

GDC 076R112-000  
Issue 2 - December 1997

**Installation and Operation**

# **SpectraComm 5002**

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**E1 Line Terminating Unit**

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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.

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# Preface

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## Scope

This manual describes how to install a General DataComm SC 5002 Line Terminating Unit.

## Revision History

This is Issue 2 of the manual. It has been updated to reflect the addition of AT command functionality and firmware downloading.

## Organization

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

- *Chapter 1 - Introduction* briefly describes the SC 5002 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 LTU front panel indicators and the use of the AT command set for controlling the LTU. AT command functions include downloading new operating firmware to the unit.
- *Chapter 4 - Timing* explains the various transmit timing sources that are available to the LTU.
- *Chapter 5 -Diagnostics* describes the test functions built into the LTU.
- *Chapter 6 - Alarms* 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.

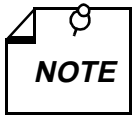
**Level 2** paragraph headers introduce subsections of major topics.

**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 5034 Data Set Emulator Installation and Operation*GDC 076R106-000

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.

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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.

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## 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.

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Installieren Sie nie die Telefonleitungen während eines Gewitters. Installieren Sie nie die Telefonbuchsen in einem feuchten Raum es sei denn die Buchs ist spezielle für Feuchträume vorgesehen. Berühren sie nie unisolierte 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 den Anwender zu wartende Teile im Gerät. Wartung darf nur durch qualifiziertes 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 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 device that can be installed as a standalone unit at a remote site. An SC 5034 DSE, for example, is compatible with a remote V.34 modem.

### Line Terminating Unit

Term for the unit in the SpectraComm 5000 system that provides network interface functions. The SC 5002 LTU connects to an E1 network; an SC 5001 LTU connects to a T1 network.



# 1 Introduction

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## Overview

This manual contains instructions for installing the SC 5002 LTU and placing it into service. The manual is divided into six chapters:

*Chapter 1, Introduction*, describes the LTU, including the options that are available for it, and lists the cables required for its installation.

*Chapter 2, Installation*, provides directions for installing the LTU in a shelf and making its required cable connections.

*Chapter 3, Front Panel Operation*, describes the LTU front panel indicators.

*Chapter 4, Timing*, describes the transmit timing arrangements the LTU can employ.

*Chapter 5, Diagnostics*, contains directions for testing the LTU and for interpreting the results of those tests.

*Chapter 6, Alarms*, identifies the fault conditions the LTU can detect and report.

In addition, the manual includes appendices:

- technical characteristics
- MIB table descriptions

The SC 5002 LTU is part of General DataComm's SpectraComm family of products and is intended to be used under the direction of an SNMP controller. Consult the controller documentation for more extensive operation and testing instructions.

## SC 5002 LTU Features

General DataComm's SC 5002 Line Termination Unit (LTU) is a highly efficient means of transmitting and receiving digital data over a E1 line supplied by a telephone company or other service provider. The SC 5002 LTU:

- Provides interface to E1 or Fractional E1 services.
- Connects, through the SpectraComm Shelf backplane, with up to 30 Data Set Emulator (DSE) cards in two shelves. DSE cards provide business equipment interface functions for data transmitted and received by the LTU.
- Functions fully under Simple Network Management Protocol (SNMP) network management. Local communication with a controller takes place through a shelf-resident SpectraComm Manager (SCM) card.
- Supports Time Slot 16 CAS signalling for operation in an MFC R2 network.
- Permits configuration of network transmitter timing from a variety of sources:
  - Network (Loop) timing
  - Shelf timing

Internal (Local) clock

- Supports HDB3 signalling.
- Provides user-selectable input impedance: 75 or 120 Ohms.

## Description

The SC 5002 LTU is intended to be co-located in a SpectraComm shelf or shelves with up to 30 DSEs. It provides the interface between the DSEs and an E1 digital carrier facility provided by the Telephone Company. The LTU performs the Channel Service Unit (CSU) functions of network interfacing and protection. The SC 5002 LTU is ideal for medium-sized, low-channel-density networks.

The SC 5002 LTU supports comprehensive, nonintrusive network management capabilities, operating in conjunction with an SNMP controller. The LTU is software controllable so that an operator at a central site can configure its options by means of SNMP. Diagnostic testing performed through SNMP requires no intervention by personnel at remote sites.

The SC 5002 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.

**Table 1-1** Equipment List

<b>Description</b>	<b>GDC Part No.</b>
GDC SC 5002 LTU	076P002-001
<b>Shelves</b>	
<b>Description</b>	<b>GDC Part No.</b>
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 3 (220/240 V ac, international) Includes two 8-slot, dual RJ48 Zone 1 connector panels	010M056-001
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.	
<b>Connector Panels</b>	
<b>Description</b>	<b>GDC Part No.</b>
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
<b>Cables</b>	
<b>Description</b>	<b>GDC Part No.</b>
Interface cable, RJ48C plug-to-plug (LTU network port to E1 line), 10 to 50 ft lengths	022H024-xxx
Connector adapter, RJ45 to dual 75 Ohm BNC jacks	209-044-001
<b>Manuals</b>	
<b>Description</b>	<b>GDC Part No.</b>
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

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## Overview

This chapter describes the installation of the SC 5002 LTU.

The SC 5002 LTU is shipped pre-assembled, tested, and ready to use. The normal procedure after unpacking the unit is to set the appropriate line impedance and insert it in its intended shelf slot. You may then proceed to make the cable connections the LTU requires.

The SC 5002 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).

Material on option selections is included in *Appendix C*, primarily for your information. Review it if you want to check the option settings and understand the process of installing and using the SC 5002 LTU in your communication network.

## 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 together by three cables to enable a total of 32 card slots to function as though connected to the same backplane. The SC 5002 LTU can be installed in any card slot when it is being used with an SCM card and an SNMP controller such as the GDC TEAM 5002 application. When the SC 5002 LTU and its associated data set emulators are to be commanded entirely by AT commands the LTU must be installed in slot 16.

For detailed information on the SpectraComm Shelf, consult GDC Publication 010R302-000.

The shelf 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 30 DSE cards. The application determines the exact selection of pc cards to be installed in a shelf. An LTU can be combined with 30 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 15 DSE cards when each DSE is providing a 128 Kbps channel.

*Figure 2-1* shows the shelf back panel. In Zone 1 the back panel provides two RJ48 connectors for each shelf slot. An SC 5002 LTU employs the upper RJ48 connector for its slot as the network interface by which it can be connected to an E1 line supplied by the Telephone Company. When the LTU is operated by means of AT commands it employs the DB 25 connector in Zone 3 as the port for those commands.

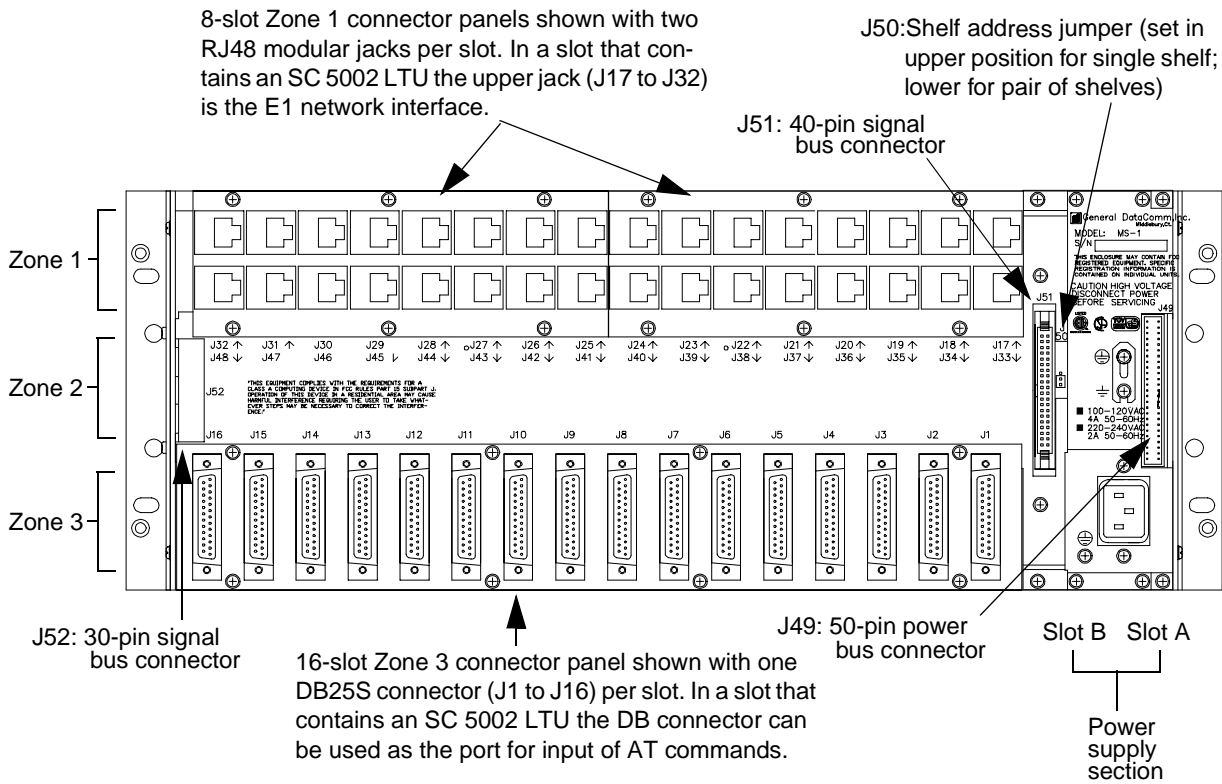


Figure 2-1 SpectraComm Shelf Back Panel

## Unpacking and Handling

The SC 5002 LTU is shipped in packing material that is enclosed in a corrugated box. Inspect the SC 5002 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 5002 LTU.

## Preoperational Check

Before you connect the SC 5002 LTU to the network, make sure that the 75/120 Ohm jumper selection is properly set (see Figure 2-2).

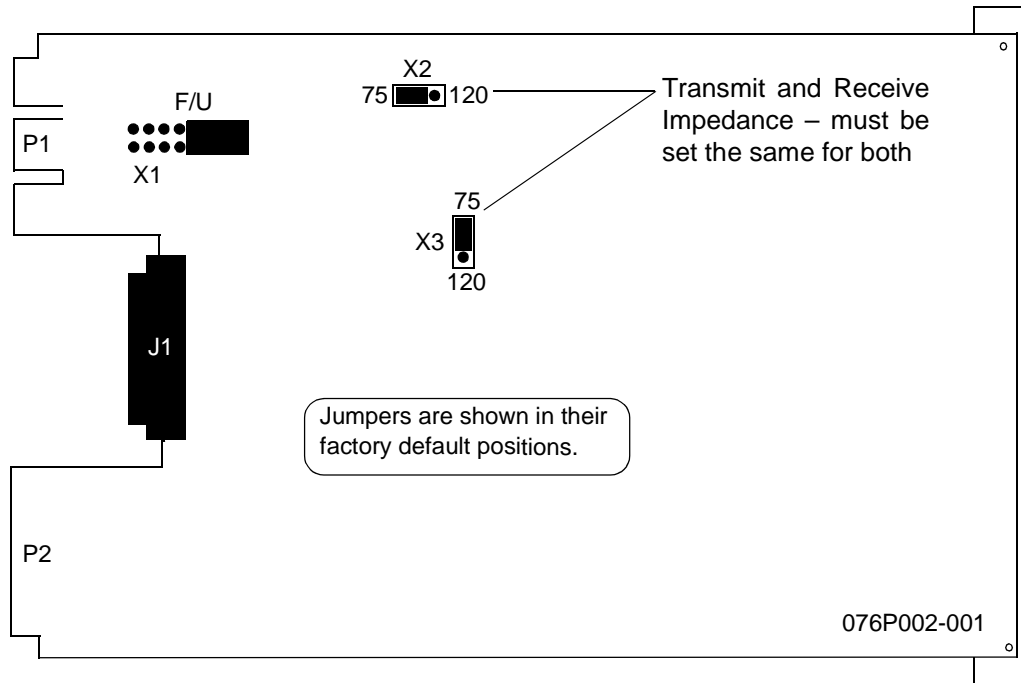
You can use the TEAM 5002 application to perform a Unit Test once the LTU is installed in the shelf.

If the SC 5002 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).

## Network Connection

The back panel of the SpectraComm Shelf has 16 RJ48C jacks, labeled **J17** through **J32**, for connections to a Telephone Company-provided E1 network. J17 corresponds to shelf slot 1 and J32 corresponds to shelf slot 16, as shown in *Figure 2-1*.

Connect the SC 5002 LTU to the network by means of the jack for its slot as described below. Refer to *Table 1-1* for the appropriate interface cable.



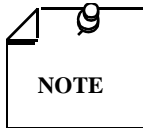
**Figure 2-2** SC 5002 PC Card, with Option Settings

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.		

## 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 LTU 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 5002 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 5002 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 E1 network.

Although the network clock is the preferred timing source, the SC 5002 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 5002 LTU timing options.



# 3 Operation

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## Overview

This chapter contains the following information:

- Descriptions of SC 5002 LTU front panel functions
- Instructions for using AT commands to control the LTU, including the downloading of new firmware to the LTU in the AT command environment

Front panel functions are limited to indicator displays. The information concerning the front panel applies to the LTU in any of its applications.

The LTU can be configured and controlled in two ways: by a Simple Network Management Protocol (SNMP) controller, or by an AT (Attention) command set.

A Simple Network Management Protocol (SNMP) controller, which communicates with the LTU through a SpectraComm Manager (SCM) card installed in the shelf with the LTU, provides capabilities for:

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

Consult the manual for your SNMP controller for detailed instructions on the use of its functions. This manual limits itself to providing information specific to the SC 5002 LTU as a supplement to those instructions.

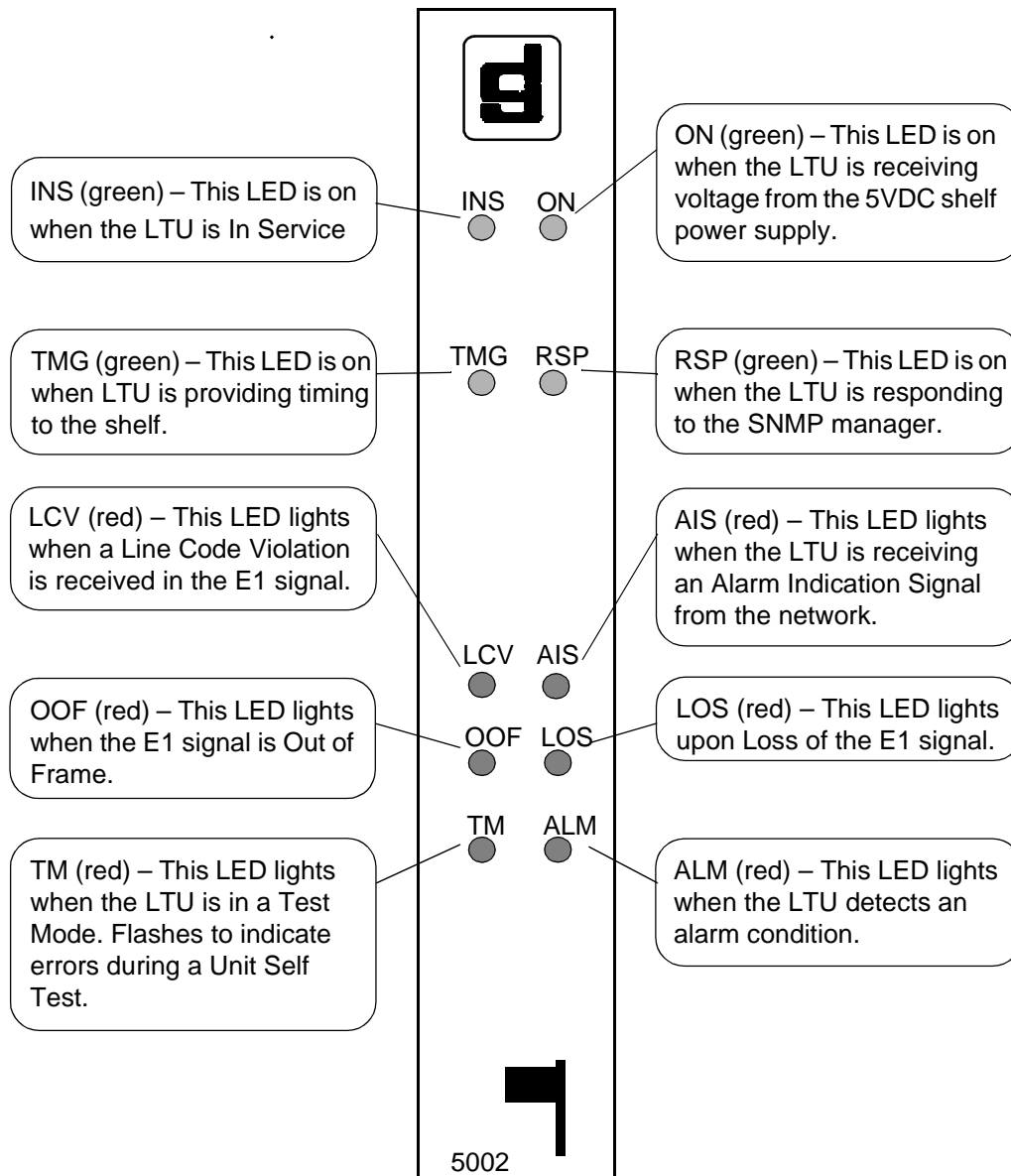
This chapter does contain full instructions for the use of the AT command set with the LTU. AT commands are used most often in the RLN system application, in which the commands are directed to the unit through the RLN Access Server by means of the Attachmate RLN Server software. An SCM card cannot be present in the shelf that contains an RLN system, hence the need for a control method that does not involve the SCM.

AT commands can also be input to the LTU from a VT100-compatible terminal or a PC running a terminal emulation program. The VT100-compatible device has to be connected to the LTU at the Zone 3 DB25 connector for its shelf slot.

*Chapter 4, Timing Options*, discusses how timing arrangements affect network performance.

## 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 rear panel of the shelf is illustrated in *Chapter 2, Figure 2-1*.



**Figure 3-1** SC 5002 Front Panel Indicators

## AT Commands

The LTU accepts AT commands in the form of an initialization string from an RLN manager or in the form of a command line from a terminal. The RLN application is the principle use of the AT command functionality; the use of a VT100-compatible terminal or terminal emulation program is supported but less common.

Each initialization string or command line must begin 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 # and a letter to identify the option. Most commands follow the letter with one or more characters that specify a setting.

The AT commands divide into four categories:

Configuration Commands:	#B	Primary Timing
	#D	CRC4 Signalling
	#R	Group Interface Configuration
Functional Commands:	#A	Operational Status
	#S	Interface Configuration
Display Commands:	\$	Command Listing and Help
	#W or \$W	Display Configuration
Special Function Command:	#Y	Firmware Download

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.

## Configuration Commands

The configuration commands establish fixed operating parameters controlling how the LTU performs its functions.

### Primary Timing

This option selects the LTU timing source for transmissions on the E1 line. Internal selects timing by the LTU internal clock. Network selects timing derived from the incoming E1 signal.

**Options:**Internal (#B0)

Network (#B1)



*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 5002 application software.*

## E1 Signalling Model

This option selects whether or not the LTU is to calculate a cyclic redundancy checksum for each frame of data, to be transmitted with the data.

**Options:** With CRC4 (#D0)  
Without CRC4 (#D1)

## Group Interface Configuration

This option 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 E1 line at the network interface.

When the LTU is part of a SpectraComm 5000 system this functionality resides in the SCM card. You can use an SNMP controller to configure it as part of the TEAM Core software. When the LTU is part of an RLN system the Group Interface Configuration functionality resides in the LTU and must be configured by means of AT commands.

The AT command for Group Interface Configuration is **#R**. It takes three setting parameters in the format:

#R $x$ : $yy$ - $zz$

where

$x$  is the data highway number: 1, 2, 3, or 4

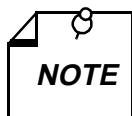
: is a divider

$yy$  is the starting data highway timeslot: 01 – 15, 17 – 31

- is a divider

$zz$  is the number of data highway timeslots: 01 – 30

The LTU transfers data from the group of timeslots you identify with this command into the corresponding DS0s of the E1 line connected to the network interface. For example, the command `AT#R2:05-20` assigns the LTU to use 20 timeslots, starting with timeslot 5, from backplane data highway 2. The timeslots it uses are 5 – 15 and 17 – 25.



*When you configure timeslots/DS0s with this command, the sum of  $yy + zz$  must not exceed 30. A group of timeslots and the corresponding group of DS0s cannot "wrap around" at 31 and begin again at 01. When this command matches Timeslots to DS0s Timeslot/DS0 16 is automatically skipped.*

## Functional Commands

The two functional AT commands perform operational control (as opposed to configuration) functions. Their purpose is to control immediate aspects of the LTU's operation.

### Interface Configuration

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

*#Snnx*

where

*nn* is a two-digit DS0 number from 01 to 15, or 17 to 31 (00 and 16 are not available for user data)

*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 = Busy Out

F = 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.

### Operational Status

The AT command Operational Status, **#A**, enables you to command the LTU in and out of service.

**Options:**LTU out of service (**#A0**)

LTU in service (**#A1**)

## Display Commands

The two display commands enable you to have the LTU provide information about the command set and about current settings in the unit.

### Help

When 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 configuration options.

To display the full AT command set for the SC 5002 LTU:

type AT\$ and press the Enter key

The result is an on-screen display that lists 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.

## Display Configuration

To display the current settings for configuration options:

type AT#W or AT\$W and press the Enter key

The result is an on-screen display that lists the names of 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 E1 line connected to LTU's network interface. It consists of the designators 00 through 31, each above a two-letter code.

The two-letter codes represent the following states for the corresponding DS0s:

Hn = carrying DSE data from the corresponding timeslot on the data highway the LTU is using ( $n = 1 - 4$  to identify the data highway)

DA = disabled

BO = busied out

DS0s 00 and 16 are permanently fixed to DA because they are dedicated to E1 network signalling and not available to carry user data.

## Special Function Command – Firmware Download

The SC 5002 LTU card can be downloaded with new operating firmware without being removed from its installed location. The download employs the same DB-25 connector used for AT commands. The card is able to store two sets of firmware and switch between them on command.

GDC may deliver new firmware to be loaded into the card by means of several media: diskette, tape, CD ROM, or on-line TFTP transfer. However the application software file is delivered, you must prepare for the download by copying it onto your computer. Make sure also to copy the Readme file that is supplied with the application software file. Consult the Readme file before performing the download; it contains important information and instructions.

Loading new firmware into the SC 5002 LTU requires the GDC Download General Utility (Part No. 080Z039-201A). The utility is supplied separately. The directory into which you copy the download file must also contain a copy of the download utility. When you copy the utility file to your directory from the diskette on which it is supplied, its name is `dlvfast.exe`.

The download utility runs in the DOS command-line environment. To perform the download, get a DOS prompt on-screen, go to the appropriate directory, and enter `dlvfast`. On-screen prompts lead you through the process once the utility is launched.

There is one AT command, #Yn, associated with the download function. The command can be associated with four values for  $n$ . Three of those values select a download mode for the unit, the other is an action command for switching between active and stored firmware:

#Y0 configures the card not to accept firmware download; when this command is sent to the unit it remains in effect until a #Y1 or #Y3 command is sent

#Y1 configures the card to accept firmware download and store newly the downloaded firmware zipped and inactive until it is put into service by a #Y2 command; when this command is sent to the unit it remains in effect until a #Y0 or #Y3 command is sent

#Y2 is the unzip and execute command that directs the SC 5001 card to unzip (decompress) stored firmware and begin using it as the active operating firmware; this is an action command that is not stored by the card; it can be used to switch back and forth between the two sets of firmware as many times as needed

#Y3 configures the card to accept firmware download, and to automatically unzip the downloaded firmware and put it into service when the download is complete; when this command is sent to the unit it remains in effect until a #Y0 or #Y1 command is sent

# 4 Timing

---

## Overview

This chapter describes aspects of the timing arrangements that are available to the SC 5002 LTU. Timing for the unit divides into two categories:

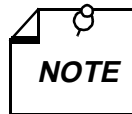
- Transmit timing for data at the network interface
- System timing that coordinates the exchange of data between the cards in the SpectraComm Shelf.

The LTU can be optioned to employ any one of three transmit timing sources:

- network timing
- internal timing
- shelf timing

One LTU per shelf (or pair of shelves) must be 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 the network or its own internal clock.

The three transmit timing sources and system timing are described under individual headings on the following pages.



*Only network timing and internal timing are available when the LTU is installed without an SCM and configured by means of AT commands. Shelf timing cannot be configured in the AT environment.*

## Transmit Timing Options

An LTU may be configured as a primary system clock provider, a secondary system clock provider, or neither. An LTU that is not a clock provider takes its transmit timing from the shelf.

### Network Timing

Network timing is the default selection for LTU transmit timing. The LTU locks its transmit timing to the timing it receives in the E1 signal from the network. This timing arrangement is sometimes called slave timing or wrap timing.

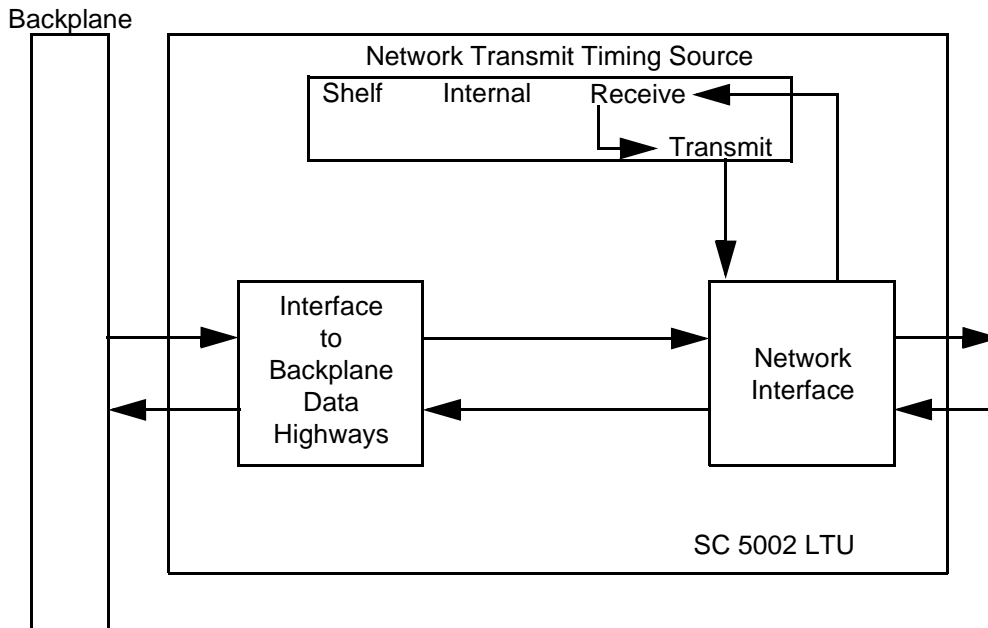


Figure 4-1 Network Timing

### Internal Timing

The LTU can be optioned to time data at its E1 network interface using internal timing. When this option is selected the LTU generates its own 2.048 Mbps clock.

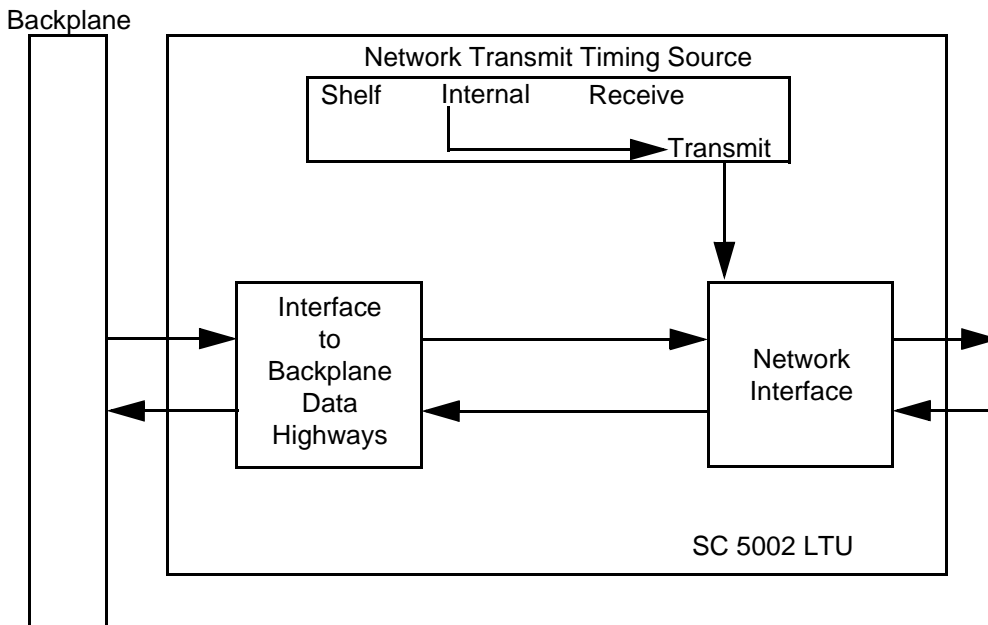


Figure 5-2 Internal Timing



### Shelf Timing

The LTU can be optioned to time data at its E1 network interface using timing it takes from the shelf. When this option is selected there must be another LTU in the shelf (or pair of shelves) configured to provide the timing signal to the backplane.

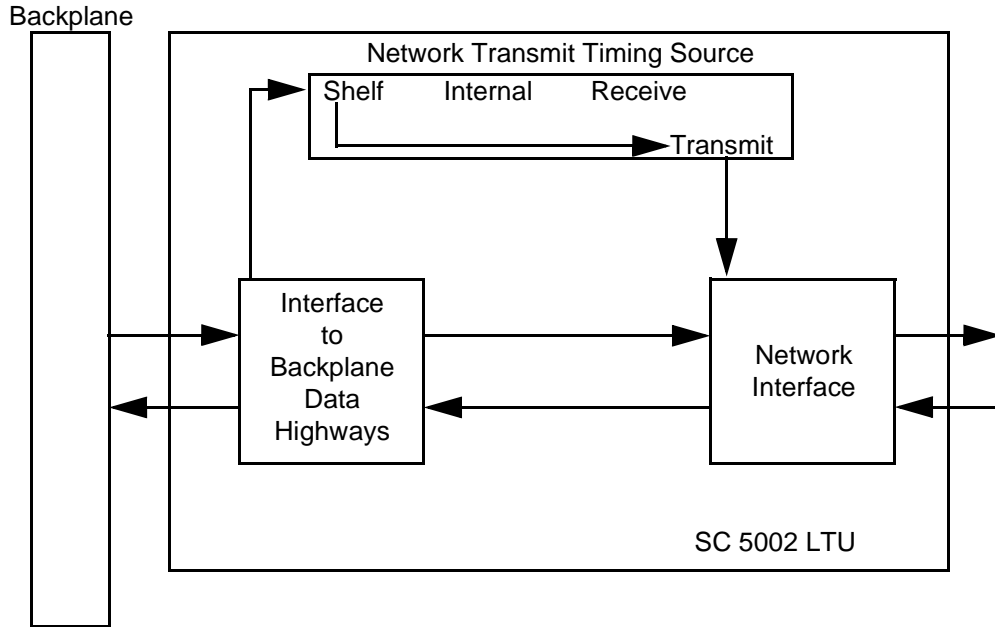


Figure 5-3 Shelf Timing

## System Timing

The rule of "one network, one clock" applies in the SpectraComm 5000 system just as in any other data communication environment. In order to have all LTUs and DSEs in a SpectraComm Shelf (or pair of shelves) operate with a common timing signal, one LRU must be designated as the source of system timing to the shelf backplane.

The system timing signal provided by that LRU is the timing reference for all data exchanges between cards in the shelf and the source of shelf timing for other LRUs optioned to base transmit timing on shelf timing.

The designation of an LRU as the source of system timing is a software function that takes place in the SNMP control application. The TEAM Core application, available from GDC for use with the SpectraComm 5000 system, supports designation of a primary and a secondary source for system timing.

The designated primary supplies timing to the backplane as long as its configured transmit timing source (network or internal) is valid. If anything causes the primary system timing source to lose its transmit timing source, it signals the secondary timing source to take over providing system timing to the shelf.

LRUs not designated as either the primary or secondary system timing provider must be configured to base their transmit timing on shelf timing.

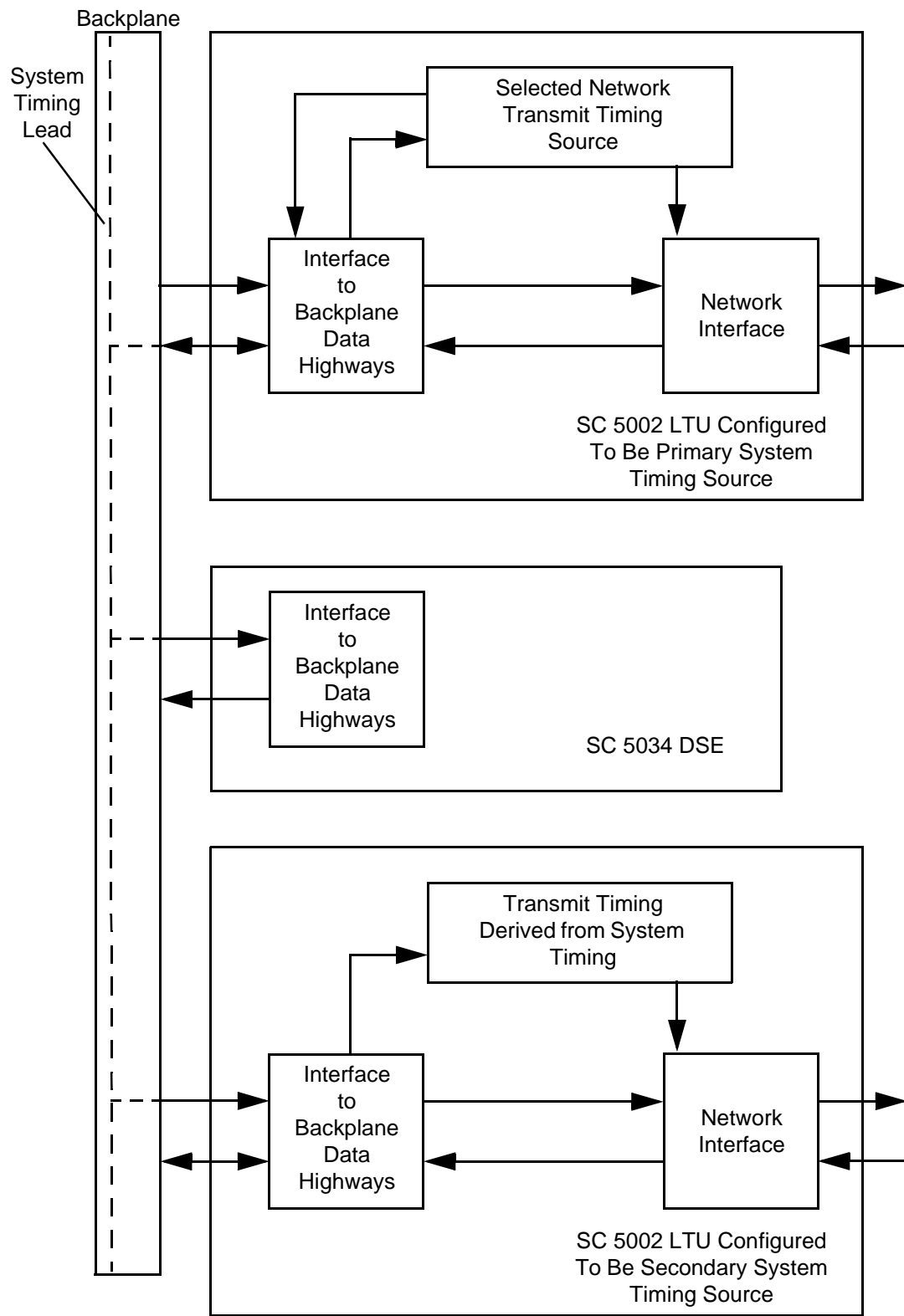


Figure 4-3 System Timing



# 5 Diagnostics

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## Overview

The SC 5002 LTU provides two diagnostic functions that can be initiated by an SNMP controller (via the SCM card located in the SpectraComm Shelf):

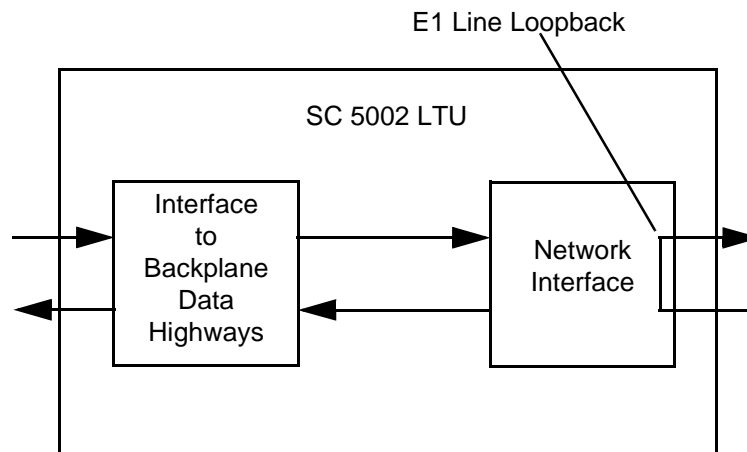
E1 Line Loopback

Unit Self Test

## E1 Line Loopback

An SNMP controller can command the LTU to perform an E1 Line Loopback. The test causes the LTU to loop received data back in the network interface as transmit data as illustrated in *Figure 5-1*. The Test Mode (TM) indicator on the LTU front panel is lit while the loopback is active.

The test 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.



**Figure 5-1** E1 Line Loopback

## Unit Self Test

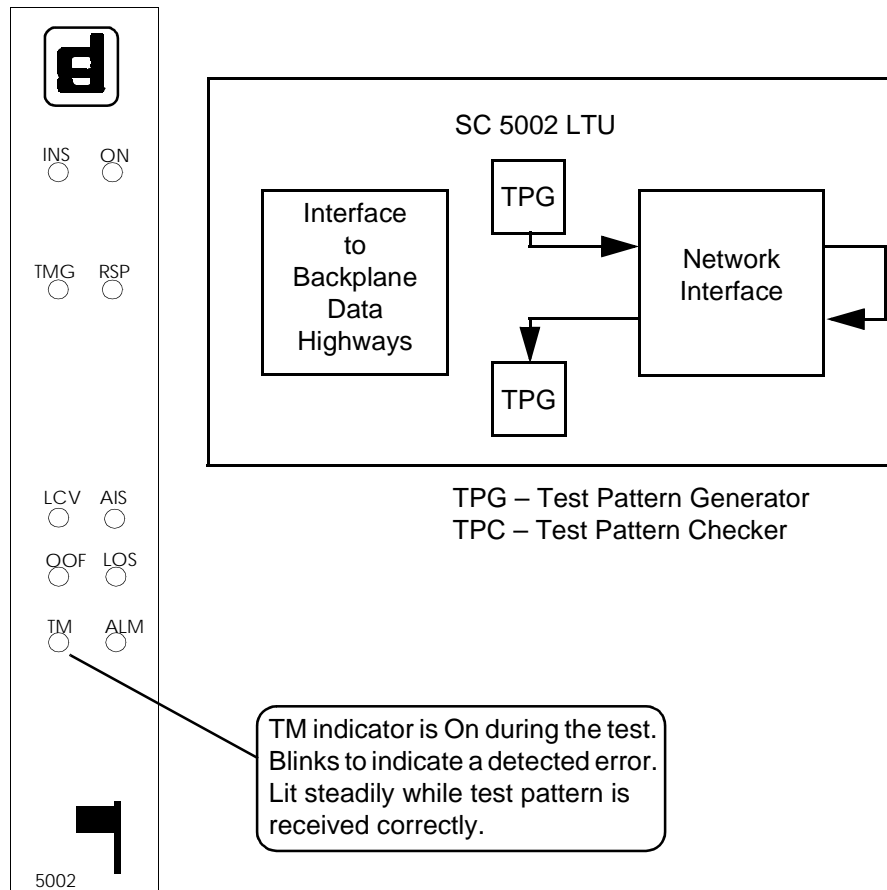
An SNMP controller can command the LTU to perform a Unit Self Test. The test establishes a Local Test loopback and directs an internally generated test signal through the LTU. The LTU is isolated from the backplane data channels during the test.

*Figure 5-2* illustrates the Unit Self Test. The Test Mode (TM) indicator on the LTU front panel is lit while the test is active. It remains lit as long as the test pattern is received without errors and blinks when an error is detected.

During Unit 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.

The Unit Self Test takes approximately 15 seconds to run. Upon completion it reports either "Pass" or "Fail" to the SNMP controller.



**Figure 5-2** Unit Self Test

# 6 Alarms

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## Overview

The SC 5002 LTU monitors for alarm conditions, and reports them to its SNMP controller. Alarms from the LTU are divided into three categories:

- Major
- Minor
- Informational.

Some alarm conditions cause the LTU to generate an alarm each time the specified alarm event occurs. There are other conditions for which the LTU generates 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 6-1* lists the alarms that the SC 5002 LTU can generate. The table identifies each alarm as Major, Minor or Other; 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 6-1.** Alarms

Name	Category	Window/ Threshold?	LED Name
Loss of Signal	Major	No	LOS
Loss of Frame	Major	No	OOF
Alarm Indication Signal	Major	No	AIS
Near End Unavailable Seconds	Minor	Yes	N/A
Near End Errored Seconds	Minor	Yes	N/A
Near End Severely Errored Seconds	Minor	Yes	N/A
Near End Background Block Errors	Minor	Yes	N/A
Near End Line Code Violations	Minor	Yes	LCV
Far End Unavailable Seconds	Minor	Yes	N/A
Far End Errored Seconds	Minor	Yes	N/A
Far End Severely Errored Seconds	Minor	Yes	N/A
Far End Background Block Errors	Minor	Yes	N/A
Timing Loss	Major	No	N/A
Unit Failure	Major	No	N/A
NV RAM Corrupt	Major	No	N/A
Power-Up	Informational	No	N/A
Fallback Timing Active	Informational	No	N/A

## Major Alarms

### Loss Of Signal

A Loss of Signal (LOS) alarm event occurs when the LTU senses an absence of E1 signal. The absence of signal for a time equivalent to 32 bits ( $\pm 16$ ) is considered no signal. The front panel LOS LED reflects the current signal status of the LTU network interface.

### Out Of Frame

An Out Of Frame (OOF) alarm event occurs when the LTU detects three consecutive framing errors. The count for an OOF alarm increments by one each time framing is lost, regardless of the number of frames affected. The front panel OOF LED reflects the current status of LTU-to-network synchronization.

### Alarm Indication Signal

An Alarm Indication Signal (AIS) alarm event occurs when the LTU receives an AIS at its E1 interface. The front panel AIS LED reflects whether the LTU is receiving an AIS at the Network Interface.

### Timing Loss

A Timing Loss alarm event occurs when the LTU that is configured to be the source of shelf timing loses timing from its configured transmit clock source. This alarm condition can only occur in an LTU that is configured to be the source of timing for its shelf.



### 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 if it occurs.

### NV RAM Corrupt

An NV RAM 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 if it occurs.

## Minor Alarms

### Line Code Violations

A Line Code Violation (LCV) alarm event occurs when the signal the LTU receives at its E1 interface does not alternate between signal levels as required for HDB3 data encoding. A window and threshold can be configured for the LCV alarm condition.

The front panel LCV LED reflects whether or not the network interface is in an LCV alarm condition.

### Near/Far End Errored Seconds

An Errored Second is one in which the LTU detects at least one Line Code Violation (LCV) or Cyclic Redundancy Checksum (CRC) error event in the signal it is receiving.

A Near End Errored Second occurs at the local unit. A Far End Errored Second occurs at the remote unit and is reported back to the local unit as part of the framing information the units exchange.

You can configure windows and thresholds to govern the reporting of alarms based on Errored Seconds.

### Near/Far End Severely Errored Seconds

A Severely Errored Second is one that meets any of the following conditions:

- received blocks contain 300 or more errors
- Alarm Indication Signal received
- Out of Frame condition occurred

A Near End Severely Errored Second occurs at the local unit. A Far End Severely Errored Second occurs at the remote unit and is reported back to the local unit as part of the framing information the units exchange.

You can configure windows and thresholds to govern the reporting of alarms based on Severely Errored Seconds.

### Near/Far End Unavailable Seconds

The LTU declares an Unavailable Second condition when a Severely Errored Second condition persists for ten seconds. It clears the Unavailable Second condition when the Severely Errored Second condition has been clear for ten consecutive seconds.

A Near End Unavailable Second occurs at the local unit. A Far End Unavailable Second occurs

at the remote unit and is reported back to the local unit as part of the framing information the units exchange.

You can configure windows and thresholds to govern the reporting of alarms based on Unavailable Seconds.

### **Near/Far Background Block Errors**

Background Block Errors is a count of the number of data blocks received that contain detectable errors.

Near End Background Block Errors occur at the local unit. Far End Background Block Errors occur at the remote unit and are reported back to the local unit as part of the framing information the units exchange.

You can configure windows and thresholds to govern the reporting of alarms based on Background Block Errors.

## **Informational Alarms**

### **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.

### **Fallback Timing Active**

A Fallback Timing Active alarm event occurs when the LTU loses its configured primary source of transmit timing and switches to using its configured fallback timing source.

# A Technical Characteristics

Item	Characteristic
<b>Physical</b>	
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)
<b>Environmental</b>	
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)
<b>Electrical</b>	
Power requirements	
Voltage	220 to 240 V ac
Power dissipation	5 W maximum +5V, 1 W maximum ±12V
Communication line	E1 digital carrier
Line impedance	75 or 120 Ohm
Network port physical interface	RJ48C modular jack

*(Continued on following page)*

Item	Characteristic
<b>Electrical (Continued)</b>	
Network transmitter Frequency Timing source	2,048,000 bps $\pm$ 50 bps Internal clock, network timing, shelf timing
Network receiver Operating range Input impedance Jitter tolerance  Transmitter Encoding Impedance	0.0 to 2.6 km over 0.6 mm twisted pair cable 75 or 120 Ohm Exceeds ETSI TBR 12/13 jitter transfer performance specifica- tions  HDB3 75 or 120 Ohm

# B MIB Support

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## Overview

This appendix details the Management Information Base (MIB) table objects by which an SNMP controller can command and monitor the SC 5002 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** Network Configuration Table

MIB Object	Syntax	Access	Enumeration	Description
sc5002NetworkCfg Index	SCInstance	read-only		Integer value which uniquely identifies the SC5002 to which this entry is applicable. SCInstance is defined to be sslldcc where: ss (byte value) - physical shelf slot location (01-32) ll (byte value) - line number (01-128) dd (byte value) - drop number (00-31) cc (byte value) - channel or interface number (always 00)
sc5002E1Signaling Mode	INTEGER	read-write	assocChanSig WithCRC4 (1), assocChanSig NoCRC4 (2)	Specifies the channel signaling scheme for the E1 network interface.

**Table B-2** SC 5002 Alarms

Alarm Name	Object ID	Maskable	Window/ Threshold	Category
NoResponse	sc5002AlarmData 1	no	no	?
DiagRxErr	sc5002AlarmData 2	no	no	?
PowerUp	sc5002AlarmData 3	no	no	Informational
NvRamCorrupt	sc5002AlarmData 4	no	no	Major
UnitFailure	sc5002AlarmData 5	no	no	Major
TimingLoss	sc5002AlarmData 6	yes	no	Major
LossOfSignal	sc5002AlarmData 7	yes	no	Major
LossOfFrame	sc5002AlarmData 8	yes	no	Major
AlarmIndSignal	sc5002AlarmData 9	yes	no	Major
FallbackTimingActive	sc5002AlarmData 10	yes	no	Informational
NearEndLnCodeViol	sc5002AlarmData 11	yes	yes	Minor
NearEndErrSec	sc5002AlarmData 12	yes	yes	Minor
NearEndBkdBlkErr	sc5002AlarmData 13	yes	yes	Minor
NearEndSevErrSec	sc5002AlarmData 14	yes	yes	Minor
NearEndUnavlSec	sc5002AlarmData 15	yes	yes	Minor
FarEndErrSec	sc5002AlarmData 16	yes	yes	Minor
FarEndBkdBlkErr	sc5002AlarmData 17	yes	yes	Minor
FarEndSevErrSec	sc5002AlarmData 18	yes	yes	Minor
FarEndUnavlSec	sc5002AlarmData 19	yes	yes	Minor

**Table B-3** Near End Alarm Configuration Table

MIB Object	Syntax	Access	Enumeration	Description
sc5002NearEndAlarmCfgIndex	SCinstance	read-only		Integer value which uniquely identifies the SC5002 to which this entry is applicable. SCinstance is defined to be sslldcc where: ss (byte value) - physical shelf slot location (01-32) ll (byte value) - line number (01-128) dd (byte value) - drop number (00-31) cc (byte value) - channel or interface number (always 00)
NearEndAlarmWindow	INTEGER	read-write	win30sec(1), win1min(2), win15min(3), win1hr (4), win24hr (5)	The time period in which a specified number of events must occur, (specified by the alarm's threshold), before declaring an alarm condition. After reporting an Alarm condition and upon expiration of the window time period, the event count is reset to zero and another time period is begun. If the specified number of events is not exceeded within the next time period, an Alarm Cleared condition is reported.
NearEndAlarmThreshold	INTEGER	read-write	thr1 (1), thr3 (2), thr10 (3), thr100 (4), thr1000 (5), thr10000(6)	The number of events which must be exceeded within the time period specified by the alarm's window before an alarm is declared.

**Table B-4** Far End Alarm Configuration Table

MIB Object	Syntax	Access	Enumeration	Description
sc5002FarEndAlarmCfgIndex	SCinstance	read-only		Integer value which uniquely identifies the SC5002 to which this entry is applicable. SCinstance is defined to be sslldcc where: ss (byte value) - physical shelf slot location (01-32) ll (byte value) - line number (01-128) dd (byte value) - drop number (00-31) cc (byte value) - channel or interface number (always 00)
FarEndAlarmWindow	INTEGER	read-write	win30sec(1), win1min(2), win15min(3), win1hr (4), win24hr (5)	The time period in which a specified number of events must occur, (specified by the alarm's threshold), before declaring an alarm condition. After reporting an Alarm condition and upon expiration of the window time period, the event count is reset to zero and another time period is begun. If the specified number of events is not exceeded within the next time period, an Alarm Cleared condition is reported.
FarEndAlarmThreshold	INTEGER	read-write	thr1 (1), thr3 (2), thr10 (3), thr100 (4), thr1000 (5), thr10000(6)	The number of events which must be exceeded within the time period specified by the alarm's window before an alarm is declared.



Table B-5 SC 5002 Maintenance Table

MIB Object	Syntax	Access	Enumeration	Description
sc5002MaintenanceLineIndex	SCinstance	read-only		Integer value which uniquely identifies the SC5002 to which this entry is applicable. SCinstance is defined to be sslddcc where: ss (byte value) - physical shelf slot location (01-32) ll (byte value) - line number (01-128) dd (byte value) - drop number (00-31) cc (byte value) - channel or interface number (always 00)
SoftReset	INTEGER	read-write	reset(1), norm(2)	Supports the action of soft resetting the unit. When this object is set to reset(1), then the unit performs a soft reset, whose meaning is specific to the type of unit being managed. The value of norm(2) will be returned when the reset is complete.  The value of norm(2) cannot be set by management.
DefaultInit	INTEGER	read-write	factoryDefault(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 effect. The value of normal(2) will be returned when the initialization is complete.  The value of normal(2) cannot be set by management.
NearEndResetStats	INTEGER	read-write	norm(1), reset(2)	Supports the action of soft resetting the sc5002NearEndValidIntervals object. When this object is set to reset(2), then the unit will reset the sc5002Valid Intervals object to zero.  The value of norm(1) cannot be set by management.
NearEndStatLastInitialized	INTEGER (1..2147483647)	read-only		Number of seconds from midnight Dec 31, 1969 up until sc5002NearEndValid Intervals was last initialized to zero.
FarEndResetStats	INTEGER	read-write	norm(1), reset(2)	Supports the action of soft resetting the sc5002FarEndValidIntervals object. When this object is set to reset(2), then the unit will reset the sc5002Valid Intervals object to zero.  The value of norm(1) cannot be set by management.
FarEndStatLastInitialized	INTEGER (1..2147483647)	read-only		Number of seconds from midnight Dec 31, 1969 up until sc5002FarEndValid Intervals was last initialized to zero.

(Continued on next page)

Table B-5 SC 5002 Maintenance Table (Continued)

MIB Object	Syntax	Access	Enumeration	Description
LedStatus	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 - NIU bit 1 - D_I bit 0 - future use Octet 2 bit 7 - not used bit 6 - future use bit 5 - NTWK AIS bit 4 - NTWK LCV bit 3 - NTWK LOS bit 2 - NTWK OOF bit 1 - ALM bit 0 - TM Octet 3 bit 7 - not used bit 6 - ST- future use bit 5 - LT- future use bit 4 - RL- future use bit 3 - TM transitions/flashing bit 2 - future use bit 1 - future use bit 0 - future use
NearEndValid Intervals	INTEGER (0..16)	read-only		The number of previous intervals for which valid data was collected. The value will be 16 unless the interface was brought on-line within the last 4 hours, in which case the value will be the number of complete 15 minute intervals since the interface has been on-line.
FarEndValid Intervals	INTEGER (0..16)	read-only		The number of previous intervals for which valid data was collected. The value will be 16 unless the interface was brought on-line within the last 4 hours, in which case the value will be the number of complete 15 minute intervals since the interface has been on-line.
SysUpTime	INTEGER (1..2147483647)	read-only		This variable is used to report the elapsed system tick time for conversion to real time at the controller and 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.

**Table B-6** SC 5002 Diagnostic Table

MIB Object	Syntax	Access	Enumeration	Description
sc5002DiagIndex	SCinstance	read-only		Integer value which uniquely identifies the SC5002 to which this entry is applicable. SCinstance is defined to be ssllddccc where: ss (byte value) - physical shelf slot location (01-32) ll (byte value) - line number (01-128) dd (byte value) - drop number (00-31) cc (byte value) - channel or interface number (always 00)
LoopbackConfig	INTEGER	read-write	noLoopBack(1), line Loop-Back(2), unitTest(3)	Selects the test to run. A get of this object returns the test that is currently running. A set of noLoopBack(1) ends the test that is currently running. A set of lineLoopBack(2) starts a line loop back test. The line loop back test runs until a set of noLoopBack(1) is sent. A set of unitTest(3) starts a unit test. The unit test runs for 15 seconds.
TestResult	INTEGER	read-only	pass(1), fail(2)	The results of the last diagnostic test completed. The value returned is only valid if a get of sc5002Loopback Config returns noLoopBack(1).



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