ST8X
Cartridge Tape Subsystem
User's Manual

EMULEX

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Effective: October 15, 1990

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CONTROLLERS – DATA COMMUNICATIONS PRODUCTS – Emulex warrants for a period of five (5) years from the date of shipment, that each product shall be free of defects in material and workmanship. These products include all disk and tape controllers, communication multiplexers, and communication servers.

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1.1   Overview

This manual describes the Emulex ST8X 8-mm Cartridge Tape Subsystem, including its installation and use. The ST8X allows high-capacity, 8-mm cartridge tape drives with SCSI interface to attach directly to the Standard Tape Interface (STI) on a Hierarchical Storage Controller (HSC), manufactured by Digital Equipment Corporation, using Tape Mass Storage Control Protocol (TMSCP).

You may connect up to four cartridge tape drives to a single port on an HSC40/50/70 storage controller. The ST8X can share the same DEC or Emulex tape data channel card with installed DEC tape drives. Because it is plug-compatible with the DEC TA series tape drives, the ST8X supports any VAXcluster system without changes to systems or applications software.

The ST8X uses advanced helical-scan, data-recording technology to achieve a very high recording density and large storage capacity. Its industry-standard 8-mm tape cartridge can store up to 2.5 gigabytes of formatted user data, depending on hardware and software configuration. You can rewrite the cartridge, and you can remove it. The ST8X is an economical approach to unattended backup for large VAXcluster disk systems.

This manual consists of the following sections:

- **Section 1, Introduction,** gives an overview of the subsystem, including related documentation, models, configurations, components, compatibility, enhancements, software, specifications, accessories, and ordering information.

- **Section 2, Installation,** discusses inspection, FCC compliance, preparation for installation, and the installation procedure, including cabling, power-up, and programming the unit ID number.

- **Section 3, Operation,** describes the subsystem switches and indicators, drive switches and indicators, tape cartridges, operating procedures, testing the ST8X, maintenance, troubleshooting, and service.

The manual concludes with an index of terms and abbreviations.

1.2   Related Documentation

If you wish details about the related DEC diagnostic and utilities protocol, controllers, and tape subsystems, see the following DEC publications:

Storage System Diagnostic and Utilities Protocol, P/N AA-L620A-TK

HSC50/70 Hierarchical Storage Controller, User Guide, P/N AA-GMEAA-TK

HSC50 Storage Controller
    Installation Manual, P/N EK-HSC50-IN
    Service Manual, P/N EK-HSC50-SV

HSC70 Storage Controller
    Installation Manual, P/N EK-HSC70-IN
    Service Manual, P/N EK-HSC70-SV

TU81/TA81 Tape Subsystem, User Guide, P/N TK-TUA81-UG

1.3   Models and Configurations

Depending on the model, the ST8X can support a one-drive unit (ST81) or a two-drive unit (ST82). The subsystem is contained in a 5.25-inch enclosure, which you can mount in a standard 19-inch rack. Figure 1-1 illustrates a typical configuration.

TAPE CHANNEL CARD   ST81/82

                         STI CABLE   PORT A

                         STI CABLE   PORT B
TAPE CHANNEL CARD

                         NO CONNECTION   SCSI IN

                         TERMINATOR   SCSI OUT
                           MODULE

            NO CONNECTION   CONTROL PANEL
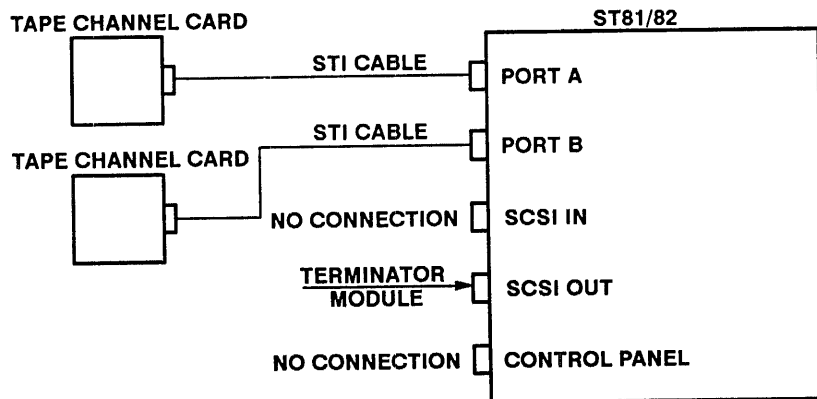
ST8X-01

Figure 1-1. Typical Subsystem Configuration

1.4 Subsystem Components

A complete ST8X unit contains the following components:

1. One or two drives

2. Subsystem control panel

3. Signal-distribution board and connectors

4. Tape adapter board

5. Power supply

The following subsections describe the main subsystem components, and Sections 2 and 3 present further details about their function.

1.4.1 Tape Drive

Figure 1-2 shows the drive used in the ST8X. It consists of an 8-mm tape transport mechanism and recording channel, servo, formatter, controller, and interface electronics.
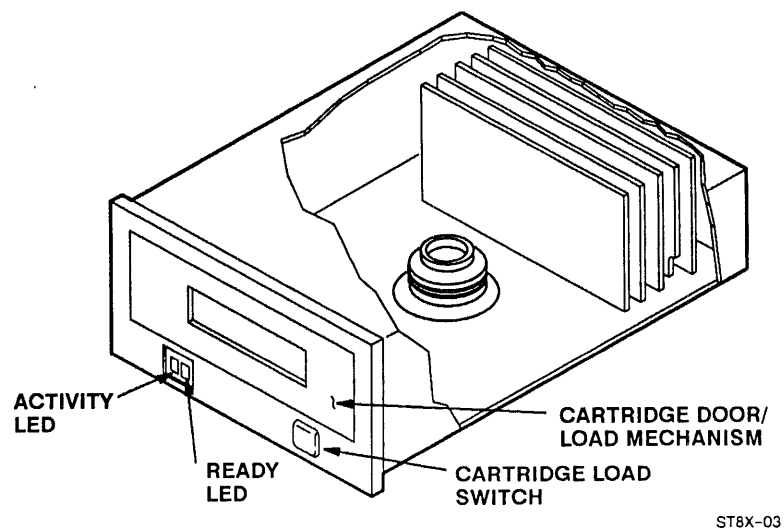
Figure 1-2. Tape Drive

The product is a true digital data storage device. While it is derived from 8-mm video recording technology, it has many performance improvements necessary for data processing applications, which are described below:

- **Helical Scan.** The tape drive uses an advanced helical scan technology that permits a very high recording density and large data-storage capacity on a removeable and rewriteable industry-standard, 8-mm tape cartridge. Cartridges store up to 2.5 G bytes of formatted user data.

- **Read After Write.** During write operations the drive records servo information and formatted user blocks on the same track and performs a read-after-write check of the recorded user data. In the event of an error during the read-back check for a write error condition, error recovery procedures are performed without host intervention and without the need to reposition the tape.

- **Error Correction Code (ECC).** The drive employs a powerful Error Correction Code (ECC) to ensure data reliability. The ECC can correct a burst as long as 264 bytes in error and as many as 80 additional random errors in each data block. The ECC is capable of multiple burst and random error corrections.

1.4.2   Subsystem Control Panel

Figure 1-3 depicts the control panel of the ST8X.
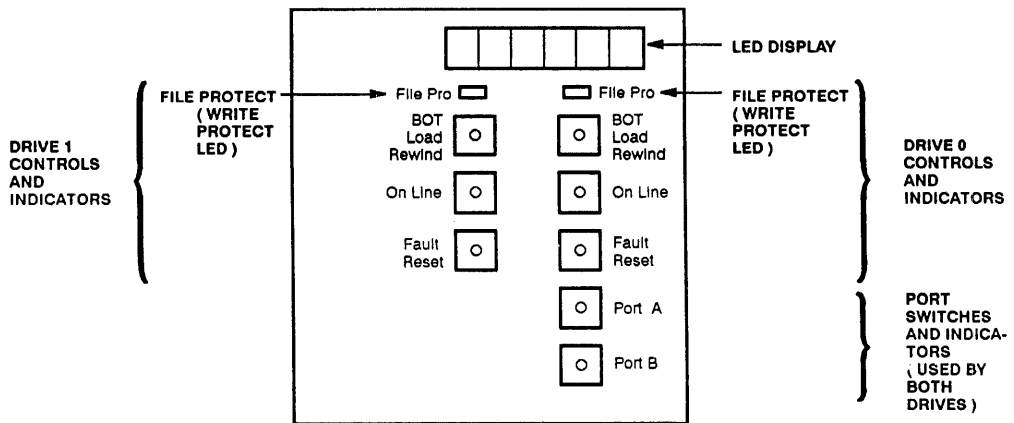
ST8X-07

Figure 1-3. ST81/82 Control Panel

1.4.3 Signal Distribution Board and Connectors

The Signal Distribution board, in the rear of the ST8X chassis, contains all the connectors and printed wiring necessary to connect the SCSI/STI adapter board, tape drives, and front-panel controls. It also contains all the connectors necessary to interface the ST8X to the outside world. The ST8X provides six connectors: two STI Port connectors, two SCSI Interface connectors, a Control Panel daisy-chain connector, which are described below, and an AC Input connector, described in subsection 2.5.2.

- **STI Port Connectors.** Each port is connected to a channel card, which is located in the HSC cabinet using standard DEC BC26V-25 or BC27V-25 STI cables. To provide DEC-compatible, dual-port capability, you may connect Ports A and B to independent STI data channels.

- **SCSI Interface Connectors.** The two 50-conductor, high-density connectors are labeled SCSI OUT and SCSI IN. Only the SCSI OUT connector, which is terminated externally using an Emulex supplied terminator module, is used in this implementation.

- **Control Panel Daisy-Chain Connector.** This connector is not used in this implementation.

Terminator power is supplied to the terminator module from a separate diode and overcurrent-protected regulator circuit located inside the ST8X chassis.

1.4.4 Tape Adapter Board (STI/SCSI Adapter)

The Tape Adapter board provides the logic necessary to connect a SCSI tape device to the Standard Tape Interface on a DEC HSC40/50/70 storage controller. It intercepts STI commands issued by the HSC40/50/70 storage controller, interprets, and converts them into SCSI commands to be issued to the 8-mm drive. It also receives SCSI sense data from the drive and translates them into STI-compatible response data.

In addition, the tape adapter buffers data for the tape drives. This ensures that complete records are available for the HSC when a transfer is initiated, and it sustains streaming-mode operation by the drives. The 9.5 x 14-inch board contains 512 K bytes of dynamic RAM, 80186 microprocessor, and SCSI controller. It interfaces to an internal Signal Distribution board, which connects the adapter to the front panel, drives, two STI ports, SCSI IN/OUT connectors, and control panel, daisy-chain connectors on the rear of the ST8X chassis.

An eight-wire (four-pair), coaxial ribbon cable with 93-ohm impedance transmits the STI signals over the four signal lines. Figure 1-4 illustrates the rear panel, and Figure 1-5 the STI data path.
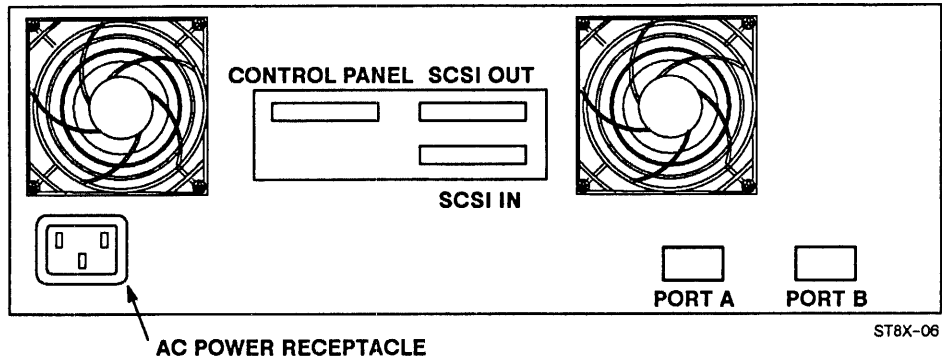
Figure 1–4. Rear Panel of the Subsystem
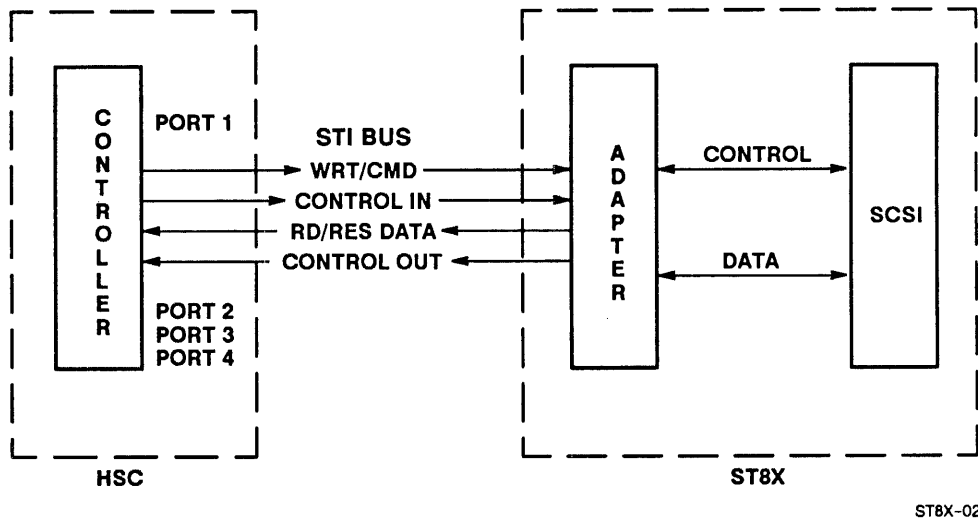
Figure 1–5. STI Data Path

1.4.5 Power Supply

The power supply (switching type) has autoranging AC input. It provides all
the necessary power for the subsystem.

1.5 Compatibility and Enhancements

The ST8X subsystem is compatible with DEC's Standard Tape Interconnect (STI), allowing users to take advantage of DEC's Digital Storage Architecture (DSA) performance features for VAXcluster systems. Special Emulex firmware-emulation techniques allow the ST8X to take advantage of the high-speed, file-mark spacing capability (Fast File Search) of 8-mm drives to provide the fastest possible operation.

1.6 Software

The ST8X is normally used as a standard tape unit under the VMS operating system to back up magnetic disk drives. It is fully compatible with the VMS BACKUP and COPY utilities, requiring no changes to the operating system software.

The ST8X is primarily used as a back-up device, writing or reading large blocks of data continuously and without interruption. As such, it does not function well in a start/stop environment. Certain operating characteristics of the drive limit the instructions that it can execute effectively. Specifically, commands that cause the tape to back up and re-read or re-write a block may not execute properly.

Since the ST8X has its own extensive ECC system, use the /NOCR option with VMS BACKUP to improve throughput and to maximize tape usage. In some cases, increasing the size of data blocks and the number of buffers may also increase throughput. Refer to VMS documentation for details on implementing these options.

1.6.1 Software Compatibility

The ST8X is compatible with VMS V5.0 and higher. To ensure proper operation on DEC HSC systems, use HSC software V3.9 or above.

1.6.2 Tape Drive Firmware Revision Compatibility

To ensure proper operation, Emulex recommends that the Exabyte tape drives used in the ST8X subsystem contain firmware of revision 4$24 or higher.

1.7 Specifications

Table 1-1 lists subsystem specifications.

Table 1-1. Specifications of the ST8X Subsystem

Parameter	Description
Dimensions of Enclosure	
Width	19 inches
Height	5.25 inches
Depth	18 inches
Weight	30 pounds
Environment	
Operating Temperature	5 to 40 degrees C (41 to 104 degrees F)
Storage Temperature	–40 to 60 degrees C (–40 to 140 degrees F)
Humidity	20 to 80 percent, non-condensing
Shock	Operating: 1 G for 20 millisec, maximum Non-operating: 40 G for 11 millisec, maximum
Input Voltage	
100–240 VAC	Autoranging (no voltage switch settings required)
Power Consumption	
115 VAC	60 Hz, 1.8 A maximum, 100 W, 342 BTU/hr
230 VAC	50 Hz, 0.9 A maximum, 100 W, 342 BTU/hr
Reliability	
MTBF	20,000 hours, typical
MTTR	30 minutes
Data Reliability	Write: 1.0 x 10-12 bits. Read: 1.0 x 10-13 bits
Data Handling	
Controller Compatibility	DEC HSC40/50/70
Controller Interface	DEC Standard Tape Interface (STI)
Software Compatibility	DEC Tape Mass Storage Control Protocol (TMSCP)
Number of Drives	ST81/82: 1 or 2
Drive Addresses	0 through 254
Controller Connectors	Two DEC STI connectors (Port A, Port B)
Tape Drive	
Drive Interface	SCSI Tape
Data Transfer Rate	1.5M bytes/second, maximum, 246K bytes/sec sustained
Tape Speed	Nominal: 0.5 inches/second File Search: 5.0 inches/second Rewind: 32.2 inches/second
Reposition Time	1115 millisec, maximum
Drum Rotation Rate	1800 rpm
Linear Recording Density	Flux: 54,000 FR/inch. Bit: 43,200 Bits/inch
Track Width	0.00098 inch
Track Density	819.35 tracks/inch
Physical Block Size	1024 data bytes + 400 ECC bytes
Logical Block Size	64K bytes, maximum

1.8   Accessories and Ordering Information

Table 1-2 lists the optional accessories available for the subsystem.

Table 1-2.   Accessories for the ST8X Subsystem

Part Numbers	Description
ST80-DU	8-mm tape unit kit used to upgrade an ST81 to an ST82
CK23	Drive cleaning kit
CT-2000	Tape cartridge, 2.5/5.0 GB capacity (functional storage capacity may vary with your hardware and software configuration)
SDI-12	External STI/SDI cable, 12-foot
SDI-25	External STI/SDI cable, 25-foot
SDI-50	External STI/SDI cable, 50-foot
PE0910414-00	Emulex Termination Module

For ordering information contact Emulex Sales Support at the following address
and telephone numbers:

> Emulex Corporation
> 3545 Harbor Boulevard
> Costa Mesa, CA 92626-1437
> (714) 662-5600
> Outside California (800) EMULEX-3

2.1 Overview

This section tells how to install the ST8X in a rack-mount cabinet. It discusses inspection, FCC compliance, the installation procedure, including selecting a location and cabling, and programming the unit ID number.

CAUTION! The ST8X contains no user-serviceable parts. For service consult an authorized service technician.

The ST8X subsystem is designed to conform to UL, CSA, and FCC standards.

2.2 Inspecting the ST8X

Immediately upon receipt, inspect the shipping container for evidence of damage. Any obvious damage to the container or equipment should be reported to the carrier company in accordance with the instructions in the container.

To avoid damaging the equipment, open the carton by cutting the sealing tape along the sides. Emulex suggests that the carton be saved in case the subsystem or any major component must be reshipped. After unpacking the ST8X subsystem, inspect the entire subsystem for damage, making sure there are no broken or loose parts. If you find cracks or dents in the outer chassis, see subsection 3.9.

2.3 FCC Compliance

The Federal Communications Commission (FCC) has established technical standards regarding radiation of Electromagnetic Interference (EMI) emitted by computing devices. The ST8X has been type tested and found to comply with the EMI emission limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules. However, there is no guarantee that interference will not occur in a particular installation. If the ST8X interferes with radio or television reception, as determined by turning the equipment on and off, take the following measures:

- Reorient the receiving antenna.

- Relocate the compliant subsystem (that contains the ST8X) with respect to the receiver.

- Move the compliant subsystem away from the receiver.

- Plug the compliant subsystem into a different outlet so that the subsystem and receiver are on different branch circuits.

- Verify that the mounting screws and grounding wires on the compliant subsystem are tightly secured.

If necessary, consult the dealer or an experienced radio/television technician for additional suggestions. You may find the following booklet prepared by the FCC helpful:

Title:	*How to Identify and Resolve Radio-TV Interference Problems*
Stock Number:	004-000-00345-4
Publisher:	U.S. Government Printing Office Washington, D.C., 20402

2.4 System Preparation

The ST8X is designed to be installed in a DEC-compatible, 19-inch RETMA equipment cabinet using the standard DEC STI or equivalent cables. The ST8X enclosure is 5.25 inches high. Using the following subsections as a guide, mount the ST8X at the top of a 42-inch cabinet to provide easy access to the drives and control panel.

2.4.1 Selecting a Location

Select a location for the ST8X that avoids the following harmful influences:
- High-powered electrical equipment
- Static electricity buildup
- Direct sunlight (maintain an air-conditioned environment)

2.4.2 AC Power

A standard IEC380 AC power receptacle mounted on the rear chassis of the ST8X (Figure 1–4) permits it to mate with most power distribution units. The AC input is autoranging; it will operate with 100 to 240 VAC, and 50 to 60 Hz.

2.4.3 Cabinet Installation

Before performing the STI cabling, install the subsystem in the desired cabinet. Mounting slides are provided with the ST8X for installation in a 19-inch RETMA cabinet. Installation requires a standard screwdriver and a Phillips-head screwdriver. Refer to Figure 2–1 and use the following procedure.

CAUTION! If you are mounting the ST8X in an empty cabinet, have an assistant keep it from falling forward. If you meet resistance when sliding the chassis into the rack, confirm that the rails on the chassis are mated properly with those on the rack.
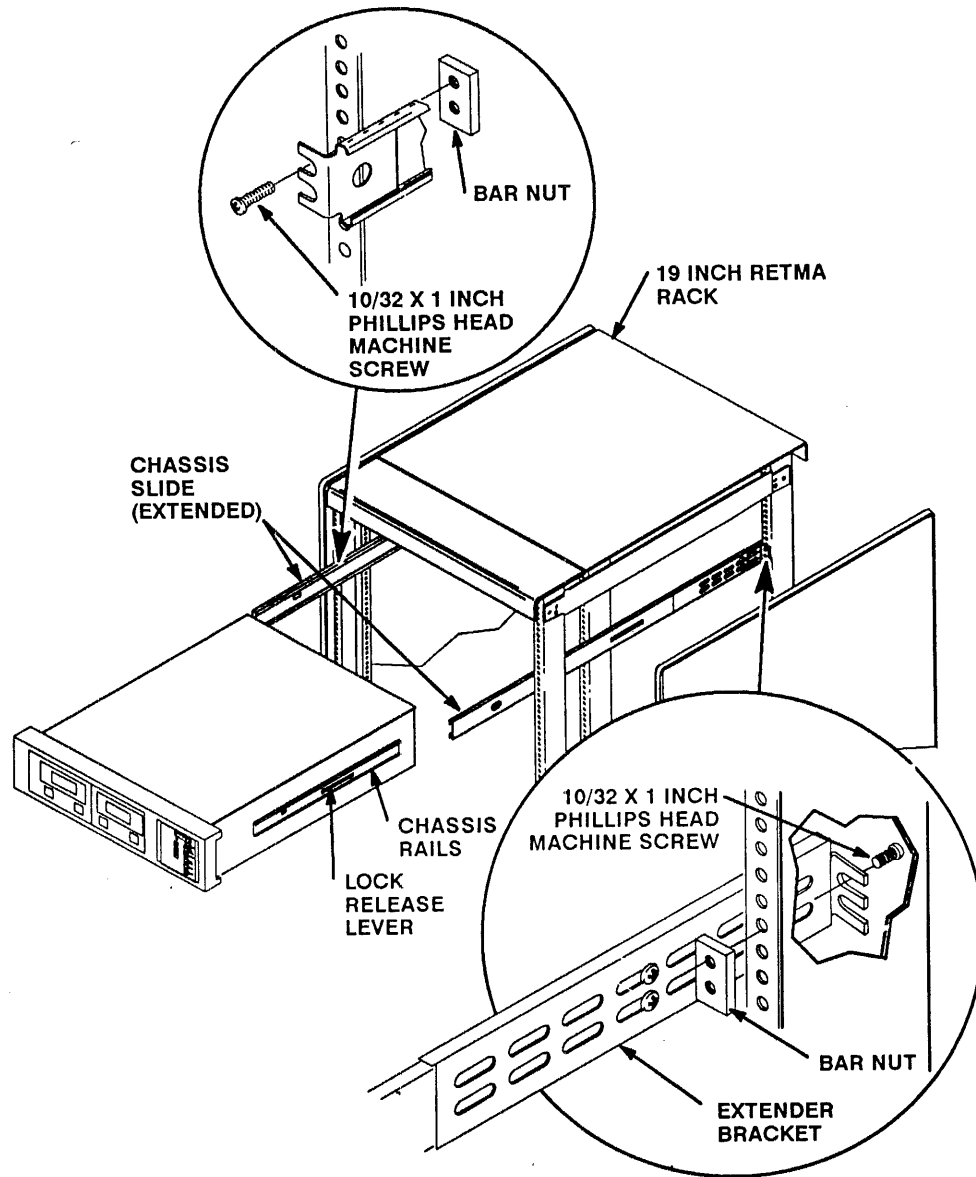
Figure 2-1. Installing the ST8X in a Cabinet

1. Attach the inner slide rails to the ST8X chassis.

2. Attach the outer slide rails to your computer rack 3.25 inches below the bottom of the item above the ST8X in the rack. If the ST8X is the only item in the rack, the distance should be about nine holes from the rack top. Place two bar nuts in the tenth and eleventh holes of each of the four corners of the rack frame. Attach the rails with the remaining screws.

3. Pull the rails out until they lock in place.

4. Slide the ST8X into the rack-mount rails, and then into the cabinet.

2.5 Cabling the Subsystem

Cable the subsystem according to the following subsections.

2.5.1 STI and SCSI Cabling

The ST8X communicates with a host computer through an HSC mass storage server. A tape data channel card in the HSC connects it through an STI bus to the ST8X STI adapter. Use standard DEC BC26V-STI cables or equivalent to attach the ST8X. To install the STI cables between the HSC cabinet I/O bulkhead and the tape drive enclosure, refer to Figures 1-1 and 1-4, and use the following procedure:

1. Plug the STI cable connector into the first available tape data channel receptacle on the HSC cabinet I/O bulkhead. STI cables enter the cabinet from the bottom.

2. Tighten the two screws that hold the STI cable connector shield in place.

3. Install additional STI cables for each ST8X Tape Subsystem, starting with the first available tape bulkhead connector position, and working down sequentially.

4. Route the STI cables to the tape drive cabinet, and feed them through the access hole in the base of the cabinet.

5. Plug the first STI cable into Port A on the ST8X enclosure, and tighten the screws on the connector shield.

6. Leaving a two-foot service loop, secure the cables to the side rail with tie wraps.

7. If the subsystem is dual ported to a second tape controller, repeat steps 5 through 7 for the Port B cables.

8. Install the SCSI terminator module in the SCSI OUT connector at the rear of the ST8X chassis.

2.5.2 AC Power Cabling

The ST8X comes with a two-meter, three-conductor power cord with a NEMA 5-15P plug. After you have installed the STI cabling and grounded the subsystem, you may apply power to the subsystem chassis.

CAUTION! Plug the ST8X into a power distribution unit in the drive cabinet. The use of AC wall outlets for powering any of the subsystem components may result in an increased soft error rate.

2.6 Powering Up and Programming the Unit ID Number

Once you have plugged the ST8X into an AC power source, the LED display (see Figure 1-3) should show Unit ID Number 314 or 316 to indicate that the unit is performing the power-up self-test. If it does not show 314 or 316, confirm that the AC cord is securely plugged in at both ends.

If the unit ID display flashes a three-digit code other than 314 or 316, the controller has detected a fault (see Table 3-1 fault code definitions). If the front panel does not illuminate at all, check your power source and breakers. If this does not solve the problem, see subsections 3.8 and 3.9.

With the ST8X enclosure in place and powered up, you may program the unit ID number. In multi-drive configurations, the unit ID number distinguishes one drive from another. You must enter a unit ID number from 0 through 254 into the three-position display on the control panel for each ST8X tape drive. The HSC requires that drive unit ID numbers be under 255. If you have multiple drives, give the first one a low enough unit ID number for the last one to be under 255.

After the unit passes the power-up self-test, the LED display indicates the address for which the unit is set. To change the address, use the following procedure:

1. Make sure that neither A nor B port is selected, and press the On Line and Fault/Reset switches simultaneously for five seconds and release. Do not press the Fault/Reset switch first because this will bring the unit offline and eject the tape cartridge. The BOT light will begin flashing, indicating that the unit address may be programmed (see subsection 3.2.2).

2. Set the base unit ID number for the first drive as follows. Observe the three right-hand digits of the LED display, and use the Port A and Port B switches, respectively, as Increment and Decrement switches. Set the unit ID number only for the first drive. The tape adapter will automatically number the second drive.

3. Once the proper ID number is displayed, press the On Line and Fault/Reset switches simultaneously again for five seconds and release. The On Line light will begin flashing.

4. Press the On Line and Fault/Reset switches simultaneously for five seconds and release once more to retain the unit ID number in non-volatile memory. The LED display will show the new unit ID numbers.

3.1 Overview

This section describes the subsystem switches and indicators, drive switches and indicators, tape cartridge, operating procedures, maintenance, troubleshooting, and service.

3.2 Subsystem Control Panel Switches and Indicators

The ST8X operator control panel has two sets of switches and indicators: one for each of the two tape drives that are installed in the subsystem. Each switch on the panel has an indicator light that displays the drive condition. The switches and indicators on the tape control panel are functionally equivalent to those on a DEC TA series tape drive. Figure 1-3 shows the arrangement of the controls on the panel.

NOTE: A flashing indicator generally indicates an action in process, and a continuously lit indicator generally indicates a completed action.

Switch settings are stored in non-volatile memory to prevent their loss in the event of a power failure. The following paragraphs describe the switch and indicator functions, starting at the top of the subsystem control panel.

3.2.1 LED Display

The LED display is a six-character screen. In addition to displaying unit ID numbers, it displays status codes and error codes on an alternating basis.

When the ST8X is on line and in operation, pressing the Load/Rewind switch activates the drive status mode sequence. The status number appears in the tens position of a cyclical display that also shows Error Correction Code (ECC) error rate, tape remaining, and current SCSI commands. To cycle through the status display, press the Load/Rewind switch momentarily for each status.

The LED display shows the following information about each drive:

■ Status 4– ECC error rate.

■ Status 3– Tape remaining in megabytes X 10.

■ Status 2– Current SCSI command in progress.

The LED alternately shows the status number, in this case 2, with the command code. Command code descriptions for Status 2 are shown below:

Status 2 Command Codes	Description
0	No command
1	Rewind
8	Read
10	Write
16	Write tape mark
17	Position tape

The sequence of status message is 4, 3, and 2. There is no status 1. When the status review is completed, press the Load/Rewind switch to return to the unit address display.

3.2.2 Load/Rewind Switch and BOT Indicator

If the transport is powered on and a cartridge is inserted, pressing the BOT/Load/Rewind switch loads the tape. If the tape is already loaded, it rewinds to Physical Beginning of Tape (PBOT). The indicator flashes during rewind. When the tape is positioned at the PBOT, the BOT indicator in the Load/Rewind switch is illuminated continuously.

3.2.3 Reset Switch and Fault Indicator

The Fault indicator highlights an error condition within the drive, and the Reset switch permits resetting the error and unloading the tape. The Fault indicator turns on when the tape drive detects an error and the LED display flashes an error code (see Table 3-1). The drive stays in its current operating state until the condition is corrected. Some errors are corrected automatically, which returns the display to its normal state (showing the unit number).

Table 3–1. Fault Codes

Code	Fault Condition
—	Daisy chain configuration error or drive not found
306	Microprocessor fault
307	STI error
308	Read/write unsafe error
309	Read/write command error
311	Write Enable and Write Protect asserted error
312	Microprocessor hardcore test error
314 or 316	Self-test and drive configuration (not an error)

With other errors, press the Reset switch to return the display to the unit number. This also takes the drive offline, tries to clear the fault condition, and returns the drive online. The Reset switch can also stop a load or rewind operation and take the drive offline. Pressing *Reset* when the BOT indicator is illuminated unloads the tape.

The LED display shows 000000 for five seconds immediately after power is applied. It then should flash 314 or 316 during the power-up self-test. If it continues to show 000000, check for bent pins, mistaken connections, or termination on the SCSI bus. If this does not solve the problem, see subsections 3.8 and 3.9.

The ST8X also has error reporting capabilities based on the Sense Key information returned by the tape cartridge drive. These errors pertain to operation of the unit after the self-test completes.

In these error codes, only the first and last digits provide useful information (see Table 3-2). For example, if one of the three-digit displays begins flashing 834 during tape drive operation, a Hardware error (last digit = 4) occurred during a Position tape command (first digit = 8).

Table 3–2. Error Code Description

Code	Description
First Digit Error Code	
4XX	Read
5XX	Write
6XX	Rewind
7XX	Write tape mark
8XX	Position tape
9XX	
Last Digit Error Code	
XX3	Media error
XX4	Hardware error
XX5	Illegal byte in CDB
XX8	Blank Tape

3.2.4   File Protect Indicator

When illuminated, the File Protect indicator shows that the Write Protect Tab is enabled (closed) on the 8-mm cartridge, inhibiting write operations. Opening the tab allows write operations.

3.2.5   On Line Switch and Indicator

If a cartridge is loaded, pressing the On Line switch makes the transport available to the HSC system. Press the Reset switch once to take the drive offline. The On Line indicator is lighted when the drive is available for online operation. All switches except Reset are inhibited when the drive is online.

3.2.6   A and B Port Switches and Indicators

The Port A and Port B switches are momentary switches with built-in lights that indicate through which port the controller is accessing the drive. With A and B switches, you can select any of the following three modes:

- Port A operation only

- Port B operation only

- Port A/B programmable operation

When the Port A switch is pressed and the Port B switch is not, the controller can access only port A. When the condition is reversed, it can access only Port B. With both switches pushed, the controller can access either port.

The indicator light begins flashing when a port switch is pressed. The subsystem is offline to any port whose indicator lights are off. The tape adapter indicates that Port A or B is online to the controller when the port indicator light is on continuously.

During normal operation, only one of the port indicators is on continuously. The on/off conditions of the port indicator lights do not always reflect changes in switch position immediately. Indicator lights change state only when a port is actually online to the controller.

3.3 Tape Drive Switch and Indicators

The front panel of the tape drive includes a Cartridge Load switch, and Ready and Activity LEDs.

Cartridge Load Switch. The Cartridge Load switch opens the cartridge door for inserting a tape cartridge.

NOTE: The Cartridge Load switch is inoperative when a cartridge is loaded and online. The way to unload a cartridge is with the Reset switch on the subsystem control panel rather than with the Cartridge Load switch on the drive (see subsection 3.2.3).

Ready LED. Upon completion of the self-test diagnostics, the Ready LED illuminates (green) to indicate that the tape drive is Ready.

Activity LED. Variable blinking of the Activity LED (red or amber) indicates activity on the SCSI interface between the initiator and the tape drive.

During power-up the Ready and Activity LEDs both are lighted to indicate that the tape drive is performing power-on self-test diagnostic. These routines take 120 seconds, maximum. When they complete successfully, both LEDs turn off. If they fail, both LEDs flash.

3.4 Tape Cartridges

The ST8X uses 8-mm tape cartridges, which come in various storage capacities.

CAUTION! Use only the cartridges listed in Table 1-2. Other cartridges may cause damage to the tape transport mechanism.

The cartridge is equipped with a Write Protect tab to prevent unintentional writing of the tape. The tab is located in the recessed window at the bottom of the cartridge. When the red tab is visible (closed), the cartridge is Write Protected, and cannot be written or erased. When the tab is not visible, it is open, and the cartridge is Write Enabled.

3.5 Operating Procedures

CAUTION! All express and implied warranties will be considered null and void if the subsystem is operated with any of the covers or outer shells removed. They must be in place to maintain proper air flow throughout the subsystem chassis.

3.5.1 Loading the Tape Cartridge

To load the tape cartridge into the drive, perform the following procedure:

1. Ensure that the Write Protect tab on the tape cartridge is set properly (see subsection 3.4).

2. If the tape drive door is closed, press the Cartridge Load switch on the drive to open the door.

3. Insert the tape cartridge, label side up, with the cartridge lid facing the drive. Gently close the door.

4. To load the cartridge press the Load switch on the ST8X control panel. The tape will be positioned at PBOT.

5. Press the On Line switch to make the tape drive available to the host computer. You may press it while the cartridge is loading. When the loading process is complete, the On Line indicator is lighted, and the drive is ready for use.

3.5.2 Unloading the Tape Cartridge

To unload the tape cartridge, perform the following procedure:

1. To take the tape drive offline, press the Reset switch on the ST8X control panel once. The On Line indicator turns off.

2. To unload the tape, press the Reset switch again. If the cartridge is at PBOT, it will eject within 30 seconds. If not, it will unload after rewinding.

3.6   Testing the ST8X

This subsection describes the self-tests and HSC ILTAPE and HSC ILEXER diagnostics for testing the ST8X for acceptance. The ST8X provides a series of power-up self-tests. If an error occurs, the LED display flashes the fault code while the tests are running. Table 3–1 lists error codes and the meaning of each.

The fault indicator highlights an error condition within the drive, and the Reset switch permits resetting the error and unloading the tape. The drive stays in its current operating state until the condition is corrected. Some errors are corrected automatically, which returns the display to its normal state (showing the unit number).

With other errors, press the Reset switch to return the display to the unit number. This also takes the drive offline, tries to clear the fault condition, and returns the drive online. The Reset switch can also stop a load or rewind operation, and it can take the drive offline. Pressing this switch when the BOT indicator is illuminated unloads the tape.

3.6.1   Self-tests

The self-tests are power-on checks that run automatically when you power up the ST8X. The drives and STI adapter board both run self-tests, displaying any fault conditions in the control panel display. They begin when the LED display replaces 000000 with a flashing 314 or 316.

When self-tests complete, the unit ID number appears. If it does not, see subsection 3.2.3.

3.6.2   Setting the Mode (Test or Normal Operation)

After successful completion of the self-tests, run the two HSC diagnostics: Inline Tape (ILTAPE) and Inline Exerciser (ILEXER). Begin by setting the ST8X to the test mode as follows:

1. Power the ST8X on. After the unit passes the power-on self-tests, the LED display shows the unit address.

2. Make sure that neither A nor B port is selected and simultaneously press the right-hand drive Fault/Reset and On Line switches for five seconds and release. (Do not press the Fault/Reset switch first as this brings the unit offline and ejects the tape cartridge). When the BOT indicator begins flashing, you may program the unit address.

3. Simultaneously press the right-hand drive Fault/Reset and On Line switches again. The On Line indicator begins flashing, and the LED display shows the drive mode code.

4. Set the drive mode code to 31 for test mode. Use the Port A and Port B switches, respectively, as Increment and Decrement switches to set the desired code in the LED display.

5. Press the On Line and Fault/Reset switches simultaneously for five seconds and release once more to retain the unit ID number in non-volitile memory. The LED display will show the new unit ID numbers.

After you complete the tests, which are detailed in the following subsections, use the Port A and Port B switches to return the unit to the normal operating mode (mode 00). Simultaneously press the right-hand drive Fault/Reset and On Line switches again. The front panel then returns to normal operation, with the unit address displayed.

3.6.3 Preparing to Run the HSC Diagnostics (ILTAPE and ILEXER)

After setting the ST8X to the test mode (subsection 3.6.2), prepare for running both HSC diagnostics (ILTAPE and ILEXER) as follows:

1. Load a write-enabled tape cartridge into the tape drive.

2. Place the tape drive online, making sure that the On Line indicator is lighted.

3. Enable the appropriate port (A, B, or both) on the ST8X control panel.

4. Boot the HSC.

To run the HSC ILTAPE diagnostics, see subsections 3.6.4 through 3.6.4.2. To run the HSC ILEXER diagnostics, see subsection 3.6.5.

3.6.4 HSC ILTAPE Diagnostics

The function of the HSC ILTAPE Diagnostics is to test the ST8X transport functions and to verify streaming operations. When you plan to use both STI ports, run ILTAPE on each. If you wish further details, you may refer to the DEC documentation listed in subsection 1.2.

Use the following procedure to run two passes each of the HSC ILTAPE Diagnostic, Tests 1 and 5:

1. Press the INIT button on the HSC control panel to begin booting. The following message will be displayed.

   `INIPIO-1 Booting...`

   When HSC booting is complete, the following message appears:

   `HSC Version XXX` *dd-mmm-yy hh:mm:ss* `System n`

2. Hold down < Ctrl > while typing Y. The following prompt appears:

```
HSCXX>        (XX may be 40, 50 or 70)
```

3. To initiate HSC Diagnostic Tests 1 and 5, begin by entering the following sequence at the prompt:

```
HSCXX> R ILTAPE

ILTAPE>D>hh:mm Execution starting

DRIVE UNIT NUMBER (U) []? Tnnn
EXECUTE FORMATTER DEVICE INTEGRITY TEST (Y/N) [Y]? N
EXECUTE TEST OF TAPE TRANSPORT (Y/N) [N]? Y
IS SCRATCH MEDIA MOUNTED (Y/N) []? Y
```

At this point, Tests 1 and 5 require different commands. To run Test 1, see subsection 3.6.4.1. For Test 5, see subsection 3.6.4.2.

3.6.4.1   HSC ILTAPE Diagnostic Test 1

Run two passes of ILTAPE Test 1 by entering the following sequence at the prompt:

```
Functional Test Sequence Number (0 thru 5) [1]?  1
ENTER CANNED SEQUENCE RUN TIME IN MINUTES (D) [1]?  1
SELECT DENSITY (0=ALL, 1=1600, 2=6250) [0]?  0
ILTAPE>D>FIXED SPEEDS AVAILABLE:
ILTAPE>D>(1)   025 IPS
ILTAPE>D>(2)   075 IPS
SELECT FIXED SPEED (D) [0=AUTOMATIC]?  0
DATA PATTERN NUMBER (1,2,3,4) [3]?  3
SELECT RECORD SIZE (greater than 0) (D) [8192]?  8192
ITERATIONS (D) [1]?  2
```

3.6.4.2   HSC ILTAPE Diagnostic Test 5

Run two passes of ILTAPE Test 5 by entering the following sequence at the prompt.

```
Functional Test Sequence Number (0 thru 5) [1]?  5
SELECT DENSITY (1=800, 2=1600, 3=6250) [3]?  3
ILTAPE>D>FIXED SPEEDS AVAILABLE:
ILTAPE>D> (1)   025 IPS
ILTAPE>D> (2)   075 IPS
SELECT FIXED SPEED (D) [0=AUTOMATIC]?  0
DATA PATTERN NUMBER (0,1,2,3,4) [3]?  3
ITERATIONS (D) [1]?  1
```

NOTE: ILTAPE Test 5 performs operations which run to the end of the tape. When using 112m (2-hour) tape cartridges, this test may time out before the ST8X reaches the end of the tape. Therefore, a shorter tape length, such as 28m (30-minute), is recommended for this test.

3.6.5 HSC ILEXER Diagnostic

The Inline Exerciser (ILEXER) Diagnostic exercises the unit by writing and reading a data pattern. When you plan to use both STI ports, run ILEXER on each. No errors are allowed, except with a bad tape cartridge. If you wish further details, you may refer to the DEC documentation listed in subsection 1.2.

Use the following procedure to run the ILEXER diagnostic for 10 minutes:

1. Press the INIT button on the HSC control panel to begin booting. The following message displays.

   ```
   INIPIO-1 Booting...
   ```

   When HSC booting is complete, the following message appears:

   ```
   HSC Version XXX dd-mmm-yy hh:mm:ss System n
   ```

2. Hold down the <Ctrl> while typing Y. The following prompt appears:

   ```
   HSCXX>        (XX may be 40, 50 or 70)
   ```

3. Run ILEXER by entering the following sequence at the prompt:

   ```
   HSCXX> R ILEXER

   ILEXER>D>hh:mm Execution Starting

   Drive Unit Number (U) []?   Tnnn
   Is a Scratch Tape Mounted (Y/N) []? Y
   Are You Sure (Y/N) [N]? Y
   Data Pattern Number (16-22) (D) [21]? 21
   Density (1=800, 2=1600, 3=6250) [3]?   3
   Select Automatic Speed Management (Y/N) [N]? N
   ILEXER>D>Fixed Speeds Available:
   ILEXER>D> (1)   025 IPS
   ILEXER>D> (2)   075 IPS
   Select Fixed Speed (D) [1]?   1
   Record Length in Bytes (2 to 12288) (D) [8192]? 8192
   Data Compare (Y/N) [N]? Y
   Another Drive (Y/N) []? N
   Run Time in Minutes (1 to 32767) [10]? 10
   Hard Error Limit (D) [20]? 20
   Narrow Report (Y/N) [N]? N
   Enable Soft Error Reports (Y/N) [N]? N
   ```

3.7 Preventive Maintenance

To keep your subsystem in peak operating condition, follow the instructions that accompany the drive-cleaning kit, which is included with each subsystem. Maintenance is preventive. With normal environmental conditions, use the head-cleaning cartridge after each 30 gigabytes of data transfer or monthly, whichever comes first (1 gigabyte is transferred each hour of continuous streaming operation). If your subsystem has read/write performance problems, run one or two cleaning passes.

When you insert the cleaning cartridge, the cleaning material moves through the tape path for 15 seconds, removing tape residue and dust. The cartridge ejects automatically, and your subsystem is ready for operation. You may order additional kits (P/N CK23) from Emulex.

CAUTION! Observe the following precautions on maintaining heads and cartridges in good working order:

1. The cleaning method given here is the only approved one. Other kits, even previous approaches used in the drive manufacturer's field tests, are unacceptable, and will void the warranty.

2. After you use a cleaning tape three times, discard it, because it has only three cleaning segments. Do not rewind it, because this will re-introduce contaminants.

3. Keep the tape cartridge in a controlled environment of 50 to 122 degrees F (10 to 50 degrees C) and 20 to 80 percent relative humidity.

4. Do not place the tape cartridge near a magnetic field or in sunlight.

5. Do not touch the tape inside the cartridge.

3.8 Troubleshooting

CAUTION! The ST8X contains no user-serviceable parts. For service refer to an authorized service technician.

In case of problems with your subsystem, review Sections 2 and 3, and confirm the following:

1. The controller has successfully completed the self-test.

2. Cabling is correct and the terminators are installed properly.

3. No connector pins are bent.

4. All power sources are working.

5. Tapes cartridges are installed properly.

3.9   Service

If you have a problem that you cannot resolve by reviewing Sections 2 and 3, you can get help by calling Emulex Technical Support at the phone numbers given below. If you determine that the subsystem contains a defective component, return the component to an authorized Emulex repair center for service.

Do not return a component to Emulex without authorization. Before you return a product to Emulex, whether it is under warranty or not, you must contact the factory or the factory representative for return-shipment instructions and a Return Materials Authorization (RMA) number. A component returned for service without an authorization will be returned to the owner at the owner's expense. Outside the United States, contact the distributor from whom the subsystem was initially purchased. In the continental United States, Alaska, and Hawaii, contact:

> Emulex Technical Support
> 3545 Harbor Boulevard
> Costa Mesa, CA 92626
>
> Telephone: (714) 662-5600
> (1-800-854-7112 outside California)
> FAX: (714) 966-1299

After you have received an RMA, package the subsystem peripheral device, preferably using the original packing material, and send it, *postage paid and insured,* to the address provided by the Emulex representative.

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