.

   If you decide not to put your changes into effect, go to step 7 without selecting `Save & Update Unit`.
7. To dismiss the Configuration screen, type selection 0, `Return to Main Menu,` and press the Enter key. The display returns to the Alarm Configuration menu screen. If you have changed the setting of Network or Cascade Bipolar Violations or CRC Errors from Masked to Reported, you need to go to step 9. Otherwise proceed to step 8.
8. Type selection 0 and press the Enter key to return to the Main Menu.
9. Type selection 2 and press the Enter key to access the Alarm Interval/Threshold configuration screen. Each alarm on the screen has two selections associated with it, one for Interval and one for Threshold.
10. Type the selection number of an Interval that you need to set and press the Enter key. Highlighting appears on the field.
11. Use the arrow keys to toggle through the potential settings: Disabled, Infinity, 1 Hour, 1 Minute, 1 Second. Press the Enter key when the field displays the setting you intend to select. (Infinity means the Alarm will be declared when the threshold value is reached, however long that takes.)
12. Type the selection number of a Threshold that you need to set and press the Enter key. Highlighting appears on the field.
13. Use the arrow keys to toggle through the potential settings: >10, >10,000, >1,000, >100. Press the Enter key when the field displays the setting you intend to select.

14. After you've made all required changes and you are certain they are correct, type selection S, `Save & Update Unit` and press the Enter key. This selection puts the changed configuration into effect in the LTU.

    If you decide not to put your changes into effect, go to step 15 without selecting `Save & Update Unit`.

15. To dismiss the Interval/Threshold screen, type selection 0, `Return to Main Menu,` and press the Enter key. The display returns to the Alarm Configuration menu screen.

16. Type selection 0 and press the Enter key to return to the Main Menu.

Monitor/Alarms

The terminal interface SC 5001 Monitor/Alarms function displays a screen of status information concerning the LTU front panel LED indicators and alarm conditions. *Figure 3-8* illustrates the Monitor/Alarms screen.

The Alarms portion of the screen displays one of three states for each alarm condition:

ACTIVE – indicates the condition currently exists at the LTU

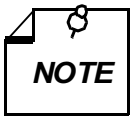
Normal – indicates either that the condition does not exist, or that Interval and Threshold conditions for its reporting have not been met

Masked – indicates the LTU has been configured not to report the alarm condition

Definitions of the alarm conditions appear in *Chapter 7, Alarms.*

The Front Panel LED Status portion of the screen displays the current status of each indicator on the LTU front panel as `OFF` or `ON`.

When you are done viewing the Monitor/Alarms screen, type 0 and press the Enter key to return to the Main Menu.



The cursor highlight constantly flickers from field to field on the screen as it updates to display current information. You can type 0 and press the Enter key to Return to Main Menu at any time, without waiting for the cursor highlight to return to the Select field.

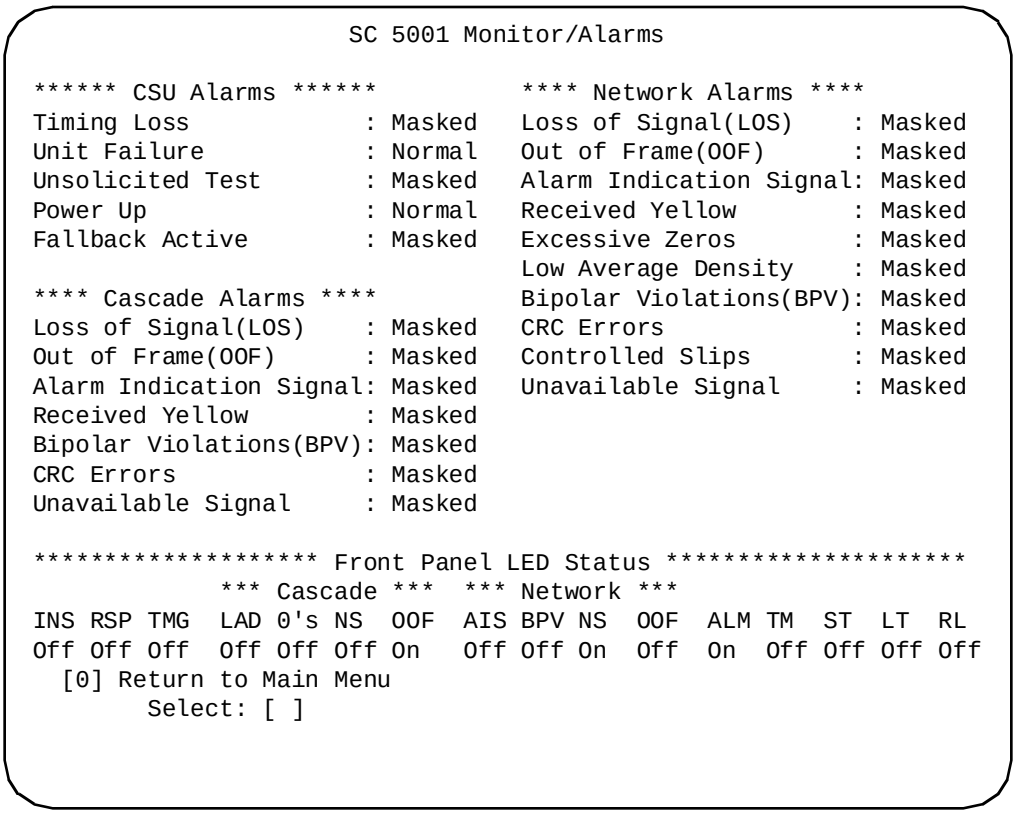


Figure 3-8 Monitor/Alarms Screen

Maintenance

The terminal interface Maintenance screen provides two specialized control functions: Soft Reset, and Reset to Factory Defaults. *Figure 3-7* illustrates the Maintenance screen.

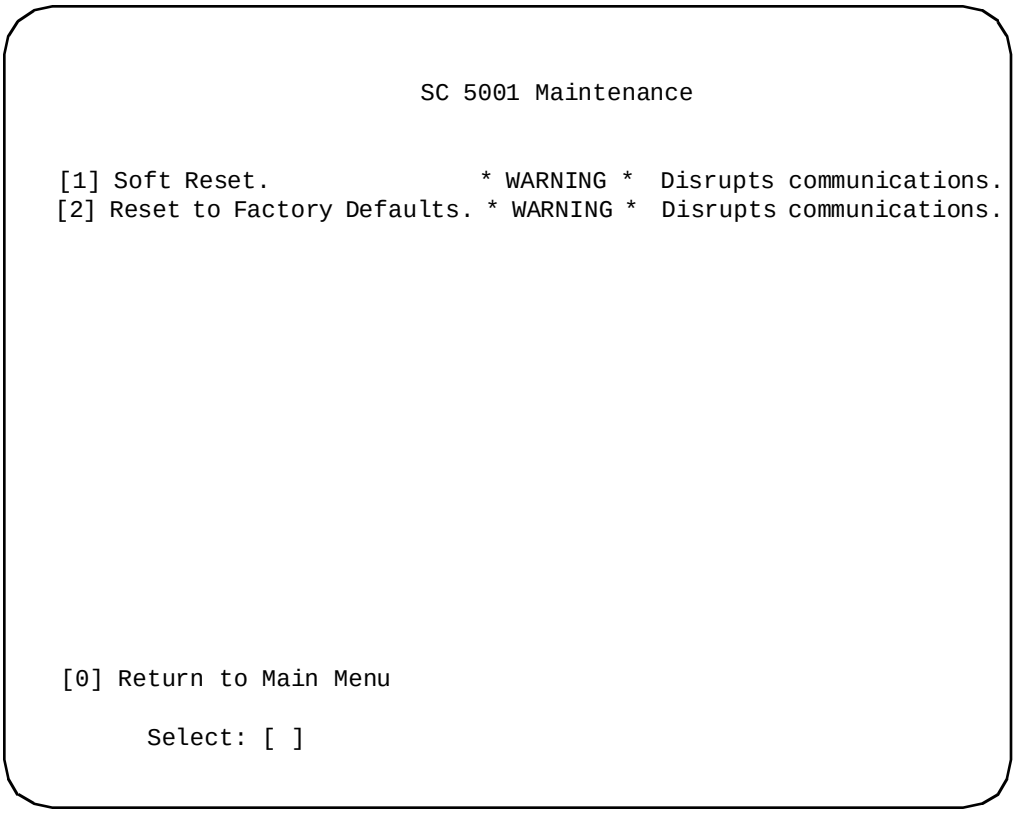


Figure 3-9 Maintenance Screen

The Maintenance screen presents two command selections:

[1] Soft Reset – causes the LTU to perform a reset and resume operation using its current configuration when you type 1 and press the Enter key.

[2] Reset to Factory Defaults – causes all options in the LTU to return to their factory default settings when you type 2 and press the Enter key.

When you are done with the Maintenance screen, type 0 and press the Enter key to return to the Main Menu.

4 Configuration Parameters

Overview

This chapter defines the configurable operating parameters of the SC 5001 LTU. You can perform configuration by means of SNMP commands from an SNMP controller or a MIB browser, by means of AT (Attention) commands, or by means of the terminal interface.

AT commands can be input to the LTU from a VT100-compatible terminal connected to the LTU at the Zone 3 DB25 connector for its shelf slot. More often they are used when the LTU is installed as part of an RLN system, and directed to the unit through the RLN Access Server, using the Attachmate RLN Server software.

Access to the terminal interface is described in *Chapter 3, Operation*.

Appendix B describes the RFC1406 and GDCDSX-1 MIB objects that are supported by the SC 5001 LTU.

AT Commands

Configuration

In the descriptions of LTU configuration options on the following pages each option selection is followed, in parentheses, by the corresponding AT command. You send AT commands to the LTU from an RLN Manager when it is installed as part of an RLN system. Less commonly, you can send the commands from a VT100-compatible terminal or terminal emulation program.

You send AT commands to the LTU in the form of an initialization string from the RLN manager or a command line from a terminal. Begin each initialization string or command line with the prefix AT, which alerts the LTU that the characters following it are commands.

You can send multiple commands to the LTU in a single initialization string or command line, up to a maximum of 60 characters. The AT prefix, spaces, line feeds, and carriage returns do not count as part of the 60-character limit.

Each command in the LTU AT command set begins with the symbol #. Most commands follow the # with a single letter, followed by a single digit. The # and letter identify the option, and the digit specifies its setting.

The AT command for Backplane Interface Configuration, #R, employs a slightly more involved format than the other commands. The #R command and its use are described below, under the heading Backplane Interface Configuration.

Each initialization string or command line must end with a carriage return (Enter key). The LTU does not begin processing the commands until it receives the carriage return character. Up until you press the Enter key you can make changes by backspacing and typing over.

The LTU returns a result code for each initialization string or command line it receives:

OK when the line is valid

ERROR if the line contains one or more invalid commands.

The result code ERROR indicates that the LTU has rejected every command between the AT prefix and the carriage return.

When using a terminal or terminal emulator you cannot send a new command line to the LTU until the result code for the previous command line is received. In the case of a terminal emulation program that ignores result codes, a three-character wait time must elapse between command lines sent to the LTU.

Help

The LTU includes an AT help function. When you're using a terminal or terminal emulator you can interrogate the unit for the names of the AT commands, the valid settings for each, and the results produced by each setting. There is also a help request that displays the current settings for all configuration options.

To display the full AT command set for the SC 5001 LTU:

type `AT $` and press the Enter key

The result is an on-screen display listing the letters and command names for the full command set. The display does not show the # that precedes the letter in each command.

To display the valid settings and their results for a selected AT command:

type `AT $` followed by the letter of the selected command and press the Enter key

The result is an on-screen display of the command name followed by definitions of the results the command provides for its valid input values.

To display the current settings for all configuration options:

type `AT $W` and press the Enter key

The result is an on-screen display that lists the names of all configuration parameters followed by their current settings. This display shows option names and functional settings rather than the AT command letter/digit combinations.

DS0 Allocation, at the bottom of the current setting display, indicates the current states of the DS0s that make up the T1 line connected to LTU's network interface. It consists of the designators 01 through 24, each above a two letter code. The codes represent the following states for the corresponding DS0s:

H*n* = carrying DSE data from the corresponding timeslot on the data highway the LTU is using (*n* = 1 – 4 to identify the data highway)

NC = not connected

DA = disabled

CC = assigned to Cascade Port

BO = busied out

Backplane Interface Configuration

Backplane Interface Configuration determines how the LTU exchanges data with its data set emulators over the SpectraComm shelf backplane. The configuration involves specifying which of the four data highways in the SpectraComm shelf and which timeslots on that highway the LTU is to use. Each timeslot on a backplane data highway is equivalent to a DS0 on the T1 line at the network interface.

When the LTU is part of a SpectraComm 5000 system the backplane configuration functionality resides in the SpectraComm Manager (SCM) card. You can use an SNMP controller to configure it as part of the TEAM Core software, or configure it by means of the SCM terminal interface. When the LTU is part of an RLN system the backplane configuration functionality resides in the

LTU and must be configured by means of AT commands.

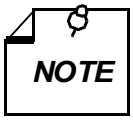
AT Configuration for the Backplane Interface

The AT command for Backplane Interface Configuration is **#R**. Unlike the other AT configuration commands for the LTU, it takes three setting parameters in the format:

#R*x*:*yy*-*zz*

where *x* is the data highway number: 1, 2, 3, or 4
: is a divider
yy is the starting data highway timeslot: 01 – 24
- is a divider
zz is the number of data highway timeslots: 01 – 24

The LTU transfers data from the group of timeslots you identify with this command into the corresponding DS0s of the T1 line connected to the network interface. All DS0s that are not in the configured group are available to carry data traffic from the Cascade Port.



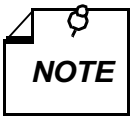
When you configure timeslots/DS0s with this command, the sum of yy + zz *must not exceed 24. A group of timeslots and the corresponding group of DS0s cannot "wrap around" at 24 and begin again at 1.*

CSU Configuration

Primary Timing

Options: Shelf (#B0)
Internal (#B1)
Network (#B2)
External (#B3)
Cascade (#B4)
Station (#B5)

This option selects the LTU timing source for transmissions on the T1 line. Shelf selects timing from the SpectraComm shelf backplane. Internal selects timing by the LTU internal clock. Network selects timing derived from the incoming T1 signal. External selects timing supplied by a DTE connected to a Fractional T1 data set emulator. Cascade selects timing derived from the DSX-1 signal at the LTU Cascade port. Station selects timing from a station clock connected to the LTU at its back panel DB25 connector.



Primary Timing is configurable in the LTU only when it is installed without an SCM and configured by means of AT commands. When there is an SCM in the system, Primary Timing is part of the SCM Backplane Control configuration when you use the terminal interface or part of the TEAM Core Shelf Configuration when you use the TEAM 5001 application software.

CSU Mode

Options: Concentrator (#C0)
CSU (#C1)

This option selects the unit to operate as either a channel service unit (CSU) or a terminating unit (concentrator) for data set emulators installed with it in the SpectraComm Shelf. As a CSU its network interface payload is connected to its cascade interface. As a concentrator it performs payload grooming on all interfaces, including the backplane.

[2] on the terminal interface Configuration screen.

When you are using the terminal interface, do not use this option to re-assign the LTU from Concentrator mode to CSU mode. Instead, access the Maintenance screen and perform Reset to Factory Defaults. That function places the unit in CSU mode and configures it for network timing. Individual options can be changed from their defaults as needed.

Circuit Identifier

The LTU provides memory locations for up to three 16-character strings of ASCII text to be entered by the user. These locations are accessible to an SNMP controller.

Front Panel

Options: Enable (#D0)
Disable (#D1)

This option enables or disables the LT, ST, and RL switches on the front panel.

[3] on the terminal interface Configuration screen.

Network Frame Type

Options: ESF (#E0)
Auto (#E1)
D4 (#E2)

This option selects the framing format for the LTU's network interface. The choices are Auto, Extended Superframe Format (ESF), and Superframe Format (D4).

When you select Auto framing the LTU adapts automatically to the framing format it receives.

[8] on the terminal interface Configuration screen.

Network Code

Options: AMI (#F0)
B8ZS (#F1)

This option selects the line code the LTU will receive and transmit at its network interface. The choices are Alternate Mark Inversion (AMI) and Bipolar with 8 Zero Substitution (B8ZS).

[9] on the terminal interface Configuration screen.

Network Interface Type

Options: DS-1 (#G0)
DSX-1 (#G1)

This option selects the signal characteristics the LTU will present at its network interface. DS-1 is the normal selection, for long-haul operation over a Telco-provided T1 line. DSX-1 should be selected for short-haul operation over an on-site wire connection.

[A] on the terminal interface Configuration screen.

Network Pre-Equalization

Options: 0 — 130 ft (#H0)
130 — 260 ft (#H1)
260 — 390 ft (#H2)
390 — 530 ft (#H3)
530 — 655 ft (#H4)

When DSX-1 is selected as the network Interface Type this option should be set to match the line length between the LTU and the signal's destination. Set this option to the lowest value that is equal to or greater than the actual line length.

This option is not available when the network Interface Type is DS-1.

[B] on the terminal interface Configuration screen.

Network Line Build-Out

Options: Manual, -7dB (#I0)
Auto (#I1)
Manual, -15dB (#I2)
Manual, 0dB (#I3)

When DS-1 is selected as the network Interface Type this option is used to adjust attenuation on the line between the LTU and the service provider's line interface. Selecting Auto permits the LTU to adjust its build-out automatically based on the signal it receives.

This selection is not available when the network Interface Type is DSX-1.

[C] on the terminal interface Configuration screen.

Network Ones Density

Options: Inhibit (#J0)
Max 15 Zeros (#J1)
Max 39 Zeros (#J2)
8(N+1)Restrict (#J3)
Minimum 1 in 8 (#J4)

This option selects the pulse density the LTU will enforce in its transmissions through the network interface. The LTU does not control pulse density when Inhibit is selected. At the Max 15 setting the LTU will transmit no more than 15 zeros before inserting a one. The Max 39 setting permits the LTU to transmit up to 39 zeros before it inserts a one. The 8(N+1) Restriction ensures that there will be at least N ones for every 8(N+1) bits, where the value of N is in the range 1 — 23. Minimum 1 in 8 ensures that there will be at least 1 one in every 8 bits.

[D] on the terminal interface Configuration screen.

Network FDL Mode

Options: ATT-54016 (#K0)
None (#K1)
ANSI T1.403 (#K2)

When ESF framing is selected, this option should be set for the type of Facilities Data Link (FDL) maintenance messages supported by the service provider. The ATT-54016 setting supports the Maintenance Message requirements described in ATT Pub 54016-1989. The ANSI T1.403 selection supports Scheduled Performance Report Messages (PRMs), bit patterned messages, and message oriented signals.

[E] on the terminal interface Configuration screen.

Network RCV Range

Options: Auto (#L0)
Normal (#L1)
Extended (#L2)

This option selects the range of signal levels the LTU will be able to receive at its network interface. The Normal range is 0 to -28 dB. The Extended range is -20 to -38 dB. Selecting Auto causes the LTU to detect the level of the incoming signal and set its own range accordingly.

[F] on the terminal interface Configuration screen.

Network Redundancy

Options: Off-line (#M0)
On-line (#M1)
Keep Alive

The controller specifies by this option which LTU in a redundant pair is primary (on-line) and which is secondary (off-line). Jumper block X1 must be positioned for redundant operation on each LTU's pc card.

The value "Keep Alive" indicates, when it is displayed, that the LTU is hardware optioned by Jumper X1 to be active. When that is the case, this option cannot be changed by application software, AT command, or terminal interface.

[G] on the terminal interface Configuration screen.

Cascade Frame Type

Options: ESF (#N0)
Auto (#N1)
D4 (#N2)

This option selects the framing format for the LTU's cascade port. The choices are Auto, Extended Superframe Format (ESF), and Superframe Format (D4).

When you select Auto framing the LTU adapts automatically to the framing format it receives.

[H] on the terminal interface Configuration screen.

Cascade Code

Options: AMI (#O0)
B8ZS (#O1)

This option selects the line code the LTU will receive and transmit through its cascade port. The choices are Alternate Mark Inversion (AMI) and Bipolar with 8 Zero Substitution (B8ZS).

[I] on the terminal interface Configuration screen.

Cascade Pre-Equalization

Options: 0 — 130 ft (#P0)
130 — 260 ft (#P1)
260 — 390 ft (#P2)
390 — 530 ft (#P3)
530 — 655 ft (#P4)

This option sets the line length between the LTU's cascade port and the interface of the device to which it is connected. Set this option to the lowest value that is equal to or greater than the actual line length.

[J] on the terminal interface Configuration screen.

Cascade Redundancy

Options: Off-line (#Q0)
On-line (#Q1)

This option specifies which LTU in a redundant pair is primary (on-line) and which is secondary (off-line).

[K] on the terminal interface Configuration screen.

Signal Mode

Options: None (#T0)
Robbed Bit (#T1)

Set this option to Robbed Bit when the DSEs supported by the LTU are to make switched network connections to their remotes. Robbed Bit signalling enables emulation of dial and ring signals. If DSEs are to use dedicated line connections set this option to None.

AIS Loopdown Time

Options: Inhibit (#U0)
5 seconds (#U1)
10 seconds (#U2)
20 seconds (#U3)
40 seconds (#U4)
60 seconds (#U5)

The setting you select for this option determines how many seconds of continuous Alarm Indication Signal (AIS) will cause the LTU to end a remotely-initiated loopback. When you select Inhibit, AIS has no effect on loopbacks.

[6] on the terminal interface Configuration screen.

Loopback Configuration

Options: Inhibit Loop (#V0)
Payload Loopback (#V1)
Line Loopback (#V2)

This option selects the type of loopback that the LTU will initiate when it receives an in-band loopback code. When you select Inhibit Loop, the LTU will not respond to an in-band loopback code.

[5] on the terminal interface Configuration screen.

D Channel Signalling

Options: Normal Mode (#X0)
ISDN Mode (#X1)

When the LTU is connected to a T1 line and DSEs that perform switched network functions transmit their switch signalling in-band, this option is to be set to Normal Mode.

When the LTU is installed in conjunction with an SC PRI card and connected to an ISDN PRI line, this option is to be set to ISDN Mode. DS0 24 then serves as the ISDN D channel by which DSEs performing switched network functions transmit their switch signalling.

[7] on the terminal interface Configuration screen.

5 Timing

Overview

This section describes the transmit timing arrangements that are available to the SC 5001 LTU. The selection of available timing arrangements varies depending on whether the LTU is optioned to operate in Concentrator mode or CSU mode.

When the LTU is operating in CSU mode it can be optioned to employ any one of five transmit timing sources:

- network timing
- internal timing
- cascade timing
- station timing
- shelf timing

When the LTU is optioned to operate in Concentrator mode, system timing on the SpectraComm Shelf backplane also comes into play. One LTU per shelf (or pair of shelves) is designated to supply system timing to the other cards, both LTUs and DSEs, in the shelf. The LTU that supplies system timing can be optioned to derive its timing from any of the five sources listed above.

Figure 5-1 illustrates the timing sources. The five transmit timing sources and system timing are described under individual headings on the following pages.

Transmit Timing Options

An LTU that is operating in CSU mode must always be optioned to employ one of the following five types of transmit timing. An LTU that is operating in Concentrator mode must be optioned to employ one of the five types of transmit timing if it is the LTU that supplies system timing to the SpectraComm Shelf backplane. LTUs in Concentrator mode that receive system timing from the backplane are not optioned for transmit timing.

Network Timing

Network timing is the LTU's default selection for transmit timing. The LTU locks its transmit timing to the timing it receives in the DS-1 signal from the T1 network. This timing arrangement is sometimes called slave timing or wrap timing.

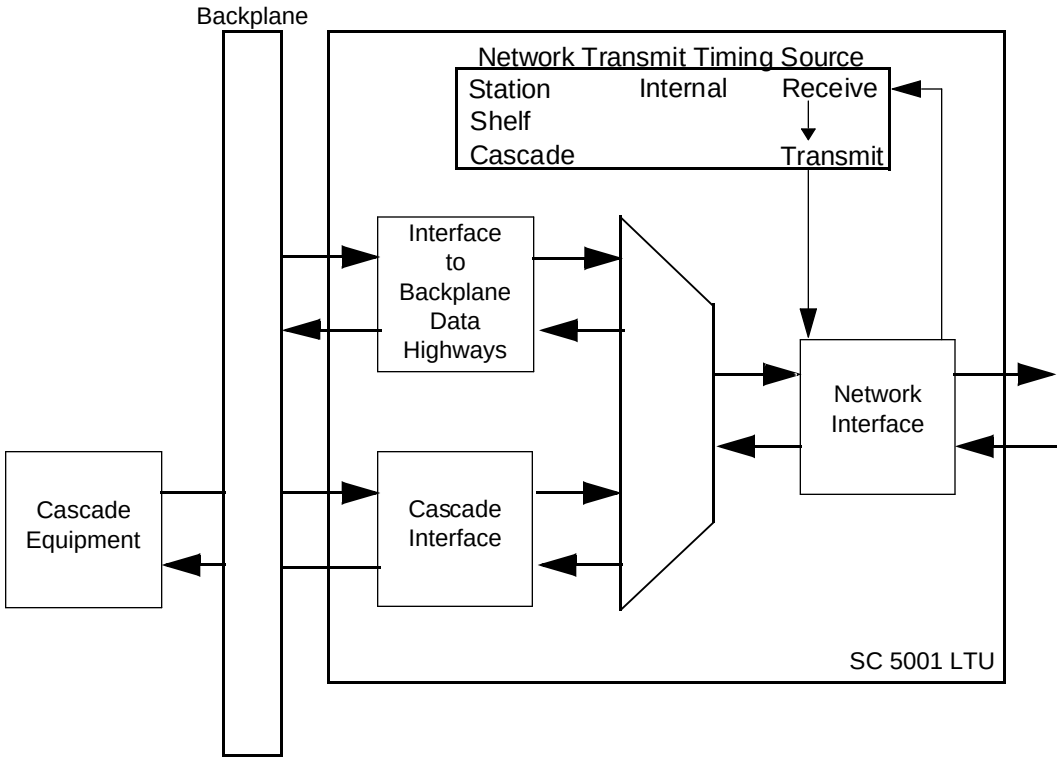


Figure 5-1 Network Timing

Internal Timing

The LTU can be optioned to time data at its DS-1 network interface using internal timing. When this option is selected the LTU generates its own 1.544 Mbps clock. Internal timing is typically selected for use by one of the two CSUs that make up a private, or wireline, network connection.

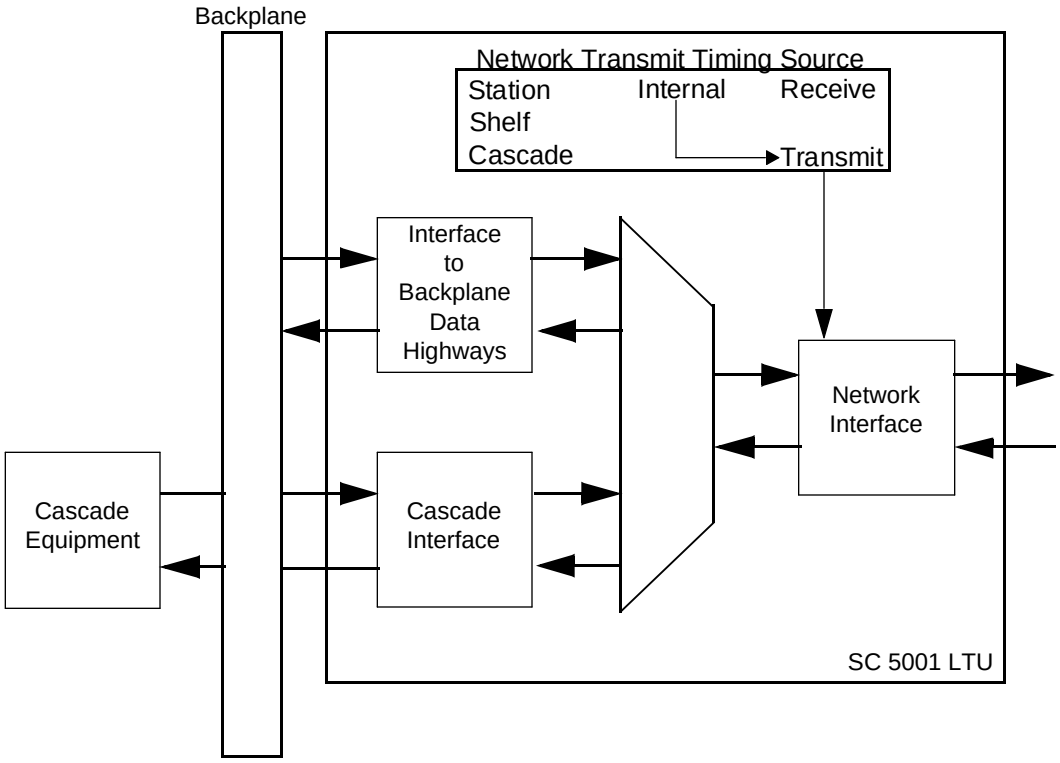


Figure 5-2 Internal Timing

Cascade Timing

The LTU can be optioned to use cascade timing to time data at its DS-1 network interface. Cascade timing is derived from the signal the LTU receives at its DSX-1 cascade interface. Cascade timing is provided for use in tail circuit applications.

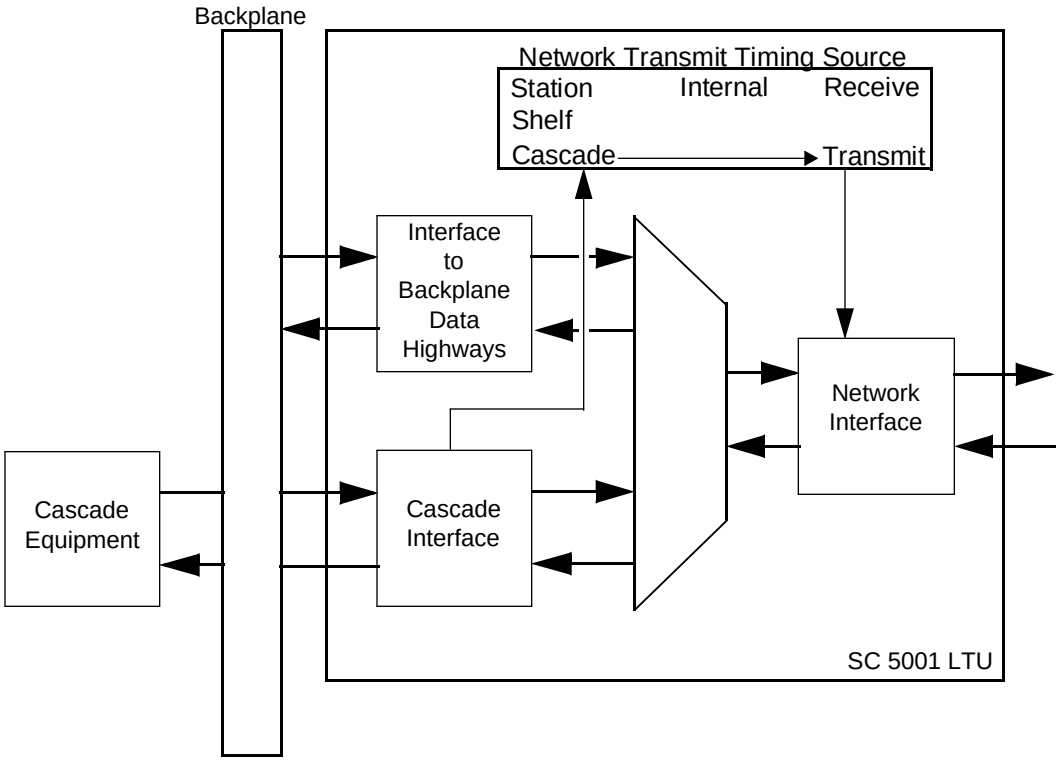


Figure 5-3 Cascade Timing

Station Timing

When the LTU is optioned for station timing it times data at its DS-1 network interface by means of a 1.544 Mbps timing signal supplied from the Telco central office on a separate circuit. The station clock signal is input to the LTU at the DB25 connector for its slot in Zone 3 of the SpectraComm Shelf back panel. The timing signals are transferred through that connector using a standard EIA RS-422 interface.

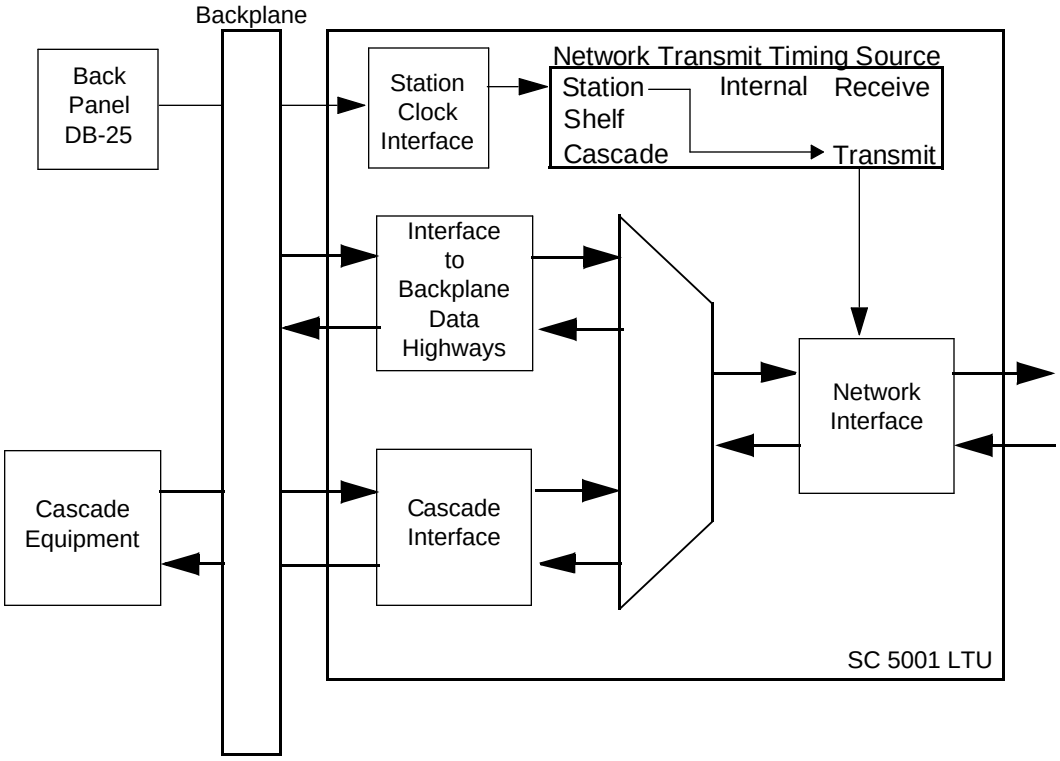
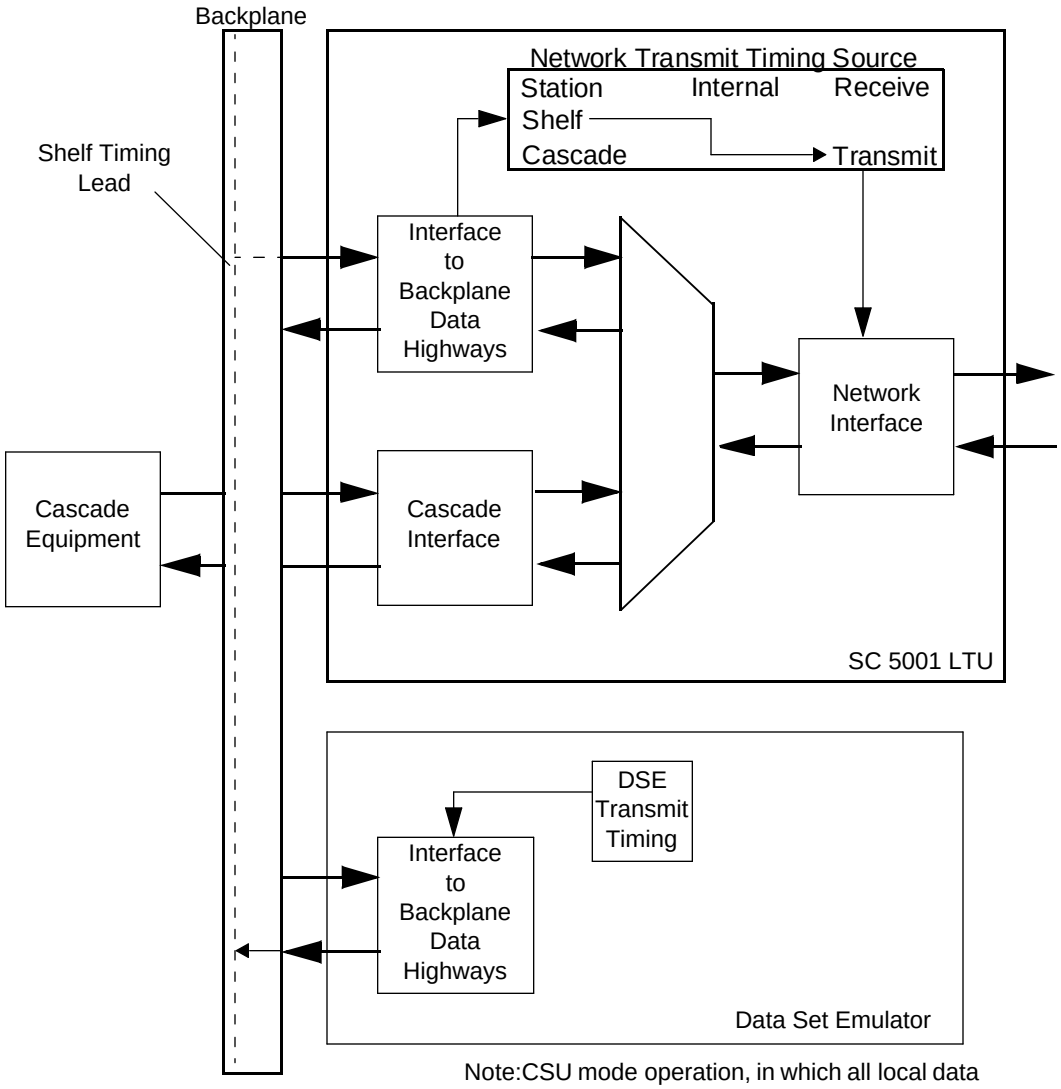


Figure 5-4 Station Timing

Shelf Timing

One Data Set Emulator (DSE) per SpectraComm Shelf (or pair of shelves) can be optioned to provide shelf timing to the backplane. When the LTU is optioned for shelf timing it uses that timing signal from the backplane to time data at its DS-1 network interface. The LTU's timing is slaved to the DSE that supplies shelf timing to the backplane.



Note: CSU mode operation, in which all local data traffic takes place through the Cascade Port, does not prevent the LTU from drawing Shelf Timing from the backplane.

Figure 5-5 Shelf Timing

System Timing

System timing is involved when the LTU operates in Concentrator mode and transfers data to and from DSEs installed with it in the SpectraComm Shelf.

When a SpectraComm Shelf contains multiple LTUs operating in Concentrator mode, one LTU must be optioned to supply system timing. The other LTUs operating in Concentrator mode receive their system timing from the backplane and derive their DS-1 interface transmit timing from it. Therefore, an LTU that is operating in Concentrator mode and does not supply the system timing must not be optioned to use any of the transmit timing sources listed above.

System timing is not involved when the LTU operates in CSU mode and only transfers data between its DSX-1 cascade interface and its DS-1 network interface.

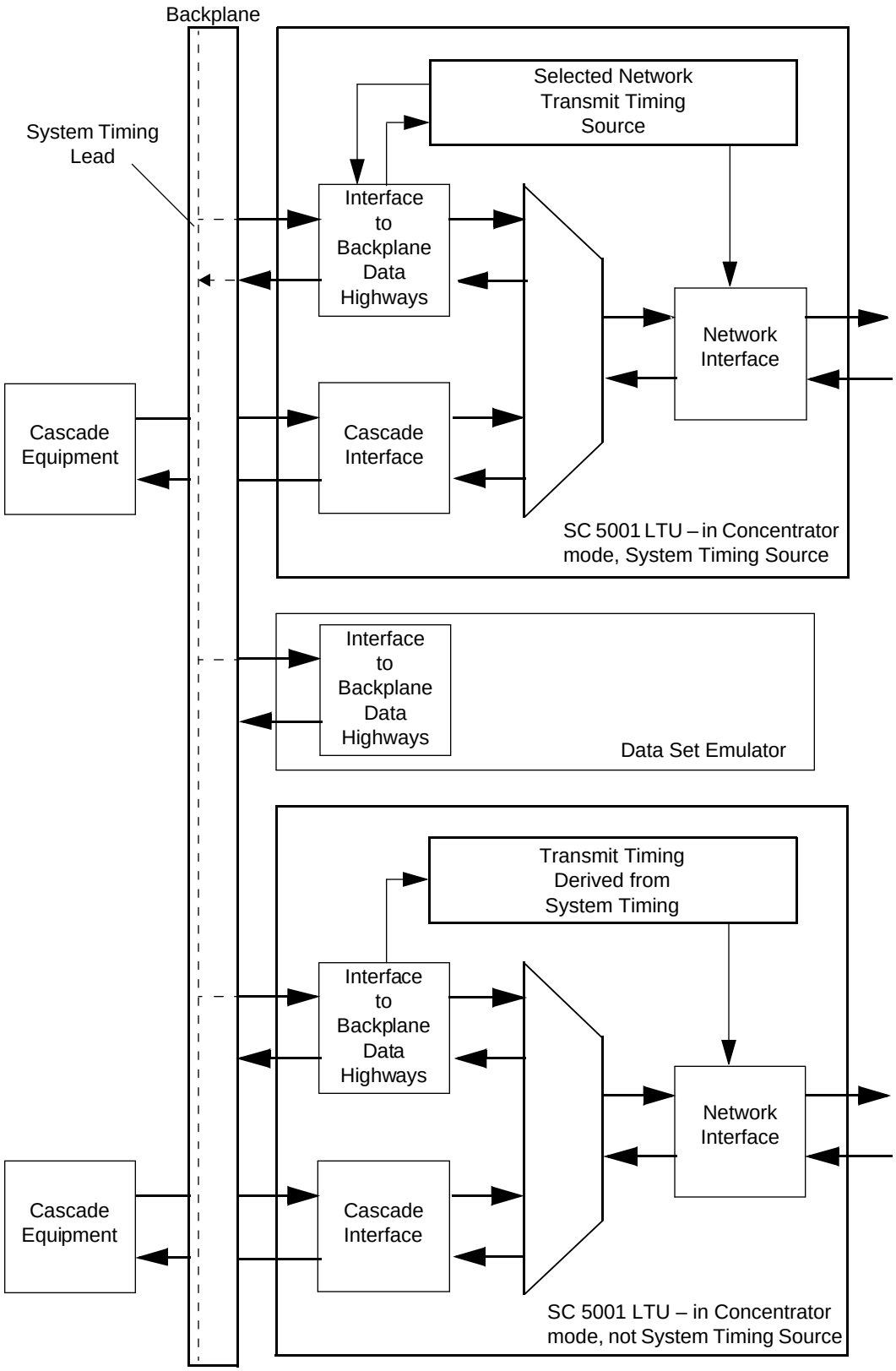


Figure 5-6 System Timing

6 Diagnostics

Overview

There are four means by which you can initiate diagnostic functions in the SC 5001 LTU:

- commands from the network (Telco):

  Line or Payload Loopback (dependent on LTU optioning)

- switches on the LTU front panel:

  Self Test

  Local Test

  Remote Test

  Local Test with Self Test

  Remote Test with Self Test

  End-to-End Test

- commands from an SNMP controller (via the SCM card located in the SpectraComm Shelf):

  All tests available from the network and the front panel

  Cascade Loopback

  DS0 Loopback

  DS0 Self Test

  Network Interface Test

  DS0 Delay Measurement

  Receive Level Measurement

- commands from the terminal interface (via the SCM card located in the SpectraComm Shelf):

  All tests available from an SNMP controller

Front panel tests and SNMP controller tests have equal priority and can override each other. If, for example, you command a Local Test from the front panel while an SNMP-commanded Cascade Loopback is already under way, the LTU terminates the Cascade Loopback and initiates the Local Test. The most recent test command from either source is the one that is in effect.

Network test commands have a higher priority than the other two categories. A test command from the Telco overrides a test in progress that has been commanded by the front panel or an SNMP controller. A test command from either of those sources cannot override a network-commanded test in progress.

Terminal Interface Diagnostics Procedure

Figure 6-1 illustrates the Diagnostics screen. Instructions for using the screen to perform tests appear following the illustration.

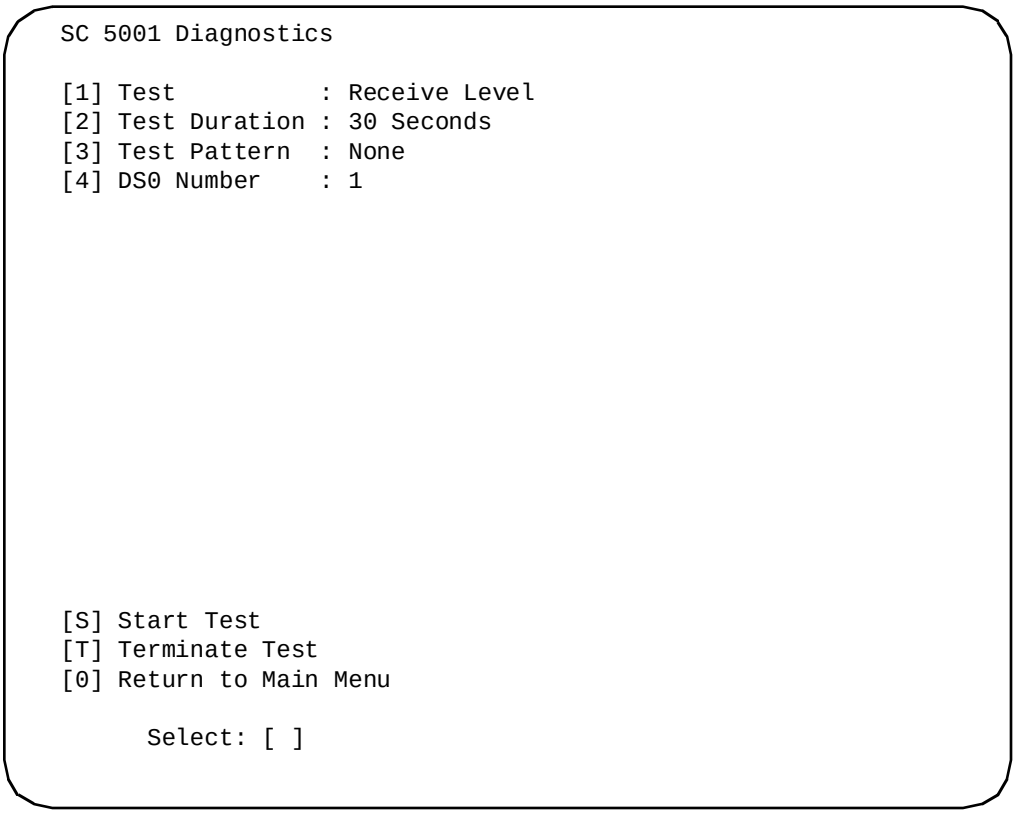


Figure 6-1 Diagnostics Screen

The terminal interface SC 5001 Diagnostics screen has four selections for specifying what test is to be performed and how long it is to run, and two selections for starting and manually ending a test. You do not have to use the Terminate Test selection when you select a test to run for a set length of time. In this chapter, the descriptions of individual tests specify the selection(s) they require you to make to run them from the Diagnostics screen.

NOTE

The descriptions on the following pages identify valid tests and how you command them from the terminal interface Diagnostics screen. Other combinations of selections on the terminal interface Diagnostics screen are invalid.

The terminal interface handles selections for [1] Test, [3] Test Pattern, and [4] DS0 Number separately. It does not prevent you from selecting invalid combinations. Invalid combinations cannot interfere with operations, but may provide misleading results.

Three points to be aware of when selecting from the Diagnostics screen:

The LTU always performs the Test type that you select.

The LTU generates a Test Pattern when one is selected (anything but None), regardless of whether there is a data path for the signal to follow. When there isn't a data path, Self Test results displayed at the end of the test are invalid.

The LTU ignores the DS0 Number selection when it isn't pertinent to the selected Test.

The procedure for performing tests from the Diagnostics screen involves the following steps:

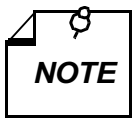
1. Type `1` and press the Enter key. Highlighting appears on the `Test` field.
2. Use the arrow keys to toggle the highlighted field until it displays the name of the test you intend to perform, then press the Enter key again. The highlighting returns to the selection field.
3. Type `2` and press the Enter key. Highlighting appears on the `Test Duration` field.
4. Use the arrow keys to toggle the highlighted field until it displays the length of time for which you want the test to run, then press the Enter key again. The highlighting returns to the selection field. The available durations are `30 Seconds`, `No Limit`, or `1 – 9 Minutes` in 1-minute increments. The test runs until ended manually if you select `No Limit`.

   If the selected test is DS0 Loopback or DS0 Delay Test, go to step 7. For any other test that does not involve the self test function go to step 9.
5. If you intend to perform an end-to-end self test or any loopback test combined with self test, Type `3` and press the Enter key. Highlighting appears on the `Test Pattern` field.
6. Use the arrow keys to toggle the highlighted field until it displays the test pattern you intend to use, then press the Enter key again. The highlighting returns to the selection field. The available patterns are `None, 3 in 24`, `QRSS`, `2047`, or `511`.

   Go to step 9.
7. If you intend to perform DS0 Loopback, DS0 Self Test, or DS0 Delay Test, Type `4` and press the Enter key. Highlighting appears on the `DS0 Number` field.
8. Use the arrow keys to toggle the highlighted field until it displays the number (1 – 24) of the DS0 you intend to use, then press the Enter key again. The highlighting returns to the selection field.
9. Type `S` and press the Enter key. A status line appears on-screen.

   If a duration is selected for the test or if DS0 Delay Test is selected, no further action is required. The test runs until the status `Test Completed` appears on-screen. For the Delay Test or a test that employs a self test pattern that status is followed by a `Test Results` line.
10. If no duration was selected for the test, type `T` and press the Enter key when you are ready for the test to end. You can also use this command when a duration was selected, but you need to end the test early.

    The status `Test Completed` appears on-screen. For the Delay Test or a test that employs a self test pattern that status is followed by a `Test Results` line.



The terminal interface does not permit a test to run 10 minutes or longer. A timeout disconnect occurs if 10 minutes pass without any keyboard activity. If the LTU disconnects due to a timeout, it performs an orderly shut-down of the test. It does not display results for a test that employs Self Test.

11. To dismiss the screen, type selection 0, `Return to Main Menu,` and press the Enter key.

Line or Payload Loopback

The LTU's Loopback Configuration option selects it to perform either a Line Loopback or a Payload Loopback in response to the appropriate command. The option can also be set to have the LTU ignore the loopback command altogether.

The commands to enter and terminate the configured loopback can come from the network or from an SNMP controller. The network can send the commands as in-band codes or by means of the facilities data link (FDL) that is incorporated in the ESF format. An SNMP controller also has the option of commanding the test on a timed basis so that it terminates after a specified duration without the need to send a second command.

Both tests cause the LTU to loop received data back in the network interface as transmit data. *Figure 6-2* illustrates both loopbacks. The LTU's front panel Test Mode (TM) indicator is lit while the loopback is active.

Both tests are available as `Test` selections from the terminal interface Diagnostics screen: `Line Test` and `Payload Test`.

Line Loopback connects receive to transmit in the analog portion of the network interface. The LTU does not correct bipolar violations and framing errors while a Line Loopback is in effect.

Payload Loopback connects receive to transmit in the digital portion of the network interface. The LTU regenerates framing while a Payload Loopback is in effect.

The LTU transmits an Alarm Indication Signal (AIS) while the test is in progress. If the LTU is operating in CSU mode, it directs an AIS consisting of unframed ones to the cascade interface. If the LTU is operating in Concentrator mode, it directs an AIS consisting of framed ones to both the SpectraComm backplane interface and the cascade interface.

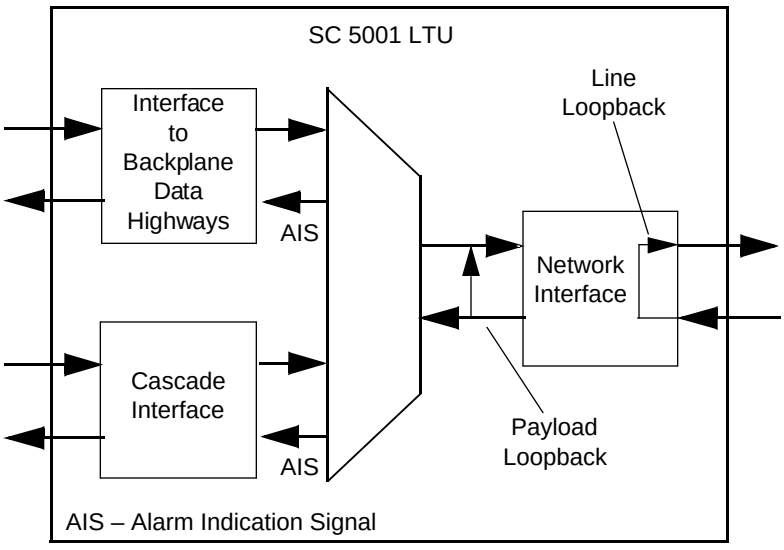


Figure 6-2 Line and Payload Loopbacks

Cascade Loopback

The LTU can be commanded by an SNMP controller to perform a Cascade Loopback. The test causes the LTU to loop received data back to the transmit path at the cascade interface, thereby isolating the LTU from the equipment connected to that interface. *Figure 6-3* illustrates the Cascade loopback. The LTU's front panel Test Mode (TM) indicator is lit while the loopback is active.

The Cascade Loopback can be commanded as an open ended test. A second command is then required to end the loopback. The controller can also command the test on a timed basis so that it terminates after a specified duration without the need to send a second command.

While the test is in progress the LTU transmits an Alarm Indication Signal (AIS) to the equipment connected to the cascade interface. If the LTU is operating in Concentrator mode, normal activity can continue through the SpectraComm backplane interface, unaffected by the Cascade Loopback.

The test is available as a `Test` selection from the terminal interface Diagnostics screen: `Cascade Test`.

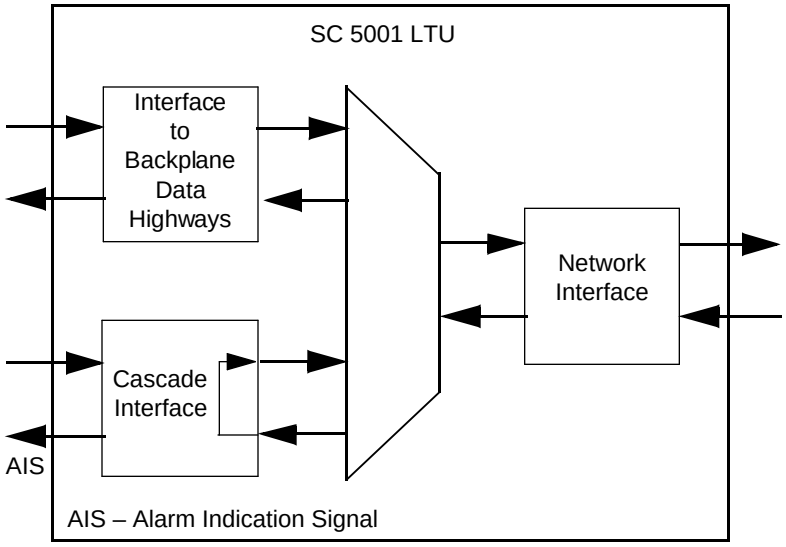


Figure 6-3 Cascade Loopback

Local Test

The LTU can be commanded into Local Test by means of its front panel Local Test (LT) switch or by a command from an SNMP controller. The test is a loopback condition that isolates the LTU from the T1 line so that you can direct an externally generated test signal through the LTU. *Figure 6-4* illustrates the Local Test loopback. The LTU's front panel LT and Test Mode (TM) indicators are lit while the loopback is active.

During Local Test:

- The LTU loops the transmit signal back to the receive path at the Network Interface.
- The LTU's interfaces remain active.
- The external device that generates and checks the test signal can be connected through one of the backplane data highways or through the cascade interface.

Local Test checks the local LTU's circuits isolated from the T1 line. Error detection and reporting is the responsibility of the external device that supplies the test signal.

To initiate Local Test from the front panel, press the LT switch briefly. Once started, the test remains in effect until the LT switch is pressed a second time.

An SNMP controller can command an open ended Local Test. A second command is then required to end the loopback. The controller can also command the test on a timed basis so that it terminates after a specified duration without the need to send a second command.

`Local Test` is available as a `Test` selection from the terminal interface Diagnostics screen.

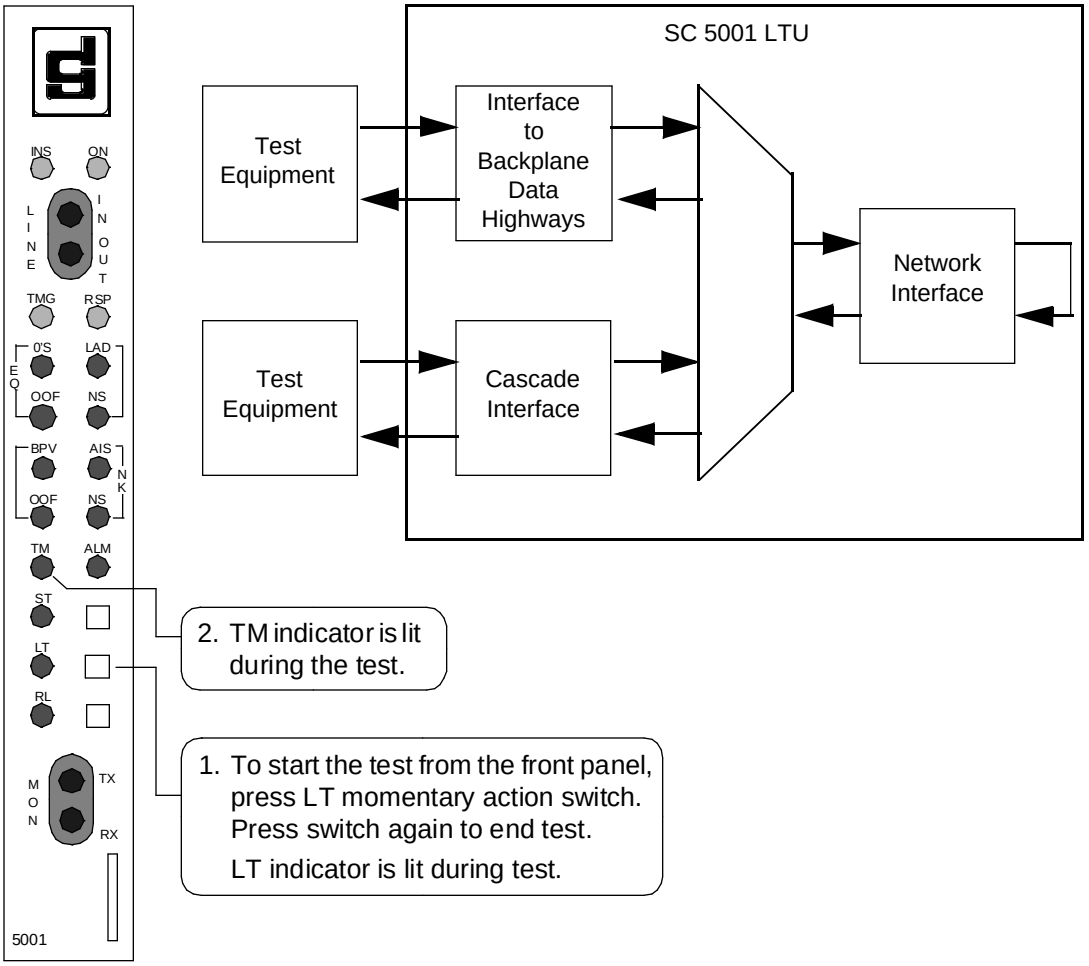


Figure 6-4 Local Test

Local Test with Self Test

The LTU can be commanded into a Local Test with Self-Test by means of its front panel Local Test (LT) and Self Test (ST) switches, or by a command from an SNMP controller. The test establishes a Local Test loopback and directs an internally generated test signal through the LTU. During the test, the LTU is isolated from the backplane data channels and the cascade interface.

Figure 6-5 illustrates the Local Test with Self Test. The LTU's front panel LT, ST, and Test Mode (TM) indicators are lit while the test is active. The TM indicator remains On as long as the test pattern is received without errors and blinks when an error is detected.

During Local Test with Self Test:

- The LTU loops the transmit signal back to the receive path at the Network Interface.
- The LTU enables its internal Test Pattern Generator to provide the signal for the Local Test loop.
- The LTU enables its Test Pattern Checker to verify the signal.

To initiate a Local Test with Self-Test from the front panel, briefly press the LT switch and the ST switch. Once started, the test remains in effect until the switches are pressed a second time.

An SNMP controller can command an open ended Local Test with Self Test. A second command is then required to end the test. The controller can also command the test on a timed basis so that it terminates after a specified duration without the need to send a second command.

The test is available from the terminal interface Diagnostics screen by combining the `Local Test` selection with a `Test Pattern` selection.

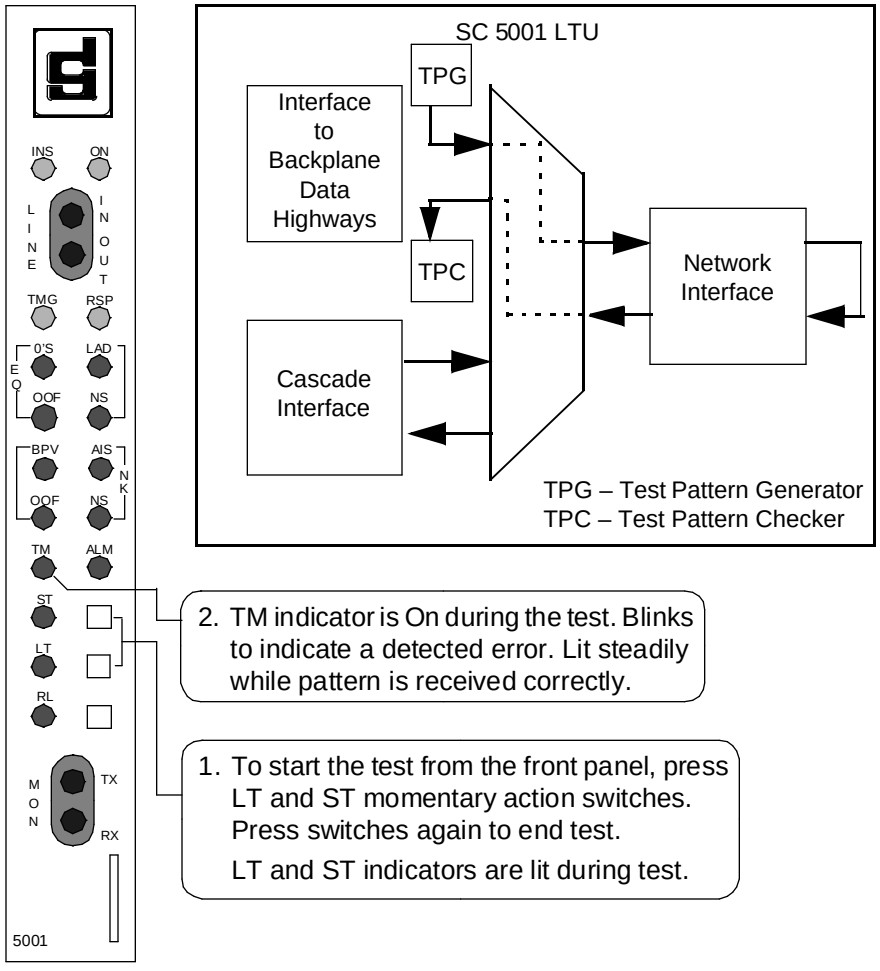


Figure 6-5 Local Test with Self-Test

DS0 Loopback

The LTU can be commanded by an SNMP controller to perform a DS0 Loopback. The test is similar to a Payload Loopback, but it affects only the data on one, selected DS0 instead of the entire T1 line. It causes the LTU to loop the selected DS0's received data back to the transmit path. By enabling testing to focus on a single DS0, this loopback reduces interference with data traffic. *Figure 6-6* illustrates the DS0 loopback. The LTU's front panel Test Mode (TM) indicator is lit while the loopback is active.

The DS0 Loopback can be commanded as an open ended test. A second command is then required to end the loopback. The controller can also command the test on a timed basis so that it terminates after a specified duration without the need to send a second command.

While the test is in progress normal activity can continue on the other DS0s that make up the LTU's T1 line, unaffected by the DS0 Loopback.

The test is available from the terminal interface Diagnostics screen by combining the `Test` selection `DS0 Loopback` with a `DS0 Number` selection.

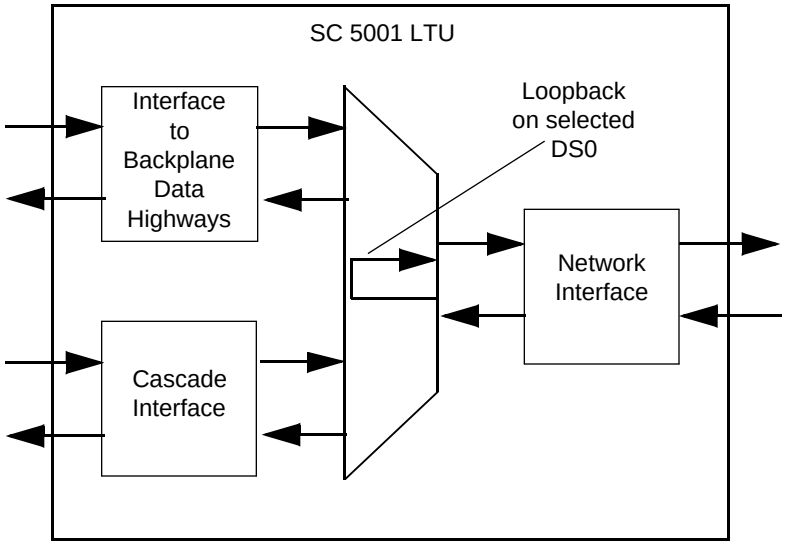


Figure 6-6 DS0 Loopback

DS0 Self Test Procedure

The LTU can be commanded by an SNMP controller or the terminal interface to activate its DS0 Self Test. The DS0 Self Test generates a test pattern and transmits it on one selected DS0. It performs error checking on the pattern it receives. *Figure 6-7* illustrates the data path for this test.

The function can be used for either of two tests, both of which require cooperation at another site. The remote site can be requested to loop the DS0 back for error checking at the local LTU. Or, if compatible equipment is available, the remote site can generate a matching pattern back to the LTU for end-to-end test checking at both sites.

The remote unit for this test is usually located at the service provider switching office to which the LTU is connected by its T1 line. The test can be used with compatible equipment located at the far end of the link.

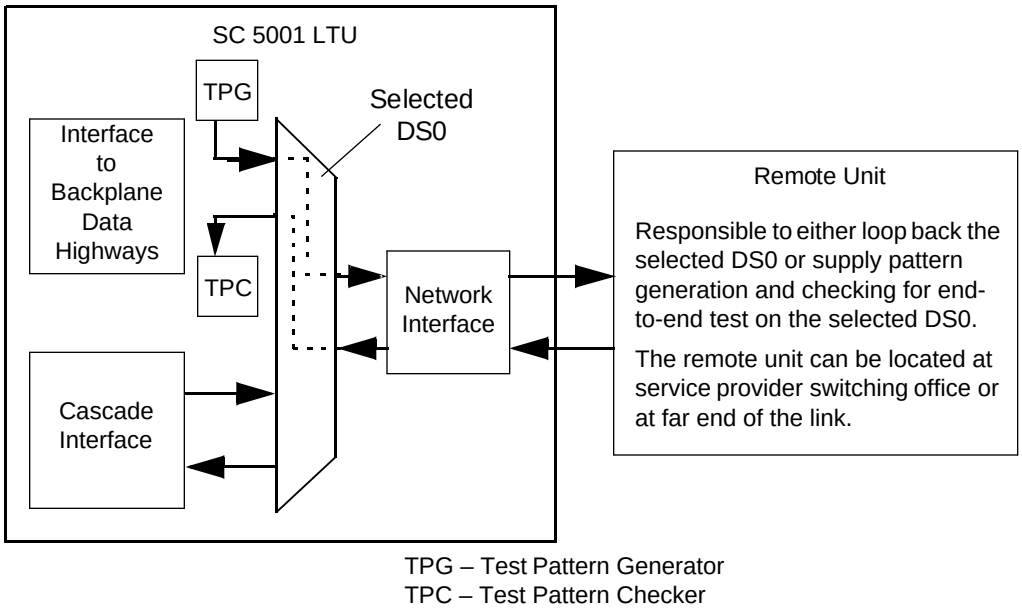


Figure 6-7 DS0 Self-Test

DS0 Delay Measurement

The LTU can be commanded by an SNMP controller to perform DS0 Delay Measurement. The procedure requires two SC 5001 LTUs. The controller commands the remote LTU into a DS0 Loopback. It then commands the local LTU to generate a fixed pattern test signal, start a timer, and transmit the test signal to the remote on the DS0 that is in loopback. The local LTU stops the timer, and the test, when it receives the test signal back from the remote LTU. The timer's value, which is the round trip delay between the two LTUs, can be viewed on the SNMP controller.

The front panel Test Mode (TM) indicators of both LTUs are lit while the test is in progress.

Normal activity, unaffected by the DS0 Delay Measurement procedure, can continue on the other DS0s that make up the LTU's T1 line while the test is in progress.

The test is available from the terminal interface Diagnostics screen by combining the `Test` selection `DS0 Delay Test` with a `DS0 Number` selection.

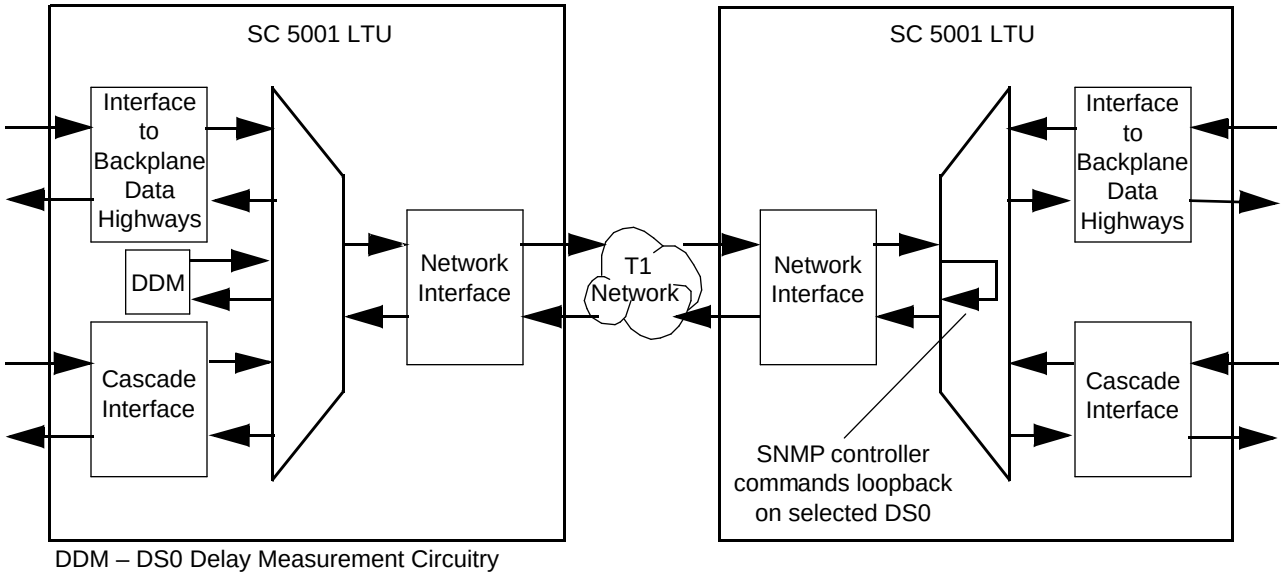
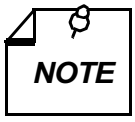


Figure 6-8 DS0 Delay Measurement

Remote Loop

The LTU can be commanded to perform a Remote Loop test by means of its front panel Remote Test (RT) switch, by a command from an SNMP controller, or by a command from the terminal interface. In a Remote Loop test the local LTU transmits an in-band command to the remote LTU or CSU, directing it to loop received signals back onto the T1 line. A test signal can be transmitted from the local LTU and then checked for errors when it is received back from the loop.



The Remote Loop function only operates when the LTU's entire T1 payload is directed to a single remote unit. It will not function when individual DS0s are directed to different destinations.

Figure 6-9 illustrates the Remote Loop. The LTU's front panel RT and Test Mode (TM) indicators are lit while the loopback is active.

During Remote Loop:

- The LTU transmits the in-band loop-up command to the remote LTU or CSU.

- In response to the command, the remote unit performs either a payload loopback or a line loopback (as determined by its configuration) and loops the receive signal back to its transmit path.
- The LTU's interfaces remain active.
- The external device that generates and checks the test signal at the local LTU can be connected through one of the backplane data highways, but more often the connection is made through the cascade interface.

Remote Loop checks the local LTU's circuits, a portion of the remote unit, and the T1 line. Error detection and reporting is the responsibility of the external device that supplies the test signal.

To initiate a Remote Loop test from the front panel, press the RT switch briefly. Once started, the test remains in effect until the RT switch is pressed a second time.

An SNMP controller can command an open ended Remote Loop test. A second command is then required to end the loopback. The controller can also command the test on a timed basis so that it terminates after a specified duration without a second command from the controller.

A Remote Loop test is terminated by the LTU transmitting a loop down code for five seconds. The code causes the remote unit to release the loopback.

The test is available as a `Test` selection from the terminal interface Diagnostics screen: `Remote Loopback`.

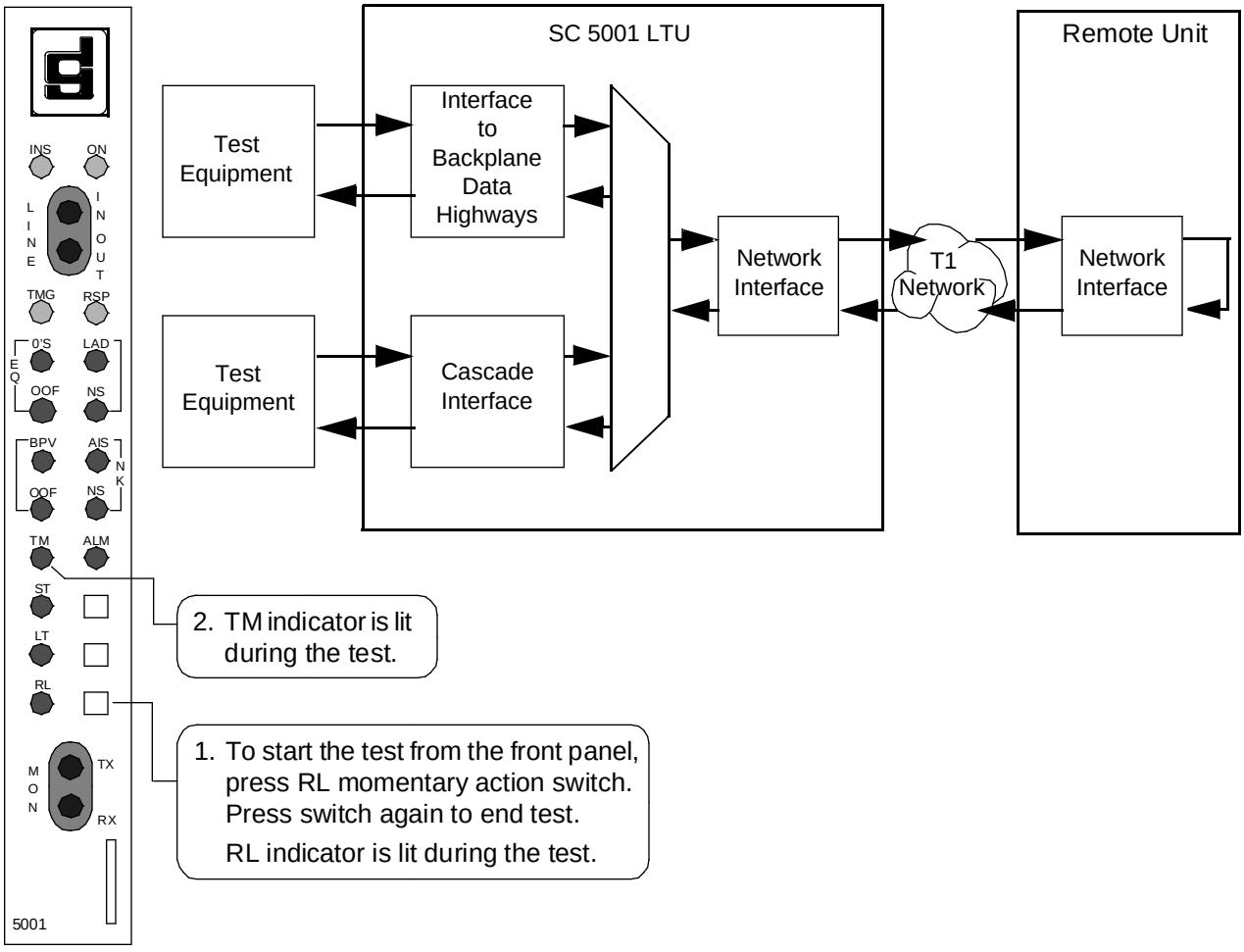


Figure 6-9 Remote Loop

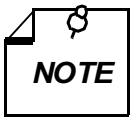
Remote Loop with Self Test

The LTU can be commanded to perform a Remote Loop with Self Test by means of its front panel Remote Test (RT) and Self Test (ST) switches, by a command from an SNMP controller, or by a command from the terminal interface. The test procedure involves two functions:

- Remote Loop — the LTU transmits the in-band loop-up command to the remote LTU or CSU. The remote unit responds to the command by performing either a payload loopback or a line loopback (as determined by its configuration) and loops the receive signal back to its transmit path.
- Self-Test — the LTU enables its internal Test Pattern Generator to provide the signal for the Remote Loop and enables its Test Pattern Checker to verify the signal. The LTU is isolated from the backplane data channels while the Test Pattern Generator and Checker are enabled.

The RL, ST, and TM indicators are On during the test. The Test Mode (TM) indicator remains On as long as the test pattern is received without errors and blinks when an error is detected.

When commanded from the front panel the test, once started, remains in effect until the ST and RL switches are pressed a second time.



The Remote Loop function only operates when the LTU's entire T1 payload is directed to a single remote unit. It will not function when individual DS0s are directed to different destinations.

The test is available from the terminal interface Diagnostics screen by combining the `Test` selection `Remote Loopback` with a `Test Pattern` selection.

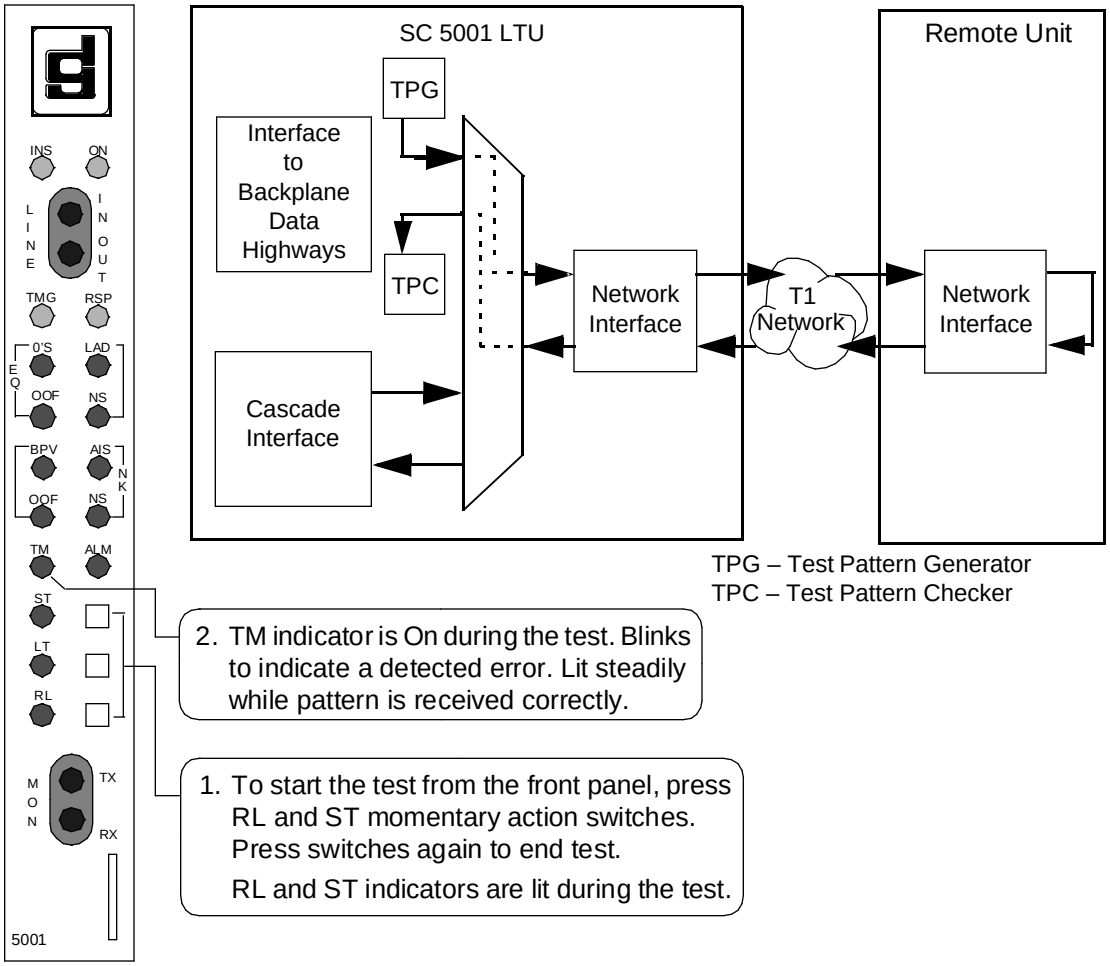


Figure 6-10 Remote Loop with Self-Test

End-to-End Test

To initiate an End-to-End Test the Self-Test (ST) switch has to be activated at both ends of the link. When that is done, each unit transmits the signal from its test pattern generator over the network to the unit at the far end. The unit receiving the test pattern checks it for errors.

The ST and TM indicators are On during the test. The Test Mode (TM) indicator remains On as long as the test pattern is received without errors and blinks when an error is detected.

In addition to performing this test with another SC 5001 LTU, the SC 5001 LTU can perform this test with an NMS 553D DSU, an NMS 553C CSU, an SNMP 553 SD DSU, or an SNMP 553 SC CSU at the far end of the link.

Once started, the test remains in effect until the ST switches are pressed a second time.

The test is available from the terminal interface Diagnostics screen by combining the `Self Test` selection with a `Test Pattern` selection.

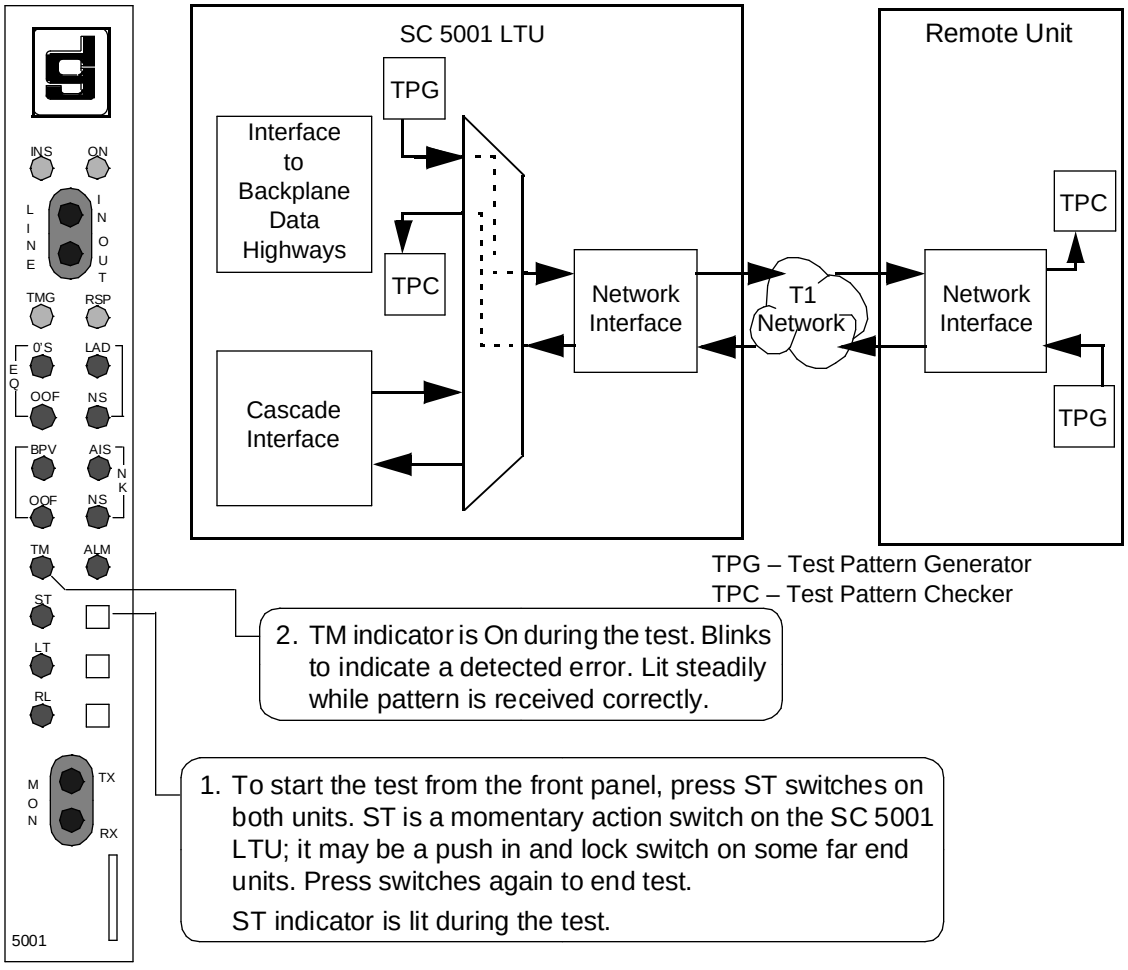


Figure 6-11 End-to-End Test

Network Loopback

The LTU can be commanded to perform a Network Loopback test by a command from an SNMP controller or from the terminal interface Diagnostics screen. In a Network Loopback test the LTU transmits a command that places its Telco interface to the T1 line in loopback.

When commanded from an SNMP controller the Network Loopback test always includes self test so that the LTU generates and transmits a test pattern that loops back at the Telco interface to be checked for errors when it is received back at the LTU.

When commanded from the terminal interface the Network Loopback test can be commanded by itself, with a test signal provided by external equipment, or the `Test` selection `Network Loopback` can be combined with a `Test Pattern` selection.

Figure 6-12 illustrates the data path for Network Loopback Test, and *Figure 6-13* illustrates the data path for Network Loopback Test with Self Test.

Errors that are detected by this test may be occurring either in the LTU or in the connection between it and the Telco interface.

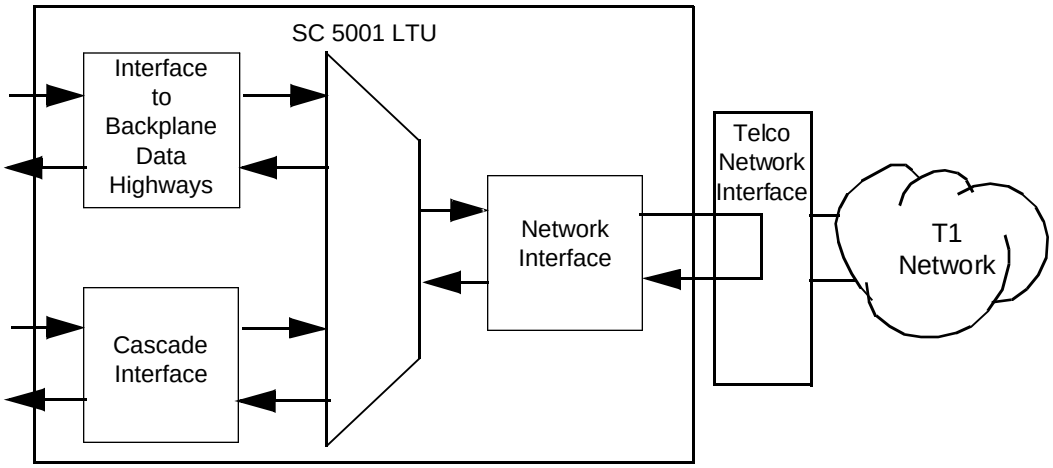


Figure 6-12 Network Loopback Test

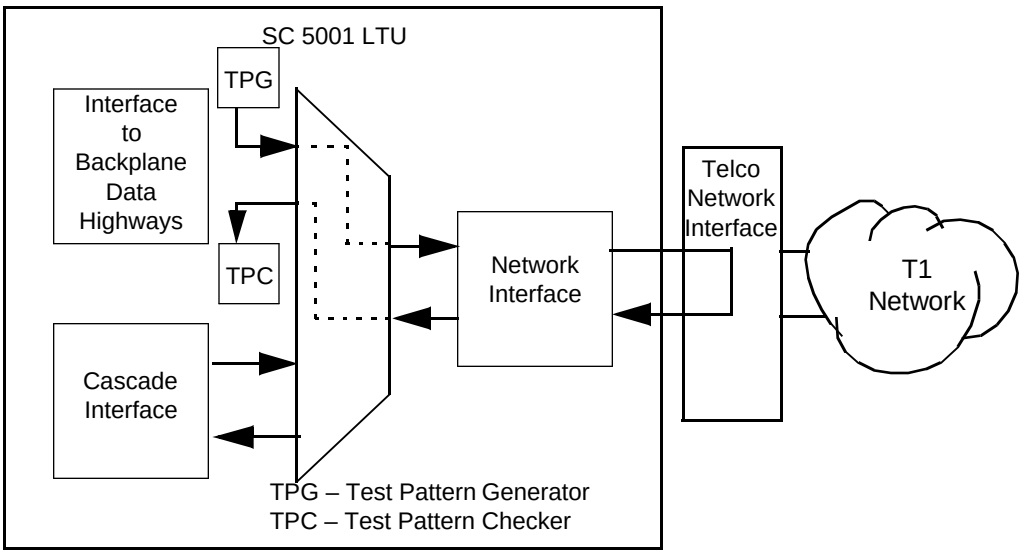


Figure 6-13 Network Loopback Test with Self Test

DS1 Receive Level

The LTU can be commanded to perform a Receive Level measurement by a command from an SNMP controller or from the terminal interface Diagnostics screen. The LTU measures the strength of the signal it is receiving on the T1 line. The measured receive level, in dBm, appears when the test is complete.

The test is available as a `Test` selection from the terminal interface Diagnostics screen: `Receive Level`.

7 Alarms and Status History

Overview

The SC 5001 LTU monitors for alarm conditions, and reports them to its SNMP controller.

Alarms from the LTU are divided into three categories. The Major Alarm and Minor Alarm categories are determined by which of two signal leads they activate on the SpectraComm Shelf backplane. LTU alarms are identified in the category "Other" if they don't put out a signal on either of those leads.

Most alarm conditions cause the LTU to generate an alarm each time the specified alarm event occurs, but the LTU generates some alarms on the basis of window/threshold criteria. The LTU does not generate an alarm governed by a window and a threshold until a specified number of alarm events (the threshold) occurs within a specified time span (the window).

Table 7-1 lists the alarms that the SC 5001 LTU can generate. The table identifies each alarm's category, and identifies the ones that are subject to window/threshold criteria. Some alarms cause a front panel LED to light when the alarm is generated. The table gives the name of the associated LED for each of those alarms.

The table is followed by definitions of the alarms.

Table 7-1. Alarms

Name	Category	Window/ Threshold?	LED Name
Network LOS	Major	No	NK NS
Network OOF	Major	No	NK OOF
Network AIS	Major	No	NK AIS
Network Received Yellow	Minor	No	N/A
Network Excessive Zeros	Minor	No	EQ 0's
Network LAD	Minor	No	EQ LAD
Network BPV	Minor	Yes	NK BPV
Network CRC	Minor	Yes	N/A
Network CSS	Minor	No	N/A
Network USS	Major	No	N/A
Cascade LOS	Major	No	EQ NS
Cascade OOF	Major	No	EQ OOF
Cascade AIS	Major	No	N/A
Cascade Received Yellow	Minor	No	N/A
Cascade BPV	Minor	Yes	N/A
Cascade CRC	Minor	Yes	N/A
Cascade CSS	Minor	No	N/A
Cascade USS	Major	No	N/A
Timing Loss	Major	No	N/A
Status Change	Other	No	N/A
Unit Failure	Major	No	N/A
EE Corrupt	Major	No	N/A
Power-Up	Other	No	N/A
Unsolicited Test	Other	No	N/A
Loss of MBI Lock	Other	No	N/A
Power Fail	Other	No	N/A

Major Alarms

Out Of Frame

An Out Of Frame (OOF) alarm event occurs when the LTU misses two out of four T1 framing bits. The LTU supports two OOF alarms, one for the network interface and one for the cascade interface. The count for an OOF alarm increments by one each time framing is lost, regardless of the number of frames affected.

Each type of OOF alarm is associated with a front panel LED. The NK OOF indicator reflects the current status of LTU-to-network synchronization. The EQ OOF indicator reflects the current status of LTU-to-cascade equipment synchronization.

Loss Of Signal

A Loss of Signal (LOS) alarm event occurs when the LTU senses an absence of T1 signal. The LTU supports two LOS alarms, one for the network interface and one for the cascade interface. The absence of signal for a time equivalent to 175 bits (± 75) is considered no signal.

Each type of LOS alarm is associated with a front panel No Signal (NS) LED. The NK NS indicator reflects the current signal status of the LTU's network interface. The EQ LOS indicator reflects the current signal status of the LTU's cascade interface.

Alarm Indication Signal

An Alarm Indication Signal (AIS) alarm event occurs when the LTU receives an AIS at one of its T1 interfaces. The LTU supports two AIS alarms, one for the network interface and one for the cascade interface.

The front panel NK AIS indicator reflects whether the DSU is receiving an AIS at the Network Interface.

Unavailable Signal State

An Unavailable Signal State (USS) alarm event occurs when 10 consecutive severely errored seconds occur. It ends when the LTU has processed 10 consecutive seconds of data without the occurrence of a severely errored second. The LTU supports two USS alarms, one for the network interface and one for the cascade interface.

The count for a USS alarm increments by one each time the alarm state occurs, regardless of how long it persists.

Timing Loss

A Timing Loss alarm event occurs when the LTU loses timing from its configured transmit clock source.

An LTU operating in CSU mode will always generate the alarm in response to the alarm event.

An LTU operating in Concentrator mode will only generate a Timing Loss alarm if it is configured to be the source of shelf timing.

Unit Failure

A Unit Failure (Unit Fail) alarm indicates that the LTU has not passed its Power On Self Test. This alarm cannot be masked, it is always transmitted to the SNMP controller.

EE Corrupt

An EE Corrupt alarm indicates that the LTU has computed a checksum for its software configuration that does not match the one it stored when it was configured. The LTU continually tests for this condition. This alarm cannot be masked, it is always transmitted to the SNMP controller.

Minor Alarms

Received Yellow

A Received Yellow alarm event occurs when the LTU receives a Yellow alarm at one of its T1 interfaces. The LTU supports two Received Yellow alarms, one for the network interface and one for the cascade interface.

Network Low Average Density

A Low Average Density (LAD) alarm event occurs when 8(N+1)Restrict is the configured selection for Ones Density and the LTU has to insert ones in the signal it transmits toward the network. The LTU inserts ones when channel data from the DTE contains fewer ones than the Ones Density option requires.

The LAD alarm is only valid when the 8(N+1)Restrict option is selected for Ones Density in the LTU's CSU Configuration. When this alarm is valid the following one, Excessive Zeros, is not. Neither alarm is valid when No Enforcement is the option selected for Ones Density.

The front panel EQ LAD indicator reflects whether or not a LAD alarm condition exists.

Network Excessive Zeros

An Excessive Zeros (XS0's) alarm event occurs when Max 15 Zeros or Max 39 Zeros is the configured selection for Ones Density and the LTU has to insert ones in the signal it transmits toward the network. The selected option determines the threshold for ones insertion and occurrence of this alarm. The LTU inserts ones when channel data from the DTE contains fewer ones than the Ones Density option requires.

The XS0's alarm is only valid when the Max 15 Zeros or Max 39 Zeros option is selected for Ones Density in the LTU's CSU Configuration. When this alarm is valid the preceding one, Low Average Density, is not. Neither alarm is valid when No Enforcement is the option selected for Ones Density.

The front panel EQ 0'S indicator reflects whether or not an Excessive Zeros alarm condition exists.

Bipolar Violations

A Bipolar Violation (BPV) alarm event occurs when the signal the LTU receives at one of its T1 interfaces does not alternate between signal levels as required for Alternate Mark Inversion (AMI) or Bipolar with 8 Zero Substitution (B8ZS) data encoding. The LTU supports two BPV alarms, one for the network interface and one for the cascade interface. A window and threshold can be configured for each BPV alarm condition.

The front panel NK BPV indicator reflects whether or not the network interface is in a BPV alarm condition.

Cyclic Redundancy Checksum

A Cyclic Redundancy Checksum (CRC) error alarm event occurs when ESF framing is in use and the CRC-6 code calculated at the receiving LTU does not match the CRC-6 code calculated by the unit that transmitted the signal. The LTU performs the CRC check on each ESF frame.

The LTU supports two CRC alarms, one for the network interface and one for the cascade interface. A window and threshold can be configured for each CRC alarm condition.

Network Controlled Slip Seconds

A Controlled Slip Seconds (CSS) alarm event occurs when the LTU replicates or deletes a received DS1 frame. An LTU does this when the difference in synchronous timing between itself and the received signal is great enough to exhaust its buffer capacity.

Other Alarms

Status Change

A Status Change (Stat Chng) alarm event occurs each time there is a change to the LTU's configuration.

Power-Up

A Power-Up alarm event occurs each time power to the LTU is turned off and then back on. It also occurs when there is a system reset.

This alarm cannot be masked, it is always transmitted to the SNMP controller.

Unsolicited Test

An Unsolicited Test alarm event occurs when the LTU is commanded into a test mode by any means other than the SNMP controller (in other words, by its front panel switches or by a command from the network).

Loss of MBI Lock

A Loss of MBI Lock alarm event occurs when an LTU operating in Concentrator mode loses its timing reference from the SpectraComm Shelf backplane.

Power Fail

A Power Fail alarm event occurs when one or more of an LTU's operating voltages falls below its designated level.

A Technical Characteristics

Item	Characteristic
Physical	
PC card assembly	
Height	0.81 in. (2.1 cm)
Width	7.0 in. (17.8 cm)
Depth	9.5 in. (24.1 cm)
Weight	10 oz. (0.28 kg)
Shipping weight	1 lb. 10 oz. (0.74 kg)
Environmental	
Temperature	
Operating	32° to 122°F (0° to 50°C) (derate by 1°C/1000 ft above sea level)
Non-operating	SpectraComm Shelf: –40° to 185°F (–40° to 85°C)
	10 Pak Enclosure: –40° to 158°F (–40° to 70°C)
Humidity, operating	5% to 95%, without condensation
Altitude	
Operating	0 to 10,000 ft (0 to 3,048 m)
Non-operating	0 to 40,000 ft (0 to 12,192 m)
Electrical	
Power requirements	
Voltage	99 to 129 V ac
Frequency	60 Hz
Power dissipation	5 W maximum +5V, 1 W maximum ±12V
Communication line	T1 digital carrier (non-loaded, staggered-twist ABAM, PIC, or pulp-insulated exchange-type cable, 19 to 26 gauge)
Line impedance	100¾
Network port physical interface	RJ48C modular jack

(Continued on following page)

Item	Characteristic
Electrical (Cont.)	
Network transmitter	
Frequency	1,544,000 bps ± 50 bps
Pulse amplitude — with surge protection	2.40 to 3.60 V at 60°F — may vary over a cycle of 60 Hz current.
Unbalance in height of adjacent negative and positive pulses	200 mV (maximum)
Width of output pulse (half amplitude)	324 nsec ± 45 nsec
Unbalance in width of positive and negative pulses	20 nsec (maximum)
Time between consecutive pulses of opposite polarity	648 nsec ± 15 nsec (measured at half amplitude point of leading edges)
Maximum rise or falling time	100 nsec
Overshoot at trailing edge of pulse	10% to 30% of pulse amplitude
Line Build-Out	0, 7.5, or 15 dB (selectable or automatic) at 772 kHz
Timing source	Internal clock, network timing, shelf timing, station clock, cascade timing
Network receiver	
Operating range	0 to 36 dB of cable loss at 772 kHz (relative to 3.0V launch pulse
Input impedance	100¾
Jitter tolerance	Conforms to specifications defined in AT&T PUB 62411, December 1988
Longitudinal balance	35 dB from 50 to 1500 kHz
Transmitter	
Pre-equalization	0 to 655 feet of line length
Impedance	100¾
Alarms and status conditions	Out of Frame (OOF), Alarm Indication Signal (AIS or Blue alarm), Loss of Signal (LOS)
Diagnostics	DS-1 line loopback, DS-1 payload loopback, DS-1 local test, DS-0 loopback, DSX-1 digital loopback, Remote loop, Network Interface Loopback, Self-Test, DS0 Delay Measurement Test. Front panel Self Test, Local Test, and Remote Loop switches Front panel test jacks for DS-1 access

B MIB Support

Overview

This appendix details the Management Information Base (MIB) table objects by which an SNMP controller can command and monitor the SC 5001 LTU.

In addition to the tables that comprise the standard RFC1406 MIB the LTU also makes use of a number of GDC proprietary MIB tables. The names of MIB objects in these tables all begin with the prefix gdc.

Table B-1 DS1 Configuration Table

MIB Object	Syntax	Access	Enumeration	Description
dsx1ValidIntervals	INTEGER (0...96)	read-only		The number of previous intervals for which valid data was collected. The value will be 96 unless the interface was brought on-line within the last 24 hours, in which case the value will be the number of complete 15 minute intervals since the interface has been on-line.
dsx1LineType	INTEGER	read-write	other(1) dsx1ESF(2) dsx1D4(3)	This variable indicates the variety of DS1 Line that is implemented in this circuit. The type of circuit affects the number of bits per second that the circuit can reasonably carry, as well as the interpretation of usage and error statistics. This variable is used in conjunction with the variable gdcDsx1LineTyp in the GDCDSX1.MIB table.
dsx1Line Coding	INTEGER	read-write	dsx1B8ZS (2) dsx1AMI (5)	This variable describes the variety of Zero Code Suppression being used on the link, which in turn affects a number of its characteristics. dsx1B8ZS refers to the use of a specified pattern of normal bits and bipolar violations to replace a sequence of eight zero bits. dsx1AMI refers to a mode in which no zero code suppression is present and the line encoding does not solve the problem directly. In this application, the higher layer must provide data, such as inverting HDLC data, which meets or exceeds the pulse density requirements.

(Continued on following page)

Table B-1 DS1 Configuration Table (Continued)

MIB Object	Syntax	Access	Enumeration	Description
dsx1SendCode	INTEGER	read-write	dsx1SendNo Code(1) dsx1SendQRS (5) dsx1Send511 Pattern(6) dsx1Send3in24 Pattern(7) dsx1SendOther TestPattern(8)	This variable indicates what type of code is being sent across the DS1 interface by the device. The values mean: dsx1SendNoCode — sending looped or normal data. dsx1SendQRS — sending a Quasi-Random Signal (QRS) test pattern. dsx1Send511Pattern — sending a 511 bit fixed test pattern. dsx1Send3in24Pattern — sending a fixed test pattern of 3 bits set in 24. dsx1SendOtherTestPattern — sending a test pattern other than those described by this object. This variable is used in conjunction with the variable gdcDsx1SendCode in the GDCDSX1.MIB table.
dsx1Circuit Identifier	DisplayString (SIZE (0..255))	read-write		This variable contains the transmission vendor's circuit identifier, for the purpose of facilitating troubleshooting.
dsx1Loopback Config	INTEGER	read-write	dsx1NoLoop(1) dsx1Payload Loop(2) dsx1LineLoop (3) dsx1OtherLoop (4)	This variable represents the loopback configuration of the DS1 interface. Agents supporting read/write access should return badValue in response to a requested loopback state that the interface does not support. The values mean: dsx1NoLoop — Not in the loopback state. A device that is not capable of performing a loopback on the interface shall always return this as its value. dsx1PayloadLoop — The received signal at this interface is looped through the device. Typically the received signal is looped back for retransmission after it has passed through the device's framing function. dsx1LineLoop — The received signal at this interface does not go through the device (minimum penetration) but is looped back out. dsx1OtherLoop — Loopbacks that are not defined here.

(Continued on following page)

Table B-1 DS1 Configuration Table (Continued)

MIB Object	Syntax	Access	Enumeration	Description
dsx1LineStatus	INTEGER (1..8191)	read-only		This variable indicates the Line Status of the interface. It contains loopback, failure, received alarm and transmitted alarm information. The dsx1LineStatus is a bit map represented as a sum, therefore, it can represent multiple failures (alarms) and a LoopbackState simultaneously. dsx1NoAlarm should be set if and only if no other flag is set. If the dsx1LoopbackState bit is set, the loopback in effect can be determined from the dsx1LoopbackConfig object. The various bit positions are: 1 dsx1NoAlarm — No Alarm Present 2 dsx1RcvFarEndLOF — Far end LOF (a.k.a., Yellow Alarm) 8 dsx1RcvAIS — Far end sending AIS 32 dsx1LossOfFrame — Near end LOF (a.k.a., Red Alarm) 64 dsx1LossOfSignal — Near end Loss Of Signal 4096 dsx1OtherFailure — Any line status not defined here
dsx1Transmit ClockSource	INTEGER	read-write	loopTiming (1) localTiming (2) throughTiming (3)	This variable is used in conjunction with the gdcDsx1TransmitClockSource variable in the GDCDSX1.MIB table to select the LTU's transmit timing source. loopTiming is equivalent to receive timing; localTiming is internal timing; and throughTiming is cascade timing.
dsx1Fdl	INTEGER	read-write	other(1) dsx1Ansi-T1-403(2) dsx1Att-54016(4) dsx1Fdl-none(8)	This bitmap describes the use of the facilities data link, and is the sum of the capabilities: 'other' indicates that a protocol other than one following is used. 'dsx1Ansi-T1-403' refers to the FDL exchange recommended by ANSI. 'dsx1Att-54016' refers to ESF FDL exchanges. 'dsx1Fdl-none' indicates that the device does not use the FDL.

Table B-2 DS1 Current Table

MIB Object	Syntax	Access	Description
dsx1CurrentESs	Gauge	read-only	The number of Errored Seconds (ESs) encountered by a DS1 interface in the current 15 minute interval.
dsx1Current SESs	Gauge	read-only	The number of Severely Errored Seconds (SESs) encountered by a DS1 interface in the current 15 minute interval.
dsx1Current UASs	Gauge	read-only	The number of Unavailable Seconds (UASs) encountered by a DS1 interface in the current 15 minute interval.
dsx1Current CSSs	Gauge	read-only	The number of Controlled Slip Seconds (CSSs)encountered by a DS1 interface in the current 15 minute interval.
dsx1Current BESs	Gauge	read-only	The number of Bursty Errored Seconds (BESs) encountered by a DS1 interface in the current 15 minute interval.

Table B-3 DSX1 Interval Table

MIB Object	Syntax	Access	Description
dsx1Interval Number	INTEGER (1..96)	read-only	A number between 1 and 96, where 1 is the most recently completed 15 minute interval and 96 is the oldest completed 15 minute interval (assuming that all 96 intervals are valid).
dsx1IntervalESs	Gauge	read-only	The number of Errored Seconds (ESs) encountered by a DS1 interface in one of the previous 96, individual, 15 minute intervals.
dsx1Interval SESs	Gauge	read-only	The number of Severely Errored Seconds (SESs) encountered by a DS1 interface in one of the previous 96, individual, 15 minute intervals.
dsx1Interval UASs	Gauge	read-only	The number of Unavailable Seconds (UASs) encountered by a DS1 interface in one of the previous 96, individual, 15 minute intervals.
dsx1Interval CSSs	Gauge	read-only	The number of Controlled Slip Seconds (CSSs) encountered by a DS1 interface in one of the previous 96, individual, 15 minute intervals.
dsx1Interval BESs	Gauge	read-only	The number of Bursty Errored Seconds (BESs) encountered by a DS1 interface in one of the previous 96, individual, 15 minute intervals.

Table B-4 DS1 Total Table

MIB Object	Syntax	Access	Description
dsx1TotalESs	Gauge	read-only	The number of Errored Seconds (ESs) encountered by a DS1 interface in the previous 24 hour interval.
dsx1TotalSESs	Gauge	read-only	The number of Severely Errored Seconds (SESs) encountered by a DS1 interface in the previous 24 hour interval.
dsx1TotalUASs	Gauge	read-only	The number of Unavailable Seconds (UASs) encountered by a DS1 interface in the previous 24 hour interval.

(Continued on following page)

Table B-4 DS1 Total Table (Continued)

MIB Object	Syntax	Access	Description
dsx1TotalCSSs	Gauge	read-only	The number of Controlled Slip Seconds (CSSs)encountered by a DS1 interface in the previous 24 hour interval.
dsx1TotalBESs	Gauge	read-only	The number of Bursty Errored Seconds (BESs) encountered by a DS1 interface in the previous 24 hour interval.

Table B-5 Version Group Table

MIB Object	Syntax	Access	Description
gdcDsx1System MIBversion	DisplayString (SIZE (5))	read-only	Identifies the version of the MIB. The format of the version is x.yzT, where 'x' identifies the major revision number, 'y' identifies the minor revision number, 'z' identifies the typographical revision, and T identifies the test revision. Acceptable values for the individual revision components are as follows: x: 1 - 9 y: 0 - 9 z: 0 - 9 T: A - Z Upon formal release, no designation for the test revision will be present.
gdcDsx1 Firmware Rev	DisplayString (SIZE (2))	read-only	The version number of the firmware, to allow products to know which revision is installed. Released version numbers are sequenced from A- to Z-, to AA-, to ZZ-. Test versions are numerical, from 01 to 99.

Table B-6 GDC DS1 Maintenance Table

MIB Object	Syntax	Access	Enumeration	Description
gdcDsx1Soft Reset	INTEGER	read-write	reset(1) norm(2)	When this object is set to reset(1) the unit performs a soft reset, whose meaning is specific to the type of unit being managed. The value norm(2) will be returned when the reset is complete. The value norm(2) cannot be set by management.
gdcDsx1Config Mode	INTEGER	read-only		The hardware configuration mode of the unit. A unit may be configured through hardware switches, jumper straps, etc. The value software(2) indicates that the unit is software configurable. The value hardware(1) indicates that some options are hard configured and that software configuration of these options is not permitted. The value hardware(1) cannot be set by management.
gdcDsx1Front Panel	INTEGER	read-write	inhibit(1) enable(2)	This variable controls whether or not the LTU's front panel switches are operational.
gdcDsx1SysUp Time	TimeTicks	read-only		This variable is used to report the elapsed system tick time for conversion to real time at the controller. It is not related to the sysUpTime referenced in MIB-II. Upon power-up of the unit, the elapsed time is cleared. The elapsed time counter rolls over upon reaching the maximum count.
gdcDsx1DefaultInit	INTEGER	read-write	factory Default(1) normal(2)	This is used to allow the NonVolatile Configuration to be set to a factory default state. When this value is set to factoryDefault(1) the unit will perform a reset to make the default configuration take affect. The value normal(2) will be returned when the initialization is complete. The value normal(2) cannot be set by management.
gdcDsx1Reset Stats	INTEGER	read-write	norm(1) reset(9)	Supports the action of soft resetting the dsx1ValidIntervals object. When this object is set to reset(9), then the unit will reset the dsx1ValidIntervals object to zero. The value norm(1) cannot be set by management.

(Continued on following page)

Table B-6 GDC DS1 Maintenance Table (Continued)

MIB Object	Syntax	Access	Enumeration	Description
gdcDsx1Led Status	OCTET STRING (SIZE(3))	read-only		Returns a bitwise snapshot of the front panel LED state. Octet 1 bit 7 - not used bit 6 - ON bit 5 - INSV bit 4 - RSP bit 3 - TMG bit 2 - EQ LAD bit 1 - EQ 0'S bit 0 - EQ NS Octet 2 bit 7 - not used bit 6 - EQ OOF bit 5 - NTWK AIS bit 4 - NTWK BPV bit 3 - NTWK NS bit 2 - NTWK OOF bit 1 - ALM bit 0 - TM Octet 3 bit 7 - not used bit 6 - ST bit 5 - LT bit 4 - RL bit 3 - future use bit 2 - future use bit 1 - future use bit 0 - future use
gdcDsx1Set TransmitClkSrc	INTEGER	read-write	txClkSrc(1) fallBackClk Src(2)	'txClkSrc' indicates that the unit is using the optioned clock source as indicated by the dsx1TransmitClock Source variable in the RFC1406 mib or the gdcDsx1 TransmitClockSource variable in the gdcdsx1 mib. 'fallBackClkSrc' indicates that the unit is using the optioned clock source as indicated by the gdcDsx1Fallback ClockSource variable in the gdcdsx1 mib.
gdcDsx1Csu Mode	INTEGER	read-write	csuMode(1) concentrator Mode(2)	'csuMode' indicates the unit is operating as a T1 channel service unit, with the payload from the network interface connected to the payload of the cascade interface. 'concentratorMode' indicates the unit is operating as a T1 channel service unit with the T1 payloads groomed to cross connect within the shelf and the network and cascade interfaces.
gdcDsx1Circuit Identifier1	DisplayString (SIZE (16))	read-write		Private data storage area for 16 bytes of user specified data.
gdcDsx1Circuit Identifier2	DisplayString (SIZE (16))	read-write		Private data storage area for 16 bytes of user specified data.

Table B-7 GDC DS1 Network Maintenance Table

MIB Object	Syntax	Access	Enumeration	Description
gdcDsx1NetMaint Receive Level	INTEGER (0..43)	read-only		This variable reports the relative network receive level (-40dB to +3dB) when the gdcDsx1InterfaceType is set for ds1(1). The values 0 to 40 equal 0 to -40 dB. The values 41 to 43 equal +1 to +3 dB.
gdcDsx1Net Maint Atten Sense	INTEGER	read-only	positive(1) negative(2)	This variable identifies the sense of the gdcdsx1NetReceiveLevel variable.

Table B-8 GDC DS1 Configuration Table

MIB Object	Syntax	Access	Enumeration	Description
gdcDsx1Line Type	INTEGER	read-write	auto(1) manEsf(2) manD4(3),	This variable indicates the variety of DSX Line implementing this circuit. The type of circuit affects the number of bits per second that the circuit can reasonably carry, as well as the interpretation of usage and error statistics. auto(1) indicates the unit is still determining framing. When gdcDsx1Line Type is set for auto (1) dsx1LineType reads other(1). manEsf(2) indicates manual selection of extended superframe format manD4(3) indicates manual selection of D4 framing format Reference rfc1406 dsx1LineType gdcDsx1Admin FramingMode dsx1Esf(2)manEsf(2) dsx1D4(3)manD4(3) All other values in dsx1LineType are not supported at this time. Default value: manESF (2)

(Continued on following page)

Table B-8 GDC DS1 Configuration Table (Continued)

MIB Object	Syntax	Access	Enumeration	Description
gdcDsx1 Interface Type	INTEGER	read-write	other(1) ds1(2) dsx1(3)	The operating mode of the interface. Setting the value of this object to ds1(2) configures the interface as standard DS1. Setting the value of this object to dsx1(3) configures the interface to operate as a standard cross-connect DSX-1. The value other(1) identifies another interface mode defined elsewhere. This value can never be set by management operation. When this object is set to ds1(2) it interoperates with the gdcDsx1 Preequalization object, and the value of that object does not apply. When this object is set to dsx1(3) it interoperates with the gdcDsx1Admin LineBuildout and gdcDsx1AdminReceive Range objects. The values of the gdcDsx1LineBuildout, gdcDsx1AutoLine Buildout, and gdcDsx1ReceiveRange objects do not apply. The value of the gdcDsx1AutoReceiveRange object is set to disabled(2).
gdcDsx1 Preequalization	INTEGER	read-write	other(1) preeq130(2) preeq260(3) preeq390(4) preeq530(5) preeq655(6) t	Is the preequalization of the transmitter of the interface. (1) another preequalization (2) preequalization for 0 — 130 feet (3) preequalization for 130 — 260 feet (4) preequalization for 260 — 390 feet (5) preequalization for 390 — 530 feet (6) preequalization for 530 — 655 feet The value other(1) identifies another preequalization value which is defined elsewhere. This value can never be set by management operation. This object interoperates with the object gdcDsx1InterfaceType. When the value of gdcDsx1InterfaceType is ds1(2) then this value is not applicable.

(Continued on following page)

Table B-8 GDC DS1 Configuration Table (Continued)

MIB Object	Syntax	Access	Enumeration	Description
gdcDsx1AdminLine Buildout	INTEGER	read-write	auto(1) man00dB(2) man75dB(3) man150dB(4)	This variable is used to set the Transmit Ntwk Build-Out value on the network side and is only valid if the gdcDsx1 InterfaceType is set for ds1(2). The values, in sequence, describe: 'auto' indicates auto detection of receive level to determine the appropriate Ntwk build out without controller intervention. 'man00dB' indicates manual selection of 0.0 dB Transmit Ntwk Build-Out. 'man75dB' indicates manual selection of -7.5 dB Transmit Ntwk Build-Out. 'man150dB' indicates manual selection of -15.0 dB Transmit Ntwk Build-Out. Set/get of auto requires a reading of gdcDsx1OperLineBuildOut to determine the selection of the Transmit Ntwk Build-Out. Caution must be used when setting auto, since only one unit on a link can be in auto at a given time.
gdcDsx1OperLine Buildout	INTEGER	read-only	inProcess(1) tx00dB(2) tx75dB(3) tx150dB(4)	This variable is used to report the current Ntwk build-out setting if the gdc Dsx1InterfaceType is set for ds1(2). inProcess indicates the unit is still determining the Ntwk build out required when the gdcDsx1AdminLine Buildout is set for auto(1). 'tx00dB' indicates the unit is set for 0.0 dB of attenuation when the gdcDsx1 AdminLineBuildout is set for auto(1) or man00dB(2). 'tx75dB' indicates the unit is set for -7.5 dB of attenuation when the gdc Dsx1AdminLineBuildout is set for auto(1) or man75dB(3). 'tx150dB' indicates the unit is set for -15.0 dB of attenuation when the gdc Dsx1AdminLineBuildout is set for auto(1) or man150dB(4).

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Table B-8 GDC DS1 Configuration Table (Continued)

MIB Object	Syntax	Access	Enumeration	Description
gdcDsx1AdminRcv Range	INTEGER	read-write	auto(1) manNorm(2) manExt(3)	This variable is used to set the receiver circuitry for signal recovery ranges when gdcDsx1InterfaceType is set for ds1(2). This function is not supported for gdcDsx1InterfaceType set for dsx1(3). Normal range is considered 0 to -28 dB, and extended range is from -20 to -40 dB relative to a DS-1 launch pulse. The values, in sequence, describe: 'auto' indicates auto selection of receiver range. 'manNorm' indicates manual selection of normal range. 'manExt' indicates manual selection of extended range. Set/get of auto requires a reading of gdcDsx1OperRcvRange to determine the selection of the receiver range. Caution must be used when setting auto, since only one unit on a link can be in auto at a given time.
gdcDsx1Oper RcvRang	INTEGER	read-only	inProcess(1) norm(2) ext(3)	This variable is used to report the current receiver range setting when gdcDsx1InterfaceType is set for ds1(2). 'inProcess' indicates the unit is still determining the required receiver range when the gdcDsx1AdminRcvRange is set for auto(1). 'norm' indicates the receiver is set for normal range when the gdcDsx1 AdminRcvRange is set for auto(1) or manNorm (2). 'ext' indicates the receiver is set for extended range when the gdcDsx1Admin RcvRange is set for auto(1) or manExt (3).

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Table B-8 GDC DS1 Configuration Table (Continued)

MIB Object	Syntax	Access	Enumeration	Description
gdcDsx1Ones Density	INTEGER	read-write	inhibit(1) max15zeros(2) max39zeros(3) restrict8XN plus1(4)	The ones density restriction for the interface. The values of this object define the ones density restriction that is enforced on the interface. The value inhibit(1) indicates that no ones density restriction is enforced. The value max15zeros(2) indicates that a maximum of 15 zeros are transmitted to the network before a one is inserted. The value max39zeros(3) indicates that a maximum of 39 zeros are transmitted to the network before a one is inserted. The value restrict8nX1(4) indicates a minimum of N ones per 8(N+1) bits, where N is in the range 1 to 24.
gdcDsx1Transmit ClockSource	INTEGER	read-write	other(1) station(2) cascade(3) channel(4) composite(5) shelf(6)	Augments the dsx1TransmitClock Source of the DS1 MIB of RFC 1406. This object defines transmit clock sources that are not defined by RFC 1406, but are supported by GDC DS1 interfaces. The value other(1) indicates that the DS1 transmit clock source is defined elsewhere. The other values identify their timing sources as indicated. The value other(1) can never be set by management operation. This object interoperates with the dsx1 TransmitClockSource object. When the dsx1TransmitClockSource is set to loopTiming(1) or localTiming(2), the value of this object reflects other(1). When this object has a value that is not other(1), then the value of the dsx1 TransmitClockSource object reflects throughTiming(3). The value channel(4) interoperates with the gdcDsuChannelTransmit-ClockSource object. When this value is selected, gdcDsuChannelTransmit-ClockSource is set to the appropriate channel of the clock source for multi-channel products.
gdcDsx1 Fallback Clock Source	INTEGER	read-write	other(1) loopTiming(4) cascade(6) localTiming(7) station(8) shelf(9)	Identifies the fallback transmit clock source. The value of other(1) identifies another fallback transmit clock source that is defined elsewhere. The value other(1) cannot be set by management operation.

(Continued on following page)

Table B-8 GDC DS1 Configuration Table (Continued)

MIB Object	Syntax	Access	Enumeration	Description
gdcDsx1AIS Loopdown	INTEGER (4..60)	read-write		When this object has a value between 5 and 60 it represents the duration, in seconds, of continuous AIS signal that will cause a remotely initiated loop-back to be terminated. When this object has the value 4 there is no time limit, and the loop must be terminated by remotely issued in-band loopdown codes.
gdcDsx1Inband LoopCfg	INTEGER	read-write	inhibit(1) payload(2) lineloop(3)	This variable is used to set the In-Band DS1 Loopback Code Detection. 'inhibit' means that in-band loopback codes will be ignored. 'payload' means that a payload loop-back will be done upon recognition of the inband loopback code. 'lineloop' means that a line loopback will be done upon recognition of the inband loopback code.
gdcDsx1 Redundancy	INTEGER	read-write	onLine(1) backUp(2) keepAlive(3)	This variable identifies which unit is the Primary unit and which unit is the Secondary unit. When the value is on-Line(1), then the unit is identified as the Primary unit. When the value is backUp(2), then the unit is identified as the Secondary unit. The value keepAlive(3) indicates that a physical strap is enabled on the unit and that the values of onLine(1) and backUp(2) are ignored. The value kee-pAlive(3) can never be set by network management.

Table B-9 GDC DS1 Diagnostics Table

MIB Object	Syntax	Access	Enumeration	Description
gdcDsx1Send Code	INTEGER	read-write	other(1) sendProg Pattern(2) send2047 pattern(3) sendInband Code(6) sendInband CodeReset(7) sendNetwork Interface Code(8) sendNtwork Interface Resetcode(9) sendDS0Delay Pattern(10)	Augments the dsx1SendCode object from the DS1 MIB of RFC 1406. This object defines other codes that are not defined by dsx1SendCode. The value other(1) cannot be set by management operation. This object and the dsx1SendCode object interoperate. When the value of dsx1 SendCode is set to something other than dsx1SendOtherTestPattern(8), then the value of this object is set to other(1). When the value of this object is set to something other than other(1), the value of dsx1SendCode is set to dsx1Send OtherTestPattern(8). This object and the gdcDsx1Prog Pattern object interrelate. When this object is set to the value sendProgPattern(4), the value of gdcDsx1ProgPattern is used as the 16 bit user programmable pattern.
gdcDsx1 Loopback Config	INTEGER	read-write	other(1) localtest(2) ds0(3) cascade(4)	Augments the dsx1LoopbackConfig object from the DS1 MIB of RFC 1406. This object defines other loopback configurations that are not defined by dsx1LoopbackConfig. The value other(1) cannot be set by management operation.
gdcDsx1DS0 Diag	INTEGER (0...32)	read-write		Defines a DS0 level diagnostic. Setting this object value to 0 disables a DS0 level diagnostic. Setting this object to a value from 1 to 32 enables a DS0 level diagnostic on the DS0 indicated. Enabling a DS0 level diagnostic by setting this object to a value from 1 to 32 alters the meaning of the diagnostic test to be specific to the DS0 specified instead of the whole DS1. Note that a DS0 level diagnostic and a DS1 level diagnostic cannot be performed simultaneously.

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Table B-9 GDC DS1 Diagnostics Table (Continued)

MIB Object	Syntax	Access	Enumeration	Description
gdcDsx1Test Duration	INTEGER	read-write	noLimit(1) testTime1Min(2) testTime2Mins (3) testTime3Mins (4) testTime4Mins (5) testTime5Mins (6) testTime6Mins (7) testTime7Mins (8) testTime8Mins (9) testTime9Mins (10)	Selects the duration to run a diagnostic test. The value(1) noLimit signifies that the test should run indefinitely until explicitly terminated. Default value: noLimit (1)
gdcDsx1Test Execution Status	INTEGER	read-only	notInTest(1) testIn Progress(2) testCompleted (4) testCompleted NotInTest(5)	This variable reports the status of a test. notInTest(1) indicates a test is not running. testInProgress(2) indicates that a test is currently running. testCompleted(4) indicates that a test has run and is completed. testCompletedNotInTest(5) indicates that a test has completed and it is no longer in test.

(Continued on following page)

Table B-9 GDC DS1 Diagnostics Table (Continued)

MIB Object	Syntax	Access	Enumeration	Description
gdcDsx1Test Exceptions	INTEGER (0...7)	read-only		Indicates exceptions that have occurred that may affect interpretation of the test results. The value of this object is a sum that initially takes the value zero. Then, for each exception, the value associated with the exception is added to the sum. The exception values are: value exception 1 a timed test was preempted so the result cannot be viewed in relation to the test duration 2 the results overflowed so the result cannot be viewed as an absolute value 4 the test was performed while synchronization could not be performed, so the result may not be accurate.
gdcDsx1Test Results	INTEGER (0..1048576)	read-only		The results of the last diagnostic test. This can be the current test running or the last completed test. Note that the interpretation of these results may be affected by the value of the gdcDsx1TestExceptions object. The unit of value for this object depends on the type of diagnostic test. For all cases except a DS0 delay measurement, the unit of value for this object is number of errors. For a DS0 delay measurement, the unit of value for this object is milliseconds.

Table B-10 ANSI Performance Table

MIB Object	Syntax	Access	Enumeration	Description
gdcDsx1ANSI CRCerror Events	INTEGER	read-only	noErrors(1) errors1(2) errors2to5(4) errors6to10(8) errors11to100(16) errors101to320(32) errors321or More (64)	Identifies how many error events occurred in the interval this entry represents.
gdcDsx1ANSI severeErrors	INTEGER	read-only	noEvents Detected(1) eventsDetected (2)	Identifies whether or not any severe errors were detected in the interval this entry represents.
gdcDsx1ANSI frameErrors	INTEGER	read-only	noEvents Detected(1) eventsDetected (2)	Identifies whether or not any framing errors were detected in the interval this entry represents.
gdcDsx1ANSI codeViolations	INTEGER	read-only	noEvents Detected(1) eventsDetected (2)	Identifies whether or not any code violations were detected in the interval this entry represents.
gdcDsx1ANSI controlledSlips	INTEGER	read-only	noEvents Detected(1) eventsDetected (2)	Identifies whether or not any controlled slips were detected in the interval this entry represents.
gdcDsx1ANSI activePayload Loops	INTEGER	read-only	noEvents Detected(1) eventsDetected (2)	Identifies whether or not any active payload loops were detected in the interval this entry represents.

Table B-11 ATT Current Performance Table

MIB Object	Syntax	Access	Description
gdcDsx1Current LOFCs	Gauge	read-only	The number of Loss of Frame Counts (LOFCs) encountered by a DS1 interface in the current 15 minute interval.

Table B-12 ATT Interval Performance Table

MIB Object	Syntax	Access	Description
gdcDsx1Interval Number	INTEGER (1...96)	read-only	A number between 1 and 96, where 1 is the most recently completed 15 minute interval and 96 is the oldest completed 15 minutes interval (assuming that all 96 intervals are valid).
gdcDsx1Interva lLOFCs	Gauge	read-only	The number of Loss of Frame Counts (LOFCs) encountered by a DS1 interface in the current 15 minute interval.

Table B-13 ATT Total Performance Table

MIB Object	Syntax	Access	Description
gdcDsx1Total LOFCs	Gauge	read-only	The number of Loss of Frame Counts (LOFCs) encountered by a DS1 interface in the previous 24 hour interval.

Table B-14 GDC DSX-1 Alarm Object Identifier Definitions

Alarm Name	Object Identifier	Maskable?	Applies to	Window/ Threshold?
dsx1NoResponseAlm	dsxAlarmData 1	No	Unit	No
dsx1DiagRxErrAlm	dsxAlarmData 2	No	Unit	No
dsx1PowerUpAlm	dsxAlarmData 3	No	Unit	No
dsx1NvRamCorrupt	dsxAlarmData 4	No	Unit	No
dsx1UnitFailure	dsxAlarmData 5	No	Unit	No
dsx1MbiLock	dsxAlarmData 6	No	Unit	No
dsx1LocalPwrFail	dsxAlarmData 7	No	Unit	No
dsx1TimingLoss	dsxAlarmData 8	Yes	Unit	No
dsx1StatusChange	dsxAlarmData 9	Yes	Unit	No
dsx1UnsoTest	dsxAlarmData 10	Yes	Unit	No
dsx1LossOfSignal	dsxAlarmData 11	Yes	Network & Cascade Interfaces	No
dsx1LossOfFrame	dsxAlarmData 12	Yes	Network & Cascade Interfaces	No
dsx1Ais	dsxAlarmData 13	Yes	Network & Cascade Interfaces	No
dsx1ReceivedYellow	dsxAlarmData 14	Yes	Network & Cascade Interfaces	No
dsx1UnavailSignalState	dsxAlarmData 15	Yes	Network & Cascade Interfaces	No
dsx1ExcessiveZeros	dsxAlarmData 16	Yes	Network Interface only	No
dsx1LowAverageDensity	dsxAlarmData 17	Yes	Network Interface only	No
dsx1ControlledSlips	dsxAlarmData 18	Yes	Network Interface only	No
dsx1BipolarViolations	dsxAlarmData 19	Yes	Network & Cascade Interfaces	Yes
dsx1CrcErrors	dsxAlarmData 20	Yes	Network & Cascade Interfaces	Yes

Table B-15 GDC DSX-1 Alarm Configuration Table

MIB Object	Syntax	Access	Enumeration	Description
gdcDsx1Alarm CountWindow	INTEGER	read-write	disabled(1) last1sec(2) last1min(3) last1hr(4) infinite(5)	This variable sets/reads the BPV alarm window. This window is used with the alarm threshold to determine how long the alarm should be active before it is reported. Default: disabled(1)
gdcDsx1Alarm CountThreshold	INTEGER	read-write	thresGT10(1) thresGT100(2) thresGT1000 (3) thresGT10000 (4)	This function sets/reads the BPV alarm threshold criteria. This threshold is used along with the alarm window to determine the number of instances in a given time frame for an alarm to occur before the alarm is considered active. Default: thresGT10(1) — greater than 10

Table B-16 GDC DSX-1 Alarm Status Table

MIB Object	Syntax	Access	Description
gdcDsx1Alarm Count	Gauge	read-only	The number of occurrences of this alarm. This object's value is incremented once for each time that the alarm occurs. The count is incremented regardless of whether or not the alarm is masked, or not reported because of threshold configuration. If the network element type does not support this variable, a noSuch will be returned.
gdcDsx1AlarmFirst Occurrence	TimeTicks	read-only	Time at which the alarm first occurred, reported as the number of TimeTicks after the interface was initialized. This can be used along with its companion object, gdcDsx1 AlarmLastOccurrence, to provide greater meaning to the value of gdcDsx1AlarmOccurrenceCount by weighing the count over the period of time. If the network element type does not support this variable, a noSuch will be returned.
gdcDsx1AlarmLast Occurrence	TimeTicks	read-only	Time at which the alarm last occurred, reported as the number of TimeTicks after the interface was initialized. This can be used along with its companion object, gdcDsx1 AlarmFirstOccurrence, to provide greater meaning to the value of gdcDsx1AlarmOccurrenceCount by weighing the count over the period of time. If the network element type does not support this variable, a noSuch will be returned.

Table B-17 GDC SC 5000 Timing Table

MIB Object	Syntax	Access	Enumeration	Description
gdcSc5000Src ShelfTiming	INTEGER	read-write	inhibit(1) fourMegClk(2) eightKiloClk(3) fourMegAnd8k Clk(4))	Identifies which unit or units are the source of shelf timing (fourMegClk) and system timing (eightKiloClk), defined as follows: If one unit is defined as fourMegClk(2) then only one other unit may be defined as eightKiloClk(3), and the remaining units must be defined as inhibit(1). If one unit is defined as eightKilo-Clk(3) then only one other unit may be defined as fourMegClk(2), and the remaining units must be defined as inhibit(1). If one unit is defined as fourMegAnd8k Clk(4) then all the remaining units must be defined as inhibit(1).

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General DataComm