HSR95 Cabinet

HSR95 Cabinet and Rackmount HSC95 Controller Installation Manual

Order Number: EK–HSCRA–IN. A01

This manual contains installation and upgrade information for the HSR95 cabinet and installation for the 50% and 100% SCSI configured rackmount HSC95 controller. A procedure for removing and replacing a K.scsi module in a rackmount HSC95 controller is also included.

Digital Equipment Corporation
Maynard, Massachusetts

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The postpaid Reader's Comments forms at the end of this document request your critical evaluation to help prepare future documentation.

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Preface

This manual contains procedures for installing and configuring the HSR95™ and the rackmount HSC95™ controller.

─────────────────────── **Note** ───────────────────────

The equipment described in this manual is listed by the Underwriters Laboratories Incorporated and bears the UL Listing mark. This equipment is also certified by the Canadian Standards Association (CSA) and bears the CSA certification mark.

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Intended Audience

This manual is intended for Digital™ Multivendor Services engineers and for personnel qualified to install and service this equipment.

Manual Organization

The information in this manual is organized as follows:

Chapter 1	Contains an overview of the HSR95 cabinet and the rackmount HSC95 controller.
Chapter 2	Contains the installation procedure for the HSR95 cabinet. This information includes procedures for site preparation, unpacking, connecting cables, and checking the cabinet configuration.
Chapter 3	Describes how to apply power to the rackmount HSC95 controller. This procedure is also used to power up the HSC95 controller in the HSR95 cabinet. The procedure to perform the UART echo test is also included in this chapter.
Chapter 4	Describes the appropriate inline diagnostic tests used to check out the rackmount HSC95 controller installation. This procedure is also used to check out the HSC95 controller in the HSR95 cabinet.
Chapter 5	Describes how to set the parameters in the rackmount HSC95 controller. This procedure is also used when adding another HSC95 controller to the HSR95 cabinet.
Chapter 6	Describes the procedures used to add HSC95 controllers or StorageWorks™ building block (SBB) shelves to an HSR95 cabinet.
Chapter 7	Contains site preparation and procedures for installing the rackmount HSC95 controller in either the inch-spacing or metric-spacing cabinets.
Chapter 8	Contains procedures for changing backplane and I/O bulkhead configurations in the rackmount HSC95 controller.

| Appendix A | Contains configuration rules for SBB shelves when used with the HSR95 cabinet or rackmount HSC95 controller. |

Document Conventions

The following conventions are used in this manual:

Convention	Meaning
Italic type	Indicates a command variable or a complete manual title.
Bold type	Indicates an introduction of a new term or text emphasis. In code examples, bold type indicates user input.

Related Documentation

Table 1 lists applicable reference documentation.

Table 1   Related Documentation

Title	Order Number
HSC Controller User Guide	AA–PFSQA–TK
HSC Controller Service Manual	EK–HSCMA–SV–003
HSC Controller Service Manual Supplement	EK–HS695–SI–002
HSC Controller Pocket Reference Card	EK–HSCPK–RC–003
SF Family Label Booklet	36–32882–01

1

Introduction

This chapter contains information and specifications for the HSR95 cabinet and rackmount HSC95 controller.

An HSC95 controller is a high-speed server used for data management between disk/tape drives and a host system. The HSC95 controller connects to the host, either directly or through a star coupler, using CI™ cables. The HSC™ controller connects to the mass storage devices (tape drives or disk drives) using SDI™/STI™/Small Computer System Interface (SCSI) cables and to terminals using EIA cables.

The HSR95 cabinet contains one or two rackmount HSC95 controllers and up to eight StorageWorks™ building block (SBB) shelves containing SCSI storage devices that are housed in an 800 millimeter cabinet.

The rackmount HSC95 controller is functionally identical to the standard HSC95 controller, except that it is housed in a rackmount cabinet. All software, including HSC High Performance Software™ and diagnostics that run on a standard HSC95 controller, operate identically in the rackmount HSC95 controller. However, due to the rackmount configuration, the operator control panel (OCP) and location of the various boot devices, switches, and indicators, as well as the mechanical details of servicing the rackmount configuration, are unique to the rackmount HSC95 controller.

Table 1–1 provides a listing of the HSC modules used in a rackmount HSC95 controller.

Table 1–1 Rackmount HSC95 Controller Module Configuration

Configuration	HSC95–SX/ZX
Port processor	L0124–AA
Port link	L0118–YA
Port buffer	L0125–AA
I/O control processor	L0142–YC
Memory standard	L0123–BA
64-Mbyte cache	L0121–BA
Disk data channel	L0108–YA
Tape data channel	L0108–YB
Disk/tape data channel	L0119–YA
8-port disk data channel [1]	L0119–YB
SCSI data channel[2]	L0131–AA
Maximum disk or tape requestors	8
Available ports	Up to 56
Diskette drive type	RX33™
Auxiliary power supply	Yes

[1]This module can only be installed in requestor 6 of an HSC95–SA/SB controller.

[2]This module can only be installed in requestors 2, 3, 4, and 5 for the HSC95–SA/SB controller (50% SCSI), and in requestors 2 through 9 for the HSC95–ZA/ZB controller (100% SCSI).

Note

These module configurations are enforced in the HSC software. If an HSC controller with an invalid configuration is turned on the operator control panel displays a fault code of 33.

1.1 HSR95 Cabinet Overview

This section provides an overview of the HSR95 cabinet and integral SBB shelves. The HSR95 cabinet consists of a storage cabinet that contains up to two rackmount HSC95–SX/ZX controllers and up to eight SBB shelves. The HSR95 cabinet is shown in Figure 1–1.

Operator controls are accessible on the front panel of each HSC95 controller. In addition, the HSR95 cabinet provides the option to install dual power controllers for redundant power.

The HSC95 controller can be used with any host system that has CI bus interface capability. It can be installed in any location relative to the central processing unit (CPU) that is allowed by the CI cabling length limits. The CI cables from the host CPU connect directly to the HSC95 controller in the cabinet.

Specifications for the HSR95 cabinet are listed in Table 1–2.

Figure 1–1 Front view of the HSR95 Cabinet

CXO-3819A-PH

Table 1–2 HSR95 Cabinet Specifications

General Specifications

Dimensions (nominal height, width, depth)	170.0 cm (66.93 inches) x 80.0 cm (31.50 inches) x 87.25 cm (34.35 inches)
Weight	
Minimum configuration	228 kg (500 lb)
Maximum configuration	635 kg (1400 lb)
Agency compliance	FCC, UL, IEC, CSA, TUV, and VDE
Electrical rating	
HSR95	120/208 volts, 50/60 Hz, 3 phase Y, 24 amperes per phase or 380-415 volts, 50/60 Hz, 3 phase Y, 16 amperes per phase
Temperature	+15° C to +32° C (+59° F to +90° F) Reduce rating by 1.8° C for each 1000 meters altitude (1.0° F for each 1000 feet altitude)
Humidity	20% to 80% at maximum wet bulb temperature of +25° C (+77° F) and minimum dew point of +2° C (+36° F)

Recommended Environmental Limits[1]

Operating environment	
Temperature	+15° C to +32° C (+59° F to +90° F) with an average rate of change of 3° C/hour maximum and a step change of 3° C or less
Relative humidity	20% to 80% (noncondensing) with a step change of 10% or less (noncondensing)
Altitude	Up to 2400 meters (8000 feet)
Air quality (maximum particle count)	Not to exceed 500,000 particles per cubic foot of air at a size of 0.5 micron or larger
Air volume (at inlet)	50 cubic feet per minute (0.026 cubic meters per second)
Nominal airflow through enclosure	360 to 650 cubic feet/minute
Nonoperating environment	
Temperature	–40° C to +66° C (–40° F to +151° F)
Relative humidity	Less than 96%
Altitude	4900 meters (16,000 feet)

[1]These limits are for optimum equipment performance and reliability.

1.2 Overview of the Rackmount HSC95 Controller

The rackmount HSC95 controller is housed in a BA65 chassis. The BA65 chassis, in turn, can be mounted in an appropriate standard 19-inch RETMA rack cabinet with either inch or metric vertical hole spacing.

The HSC95–SX controller is configured to handle both SCSI data channel requestors and any other data channel requestors that can be connected to a standard HSC controller model in a 50/50 arrangement. The HSC95–ZX controller is configured to handle SCSI data channel requestors only.

Refer to Table 1–1 for a listing of the module configurations for rackmount HSC95 controllers.

1.2.1 Major Components of the Rackmount HSC95 Controller

The rackmount HSC95 controller contains the following major components:

- OCP enclosure assembly
- Floppy drive assembly
- Power supply assemblies
- Card cage with modules
- Rear panel

A description of each component is given in the following sections.

1.2.1.1 OCP Enclosure Assembly

The OCP enclosure assembly is located on the HSC95 controller front panel as shown in Figure 1–2. The OCP contains the following controls and indicators:

- DC Power on/off switch
- Secure/Enable switch
- State LED
- Power LED
- Init switch
- Fault switch
- Online switch

These controls and indicators function exactly like their counterparts on standard HSC controller models. Refer to the *HSC Controller User Guide* for information on operating the rackmount HSC95 controller.

1.2.1.2 Floppy Disk Drive Assembly

The floppy disk drive assembly, containing RX33 disk drives DX0 and DX1, is located on the front panel of the HSC controller as shown in Figure 1–2.

The floppy disk drive assembly is used to load HSC software and diagnostics. Refer to the applicable HSC controller documentation for information on loading software and diagnostics using the floppy drive assembly.

1.2.1.3 Power Supply Assemblies

Power supply assemblies include the following units:

- Standard power supply assembly
- Auxiliary power supply assembly

The power supply assemblies are located under the chassis top cover. Connections are accessed from the bottom.

Figure 1–2 Rackmount HSC95 Controller Front panel

Secure/Enable SWITCH

DC Power SWITCH

State LED

Power LED

Init SWITCH

Online SWITCH

Fault SWITCH

HSC95
Rack-mountable

RX33 DRIVE DX0

RX33 DRIVE DX1
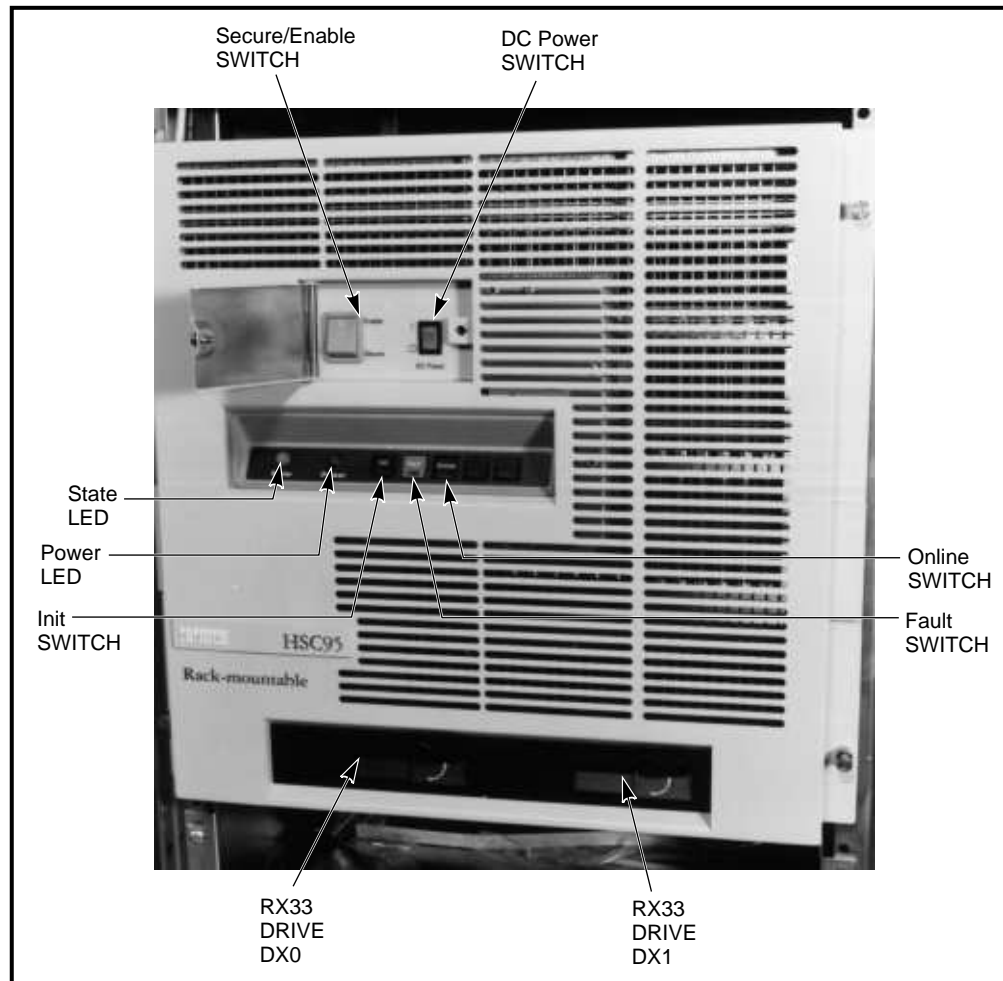
CXO-3820A-PH

1.2.1.4 Card Cage with Modules

The card cage contains modules for communicating on the CI bus, for communicating with disk drives and tape formatters/drives, and for performing HSC95 controller functions. Because the placement of modules in the card cage is critical to the performance of the rackmount HSC95 controller, refer to the *HSC Controller User Guide* before installing a rackmount HSC95 controller. Refer to Table 1–1 for a complete listing of the modules that can be installed in the rackmount HSC95 controller.

The card cage is located under the chassis top cover. Connections are accessed from the bottom.

1.2.1.5 Rear Panel

Figures 1–3 and 1–4 show the rear panels of the 50-percent (HSC95–SX) and 100-percent (HSC95–ZX) SCSI-configured rackmount HSC95 controllers. The following components are mounted on the rear panel of the rackmount HSC95 controller:

- Fans (2)
- Airflow sensors (2)
- EIA terminal connectors (3)
- CI cable connector ports (4)
- I/O bulkhead
- AC power connector
- AC circuit breaker
- Line transients suppresser

The I/O bulkhead is mounted to the back of the chassis just below the rear panel. The ac circuit breaker and EMI filter are mounted on the back of the chassis.

The device port cable connectors for the console, SDI/STI devices, and SCSI devices are mounted on the I/O bulkhead portion of the rear panel.

Figure 1–3 50 Percent SCSI Configuration Rear Panel

CI CONNECTORS

SCSI CONNECTORS

CONSOLE CONNECTOR

REAR PANEL CIRCUIT BREAKER

SDI/STI CONNECTORS
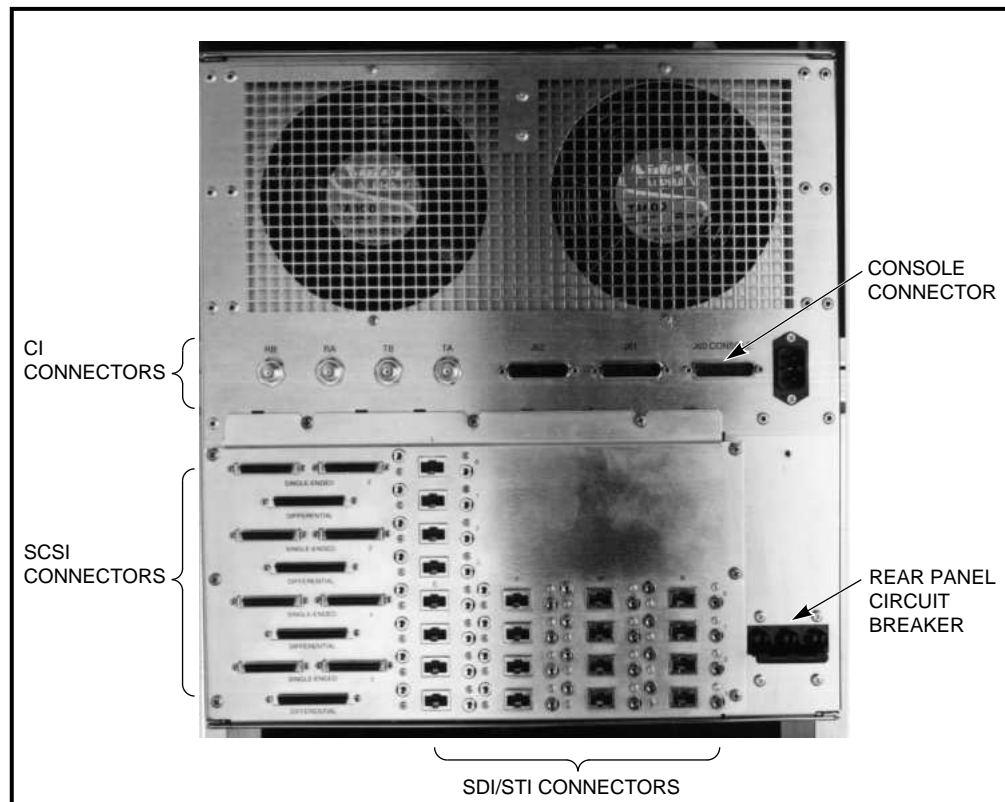
CXO-3821A-PH

1.2.2 Rackmount HSC95 Maintenance Positions

Maintenance can be performed on the rackmount HSC95 controller by pulling the controller out from the cabinet as described in the following sections

_____ **CAUTION** _____

Do not operate the rackmount HSC95 controller for an extended period with either the top or bottom cover removed. This condition alters the airflow through the BA65 chassis and may cause the airflow sensors to shut down the unit.

_____ **WARNING** _____

The rackmount HSC95 controller chassis weighs approximately 59 kilograms (130 pounds). To avoid personal injury, verify that the cabinet stablilizer foot is fully extended and use sufficient personnel or proper lifting equipment before installing the chassis or extending the chassis on slides for maintenance.

Figure 1–4 100 Percent SCSI Configuration Rear Panel

CXO-3826A-PH
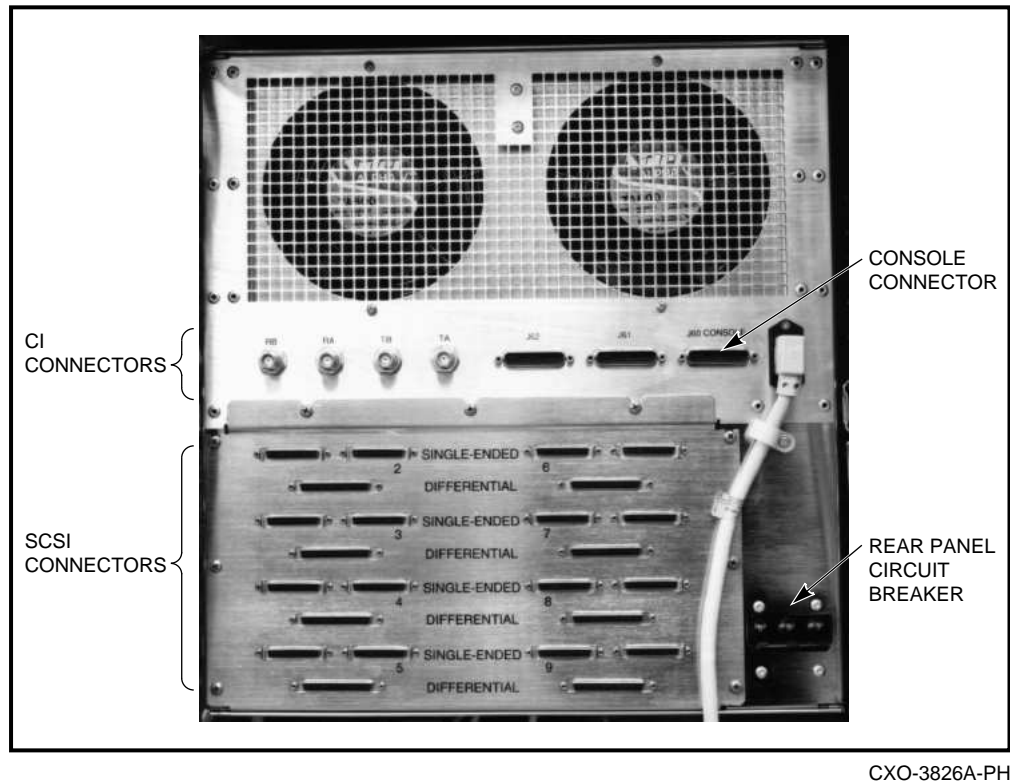
Extend the rackmount HSC95 controller chassis by releasing the four captive screws on the front bezel of the unit and sliding the chassis forward until it locks in the fully extended position. After extending the chassis, the HSC controller can be placed into any one of the following three maintenance positions:

- **Maintenance Position 1**—Door bezel assembly removed

- **Maintenance Position 2**—Chassis top cover removed

- **Maintenance Position 3**—Chassis rotated and chassis bottom cover removed

These maintenance positions are described in the following sections.

1.2.3 Maintenance Position 1

Maintenance position 1 is used to remove and replace the following field replaceable units (FRUs):

- OCP

- OCP enclosure assembly

Complete the following procedure to place the rackmount HSC95 controller in maintenance position 1, as shown in Figure 1–5:

1. Fully extend the chassis on its equipment mounting slides.

Figure 1–5 Maintenance Position 1

Indexing
Mechanism

Screws

Screws

Equipment
Mounting
Slides
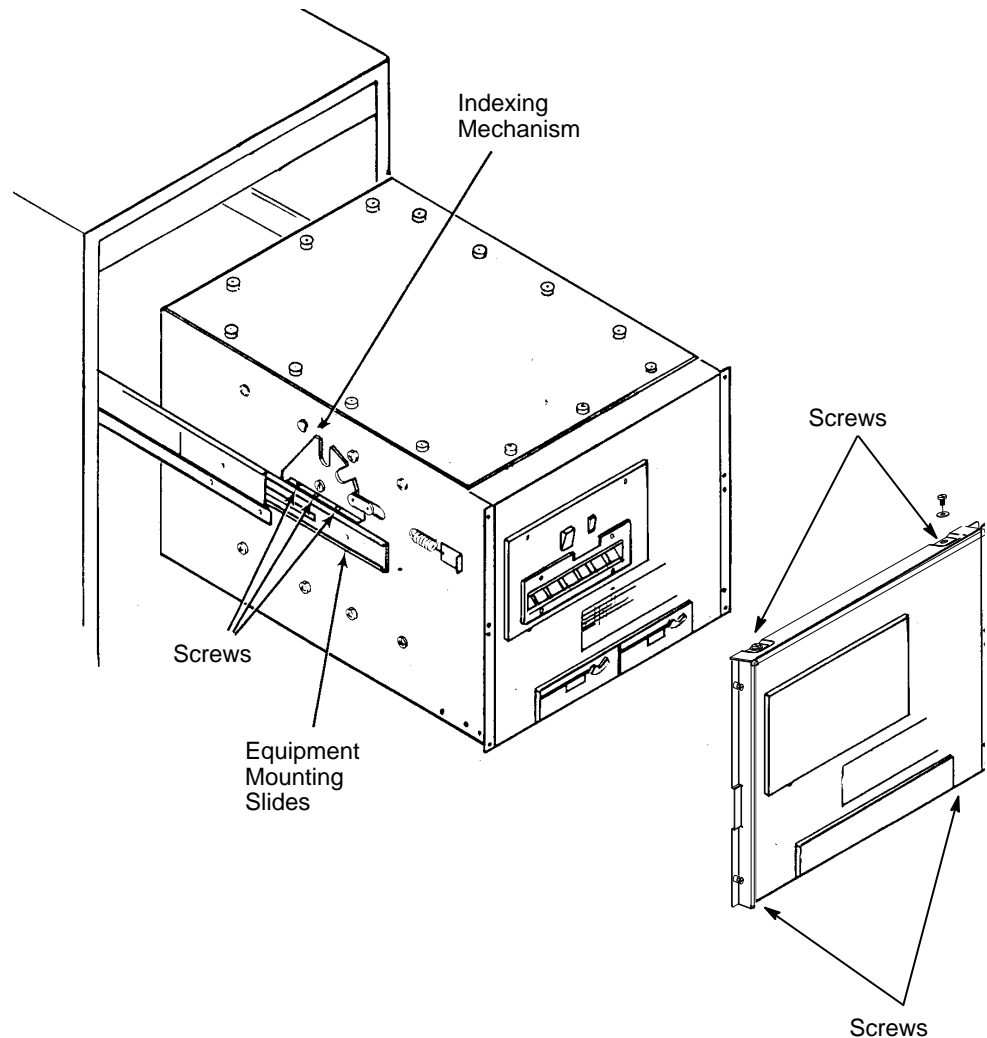
Screws

CS–8325

2. To remove the door bezel assembly, remove the four 10 x 32 screws at the top and bottom of the bezel and lift the door bezel assembly away from the chassis.

1.2.4 Maintenance Position 2

Maintenance position 2 is used to remove or replace the following field replaceable units:

- Backplane modules

- Airflow sensors

- Fans

- Standard power supply (after disconnecting cables in maintenance position 3)

- Auxiliary power supply (after disconnecting cables in maintenance position 3)

Complete the following procedure to place the rackmount HSC95 controller in maintenance position 2, as shown in Figure 1–6:

1. Fully extend the chassis on its equipment mounting slides.

2. Remove the chassis top cover. Release the captive screws around the edge of the chassis top cover and lift the cover away from chassis.

Figure 1–6   Maintenance Position 2

Top Cover
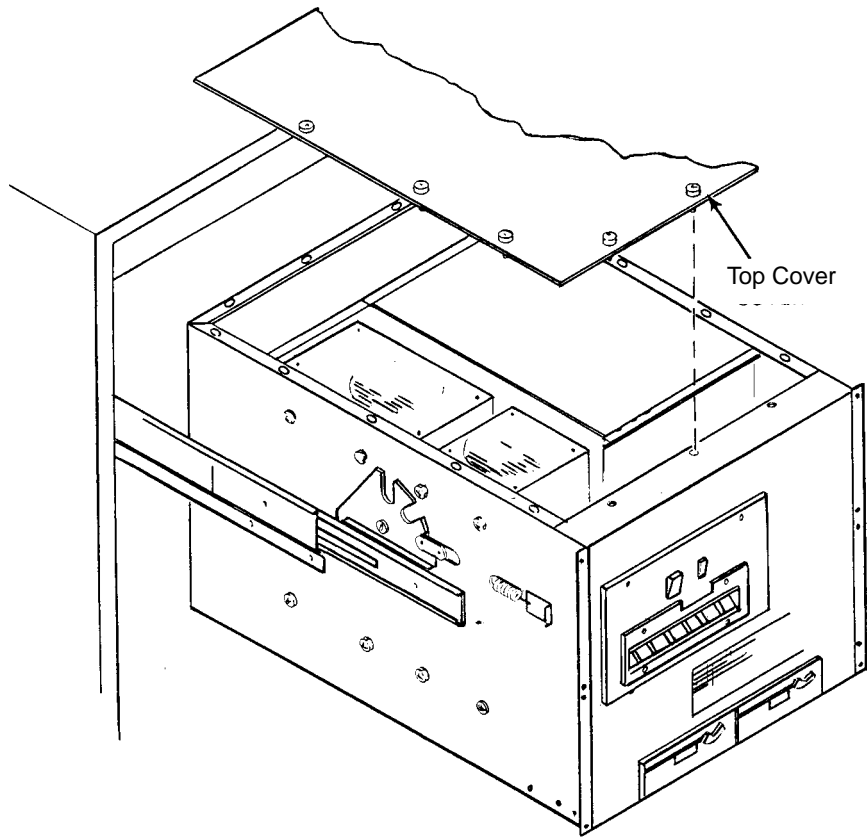
CS-8351

1.2.5 Maintenance Position 3

Maintenance position 3 is used to remove or replace the following FRUs:

- EMI filter
- AC circuit breaker
- Standard power supply (disconnecting and reconnecting wiring)
- Auxiliary power supply (disconnecting and reconnecting wiring)
- RX33 diskette drive

• I/O bulkhead

CAUTION

Do not place the rackmount HSC95 controller into maintenance position 3 unless directed to do so by Digital Services. This position may disconnect some of the cables attached to the HSC I/O backplane and interrupt service on the controller, or on the other controller of a dual-pathed pair.

Complete the following procedure to place the rackmount HSC95 controller in maintenance position 3, as shown in Figure 1–7:

1. Fully extend the chassis on its equipment mounting slides.

2. Tilt the chassis by pulling the slide index plate locking levers (one on each side of the chassis) forward and rotating the chassis up. Release the levers to lock the chassis in the upright position.

3. Remove the bottom cover screws and lift chassis bottom cover away from chassis. Be careful to keep all the screws in a safe place for reassembly.

Figure 1–7 Maintenance Position 3
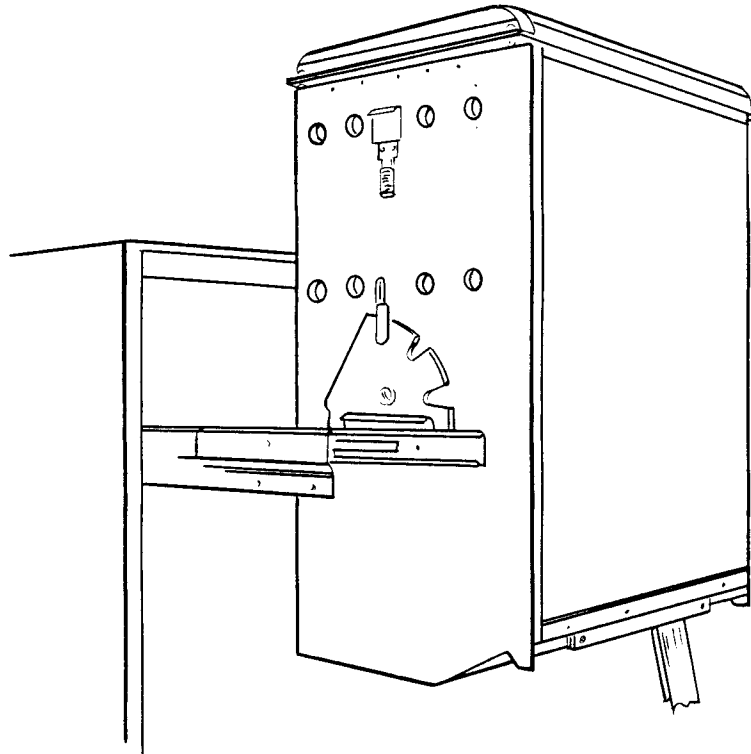
NOTE: Bottom cover is removed.

CS-8352

1.2.6 Rackmount HSC95 Controller Specifications

Table 1–3 lists the physical, electrical, and environmental limits for the
rackmount HSC95 controller. Table 1–4 lists the dimensions of the rackmount
HSC95 controller.

_____ **Note** _____

Diagonal measurement of the BA65 chassis without bezels is
approximately 61.0 centimeters (24 inches). Mounting conforms to
ANSI/EIA STD RS–310–C–77 and MIL–STD–189.

_____

_____ **WARNING** _____

To prevent damage to equipment and personnel, ensure that power
sources meet the specifications required for this equipment. Use the
specifications listed in the following tables to plan for adequate power,
floor space, and weight requirements.

_____

Table 1–3 Rackmount HSC95 Controller Environmental Specifications

Recommended Environmental Limits

Nonoperating environment

Temperature	–40° C to +66° C (–40° F to +151° F)
Humidity	Less than 96%
Altitude	9,100 m (30,000 ft)

Operating Environment

Temperature	+15° C to +32° C (+59° F to +90° F)
Humidity	20% to 80%
Altitude	2,400 m (8,000 ft)
Maximum heat	5,310 Btu/hr dissipation

Vibration

5–22 Hz	0.01 in double amplitude
22–500 Hz	0.25 g peak
500–22 Hz	0.25 g peak
22–5 Hz	0.01 in double amplitude
Shock	5 peak half sine pulse, 10 ms duration
Sweep rate	1 octave per minute all 3 axes

Acoustic Levels Produced by the Rackmount HSC95 Controller[1]

Sound power level (LwAd)	
Idle	7.9 B
Operate	7.9 B
Sound pressure level (LpAm)	
Idle	60
Operate	60

Power Requirements[2]

Steady state:	
@100 Vac to 120 Vac	11.7 A
@220 Vac to 240 Vac	9.0 A
Surge current:	
@100 Vac to 120 Vac	350A/16 milliseconds
@220 Vac to 240 Vac	350A/20 milliseconds

[1]Preliminary declared values per ISO 9296 and ISO 7779 (1 B = 10 dBA). Sound level values for specific configurations are available from Digital Equipment Corporation. Sound pressure level is in bystander position.

[2]Assumes maximum configuration of HSC5X–BA/CA modules. If HSC5X–DA modules (or HSC5X–FA/SX modules, where supported) are utilized for requestors, current drawn will be less. Frequency tolerance for all models is 50 Hz to 60 Hz. All models use single-phase power.

Table 1–4 Dimensions of the Rackmount HSC95 Controller

Item	Height (cm/in)	Width (cm/in)	Depth (cm/in)	Weight (kg/in)[1]
Chassis	44.5/17.5	41.9/16.5	66.1/26.0	56.8/125.0
Chassis with slides and bezel	44.5/17.5	48.3/19.0	67.3/26.5	65.9/145.0
With cable management tray	53.3/24.5	48.3/19.0	67.3/26.5	76.4/168.0
Cable management space allocation	26.7/7.0	48.3/19.0	N/A	N/A

[1]Weight is estimated.

2

Installing the HSR95 Cabinet

This chapter contains the installation procedure for the HSR95 cabinet.

2.1 Site Preparation and Planning

The HSR95 cabinet is intended for installation in a Class A computer room
environment. Before installing the cabinet, make sure the following conditions
are met:

- The computer room environment meets the specifications given in Table 1–2.

- Adequate 3-phase ac power is available. In a fully configured HSR95 cabinet,
  each phase draws up to 24.0 amperes at 120V/60 Hz power and 16.0 amperes
  at 240V/50 Hz power.

- Sufficient space is provided around the HSR95 cabinet for opening the front
  and rear doors, for accessing cables, and for adequate airflow. See Figure 2–1
  for specific space requirements.

- Power reserves are available to support the planned number of storage
  enclosures. Refer to Table 1–2 for electrical specifications.

- The floor of the installation site can safely support the weight of the HSR95
  cabinet. Refer to Table 1–2 for HSR95 cabinet weight specifications.

- The correct NEMA plug or plugs are available. The NEMA plug types are
  shown in Figure 2–2.

Power Distribution Systems Requirements

Ensure that the power distribution systems meet local codes prior to system
installation. In properly wired power distribution systems with properly
functioning equipment (no ground faults), there is generally no need for any
further attention to grounding. The power distribution system provides a
satisfactory path between enclosures.

To ensure that the system is properly grounded, perform a power system survey
before installation to check for the following conditions:

- Do any outlets being used not have power-ground connections?

- Is the grounding prong missing on any of the computer equipment power
  cords?

- Are any of the power outlet neutral connections actually ground connections?

Figure 2–1 Minimum Clearance Required for Installation

31.50 in
800.0 mm

DOOR

REAR

HSR95

FRONT

DOOR

29.33 in
74.5 cm

34.45 in
87.5 cm MAX

29.33 in
74.5 cm

CXO-3827A-MC
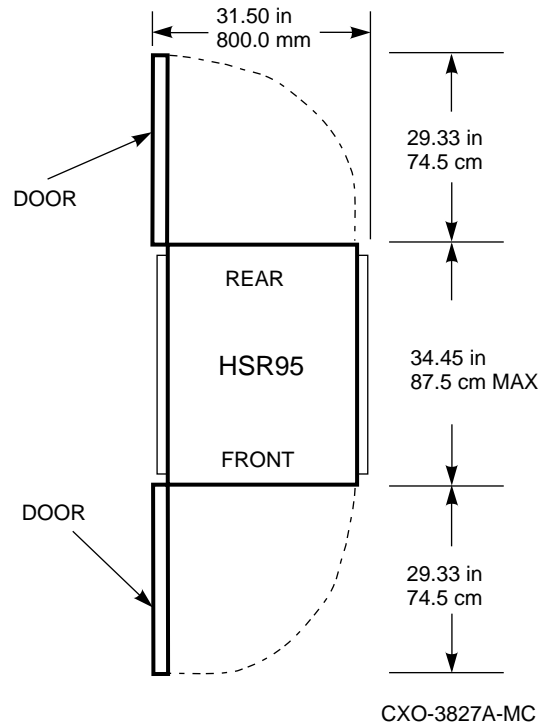
Figure 2–2 NEMA Plugs for the 881 Power Controller

PLUGS GOING TO WALL OUTLET (FROM CONTROLLER)

120/208V AC 60HZ
30A
3-PHASE
WYE
USED WITH 881-A AND 881-C
POWER CONTROLLERS

5-WIRE
NEMA NO. L21-30P

220-240/380-415V AC 50HZ
20A OR 16A
3-PHASE
WYE
USED WITH 881-B
POWER CONTROLLER

5-WIRE, 4-POLE,
IEC 309

CXO-2468B

- Are all the ground connections for the power distribution circuits (outlets) connected to the same power distribution panel?

- Are any devices that are not UL- or IEC-approved connected to the same breaker as any of the computer equipment?

2.2 Unpacking the HSR95 Cabinet

_____ Note _____

Before unpacking the HSR95 cabinet, ensure that the site is ready
to receive it by verifying that the site preparation criteria given in
Section 2.1 have been met.

_____

The HSR95 cabinet is packed in a corrugated carton attached to a wooden
shipping pallet, as shown in Figure 2–3. Use the following procedure to unpack
the cabinet and check for shipping damage:

1. Before unpacking the equipment, inspect the shipping carton for signs of
   external damage. Report any damage to the local carrier and to Digital
   Multivendor Services or your local sales office.

2. Cut the shipping straps, release the fasteners, and remove the outer
   corrugated carton and associated packing material. Some HSR95 cabinets are
   packaged with a plastic bag. If the HSR95 cabinet arrives in a plastic bag,
   leave the plastic bag in place until the required environmental stabilization
   time has elapsed. Environmental stabilization occurs after 24 hours.

_____ CAUTION _____

Failure to stabilize the equipment thermally may damage the drive
media or associated electronics when the unit is powered up. Thermal
stabilization begins when the equipment is placed in the room where it is
to be installed.

_____

3. Once the HSR95 cabinet is unpacked, examine the front and rear doors, the
   right and left side panels, and the undercarriage for any apparent damage.
   Report any damage to Digital Multivendor Services or your local sales office.

4. Retain the shipping container and all packing materials.

2.3 Removing the HSR95 Cabinet from the Pallet

This section describes how to remove the HSR95 cabinet from the shipping pallet
and how to level it.

_____ WARNING _____

The HSR95 cabinet weighs between 500 and 1400 pounds, depending on
the installed options. To avoid injury, use sufficient personnel and proper
equipment when moving the cabinet.

_____

Figure 2–3 Contents of Shipping Container

COVER

CARTON
CONTAINING
SKIRT KIT

CORRUGATED
BOARD

FASTENERS

MANUALS

FASTENERS

PLASTIC OR
BARRIER BAG

SHIPPING
STRAPS

PALLET

CARTON
CONTAINING
UNLOADING
RAMPS
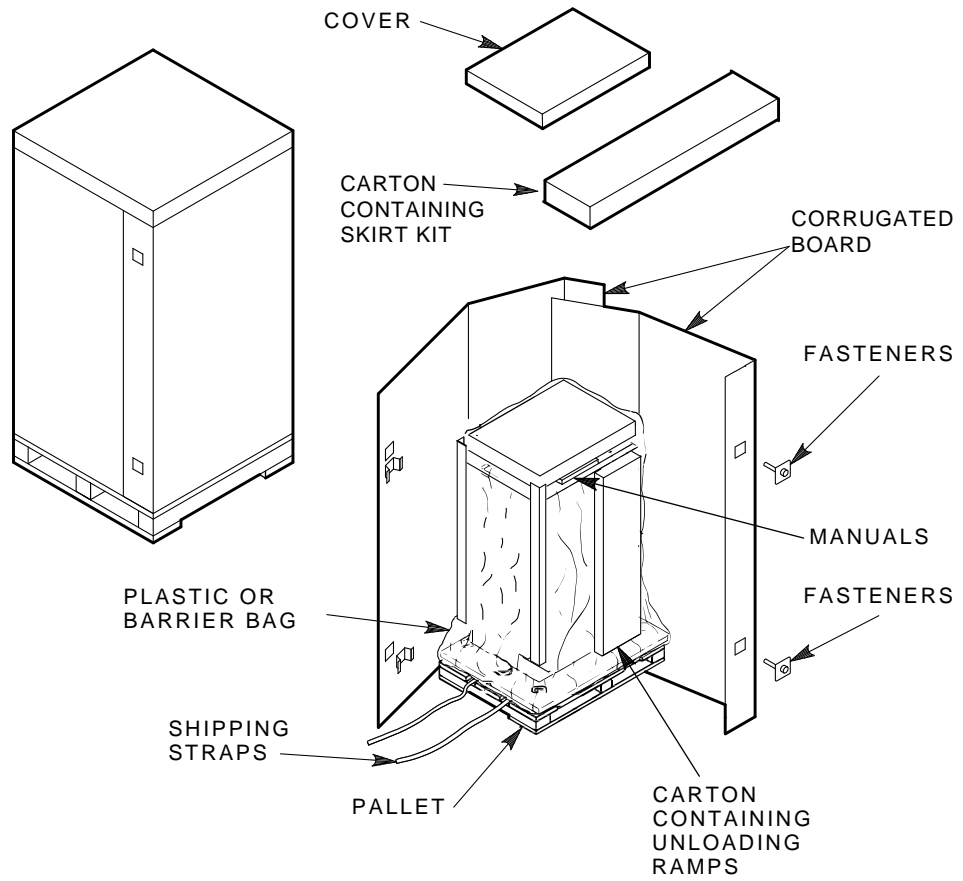
CXO-3533A-TI

The following tools and equipment are needed to install the HSR95 cabinet:

- 7/16-inch wrench
- 9/16-inch wrench
- 3/4-inch wrench
- Safety glasses

_____ **WARNING** _____

Serious personal injury may result if correct safety conditions are not met. During the unpacking procedure, personnel should wear safety glasses. Inspect the ramps, ramp side rails, and metal hardware for the following defects:

- Cracks more than 25 percent of the ramp depth, either across or lengthwise on the ramp
- Knots or knotholes going through the thickness of the ramp and greater than 50 percent of the ramp width
- Loose, missing, or broken ramp side rails
- Loose, missing, or bent metal hardware

If any of these defects exist, DO NOT USE THE RAMP. Investigate alternate means of removing the HSR95 cabinet or order a new ramp. The part number for the ramp set is 99–08897–05.

See Figure 2–4 and use the following procedure to remove the HSR95 cabinet from the shipping pallet:

Figure 2–4 Ramp Installation on Shipping Pallet

LEFT
UNLOADING
RAMP

SHIPPING
PALLET

REAR

FRONT

RIGHT RAMP
ATTACHES HERE

RIGHT
UNLOADING
RAMP

EXTEND RAMP TO
FULL LENGTH
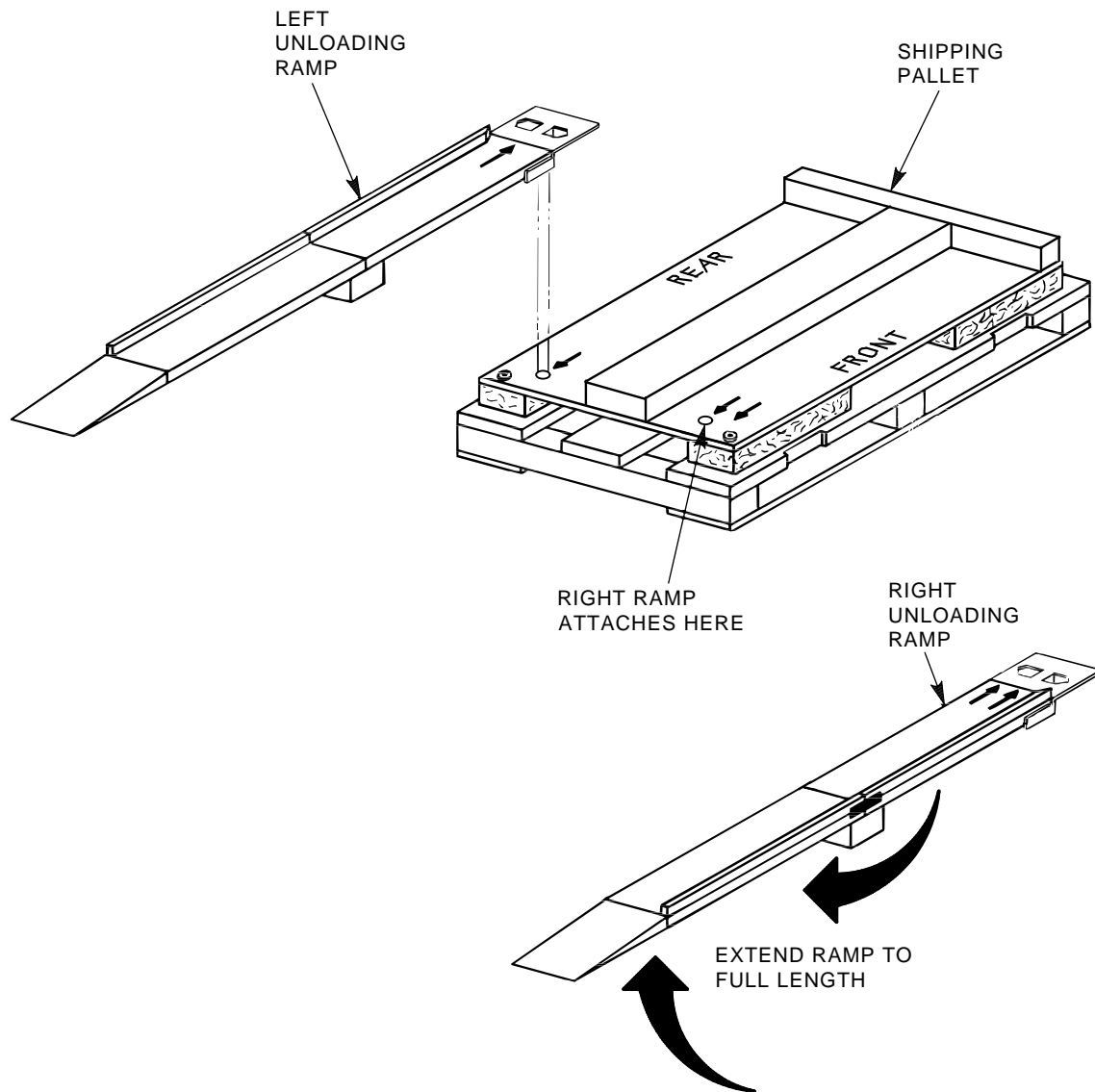
CXO-688D_S

1. Verify that all packing material has been removed.

2. Remove and inspect the two unloading ramps.

3. Attach the ramps to the pallet by fitting the metal prongs into the holes
   on the pallet. Make sure that the arrows on the ramps match up with the
   arrows on the pallet as shown in Figure 2–4.

4. Extend the ramps to their full length.

5. Remove the shipping bolts shown in Figure 2–5.

6. Remove the shipping brackets from the cabinet levelers.

7. Screw the cabinet levelers all the way up.

Figure 2–5 Shipping Bolts

LEVELER

SHIPPING
BOLT
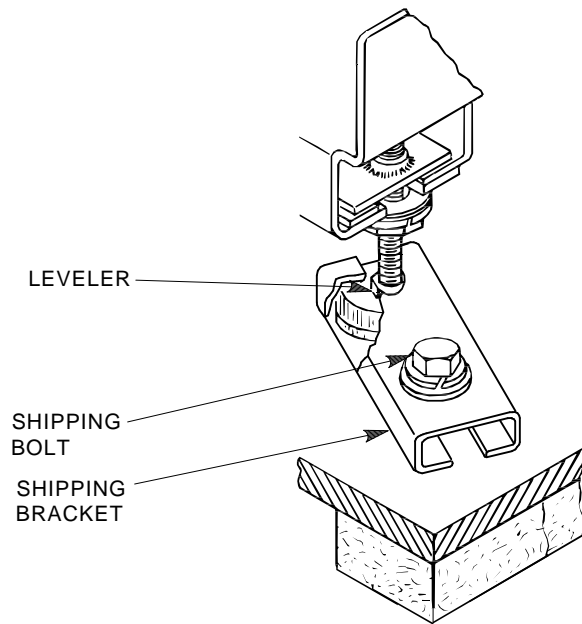
SHIPPING
BRACKET

SHR_X1102A_89_SCN

_____ **CAUTION** _____

The levelers must be all the way up for the HSR95 cabinet to roll properly
down the unloading ramps. Failure to do so may result in the cabinet
tipping off the pallet.

8. Carefully roll the HSR95 cabinet down the ramps as shown in Figure 2–6.

Figure 2–6 HSR95 Cabinet Removal from the Pallet
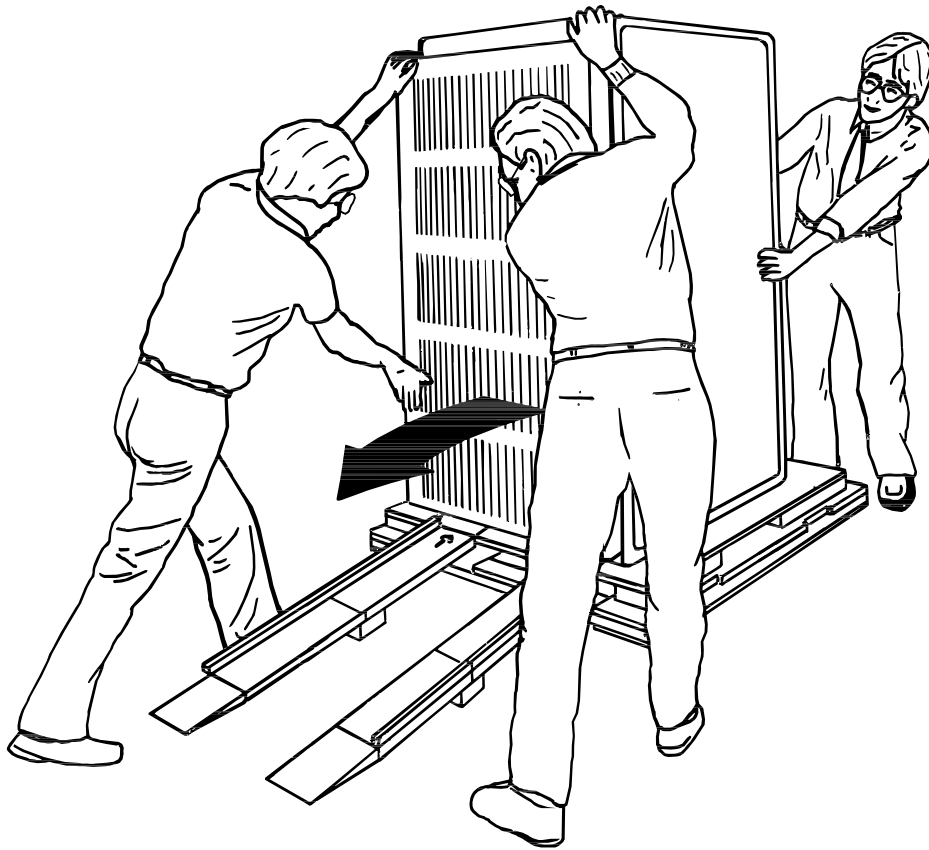
CXO-924A_S
SHR_X1104_89_SCN

9. Move the HSR95 cabinet to its final position. Before leveling, ensure that the HSR95 cabinet is within sufficient distance of the system cabinet to enable proper connection of the system interface cables.

2.4 Leveling the HSR95 Cabinet

One of the leveler feet for the cabinet is shown in Figure 2–7. Perform the following steps to level the HSR95 cabinet after it is in its final position:

1. Loosen the locknuts on all four leveler feet.

2. Turn each leveler hex nut clockwise until the leveler foot contacts the floor.

3. Adjust all four feet until the cabinet is level and the load is removed from all the casters. Verify that the casters spin freely.

4. Tighten the locknuts on all four leveler feet.

Figure 2–7 Adjusting Leveler Feet

LOCKNUT

LEVELER
HEX NUT

LEVELER
FOOT
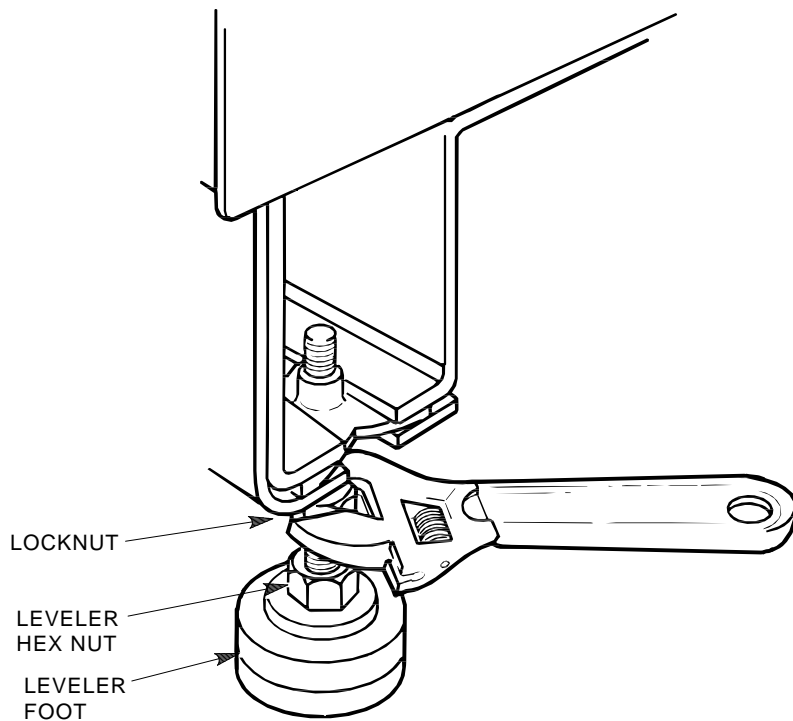
CXO-395C_S
SHR_X1105_89_SCN

2.5 Installing the Trim Kit

Use the following procedure to install the trim (skirt) kit around the base of the
HSR95 cabinet:

1. Locate the Base Trim kit, part number H9C02–UD, packaged separately
   inside the corrugated carton with the HSR95 cabinet.

2. Locate the side trim right and left hand pieces. With the four bosses in the
   rear, use a Phillips screwdriver to push the spring loaded fastener into the
   mating receptacles.

3. Locate the right and left hand corner trims. Slide on the middle trim
   extrusion. Fasten the extrusion to the front base and rear extender. Attach
   as above.

   Trim pieces may be adjusted up or down slightly to align with each other.

4. To remove a trim piece, rotate the spring loaded fastener 90 degrees (one
   quarter turn) and pull away from the cabinet.

2.6 Inspecting the HSR95 Cabinet

See Figures 2–8 and 2–9 as you inspect the cabinet for damage and other irregularities using to the following procedure:

_____ WARNING _____

The rackmount HSC95 controller chassis weighs approximately 59 kilograms (130 pounds). To avoid personal injury, verify that the cabinet stablilizer foot is fully extended and use sufficient personnel or proper lifting equipment before installing the chassis or extending the chassis on slides for maintenance.

_____

1. Open the front and rear cabinet doors as follows:

   a. Unlock a door by turning the two hex-Allen fasteners at the right edge of the door counterclockwise.

   b. Grasp the door by its edge, and pull towards you.

_____ CAUTION _____

Use electrostatic discharge (ESD) procedures at all times.

_____

2. At the rear of the HSR95 cabinet, check the serial/logo label, shown in Figure 2–10 to verify that the correct voltage variation of the power controller exists to meet the power supplied to the installation site

3. Ensure that all the ac power cords going to the power controller from devices installed in the HSR95 cabinet are correctly seated in the power controller connectors.

4. Ensure that the ac breaker shown in Figure 2–10 is in the off (0) position.

5. Ensure that the bus switch of the power controller shown in Figure 2–10 is in the SECONDARY ON (left) position.

6. Check the ac power cords for each SBB shelf. Make sure that each power cord is correctly seated.

7. Make sure that the voltage selection switches for each SBB shelf are in the correct position for the power supplied at the installation site.

8. Make sure that all SCSI cables internal to the HSR95 cabinet are firmly seated.

Figure 2–8 Arrangement of Components in the HSR95 Cabinet (Front View)

BA350 SHELF
(6TH POSITION)

BA350 SHELF
(5TH POSITION)

HSC95
CONTROLLER
(1ST POSITION)

HSC95
CONTROLLER
(2ND POSITION)

BA350 SHELF
(3RD POSITION)

BA350 SHELF
(1ST POSITION)

881 POWER
CONTROLLER
(2ND POSITION)
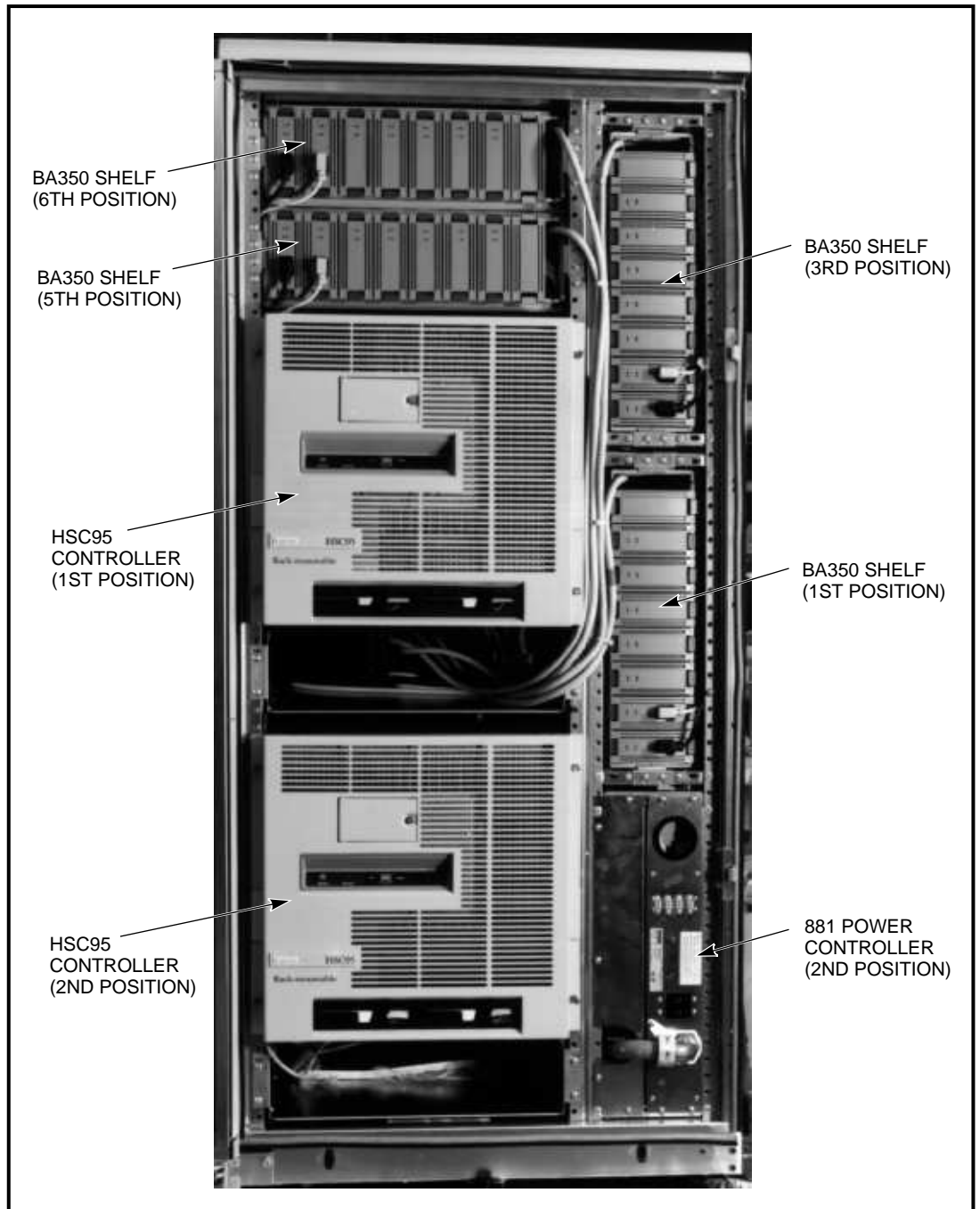
CXO-3673B-PH

2.7 Connecting the CI Cables

After inspecting the cabinet, connect the CI cables as follows:

1. Locate the four CI cable connectors on the rear panel of the rackmount HSC95 controller chassis.

Figure 2–9 Arrangement of Components in the HSR95 Cabinet (Rear View)

BA350 SHELF
(8TH POSITION)

BA350 SHELF
(4TH POSITION)

BA350 SHELF
(7TH POSITION)

HSC95
CONTROLLER
(1ST POSITION)

BA350 SHELF
(2ND POSITION)

881 POWER
CONTROLLER
(1ST POSITION)

HSC95
CONTROLLER
(2ND POSITION)
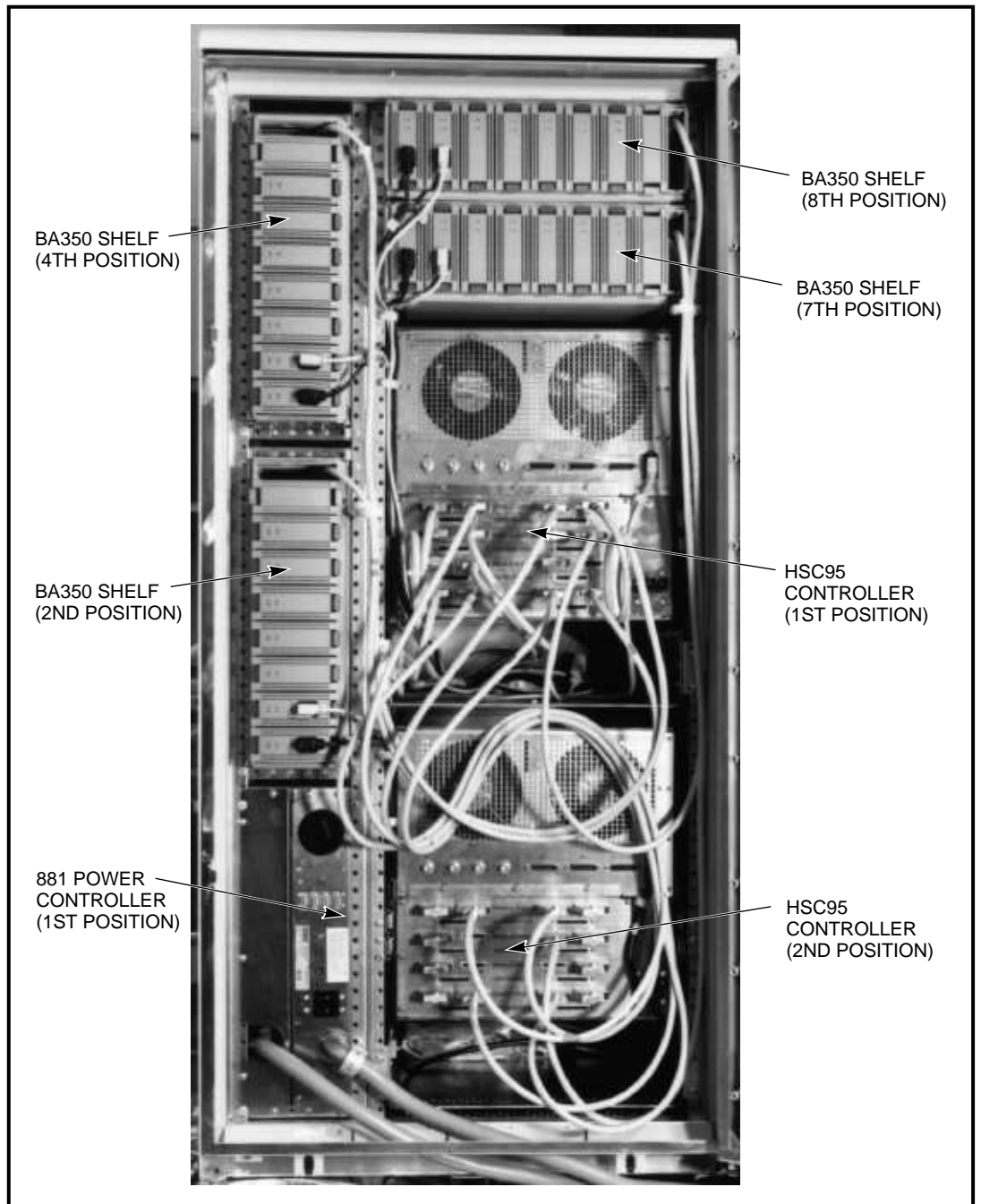
CXO-3674B-PH

2. Screw each CI cable into the appropriate CI cable connector on the rear panel
    of the HSC95 controller.

3. Adjust the length of the cable loop and cinch the tie wraps attaching the cable
    bundle to the cable tray to align with length of other cables in the tray as
    shown in Figure 2–11. Ensure the CI cable bundle runs along the side of the
    tray and does not interfere with motion of the other cables.

Figure 2–10 881 Power Controller Panel

GROMMETED
CORD
OPENING

POWER CONTROL
BUS CONNECTORS

DELAYED
(0.5 SEC)
(IN FROM
PREVIOUS
DEVICE)

J13 J12 J11 J10

UNDELAYED
(OUT TO NEXT
DEVICE)

INTERNATIONAL SYMBOLS

SECONDARY
ON

SECONDARY
OFF

SERIAL LOGO
LABEL

FUSE

BUS/OFF/ON
SWITCH

REMOTE BUS
CONTROL

O   CB   I

FUSE
LABEL

CIRCUIT
BREAKER

POWER
CONNECTOR
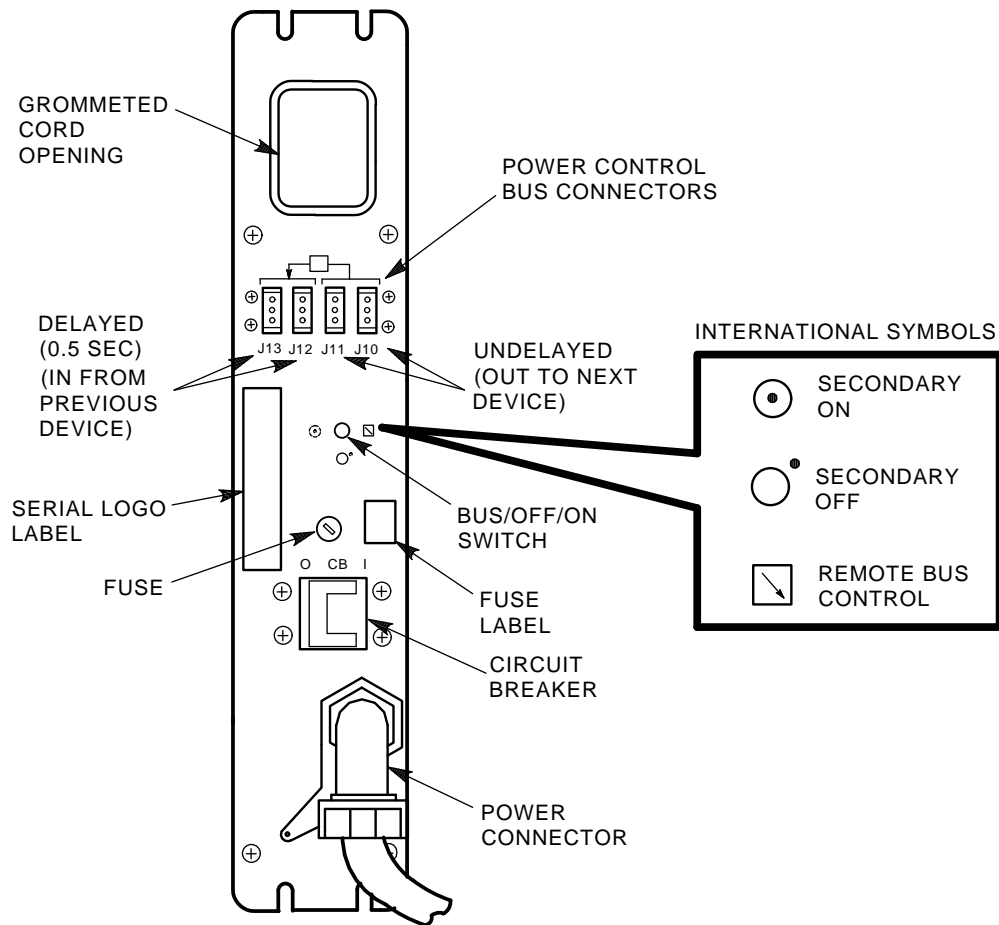
CXO-893A

4. Screw the other end of each CI cable into the star coupler bulkhead panel
as described in the installation chapter of the *Star Coupler User's Guide*, or
into the host computer bulkhead panel as described in the host computer
documentation.

2.8 Connecting the Console Cable

Connect the console cable as follows:

1. Lay out the console cable along the same path as the other cables in the tray.
Extend the cable 55.9 centimeters (22 inches) beyond the front edge of the
cable tray.

2. Connect the console cable to one of the EIA terminal connectors on the rear
panel of the HSC95 controller.

3. Tie the cable to an existing cable bundle using tie wraps.

Figure 2–11 Rear Panel Cable Connections
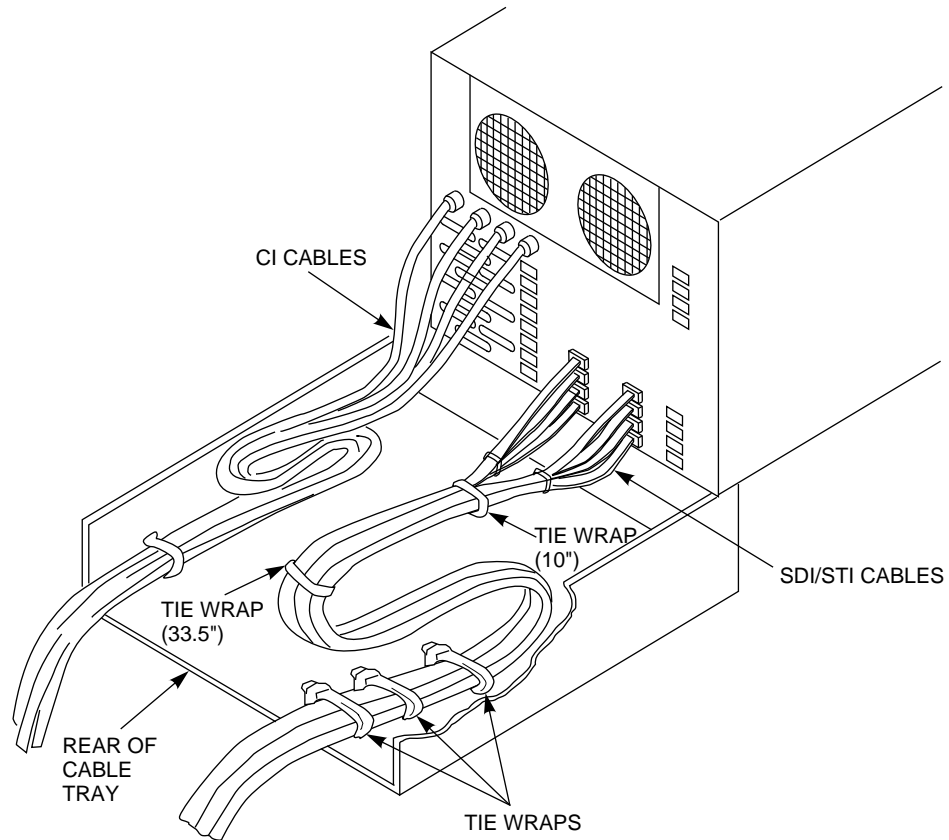
CI CABLES

TIE WRAP (10")

SDI/STI CABLES

TIE WRAP (33.5")

REAR OF CABLE TRAY

TIE WRAPS

NOTE: NUMBER AND LOCATION OF CONNECTIONS VARY.
THE APPEARANCE OF SDI/STI CABLES MAY VARY IN SOME APPLICATIONS.

CXO-3822A-MC

Connecting the SCSI Cables

The cabinet internal and external cables are labeled according to the *SF Family Label Booklet*. Figure 2–12 shows the SCSI cable connections on the rear bulkhead of a 100-percent SCSI configured rackmount HSC95 controller.

CAUTION

Do not place the rackmount HSC95 controller into Maintenance position 3 unless directed to do so by Digital Multivendor Services. This position can disconnect some of the cables attached to the HSC I/O backplane and interrupt service on the controller, or on the other controller in a dual-pathed pair.

Gather any external SCSI cables into bundles of four cables each and secure to the cable management tray with tie wraps. Be sure that each HSC95 controller can be pulled out to the Maintenance 3 position (described in Section 1.2.2) without binding the cables. However, you may have to cut the tie wraps for future maintenance operations.

Figure 2–12 HSC95 Controller 100-Percent SCSI Configuration I/O Bulkhead

CXO-3826A-PH
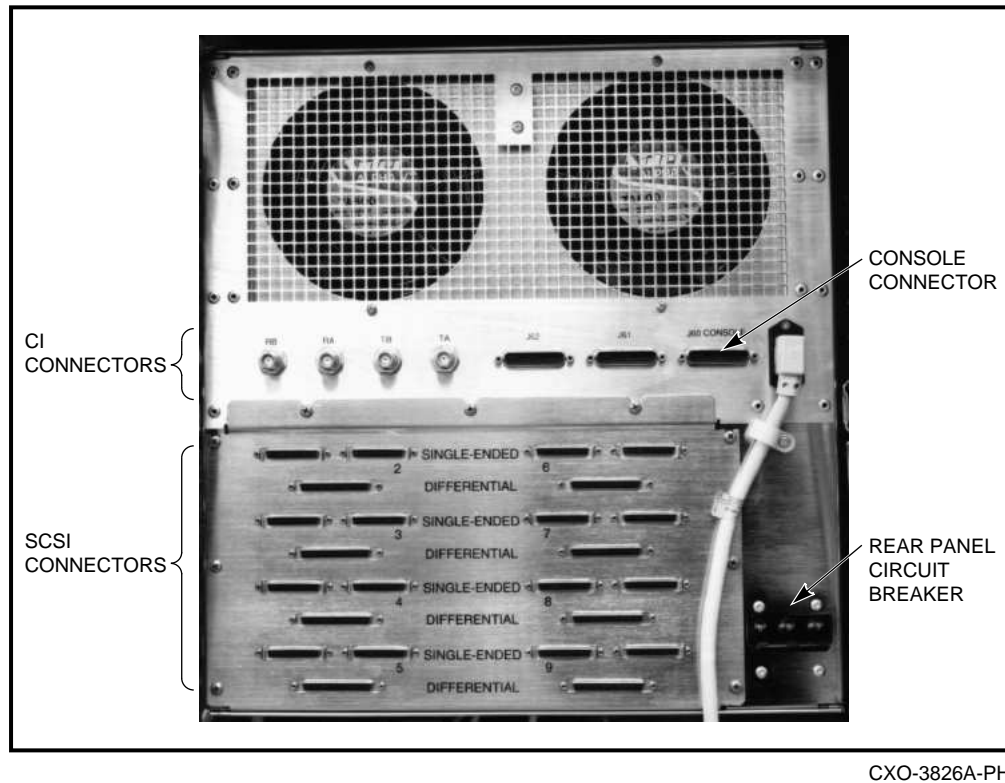
2.9 Connecting the SDI/STI Cables

The HSC95 controller 50-percent SCSI I/O bulkhead is divided into data channel cabling sections. There are five data channel cabling sections labeled E, F, L, M, and N. Each of these data channel sections contains four cable connector ports. Each port slot (labeled 0, 1, 2, or 3) has the same performance characteristics. Connecting SDI/STI cables to any one of the four ports in the same data channel sections allows all of the disks/tapes connected to be controlled by the same requestor module The module utilization label located on the underside of the top cover shows the configuration of modules in the HSC95 controller.

Figure 2–13 shows the 50-percent SCSI I/O bulkhead.

The external SDI and STI cables are identical, and the number of cabling sections used depends on the quantity of optional data channel modules installed.

The cabling sections are utilized as follows:

- A single cabling section driven by disk/tape data channel module (L0119) supports either disk drives or tape drives, but not both.

- A single cabling section driven by disk data channel module (L0108–YA) supports only disk drives.

- A single cabling section driven by tape data channel module (L0108–YB) supports only tape drives.

Figure 2–13 HSC95 Controller 50-Percent SCSI Configuration I/O Bulkhead
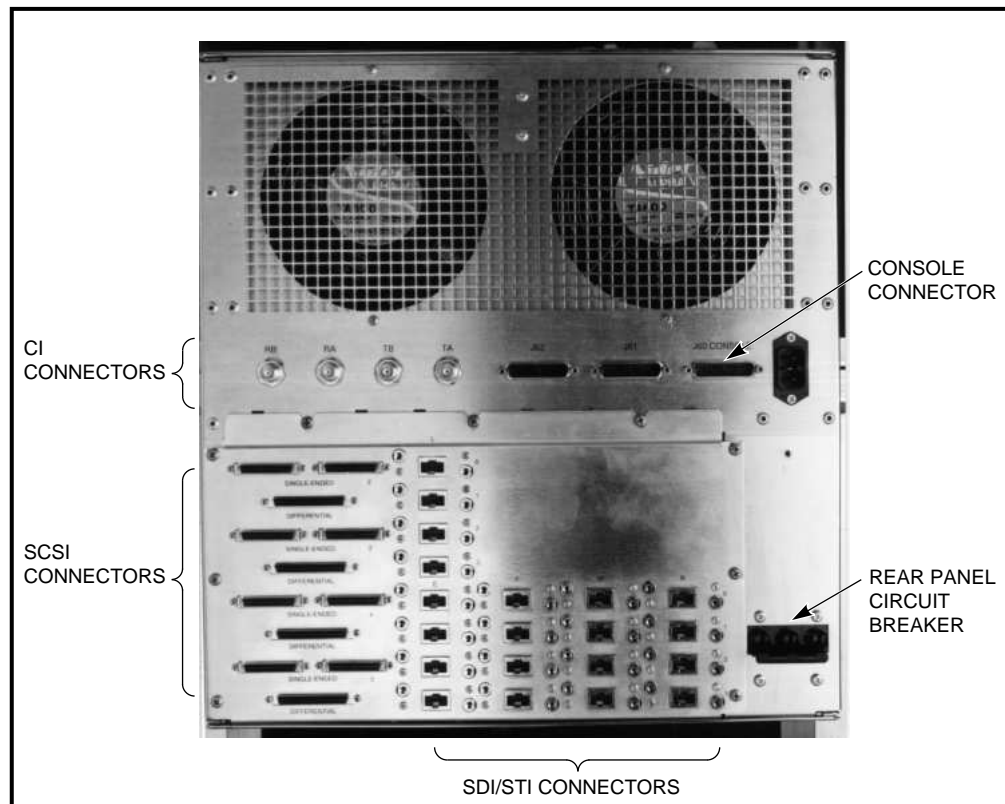
CXO-3821A-PH

Use the following procedure to connect SDI/STI cables to the 50-percent SCSI I/O
bulkhead. Do not secure the SDI/STI cables to the I/O bulkhead panel with tie
wraps until all the ports of each requestor have been tested with the ILDISK or
ILTAPE device integrity tests and a known good disk or tape drive. Instructions
for completing these tests are given in Chapter 4.

1. Start cabling at the bottom of the I/O bulkhead. This will allow connection
   to the top row of cables without interference. Refer to the module utilization
   label on the underside of the HSC95 top cover to determine the active
   bulkhead cabling sections.

2. Group the SDI/STI cables as shown in Figure 2–11.

3. Install the device end of the SDI/STI cables into each device I/O bulkhead as
   described in the appropriate disk drive or tape drive formatter user guide.

4. Adjust the length of the cable loop and cinch the tie wraps attaching the cable
   bundle to the cable tray.

2.10 Checking Switch Positions

The K.pli2 and K.si modules have switchpacks that are set during manufacturing. These switches must be in the OFF position for normal operation of the HSC controller. Use the following procedure to verify that the switches on the K.pli2 module and the K.si modules are properly set for normal operation.

1. With the HSC conroller in Maintenance 2 position, locate and remove the K.pli2 module.

2. Refer to Figure 2–14 and verify that the swiches on the switch pack are all set to the OFF position.

3. Reinstall the K.pli2 module in the card cage.

4. Locate and remove the first K.si module in the card cage.

5. Refer to Figure 2–15 and verify that the switches on the switch pack are all set to the OFF position.

6. Reinstall the K.si module and repeat the verification step for all other K.si modules in the card cage.

2.11 Setting the LINK Module Switches

The port link module has three switches that must be set for each installation. Two of these switches set the unique node address for the HSC controller; the third switch sets the slot count timing according to the VAXcluster™ configuration.

2.11.1 Guidelines for Setting the Node Address Switches

Unique node addresses are set using the two node address switches on the HSC port LINK module. Use the following guidelines when setting the node address switches on the LINK module:

1. If the HSC controller or a new CPU is added to a cluster, set the address switches to the next available node address for the cluster. The HSC controller should be assigned to lower node addresses.

2. If the HSC controller is presently part of a cluster to which no new nodes have been added, but a LINK module has been replaced, ensure the node address on the new LINK module is set to the same address as the previous module.

2.11.2 Guidelines for Setting the Slot Count Timing Switch

Incorrect switch and/or jumper settings on the CI interface modules in both the HSC controllers and the CI host nodes can cause various cluster disturbances, including:

• Disks in Mount Verification

• Many virtual circuit (VC) closures, resulting in shadow copy initiation on shadowed disks

Figure 2–14 Location of the K.pli2 Module Switchpack

PILA
MODULE

NOTE:
ALL SWITCHES
MUST BE OFF FOR
NORMAL OPERATION.

RED STATUS
LED

GREEN STATUS
LED

CXO-3960A-TI

Figure 2–15   Location of the K.si Module Switchpack

K.SI DATA CHANNEL
MODULE

NOTE:
ALL SWITCHES
MUST BE OFF FOR
NORMAL OPERATION.

AMBER LEDs,D1-D8
(D1 IS ON TOP)

J1

RED STATUS LED

GREEN STATUS LED
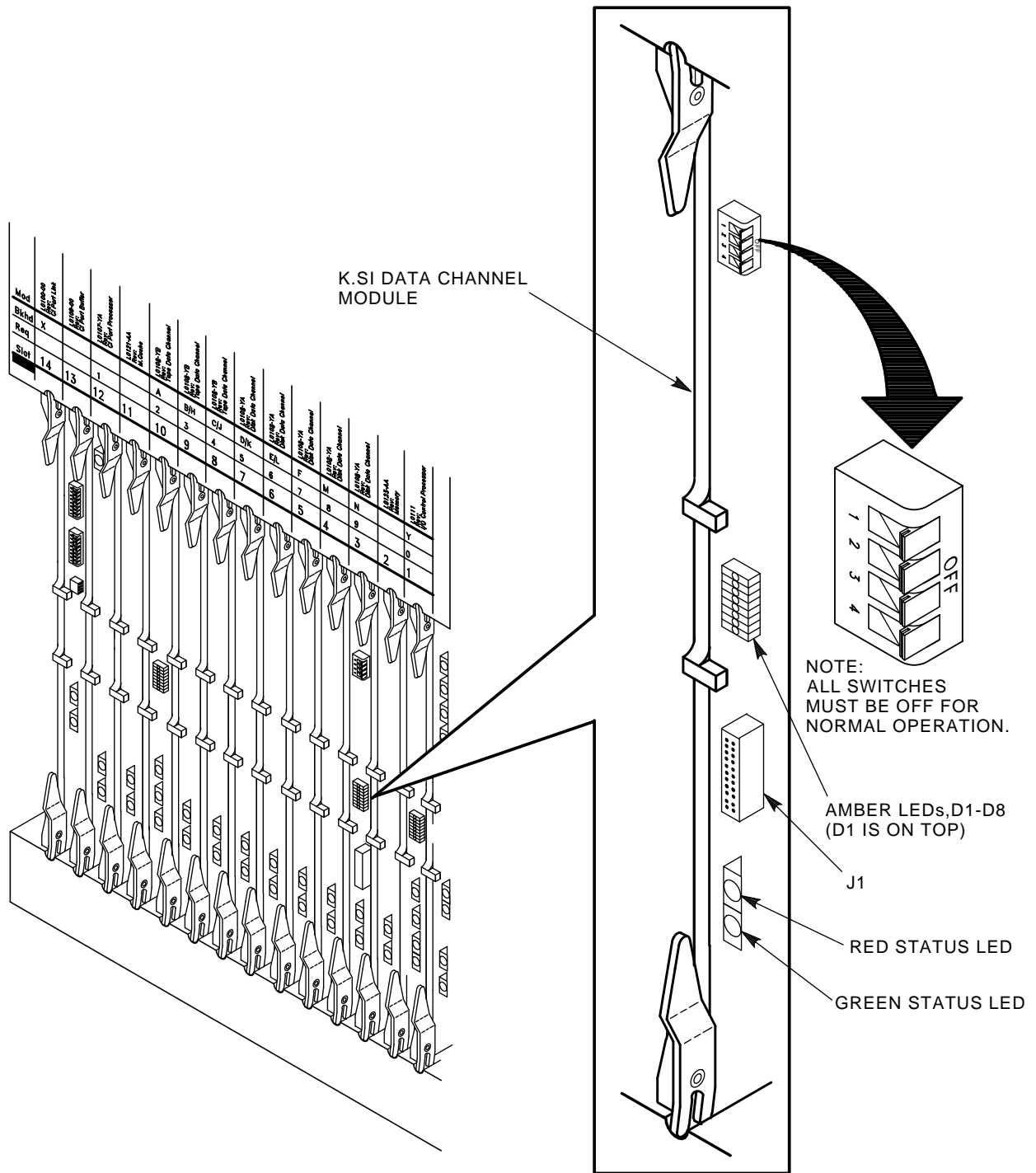
CXO-2495B

- Various OpenVMS™ bugchecks, most commonly \CLUEXIT

The cause of these disturbances are CI collisions caused by mismatched CI communication mechanisms. There are two mechanisms involved:

- Slot count (also called "quiet time")
- Cluster size

Settings for these mechanisms are selected by switch positions on the LINK modules in HSC controllers and older VAX host systems, and by backplane jumpers for CIBCA and CIXCD CI port adapters on newer VAX hosts.

Slot count has two possible settings: 7 or 10. At the time of HSC controller installation, it is necessary that all LINK and CI adapter modules in the cluster be set to a consistent value to avoid the cluster disturbances mentioned above.

Digital recommends that the slot count for all CPU and HSC controller nodes within a cluster be set to a value of 10 (not 7). Rackmount HSC95 controllers are shipped with their LINK modules set to a slot count of 10.

However, LINK modules for some previously installed HSC controllers in a cluster or CI port adapter modules in host systems may still be set at a slot count of 7. If your cluster does not contain a CIXCD adapter and is operating without problems at a slot count of 7, you may set the HSC95 controller LINK module to 7 for installation, and defer resetting the entire cluster to slot count 10 until a more convenient time.

If your cluster does contain a CIXCD adapter, all LINK and CI adapter modules should already be set to 10 because the CIXCD adapter does not support a slot count of 7.

To assist you with setting the slot count in your cluster, Table 2–1 lists LINK and adapter module switch and jumper settings.

In addition, the cluster size parameter must be consistent throughout the cluster at a value of either 16 or 32. If **all** nodes in your cluster are numbered in the range of 0 to 15, you may select a cluster size of either 16 or 32. If your cluster has **any** node numbered in the range of 16 to 31, you must select a cluster size of 32. Table 2–1 also contains a list of LINK and adapter module switch and jumper settings to select the appropriate cluster size.

Table 2–1   L0118 LINK Module and CI Adapter Module Switch/Jumper Settings

Adapter Type	Host System	LINK Module	Function	Switch/Jumper Setting
	HSC95[1]	L0118–YA	Slot=7 Slot=10 Clu_size=16 Clu_size=32	S3–4=Open S3–4=Closed S3–1=Open S3–1=Closed
CIBCA–Ax, CIBCA–Bx[2, 3]	VAX™ 82x0, VAX 83x0 VAX 85x0, VAX 8700 VAX 88x0, VAX 6000™	T1025 T1046	Slot=7 Slot=10 Clu_size=16 Clu_size=32	Jumper E11–41=Out Jumper E11–41=In Jumper D30–60=Out Jumper D30–60=In
CIXCD–xx[3]	VAX 6000, VAX 9000™	T2080	Slot=7 Slot=10 Clu_size=16 Clu_size=32	Not Supported Jumper E15–45=In Jumper D15–45=Out Jumper D15–45=In

[1]On L0118 modules, all on-module jumpers must be left in their default positions and S3–2 and 3 must remain open.

[2]For CIBCA options, all referenced jumpers are located on the backplane slot for the PORT (T1015/T1045) module, *not* the slot allocated to the LINK (T1025/T1046) module. For CIBCA options, all reference jumpers are on the backplane slot for the PORT (T1015 or T1045 module).

[3]For CIBCA and CIXCD options, install *only* those backplane jumpers listed and those required to specify the node address.

2.11.3 LINK Module Switch Setting Procedure

The procedure that follows contains the steps for setting the node address and slot count timing switches.

Set the LINK module switches as follows:

1. Connect the HSR cabinet to its ac power source. If you have an HSR cabinet operating from 240 Vac source power, open the rear door of the cabinet and plug the separate power cable to the connector on the rear of the power controller. This cable is packed with the HSR cabinet. HSR cabinets using 120 Vac source power have the power cable permanently installed on the power controller.

   Do not apply power to the HSR cabinet at this time. The purpose of this step is to properly ground the HSC95 controller chassis for ESD protection when handling modules.

2. Ask your system manager to identify the unique node address for each device on the CI bus.

3. Place the HSC controller in the maintenance 2 position as described in Section 1.2.2.

4. Open the HSC card cage cover by turning the card cage cover nylon latches.

5. If this is a new HSC controller installation, remove and replace all modules (while wearing your properly grounded ESD wrist strap) to ensure they are properly seated. The modules may have loosened during shipping.

6. Locate the LINK module in the HSC controller card cage. Refer to
   Figure 2–16 for the location of the node address switches on the LINK
   module.

7. Set the node address switches to a unique node address.

Note

Remember to set the S1 and S2 node address switches to the same value.

---

8. Locate the slot count timing switch (S3) on the L0118–YA port LINK module.

9. Set the cluster size on S3–1. Switch S3–1 can be set to open (1) or Closed
   (0) if all nodes in the cluster have a node number of 15 or less. Set S3–1
   to Closed (0) if **any** node in the cluster has a node number of 16 or greater.
   Refer to Table 2–1 for a listing of LINK module switch and jumper settings
   for various VAXcluster configurations.

10. Set the slot count switch to the proper value for the cluster by using the
    settings for S3–2, S3–3, and S3–4 (either 7 or 10) given in Table 2–1. Refer to
    Figure 2–16 for the location of the slot count switch pack.

    Table 2–2 lists the settings of the switches as Open or Closed on the LINK
    module for slot counts of 7 and 10. The table also lists two additional
    reserved settings for S3. These settings should be used only as directed by
    Digital Multivendor Services.

Table 2–2 L0118–YA LINK Module S3 Switch Slot Count Timing Settings

Slot Count	S3–2	S3–3	S3–4	Comment
7	Open	Open	Open	
10	Open	Open	Closed	Default
Reserved #1	Open	Closed	Open	Slot count=11
Reserved #2	Open	Closed	Closed	Slot count=14

Note

When setting the S3 switches, Open= 1 and Closed= 0. Remember that
S3–1 is used to set the cluster size and is not related to the slot count
timing settings.

---

11. Insert the LINK module into the backplane slot after the node address (S1
    and S2) and slot count (S3) switches have been set.

12. Install other requestors in the HSC controller backplane.

Figure 2–16 Location of the Switches on L0118–YA LINK Module

NODE
ADDRESS
SWITCHES

S1

S2

-- OPEN --

SLOT
COUNT
SWITCH — S3

SLOT
COUNT
TIMING

CLUSTER
SIZE

PORT LINK MODULE

OPEN = 1
CLOSED = 0

CXO-3085A
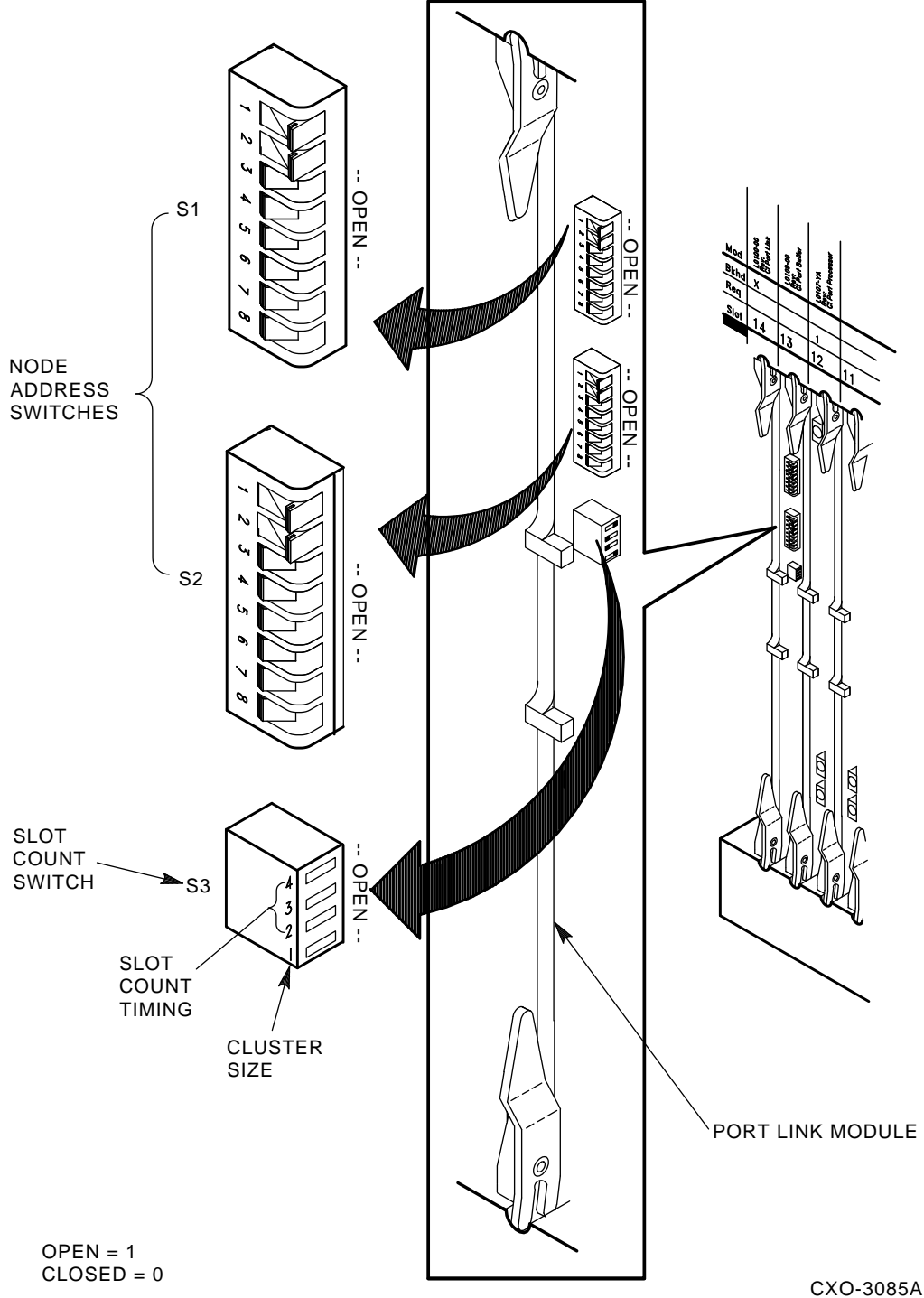
13. Replace the card cage cover and restore the HSC controller in the cabinet.

2.12 HSR95 Cabinet Final Checkout

Perform all the procedures in Chapter 3, then refer to the *HSC Controller User Guide* and use the KSUTIL utility to configure the SCSI devices in the cabinet. After configuring the devices, perform all applicable procedures in Chapters 4 and 5 to check out the system.

Once the verification is complete, close the cabinet doors and turn the door lock fasteners one half turn clockwise to lock the doors. The system is ready to be turned over to the system manager.

3

Applying Power to the Rackmount HSC95 Controller

This chapter contains the procedure for applying power to the rackmount HSC95 controller before online testing of the system.

_____ **Note** _____

During the acceptance and checkout procedure, error messages may be displayed. Refer to the *HSC Controller Service Manual* for error message information.

_____

3.1 Procedure for Applying Power

Perform the following steps to apply power to an HSC95 controller:

1. Place the HSC95 controller in maintenance position 1 as described in Section 1.2.2.

2. See Figure 3–1 and verify that the ac circuit breaker on the cabinet power controller(s) is in the off (0) position. If there are two power controllers installed in the cabinet, the rear power controller, labeled A, is connected to the HSC95 controller in position 1, and the front power controller, labeled B, is connected to the HSC95 controller in position 2.

3. See Figure 3–2 and verify that the circuit breaker on the rear panel of the HSC95 controller is in the OFF position.

_____ **Note** _____

The BUS/OFF/ON switch on the power controller panel is labeled with international symbols that represent REMOTE BUS CONTROL and SECONDARY OFF, SECONDARY ON positions. See Figure 3–1 for the translation of these international symbols.

_____

4. See Figure 3–3 and locate the DC Power switch on the front panel of the HSC95 controller and ensure that it is in the OFF position.

5. Verify that the source ac power to be used for the HSR95 cabinet or other cabinet power controller is wired for proper output before connecting the power controller.

6. Set the circuit breaker on the cabinet power controller to the on (1) position.

7. Turn the BUS/OFF/ON switch on the power controller to the proper position. If the cabinet power controller is connected to a remote bus, set the switch on the power controller panel to the symbol depicting REMOTE BUS CONTROL; otherwise, set it to the symbol depicting SECONDARY ON.

8. Set the circuit breaker on the rear panel of the HSC95 controller to the ON position.

9. Ensure that the power supply fans of the HSC95 controller are working by checking the air flow at the rear of the controller. If airflow or fan movement is absent, turn off the ac power to the HSC95 controller by setting the circuit breaker on the rear panel of the HSC95 controller to the OFF position. Check to make sure that the power cord to the HSC95 controller is plugged into the power controller. If connected, set the circuit breaker on the cabinet power controller to the off (0) position and check that the plug from the power controller to the source is properly connected. If not connected, plug in these cords and reset the appropriate circuit breakers to the on position.

10. Install the system load media to prepare for running the device integrity tests.

11. Turn the DC Power switch on the front panel of the HSC95 controller to the ON position.

12. Ensure that the power indicator on the operator control panel (OCP) is lit.

---------------- **Note** ----------------

The Power indicator on the OCP indicates the presence of all three voltages required for HSC95 controller operation. If the Power indicator lamp is not lit, a required voltage is missing or the power fail line is asserted from the power supplies. Check the output voltages of the power supply/supplies for the missing voltage(s).

_____

3.2 Running the UART Echo Test

Perform the UART Echo test before booting the HSC95 controller to ensure that the I/O control processor module and the console terminal are communicating properly.

To test the serial path between the local console terminal and the UART chip on the HSC95 I/O control processor (P.ioj2) module, the HSC95 controller echoes characters typed on the console terminal as if the terminal were in local mode.

The UART Echo test can be performed by one person if the console terminal has been installed near the HSC95 controller. If for some reason the console terminal is at a remote location from the HSC95 controller, two people are needed to run this test.

Figure 3–1 Locating the Power Controller Circuit Breaker
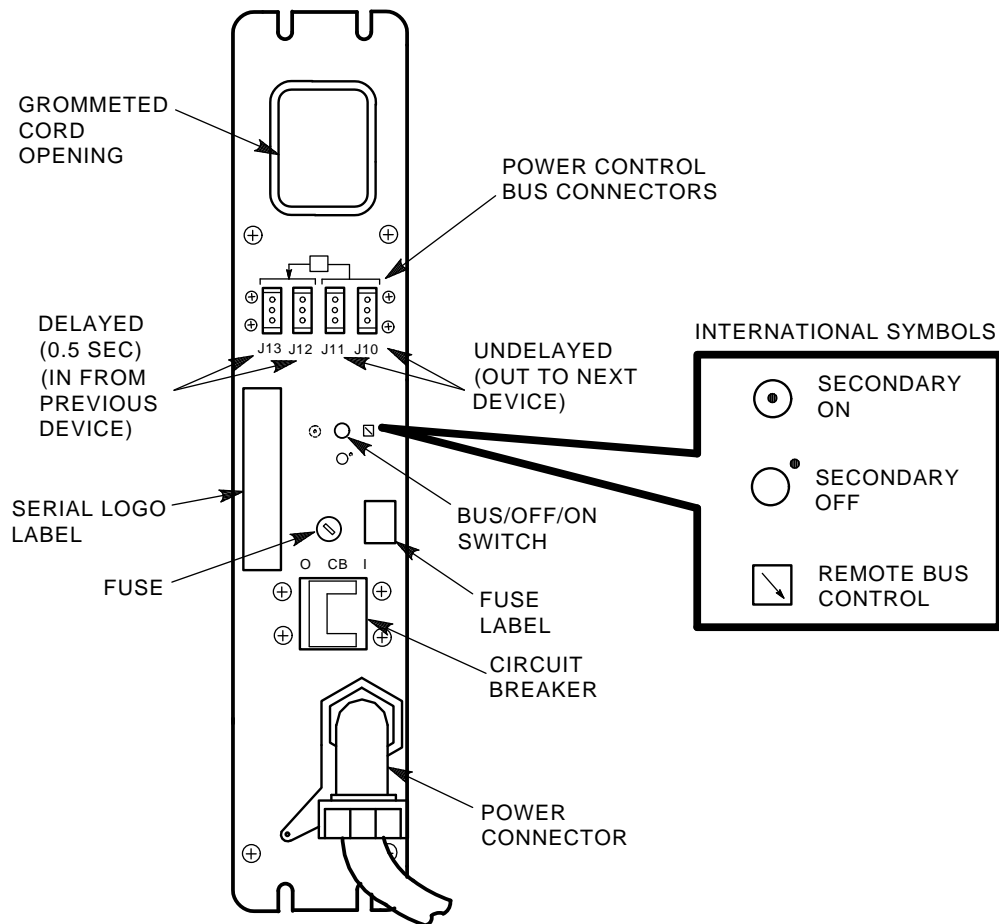
CXO-893A

Perform the UART echo test procedure as follows:

1. Make sure that the Secure/Enable switch on the HSC95 controller load device panel is in the ENABLE position. Refer to Figure 3–3 for the location of the Secure/Enable switch.

2. With the power on, push in and hold the Init switch on the OCP.

3. Type any series of characters on the console terminal keyboard while holding in the Init switch.

4. Ensure that the string of characters you typed are echoed on the console terminal's screen.

5. If the string of characters are not echoed, refer to the *HSC Controller Service Manual* or video terminal installation manual for information on troubleshooting communication problems between the HSC95 controller and local console terminal.

Figure 3–2 Locating the HSC95 Controller Circuit Breaker

CXO-3826A-PH
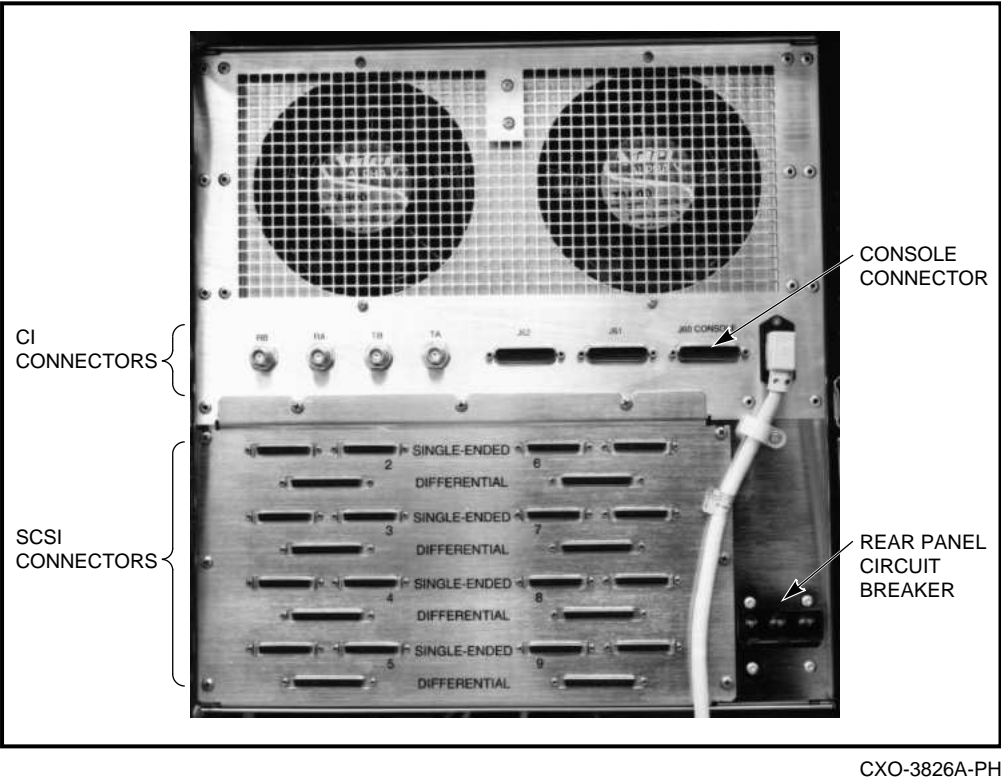
Figure 3–3 Location of the HSC95 Controller DC Power Switch

CXO-3820A-PH

4
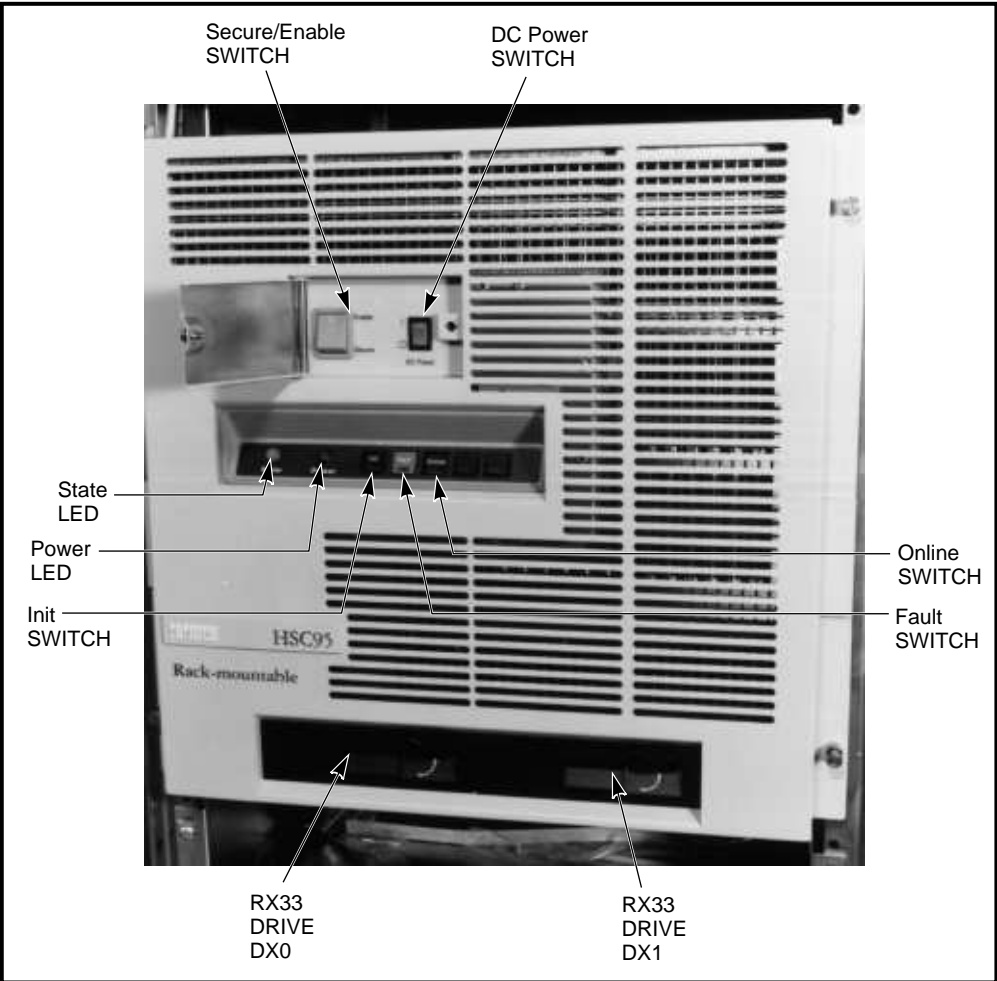
Device Integrity Tests

This chapter presents seven device integrity tests that execute on the HSC controller. These tests only affect the device being tested, though the HSC controller may experience some performance degradation. The device integrity tests reside on the HSC controller system media disk.

The tests described in this chapter are as follows:

- ILRX33—RX33 disk drive integrity test
- ILMEMY—Memory integrity test
- ILCACH—Cache memory integrity test
- ILDISK—Disk drive integrity test
- ILTAPE—Tape device integrity test
- ILTCOM—Tape compatibility test
- ILEXER—Multidrive exerciser

4.1 Generic Prompt Syntax and Error Message Format

Before you run any of these tests, you need to familiarize yourself with the generic prompt syntax and error message format. A description of each is given in the following sections.

4.1.1 Generic Prompt Syntax

All prompts issued by the HSC controller tests use a generic syntax, as follows:

- Prompts requiring user action or input are followed by a question mark.
- Prompts offering a choice of responses show those choices in parentheses.
- A capital D in parentheses indicates that the response should be in decimal format.
- Square brackets ([ ]) enclose the prompt default. If the square brackets are empty, no default exists for that prompt.

4.1.2 Generic Error Message Format

All device integrity tests follow a generic error message format, as follows:

```
    XXXXXX>x>tt:tt T#aaa E#bbb    U-ccc
<TEXT STRING DESCRIBING ERROR>

    FRU1-dddddd FRU2-dddddd
    MA-eeeeee
    EXP-yyyyyy
    ACT-zzzzzz
```

where:

XXXXXX> is the appropriate device integrity test prompt.
x> is the letter indicating the type of integrity test that was initiated:

> D> is the demand integrity test.
> A> is the automatic integrity test.
> P> is the periodic integrity test.

tt:tt is the current time.
aaa is the decimal number denoting the test that failed.
bbb is the decimal number denoting the error detected.
ccc is the unit number of the drive being tested.
FRU1 is the most likely field replaceable unit (FRU).
FRU2 is the next most likely FRU.
dddddd are the names of FRU1 and FRU2.
MA is the media address.
eeeee is the octal number denoting offset within the block.
EXP is the expected contents.
yyyyyy is the octal number denoting data expected.
ACT is the actual contents.
zzzzzz is the octal number denoting data actually found.

The first line of the error message contains general information about the error. The second line describes the nature of the error. Lines 1 and 2 are mandatory and appear in all error messages. Line 3 and any succeeding lines display additional information and are optional.

4.2 ILRX33—RX33 Disk Drive Device Integrity Test

The ILRX33 exerciser tests either of the RX33 disk drives attached to the HSC controller. ILRX33 runs concurrently with other HSC controller processes and uses the services of the HSC control program and the diagnostic execution monitor (DEMON).

ILRX33 performs several writes and reads to verify the RX33 disk drive internal data paths and read/write electronics.

A scratch diskette is not required. ILRX33 does not destroy any data on the HSC software media.

The exerciser tests only the RX33 disk drive, the RX33 disk drive controller on the memory module, and the data path between the P.ioj module and the RX33 disk drive. All other system hardware is assumed to be working properly.

ILRX33 verifies that only a particular RX33 disk drive and controller combination is working or failing. Therefore, the test should not be used as a subsystem troubleshooting aid. This test does not support flags. If the test indicates that a drive or controller is not operating correctly, replace the drive and/or controller.

4.2.1 System Requirements

The hardware and software requirements include the following:

- I/O control processor module with boot ROMs
- Memory/disk controller module
- RX33 disk drive controller with at least one working drive
- HSC controller system media
- Console terminal

4.2.2 Operating Instructions

Enter Ctrl/Y to display the HSCxx> prompt. Then, enter either RUN ILRX33 or RUN DX*n*:ILRX33 to initiate the test.

Note

The term DX*n*: refers to the RX33 disk drives (DX0: or DX1:).

If ILRX33 cannot load from the specified diskette, try loading the test from the other diskette. For example, if RUN ILRX33 fails, try RUN DX*n*:ILRX33.

4.2.3 Test Termination

ILRX33 can be terminated by entering Ctrl/Y. The test automatically terminates after reporting an error; however, if the error displayed is "Retries Required", the test continues.

4.2.4 Parameter Entry

The device name of the RX33 disk drive to be tested is the only parameter sought by this test. When the test is invoked, the following prompt is displayed:

```
Device Name of RX33 to test (DX0:, DX1:, LB:) [] ?
```

Note

The string LB: indicates which RX33 disk drive was last used to boot the control program.

One of the indicated strings must be entered. If one of these strings is not entered, the test displays the message "Illegal Device Name" and the prompt is repeated.

4.2.5 Progress Reports

At the end of the test, the following message is displayed:

```
ILRX33>D>tt:tt Execution Complete
```

where *tt:tt* is the current time.

4.2.6 Test Summary

Test 001, Read/Write Test—Verifies that data can be written to the diskette and read back correctly. All reads and writes access physical block 1 of the RX33 disk drive (the RT–11 operating system volume ID block). This block is not used by the HSC controller operating software.

Initially, the contents of block 1 are read and saved. Three different data patterns are then written to block 1, read back, and verified. The read/write electronics in the drive and the internal data path between the RX33 disk drive controller and the drive are checked. Following the read/write test, the original contents of block 1 are written back to the diskette.

If the data read back from the diskette does not match the data written, a data compare error is generated. The error report lists the media address (MA) in error within the block together with the expected (EXP) and actual (ACT) contents of the word.

4.2.7 Error Message Example

All error messages issued by ILRX33 conform to the HSC generic error message format described in Section 4.1.2. Following is a typical ILRX33 error message:

```
ILRX33>D>00:00 T#001 E#003 U- 50182
ILRX33>D> No Diskette Mounted
ILRX33>D> FRU1-Drive
ILRX33>D>00:00 Execution Complete
```

Additional (optional) lines may be found on some error messages.

4.2.8 Error Messages

This section describes error messages issued by ILRX33. Hints about the possible cause of the error are provided where feasible.

- **Block Number Out of Range**—Indicates that the driver detected a request to read a block number outside the range of legal block numbers (0 through 2399 decimal). Because the ILRX33 reads and writes disk block 1, this error message may indicate a software problem.

- **Data Compare Error**—Indicates data subsequently read back:

  ```
  MA -aaaaaa
  EXP-bbbbbb
  ACT-cccccc
  ```

  Where:
  aaaaaa represents the address of the failing word within the block (512 bytes) that was read.
  bbbbbb represents the data written to the word.
  cccccc represents the data read back from the word.

  Because this test only reads and writes block 1 of the diskette, all failures are related to block 1.

- **Hard I/O Error**—Indicates that the program encountered a hard error while attempting to read or write the diskette.

- **Illegal Device Name**—Indicates the user specified an illegal device name when the program prompted for the name of the drive to be tested. Legal device names include DX0:, DX1:, and LB:. After displaying this error, the program again prompts for a device name. Enter one of the legal device names to continue the test.

- **No Diskette Mounted**—Indicates the RX33 disk drive being tested does not contain a diskette. Insert a diskette before repeating the test. If this error is displayed when the drive does contain a diskette, the drive or controller is at fault.

- **Operation Aborted**—Reported if ILRX33 is aborted by entering Ctrl/Y.

- **Retries Required**—Indicates a read or write operation failed when first attempted, but succeeded on one of the retries performed automatically by the driver software. This error normally indicates that the diskette media is degrading and the diskette should be replaced.

- **Unknown Status STATUS=*xxx***—Indicates ILRX33 received a status code it did not recognize. The octal value *xxx* represents the status byte received. RX33 disk drive reads and writes are performed for ILRX33 by the control program's driver software. At the completion of each read or write operation, the driver software returns a status code to the RX33 disk drive test, describing the result of the operation. The test decodes the status byte to produce a description of the error.

  An unknown status error indicates that the status value received from the driver did not match any of the status values known to the test. The status value returned (*xxx*) is displayed to help determine the cause of the problem. Any occurrence of this error should be reported through a Software Performance Report (SPR). See the *HSC Controller Service Manual* for detailed information on SPR submission.

- **Write-Protected**—Indicates the RX33 disk drive being tested contains a write-protected diskette. Try again with a write-enabled diskette. If the diskette is already write-enabled, the RX33 disk drive or controller is faulty.

4.3 ILMEMY—Memory Integrity Test

The memory integrity test (ILMEMY) is designed to test HSC controller data buffers. This test can be initiated automatically or on demand. It is initiated automatically to test data buffers that produce a parity or nonexistent memory (NXM) error when in use by any of the K modules.

ILMEMY tests only data memory buffers. Control program memory errors typically cause a reboot of the HSC controller.

Buffers that fail the memory test are removed from service and sent to the disabled buffer queue.

Note

The contents of the disabled buffer queue are lost during a reboot of the HSC controller. As a result, all bad memory locations are lost.

Buffers sent twice to the ILMEMY test are also sent to the disabled buffer queue even if they did not fail the test. Buffers that pass the memory test and have not been tested previously are sent to the free buffer queue for further use by the control program.

When the test is initiated on demand, any buffers in the disabled buffer queue are tested and the results of the test are displayed on the terminal from which the test was initiated.

This test runs concurrently with other HSC controller processes and uses the services of the control program and the DEMON.

_____ **Note** _____

If an I/O control processor module or a memory module fails during the periodic memory tests, the FACILITY section of the crash code displays PRMEMY, which indicates that the failure occurred during the periodic tests.

_____

4.3.1 System Requirements

Hardware requirements include the following:

- I/O control processor module
- At least one memory module
- RX33 disk drive controller with one working drive
- A console terminal to start ILMEMY on demand

This program only tests data buffers located in the HSC controller data memory. All other system hardware is assumed to be working.

HSC software must be loaded to run this test.

4.3.2 Operating Instructions

Enter Ctrl/Y to display the HSCxx> prompt:

Ctrl/Y
HSCxx>

Enter RUN dev:ILMEMY to initiate the memory integrity test. This program has no user-supplied parameters or flags.

If the memory integrity test is not contained on the specified device (dev:), an error message is displayed.

4.3.3 Test Termination

You can terminate ILMEMY at any time by entering Ctrl/Y.

4.3.4 Progress Reports

Error messages are displayed as needed. At the end of the test, the following message is displayed (by DEMON):

    ILMEMY>D>*tt:tt* Execution Complete

where *tt:tt* is the current time.

4.3.5 Test Summary

Test 001 receives a queue of buffers for testing. If the ILMEMY is initiated automatically, the queue consists of buffers from the suspect buffer queue.

When the control program detects a parity or NXM error in a data buffer, the buffer is sent to the suspect buffer queue. While in this queue, the buffer is not used for data transfers. The HSC controller periodic scheduler checks the suspect buffer queue at regular intervals to determine if it contains any buffers. If buffers are found on the queue, they are removed and ILMEMY is automatically initiated to test those buffers.

If the ILMEMY test is initiated on demand, it retests only those buffers already known to be disabled.

If the test is initiated automatically and the buffer passes the test, the program checks to see if this is the second time the buffer was sent to the memory integrity test. If this is the case, the buffer is probably producing intermittent errors. The buffer is retired from service and sent to the disabled buffer queue. If this is the first time the buffer is sent to the memory integrity test, it is returned to the free buffer queue for further use by the control program. In this last case, the address of the buffer is saved in case the buffer again fails and is sent to the memory integrity test a second time.

ILMEMY will terminate when all buffers on the test queue are tested.

4.3.6 Error Message Example

All error messages issued by the ILMEMY conform to the generic error message format described in Section 4.1.2. Following is a typical ILMEMY error message:

```
ILMEMY>A>09:33  T#001 E#000
ILMEMY>A>Tested Twice with no Error (Buffer Retired)
ILMEMY>A>FRU1-M.std2  FRU2-
ILMEMY>A>Buffer Starting Address (physical) = 15743600
ILMEMY>A>Buffer Ending Address   (physical) = 15744776
ILMEMY>D>09:33 Execution Complete
```

4.3.7 Error Messages

This section describes the error messages issued by ILMEMY.

- **Can't Allocate Timer, Test Aborted**—Indicates that the program failed to allocate a timer for SLEEP.

- **Memory Data Error**—Indicates the wrong data was read while testing a buffer. The buffer is retired from service and sent to the disabled buffer queue.

- **Memory Parity Error**—Indicates a parity error occurred while testing a buffer. The buffer is retired from service and sent to the disabled buffer queue.

- **NXM Trap (Buffer Retired)**—Indicates that an unknown address or memory location is being referenced. The buffer is retired from service and its address is sent to the disabled buffer queue.

- **Returned Buffer to Free Buffer Queue**—Indicates a buffer failed during use by the control program but that no error was detected. Because this is the first time the buffer was sent to the memory integrity test, it is returned to the free buffer queue for further use by the control program. The address of the buffer is stored by the memory integrity test in case the buffer fails again when in use by the control program.

- **Tested Twice with No Error**—Indicates the buffer under test passed the memory test. However, this is the second time the buffer was sent to the memory test and passed it. Because the buffer has a history of two failures while in use by the control program, yet does not fail the memory test, intermittent failures on the buffer are assumed. The buffer is retired from service and sent to the disabled buffer queue.

4.4 ILCACH—Cache Memory Integrity Test

The ILCACH test is designed to test the M.cache hardware module. ILCACH can be invoked in three ways:

- ILCACH is always initiated when the HSC controller is turned on if the boot code determines that an M.cache module is available and properly connected to the memory module.

- The cache server software can automatically invoke the ILCACH test if the M.cache module exceeds error thresholds.

- ILCACH may be run on demand at the HSC console.

When ILCACH is initiated at HSC controller power-up, it verifies the results of the M.cache module self-test. The M.cache module self-test checks all of the cache and data memory resident on the module. If there are no memory errors, the ILCACH exerciser runs a series of tests to verify the operation of the portions of the M.cache module that the self-test does not verify.

If the M.cache module self-test reports an error, the ILCACH exerciser performs two tasks:

- It determines if the M.cache module is usable.

- If the module is usable, ILCACH verifies the cache memory to determine what portions of it are usable. The result of this test is a Good Cache List, which is sent to the Cache Server software for further processing.

ILCACH is started automatically by the cache server software when the server determines that the M.cache module has exceeded its error thresholds. ILCACH tests all of the functions on the M.cache module and determines if the error that occurred was fatal or if just portions of the onboard memory were recording errors. If the M.cache module has a fatal error, all caching is disabled. If portions of the memory are found to be usable, a new Good Cache List is generated and reported to the cache server software.

When ILCACH is started on demand by a user, the exerciser runs its set of tests, and a new Good Cache List is generated and reported to the cache server software. ILCACH can only be started on demand if the M.cache module is not being used to cache valid data.

ILCACH runs concurrently with other processes in the HSC controller and uses the services of the HSC software control program and DEMON.

4.4.1 System Requirements

Hardware requirements include the following:

- P.ioj–18/P.ioj2 I/O control processor module

- M.std4/M.std5 memory module

- M.cache module

- RX33 disk drive controller with one working RX33 disk drive

- Console terminal from which to start ILCACH on demand

Software requirements include the following:

- HSC Version 6.0 or higher control program software on an RX33 diskette

---
Note

Earlier software versions are not compatible with the M.cache module.

4.4.2 Operating Instructions

Enter Ctrl/C. The keyboard monitor responds with the prompt:

Ctrl/C
HSC>

Enter RUN ILCACH to initiate the M.cache integrity test. This program has no user-supplied parameters or flags.

4.4.3 Progress Reports

Error messages are displayed as needed. At the end of the test, the following message is displayed (by DEMON):

    ILCACH>D>*hh:mm* Execution Complete

where *hh:mm* is the current time.

The following is an example run of ILCACH with no error message:

    HSC>**RUN ILCACH**

    ILCACH>D>hh:mm Execution Starting

    ILCACH>D>hh:mm Execution Complete

4.4.4 Test Termination

ILCACH cannot be terminated while running.

4.4.5 Test Summaries

Test summaries for ILCACH are as follows:

- **Test 001, Verify M.cache Self-Test**—Verifies that the M.cache module self-test, invoked by INIPIO, returns a successful status.

- **Test 002, DIAGNOSTIC Buffers Test**— Verifies that all of the diagnostic bytes of cache memory can be written and read back. The diagnostic bytes are the 8 bytes at the top of every 32 kilowords. There are a total of 1024 diagnostic buffers. The data written to the diagnostic bytes is generated by the M.cache module pattern generator.

- **Test 003, Cache Data Register Test**—Verifies that the cache data register can be written and read back. Triplets generated by the M.cache module pattern generator are written to the register and then read back.

- **Test 004, CBUS Address Test**—Verifies that the CBUS address register can be correctly read and that it contains the correct value.

- **Test 005, Refresh Rate Test**—Verifies that the cache memory does a refresh cycle every 25 bus cycles. The test writes a sector to M.cache memory, waits 2 seconds, then reads back the sector and checks for errors. The test also verifies that only one sector of data was transferred to check for underwriting or overwriting.

4.4.6 Error Message Example

All error messages issued by ILCACH conform to the generic error message format described in Section 4.1.2. Following is a typical ILCACH error message:

```
ILCACH>A>09:33 T#001 E#000
ILCACH>A>Error detected with REFRESH CYCLE
ILCACH>A>FRU1-MCACHE

ILCACH>D>09:33 Execution Complete
```

4.4.7 Error Messages

This section describes the error messages issued by ILCACH.

- **Cannot Allocate A Timer, Test Aborted**—ILCACH cannot allocate a timer to properly run its tests.

- **ILCACH cannot be aborted via CTRL/Y or CTRL/C**—ILCACH cannot be terminated while running.

- **MCACHE hardware module not present, or not installed correctly**—ILCACH was invoked by the user but there was no M.cache module installed in the HSC controller, or the M.cache module was incorrectly installed.

- **MCACHE Memory Address Error**—This error is displayed in the following form:

  ```
  MCACHE Memory Address Error.
  Expected Address = xxxxxxxx
  Actual Address   = yyyyyyyy
  ```

  This error occurs when Test 004, CBUS Address Test, finds that the cache memory address did not match the expected value.

- **MCACHE Module is unusable. Caching will be disabled**—The M.cache module is unusable due to errors found in the ILCACH test

- **MCACHE must be disabled. Use SET SERVER DISK/NOCACHE to disable cache**—The user has attempted to run ILCACH on an M.cache module that is still on line to the cache server.

- **More than 50% of CACHE is bad.**—More than 50% of the memory on the M.cache module has single-bit ECC errors. No caching will be done on this module.

- **Status Word Not Expected Value**—The M.cache module status word did not contain the expected value. ILCACH reports the returned status word and the associated error as shown in the following example:

  ```
  ILCACH>A>09:33 T#001 E#001
  ILCACH>A>MCACHE Detected Error
  ILCACH>A>FRU1-MCACHE
  ILCACH>A>MCACHE Status Word = 006377
  ILCACH>A>Summary Error Bit
  ILCACH>A>Multi-bit ECC Error

  ILCACH>D>09:33 Execution Complete
  ```

- **Timed out reading the MCACHE Status Register**—The M.cache module state machine is not processing any cache commands.

- **Unable to transfer one sector from CACHE to DATA memory**—The M.cache module is either overwriting or underwriting one sector's worth of information to data memory.

- **Unsupported invocation of ILCACH**—ILCACH was invoked incorrectly.
- **MCACHE Memory Address Error**—ILCACH Test 04 found an M.cache module address that did not match the expected value. This error is reported in the following form:

    ```
    Expected Address = xxxxxxxxx
    Actual Address   = yyyyyyyyy
    ```

- **Between 25% and 50% of CACHE is bad**—One 8-megabyte bank of memory on the M.cache module is bad. The M.cache module is still usable but is not operating with its full memory.

4.5 ILDISK—Disk Drive Integrity Test

The ILDISK test isolates disk drive-related problems to a disk drive (including the Enhanced Mode ESE20 storage element) an SDI cable, or a disk data channel module.

ILDISK runs in parallel with disk I/O from a host CPU. However, the drive being diagnosed cannot be on line to any host.

ILDISK can be initiated upon demand through the console terminal or automatically by the control program when an unrecoverable disk drive failure occurs.

ILDISK is automatically invoked by default whenever a drive is declared inoperative, except when a drive is declared inoperative while in use by an integrity test or utility.

Automatic initiation of ILDISK can be inhibited by entering the SETSHO command SET AUTOMATIC DIAGNOSTICS DISABLE. If the SET AUTOMATIC DIAGNOSTICS command is entered and DISABLE is specified, ILMEMY (a test for suspect buffers) is also disabled. For this reason, leaving ILDISK automatically enabled is preferable.

The tests that are performed vary, depending on whether the disk drive is known to the HSC controller disk server.

If the disk drive is unknown to the disk server, it was either unable to communicate with the HSC controller or was declared inoperative when it failed while communicating with the HSC controller.

Because the drive cannot be identified by unit number, the user must supply the requestor number and port number of the drive. Once the user has supplied these identification numbers, then the SDI verification tests can execute. The SDI verification tests check the path between the K.sdi/K.si module and the disk drive and command the drive to run its integrity tests. If the SDI verification tests fail, the most probable FRU is identified in the error report. If the SDI verification tests pass you can assume that the drive is the FRU.

If the drive is known to the disk server, that is, identifiable by unit number, the Read/Write/Format tests are performed in addition to the SDI verification tests. If an error is detected, the most probable FRU is identified in the error report. If no errors are detected you can assume that the FRU is the drive.

To find the drives known to the disk and tape servers, enter the SETSHO command SHOW DISKS or SHOW TAPES.

4.5.1 System Requirements

Hardware requirements include the following:

- Disk drive

- Disk data channel, connected by an SDI cable

The software requirements for this test reside on the system media and include the following:

- HSC software

- ILDISK.DIA program

- DEMON

- K.sdi/K.si microcode (installed with the K.sdi/K.si module)

The ILDISK test assumes that the I/O control processor module and the memory module are working.

Refer to the disk drive documentation to interpret errors that occur in the drive's integrity tests.

4.5.2 Operating Instructions

Use the following procedure to initiate ILDISK.

------------------------------ **Note** ------------------------------

To prevent access from another HSC controller, deselect the alternate port switch on the drive to be tested. The alternate port switch is the drive port switch allowing alternate HSC controller access to the drive.

----

1. Enter Ctrl/Y to display the HSCxx> prompt. The keyboard monitor responds with the following prompt:

    ```
    HSCxx>
    ```

2. Enter RUN dev:ILDISK to initiate the disk drive integrity tests. Wait until ILDISK is read from the system software load media into the program memory.

    If the software media containing ILDISK is not loaded when the RUN dev:ILDISK command is entered, an error message is displayed. Insert the software media containing ILDISK and repeat steps 1 and 2.

3. Enter the parameters after ILDISK is started. Refer to Section 4.5.4 for the parameter entries.

4.5.3 Test Termination

You can terminate the ILDISK test by entering Ctrl/Y or Ctrl/C. Test termination may not take effect immediately because certain parts of the program cannot be interrupted. An example would be during SDI commands. If an SDI DRIVE DIAGNOSE command is in progress, interfering with the disk drive at this time can cause the program to wait 2 minutes before aborting.

When ILDISK is aborted, it display the following message:

```
Execution Aborted
```

4.5.4 Parameter Entry

When run on demand, ILDISK first prompts with the following:

```
DRIVE UNIT NUMBER (U) [] ?
```

Enter the unit number of the disk drive being tested. Unit numbers are in the form D*nnnn*, where *nnnn* is a decimal number between 0 and 4094, corresponding to the number printed on the drive unit plug. Terminate the unit number response by pressing Return.

ILDISK attempts to acquire the specified unit through the diagnostic interface. If the unit is acquired successfully, ILDISK next prompts for the drive integrity test to be executed.

If the acquire fails, one of the following conditions is encountered:

- The specified drive is unavailable. This indicates that the drive is connected to the HSC controller but is currently on line to a host CPU or an HSC controller utility. Online drives cannot be diagnosed. ILDISK repeats the prompt for the unit number.

- The specified drive is unknown to the disk functional software. Drives are unknown for one of the following reasons:

  - The drive and/or disk data channel port is broken and cannot communicate with the disk functional software.

  - The drive was previously communicating with the HSC controller but a serious error occurred; consequently the HSC controller has ceased communicating with the drive (marked the drive as inoperative).

  In either case, ILDISK prompts for a requestor number and port number. See Section 4.5.5.

After receiving the unit number (or requestor and port), ILDISK prompts you with the following:

```
RUN A SINGLE DRIVE DIAGNOSTIC (Y/N) [N] ?
```

Entering "N" causes the drive to execute its entire integrity test set. Entering "Y" executes a single drive integrity test. If a single drive integrity test is selected, the test prompts you with the following:

```
DRIVE TEST NUMBER (H) [] ?
```

Enter a number (in hex) specifying the drive integrity test to be executed. Consult the appropriate disk maintenance or service manual to determine the number of the test to perform. Entering a test number not supported by the drive results in an error generated in Test 05.

The test prompts you for the number of passes to perform:

```
# OF PASSES TO PERFORM (1 to 32767) (D) [1] ?
```

Enter a decimal number between 1 and 32767, specifying the number of test repetitions. Pressing Return without entering a number runs the test once.

4.5.5 Specifying Requestor and Port

To test drives unknown to the disk functional software, you must specify the requestor number and port number. The requestor number is any number 2 through 9 specifying the disk data channel connected to the drive under test.

The port number is 0 through 7; it specifies which of eight disk data channel ports is connected to the drive under test. The requestor number and port number can be determined in one of two ways:

- By tracing the SDI cable from the desired disk drive to the bulkhead connector, then tracing the bulkhead connector to a specific port on one of the disk data channels.

- By using the SHOW DISKS command to display the requestor and port numbers of all known drives. To use this method, exit ILDISK by entering Ctrl/Y. Enter SHOW DISKS at the HSCxx> prompt.

  The SHOW DISKS command displays a list of all known drives including the requestor number and port number for each drive. Each disk data channel has four or eight possible ports to which a drive can be connected. By inference, the port number of the unknown unit must be one not listed in the SHOW DISKS display (assuming the unknown drive is not connected to a defective disk data channel). A defective disk data channel illuminates the red LED on the lower front edge of the module. Refer to the *HSC Controller User Guide* for detailed information on submitting an SPR.

After you have supplied a requestor number and port number to ILDISK, the program checks to ensure the specified requestor and port do not match any drive known to the HSC controller software. If the requestor and port do not match a known drive, ILDISK prompts for the number of passes to perform, as described in Section 4.5.4. If the requestor and port do match a known drive, ILDISK reports an error.

4.5.6 Progress Reports

ILDISK produces an end-of-pass report at the completion of each pass of the integrity test. One pass of the program can take several minutes, depending upon the type of drive being diagnosed.

4.5.7 Test Summaries

The test summaries for ILDISK are as follow:

- **Test 00, Parameter Fetching**—Fetches the user-selected parameters. The user is prompted to supply a unit number and/or a requestor and port number. This part of ILDISK also prompts for the number of passes to perform.

- **Test 01, Run K.si/K.sdi Microdiagnostics**—Commands the disk data channel to execute two of its resident microdiagnostics. The revision level of the disk data channel microcode must be up to date to execute the microdiagnostics. The microdiagnostics executed are the partial SDI test (K.sdi test 7) and the SERDES/RSGEN test (K.sdi/K.si test 10).

- **Test 02, Check for Clocks and Drive Available**—Issues a command to interrogate the real-time drive state of the drive. This command does not require an SDI exchange but the real-time status of the drive is returned to ILDISK. The real-time status should indicate that the drive is supplying clocks and that the drive should be in the available state.

- **Test 03, Drive Initialize Test**—Issues a DRIVE INITIALIZE command to the drive under test. This checks both the drive and the controller real-time state line of the SDI cable. The drive should respond by momentarily stopping its clock, then restarting it.

- **Test 04, SDI Echo Test**—First ensures that the disk data channel microcode supports the ECHO command. If not, a warning message is displayed and the rest of Test 04 is skipped. Otherwise, the test directs the disk data channel to conduct an ECHO exchange with the drive. An ECHO exchange consists of the disk data channel sending a frame to the drive and the drive returning it. An ECHO exchange verifies the integrity of the write/command data and the read/response data lines of the SDI cable.

- **Test 05, Run Drive Integrity Tests**—Directs the drive to run its internal integrity test. The drive is commanded to run a single integrity test or its entire set of integrity tests, depending upon user response to the following prompt:

  ```
  Run a Single Drive Diagnostic?
  ```

  Before commanding the drive to run its integrity tests, the drive is brought on line to prevent the drive from giving spurious available indications to its other SDI port. The drive integrity tests are started when the disk data channel sends a DIAGNOSE command to the drive. The drive does not return a response frame for the diagnose until it is finished performing the integrity tests. This can require two or more minutes. While the disk data channel is waiting for the response frame, ILDISK cannot be interrupted by entering Ctrl/Y.

- **Test 06, Disconnect From Drive**—Sends a DISCONNECT command to the drive and then issues a GET LINE STATUS internal command to the K.sdi/K.si to ensure that the drive is in the available state. The test also expects that Receiver Ready and Attention are set in drive status and that Read/Write Ready is not set.

- **Test 07, Check Drive Status**—Issues a GET STATUS command to the drive to check that none of the drive's error bits are set. If any error bits are set, they are reported and the test issues a DRIVE CLEAR command to clear the error bits. If the error bits fail to clear, an error is reported.

- **Test 08, Drive Initialize**—Issues a command to interrogate the real-time drive state of the drive. The test then issues a DRIVE INITIALIZE command to ensure that the previous DIAGNOSE command did not leave the drive in an undefined state.

- **Test 09, Bring Drive On Line**—Issues an ONLINE command to the drive under test. Then a GET LINE STATUS command is issued to ensure that the drive's real-time state is proper for the online state. Read/Write Ready is expected to be true; Available and Attention are expected to be false.

- **Test 10, Recalibrate and Seek**—Issues a RECALIBRATE command to the drive. This ensures that the disk heads start from a known point on the media. Then a SEEK command is issued to the drive, and the drive's real-time status is checked to ensure that the SEEK did not result in an Attention condition. Then another RECALIBRATE command is issued, returning the heads to a known position.

- **Test 11, Disconnect From Drive**—Issues a DISCONNECT command to return the drive to the available state. Then the test checks the drive's real-time status to ensure that Available, Attention, and Receiver Ready are true, and that Read/Write Ready is false.

- **Test 12, Bring Drive On Line**—Attempts to bring the disk drive to the online state. Test 12 is executed only for drives known to the disk functional software. Test 12 consists of the following steps:

  1. GET STATUS—ILDISK issues an SDI GET STATUS command to the disk drive.

  2. ONLINE—ILDISK directs the diagnostic interface to bring the drive on line.

  If the GET STATUS and the ONLINE commands succeed, ILDISK proceeds to Test 13. If the GET STATUS and the ONLINE commands fail, ILDISK goes directly to Test 17 (termination). Note the online operation is performed through the diagnostic interface, invoking the same software operations a host invokes to bring a drive on line. An online operation at this level constitutes more than just sending an SDI ONLINE command. The factory control block and replacement control block of the drive are also read and certain software structures are modified to indicate the new state of the drive. If the drive is unable to read data from the disk media, the online operation fails. If Test 12 fails, ILDISK skips the remaining tests and goes to Test 17.

- **Test 13, Read Only I/O Operations Test**—Verifies that all read/write heads in the drive can seek and properly locate a sector on each track in the drive read-only diagnostic block number (DBN) space. DBN space is an area on all disk media devoted to diagnostic or integrity test use.

  Test 13 attempts to read at least one sector on every track in the read-only area of the drive's DBN space. The test checks the sector to ensure that the sector contains the proper data pattern. Bad sectors are allowed but there must be at least one good sector on each track in the read-only area. After each successful DBN read, ILDISK reads one logical block number (LBN) to further enhance seek testing. This ensures that the drive can successfully seek to and from the DBN area from the LBN area of the disk media. ILDISK performs Test 14 when Test 13 completes.

- **Test 14, I/O Operations Test (Read/Write 512 byte format)**—Checks to see if the drive can successfully write a pattern and read it back from at least one sector on every track in the drive read/write DBN area. The read/write DBN space is an area on every disk drive devoted to diagnostic or integrity test read/write testing.

  Bad sectors are allowed but at least one sector on every track in the read/write area must pass the test. After Test 14 completes, ILDISK goes to Test 16.

- **Test 16, Format Test**—This test will only be executed if ILDISK did not encounter any errors during the previous tests. If previous errors were detected, ILDISK goes directly to Test 17. In Test 16, ILDISK formats blocks 0 and 1 in the drive's read/write DBN space. After formatting blocks 0 and 1, ILDISK checks that at least one of these blocks can be read without error. After Test 16 completes, ILDISK goes to Test 17.

- **Test 17, Terminate ILDISK**—The ILDISK termination routine performs the following steps:

  1. If the drive is unknown to the disk functional software, or if the SDI verification test failed, the test goes to step 5.

  2. An SDI CHANGE MODE command is issued to the drive. The CHANGE MODE command directs the drive to disallow access to the DBN area.

  3. The drive is released from exclusive integrity test use. This returns the drive to the available state.

  4. The drive is reacquired for exclusive integrity test use. This is to allow looping if more than one pass is selected.

  5. If more passes are left to perform, the test is reinitiated.

  6. If no more passes are left to perform, ILDISK releases the drive, returns all acquired structures, and terminates.

4.5.8 Error Message Example

All error messages issued by ILDISK conform to the generic error message format described in Section 4.1.2. The following is a typical ILDISK error message:

```
ILDISK>D>09:35 T#005 E#035 U-D00082
ILDISK>D>Drive Diagnostic Detected Fatal Error
ILDISK>D>FRU1-Drive    FRU2-
ILDISK>D>Requestor Number 04
ILDISK>D>Port Number 03
ILDISK>D>Test  0025 Error  007F
ILDISK>D>End Of Pass  00001
```

4.5.9 Error Messages

This section describes the error messages issued by ILDISK.

- **512-Byte Format Failed**—The program attempted to perform a 512-byte format to the first two sectors of the first track in the read/write DBN area. No errors were detected during the actual formatting operation but subsequent attempts to read either of the reformatted blocks failed. The specific error detected is identified in the error report.

- **Attention Not Set in Available Drive**—The SDI verification routine executed a command to interrogate the real-time drive state line of the drive and found Attention was not asserted even though the drive is Available.

- **Attention Set After SEEK**—The SDI verification routine issued a SEEK command to the drive which resulted in an unexpected Attention condition. The drive status is displayed with the error report. Refer to the service manual for that drive.

- **Attention Set in On-Line Drive**—The SDI verification routine issued an ONLINE command to the drive. The drive entered the online state but an unexpected Attention condition was encountered.

- **Available Not Set In Available Drive**—The SDI verification routine executed a command to interrogate the real-time drive state line of the drive. ILDISK found Available was not set in a drive that should be Available.

- **Available Set in On-Line Drive**—The SDI verification routine issued an ONLINE command to the disk drive. Then a command was issued to interrogate the real-time drive state line of the drive. The line status indicates that the drive is still asserting Available.

- **Can't Acquire Drive State Area**—ILDISK cannot perform the low-level SDI tests because it cannot acquire the drive state area for the drive. The drive state area is a section of the K Control Area used to communicate with the drive through the SDI interface. To perform the SDI tests, ILDISK must take exclusive control of the drive state area; otherwise, the operational software may interfere with the tests. The drive state area must be in an inactive state (no interrupts in progress) before it can be acquired by ILDISK. If the drive is rapidly changing its SDI state and generating interrupts, ILDISK may be unable to find the drive in an inactive state.

- **Can't Acquire Specified Unit**—ILDISK was initiated automatically to test a disk drive that was declared inoperative. When initiated by the disk functional software, ILDISK was given the requestor number, port number, and unit number of the drive to test. ILDISK successfully acquired the drive by unit number but the requestor and port number of the acquired drive did not match the requestor and port number given when ILDISK was initiated. This indicates that the HSC controller is connected to two separate drives with the same unit number plugs. To prevent inadvertent interaction with the other disk drive, ILDISK performs only the low-level SDI tests on the unit specified by the disk functional software. Read/write tests are skipped because the drive must be acquired by unit number to perform read/write transfers.

- **Can't Read Any Sector on Track**—As part of Test 13, ILDISK attempts to read a pattern from at least one sector of each track in the read-only area of the drive DBN space. (The DBN space is an area on every disk drive reserved for diagnostic or integrity test use.) All drives have the same pattern written to each sector in the read only DBN space.

  During the read process, ILDISK detected a track that does not contain any sector with the expected pattern. Either ILDISK detected errors while reading, or the read succeeded but the sectors did not contain the correct pattern. The error information for the last sector accessed is supplied in the error report. The most likely cause of this error is a disk media error. If Test 14 also fails, the problem may be in the disk read/write electronics, or the DBN area of the disk may not be formatted correctly. To interpret the MSCP™ status code, refer to the *HSC Controller Service Manual*.

- **Can't Write Any Sector on Track**—As part of Test 13, ILDISK attempts to write a pattern to at least one sector of each track in the read/write area of the drive DBN space. (The DBN space is an area on every disk drive reserved for diagnostic use only.)

  During the write process, ILDISK detected a track with no sector that passed the read/write test. That is, ILDISK could not write a pattern and read it back successfully on any sector on the track. The error information for the last sector accessed is identified in the error report. The most probable cause of this error is a disk media error.

  If Test 13 also failed, the problem could be in the disk read/write electronics, or the DBN area of the disk may not be formatted correctly. To interpret the MSCP status code, see Section 4.5.10.

- **Change Mode Failed**—ILDISK issued an SDI CHANGE MODE command to the drive and the command failed. The drive is presumed to be the failing unit because the SDI interface was previously verified.

- **Command Failure**—The SDI verification test detected a failure while attempting to send an SDI command to the drive. One of the following errors occurred:

  – Did Not Complete—The drive did not respond to the command within the allowable time. Further SDI operations to the drive are disabled.

  – K.sdi Detected Error—The K.sdi/K.si detected an error condition while sending the command or while receiving the response.

  – Unexpected Response—The SDI command resulted in an unexpected response from the drive. This error can be caused by a DIAGNOSE command if a single drive integrity test was selected and if the drive does not support the specified test number.

- **DCB Not Returned, K Failed for Unknown Reason**—The SDI verification test directed the disk data channel to execute one of its microdiagnostics. The microdiagnostic completed without reporting any error but the disk data channel did not return the dialog control block (DCB). All drives connected to the disk data channel may now be unusable. The disk data channel is the probable FRU and the HSC controller probably will have to be rebooted.

- **DDUSUB Initialization Failure**—The diagnostic interface did not initialize. This error is not recoverable and is caused by the following:

  – Insufficient memory to allocate buffers and control structures required by the diagnostic interface.

  – The disk functional software is not loaded.

- **Drive Acquired But Can't find Control Area**—The disk drive was acquired, and ILDISK obtained the requestor number and port number of the drive from the diagnostic interface. However, the specified requestor does not have a control area. This indicates that a software problem and should be reported through a Software Performance Report (SPR). See the *HSC Controller Service Manual* for detailed information on SPR submission.

- **Drive Can't Be Brought On Line**—A failure occurred when ILDISK attempted to bring the specified drive on line. One of the following conditions occurred:

  – Unit Is Offline—The specified unit went to the offline state and now cannot communicate with the HSC controller.

  – Unit Is In Use—The specified unit is now marked as in use by another process.

  – Unit Is a Duplicate—Two disk drives are connected to the HSC controller, both with the same unit number.

  – Unknown Status from DDUSUB—The diagnostic interface returned an unknown status code when ILDISK attempted to bring the drive on line.

- **Drive Clear Did Not Clear Errors**—When ILDISK issued a GET STATUS command, error bits were set in the drive response. Issuing a DRIVE CLEAR failed to clear the error bits. The drive is the probable FRU.

- **Drive Diagnostic Detected Error**—The SDI verification test directed the disk drive to run an internal integrity test. The drive indicated the integrity test failed but the error is not serious enough to warrant removing the drive from service. The test number and error number for the drive are displayed

(in hex) in the error report. For the exact meaning of each error, refer to the service manual for that drive.

- **Drive Diagnostic Detected Fatal Error**—The SDI verification test directed the disk drive to run an internal integrity test. The drive indicated the integrity test failed and the error is serious enough to warrant removing the drive from service. The test and error number are displayed (in hex) in the error report. For the exact meaning of each error, refer to the service manual for that drive.

- **Drive Disabled Bit Set**—The SDI verification test issued an SDI GET STATUS command to the drive under test. The drive disabled bit was set in the status returned by the drive, indicating the drive detected a serious error and is now disabled.

- **Drive online in enhanced ESE mode.**—An ESE20 storage element, capable of running in enhanced mode, has been brought on line in enhanced mode for ILDISK tests.

- **Drive online in normal mode.**—An ESE20 storage element, capable of running in enhanced mode, has been brought on line in normal mode for ILDISK tests.

- **Drive online in normal mode. HSC variants not currently enabled.**— ILDISK attempted to bring an ESE20 storage element on line in enhanced mode. However, the HSC controller has not been enabled to support the enhanced (variant) mode of operation. Refer to the *HSC Controller User Guide* for information on using the SETSHO command SET SERVER DISK/VARIANT_PROTOCOL to enable enhanced mode operations on the HSC controller.

- **Drive online in normal mode. Requested variant is not supported.**— ILDISK tried to bring an ESE20 storage element on line in enhanced mode. However, some component of the HSC controller does not support the enhanced mode of operation. Verify that the ESE20 is attached to a K.si data channel module that is configured with disk microcode by using the SETSHO commands SHOW DISK and SHOW REQUESTORS. Refer to the *HSC Controller User Guide* for information on using these SETSHO commands.

  The ESE20 storage element cannot be run in enhanced mode on a K.sdi disk data channel module. If the ESE is attached to a properly configured K.si module and this message is still being sent, there may be a software problem. Submit an SPR with the HSC console log and any other information pertinent to the HSC controller configuration.

- **Drive online in normal mode. Retry operation later.**—ILDISK attempted to bring an ESE20 storage element on line in enhanced mode. However, the drive indicated that the enhanced mode of operation cannot currently be enabled.

  The ESE20 does not allow enhanced mode operations to be enabled while it is restoring data from its data retention system (this restoration takes approximately 10 minutes on an ESE20). If, during the restoration period, the ESE20 storage element receives a request from the HSC controller to bring the drive on line in enhanced mode, the ESE responds by issuing this message. Retry the operation after the data restore operation is completed.

- **Drive Spindle Not Up to Speed**—ILDISK cannot continue testing the drive because the disk spindle is not up to speed. If the drive is spun down, it must be spun up before ILDISK can completely test the unit. If the drive appears to be spinning, it may be spinning too slowly or the drive may be returning incorrect status information to the HSC controller.

- **Drive Transfer Queue Not Empty Before Format**—ILDISK found a transfer already queued to the K.sdi/K.si when the format test began. ILDISK should have exclusive access to the drive at this time, and all previous transfers should have been completed before the drive was acquired. To avoid potentially damaging interaction with another disk process, ILDISK aborts testing when this condition is detected.

- **Drive Unavailable**—The selected disk drive is not available for ILDISK.

- **Drive Unknown to Disk Functional Code**—The disk drive selected is not known to the disk functional software. The drive may not be communicating with the HSC controller, or the disk functional software may have disabled the drive due to an error condition. ILDISK prompts the user for the drive's requestor and port. Refer to Section 4.5.5 for information on specifying requestor and port.

- **Drive Went Off Line**—The drive previously acquired by the integrity test is now unknown to the disk functional code. This indicates that the drive spontaneously went off line or stopped sending clocks and is now unknown. Restart the test using the requestor and port numbers instead of the drive unit number.

- **Duplicate Unit Detected**—At times during the testing sequence, ILDISK must release, then reacquire the drive under test. After releasing the drive and reacquiring it, ILDISK noted that the requestor and port numbers of the drive it was originally testing do not match the requestor and port numbers of the drive just acquired. This indicates that the HSC controller is connected to two separate drives with the same unit number. If this error is detected, ILDISK discontinues testing to prevent inadvertent interaction with the other disk drive.

- **Echo Data Error**—The SDI verification test issued an SDI ECHO command to the drive. The command completed but the wrong response was returned by the drive. The SDI set and the disk drive are the probable FRUs.

- **Echo Framing Error**—The framing code (upper byte) of an SDI ECHO command response is incorrect. The expected and actual ECHO frames are displayed with the error message. The K.sdi/K.si module cable and the drive are the probable FRUs.

- **Error Bit Set in Drive Status Error Byte**—The SDI verification test executed an SDI GET STATUS command to the drive under test. The error byte in the returned status was nonzero, indicating one of the following conditions:

  - Drive error

  - Transmission error

  - Protocol error

  - Initialization integrity test failure

  - Write lock error

For the exact meaning of each error, refer to the service manual for that drive.

- **Error Reading LBN**—This test alternately reads DBNs and LBNs to test the drive's ability to seek properly. The error indicates that an LBN read failed. The drive is the probable FRU.

- **Error Releasing Drive**—ILDISK attempted to release the drive under test. The release operation failed. One of the following conditions occurred:

  - Could Not Disconnect—An SDI DISCONNECT command to the drive failed. Check the drive port lamp to see if the drive has been allocated to an alternate HSC controller.

  - Unknown Status from DDUSUB—The diagnostic interface returned an unknown status code. This indicates a software error and should be reported through a Software Performance Report (SPR). See the *HSC Controller Service Manual* for detailed information on SPR submission.

- **Error Starting I/O Operation**—ILDISK detected an error when initiating a disk read or write operation. One of the following conditions occurred:

  - Invalid Header Code—ILDISK did not supply a valid header code to the diagnostic interface. This indicates a software error and should be reported through a Software Performance Report (SPR). See the *HSC Controller Service Manual* for detailed information on SPR submission.

  - Could Not Acquire Control Structures—The diagnostic interface could not acquire sufficient control structures to perform the operation. Retry ILDISK during a period of lower HSC controller activity if this condition persists.

  - Could Not Acquire Buffer—The diagnostic interface could not acquire a buffer needed for the operation. Retry ILDISK during a period of lower HSC controller activity if this condition persists.

  - Unknown Status from DDUSUB—The diagnostic interface returned an unknown status code. This indicates a software error and should be reported through a Software Performance Report (SPR). See the *HSC Controller Service Manual* for detailed information on SPR submission.

- **Error in DCB on Completion**—The SDI verification test directed the disk data channel to execute one of its microdiagnostics. The microdiagnostic completed without reporting any error but the disk data channel returned the dialog control block (DCB) with an error indicated. The disk data channel is the probable FRU.

- **Failed To Reacquire Unit**—In order for ILDISK to allow looping, the drive under test must be released then reacquired. (This method is required to release the drive from the online state.) The release operation succeeded but the attempt to reacquire the drive failed. One of the following conditions occurred:

  - Drive Unknown to Disk Functional Code—A fatal error caused the disk functional software to declare the drive inoperative, so the drive unit number is not recognized. You must now test the drive by specifying requestor and port number.

  - Drive Unavailable—The specified drive is not available for integrity test use. The drive may be allocated to an alternate HSC controller. Check the drive port lamp to see if this caused the error.

- Unknown Status from DDUSUB—This indicates a software error and should be reported through a Software Performance Report (SPR). See the *HSC Controller Service Manual* for detailed information on SPR submission.

- **Failure While Updating Drive STATUS**—When in the process of returning the drive to the same mode as ILDISK originally found it in, an error occurred while performing an SDI GET STATUS command. In order to ensure that the disk functional software is aware of this mode change, ILDISK calls the diagnostic interface routines to perform a GET STATUS on the drive. These routines also update the disk functional software information on the drive to reflect the new mode.

  This error indicates that the drive status update failed. The diagnostic interface returns one of three different status codes with this error:

  - Drive Error—The GET STATUS command could not be completed due to an error during the command. If informational error messages are enabled (through a SET ERROR INFO command), an error message describing the failure is displayed on the console terminal.

  - Bad Unit Number—The diagnostic interface could not find the unit number specified. The drive may have spontaneously transitioned to the offline state (no clocks) since the last ILDISK operation. For this reason, the unit number is unknown when the diagnostic interface tries to do a GET STATUS command.

  - Unknown Status From DDUSUB—Refer to the listing for this error.

- **Format DRAT Was Not Returned to Completion Queue**—The K.sdi/K.si module failed to complete a format operation. A format operation consists of a read followed by a format. The read completed successfully, and the fragment request block (FRB) for the format was returned by the K.sdi/K.si module with no error indicated. However, the disk rotational access table (DRAT) for the format operation was never returned, indicating a probable K.sdi/K.si module failure. After reporting this error, the format test aborts.

- **Format Operation Timed Out**—The K.sdi/K.si module failed to complete a format operation. A format operation consists of a read followed by a format. The read completed successfully but after waiting a 16-second interval, the format was not complete. A change in drive state may prevent formatting, the drive may no longer be sending sector/index information to the K.sdi/K.si module, or the K.sdi/K.si module may be unable to sample the drive state. The format test aborts on this error to prevent damage to the existing disk format.

- **Format Tests Skipped Due to Previous Error**—To prevent possible damage to the existing disk format, ILDISK does not attempt to format if any errors were detected in the tests preceding the format tests. This error message informs the user that formatting tests will not be performed.

- **I/O Operation Lost**—While ILDISK was waiting for a disk read or write operation to complete, the diagnostic interface notified ILDISK that no I/O operation was in progress. This error may have been induced by a hardware failure but it actually indicates a software problem, and the error should be reported by a Software Performance Report (SPR). See the *HSC Controller Service Manual* for detailed information on SPR submission.

- **Init Did Not Stop State Line Clock**—The SDI verification test sent an SDI INITIALIZE command to the drive. When the drive receives this command, it should momentarily stop sending state line clock to the disk data channel. The disk data channel did not see the state line clock stop after sending the initialize. The drive is the most probable FRU.

- **Insufficient Memory, Test Not Executed**—The SDI verification test could not acquire sufficient memory for control structures. The SDI verification test could not be executed. Use the SETSHO command SHOW MEMORY to display available memory. If any disabled memory appears in the display, consider further testing of the memory module. If no disabled memory is displayed and no other integrity test or utility is active on this HSC controller, submit a Software Performance Report (SPR). See the *HSC Controller Service Manual* for detailed information on SPR submission.

- **Insufficient Resources to Perform Test**—This error indicates that further testing cannot be completed due to a lack of required memory structures. To perform certain drive tests, ILDISK needs to acquire timers, a dialog control block (DCB), free control blocks (FCBs), data buffers, and enough control memory to construct two disk rotational access tables (DRATs). If any of these resources are unavailable, testing cannot be completed. Under normal conditions, these resources should always be available.

- **Invalid Requestor or Port Number Specified**—The requestor number given was not in the range 2 through 9, or the port number given was not in the range 0 through 7. Specify requestor and port numbers within the allowable ranges.

- **K Microdiagnostic Did Not Complete**—The SDI verification test directed the disk data channel to execute one of its microdiagnostics. The microdiagnostic did not complete within the allowable time. All drives connected to the disk data channel may now be unusable (if the microdiagnostic never completes) and the HSC controller will probably have to be rebooted. The disk data channel module is the probable failing FRU.

- **K Microdiagnostic Reported Error**—The SDI verification test directed the disk data channel to execute one of its microdiagnostics. The microdiagnostic completed and reported an error. The disk data channel is the probable FRU.

- **K.sdi Detected Error During Format**—The K.sdi/K.si module detected an error during a format operation. Each error bit set in the fragment request block (FRB) is translated into a text message that accompanies the error report.

- **K.sdi Detected Error in Read Preceding Format**—To guarantee that the disk is on the correct cylinder and track while formatting, ILDISK queues a read operation immediately preceding the FORMAT command. The read operation failed, so ILDISK aborted the format test. Each error bit set in the fragment request block (FRB) is translated into a text message that accompanies the error report.

- **K.sdi Does Not Support ECHO**—The disk data channel connected to the drive under test does not support the SDI ECHO command because the disk data channel microcode is not the latest revision level. This is not a fatal error but the disk data channel microcode should be updated to allow for improved isolation of drive-related errors.

- **K.sdi Does Not Support Microdiagnostics**—The K.sdi/K.si module connected to the drive under test does not support microdiagnostics. This indicates that the K.sdi/K.si microcode is not at the latest revision level. This is not a fatal error but the K.sdi/K.si module should probably be updated with the latest microcode to improve error detection capabilities.

- **Not Enough Good DBNs for Format**—In order to guarantee that the disk is on the proper cylinder and track, all formatting operations are immediately preceded by a read operation on the same track where the format is planned. This requires the first track in the drive's read/write DBN area to contain at least one good block that can be read without error. This error message indicates that a good block was not found on the first track of the read/write DBN area, so the formatting tests are skipped.

- **Read DRAT Not Returned to Completion Queue**—To guarantee the disk is on the correct cylinder and track while formatting, ILDISK queues a read operation immediately preceding the format command. The read operation apparently completed successfully because the fragment request block (FRB) for the read was returned with no error bits set. However, the disk rotational access table (DRAT) for the read operation was not returned indicating a problem with the K.sdi/K.si module.

- **Read Operation Timed Out**—To guarantee that the disk is on the correct cylinder and track while formatting, ILDISK queues a read operation immediately preceding the FORMAT command. The read operation did not complete within 16 seconds indicating the K.sdi/K.si module is unable to sense sector/index pulses from the disk, or the disk is not in the proper state to perform a transfer. ILDISK aborts the format test following this error report.

- **Read/Write Ready Not Set in On-line Drive**—The SDI verification test executed a command to interrogate the real-time drive state line of the drive. The drive should be in the online state but the Read/Write Ready bit was not set in the status register.
  This could be caused by a failing disk drive, bad Read/Write logic, or bad media.

- **Read/Write Ready Set in Available Drive**—The SDI verification routine executed a command to interrogate the real-time drive state line of the drive and found the Available bit asserted. However, Read/Write Ready also was asserted. Read/Write Ready should never be asserted when a drive is in the available state.

- **Receiver Ready Not Set**—The SDI verification routine executed a command to interrogate the Real-Time Drive State Line of the drive. The routine expected to find Receiver Ready asserted but it was not.

- **Req/Port Number Information Unavailable**—ILDISK was unable to obtain the requestor number and port number from the HSC disk software tables. The drive may have changed state and disappeared while ILDISK was running. If this error persists, submit a Software Performance Report (SPR). See the *HSC Controller Service Manual* for detailed information on SPR submission.

- **Requestor Does Not Have Control Area**—ILDISK cannot find a control area for the requestor supplied by the user. One of the following conditions exists:

  – The HSC controller does not contain a disk data channel (or other type of requestor) in the specified requestor position.

  – The disk data channel (or other type of requestor) in the specified requestor position failed its initialization integrity tests and is not in use by the HSC controller.

  Open the HSC controller and remove the cover from the card cage. Locate the module slot in the card cage that corresponds to the requestor. Refer to the module utilization label above the card cage to help locate the proper requestor.

  If a blank module (air baffle) is in the module slot, the HSC controller does not contain a requestor in the specified position. If a requestor is in the module slot, check that the red LED on the lower front edge of the module is lit. If so, the requestor failed and was disabled by the HSC controller. If the red LED is not lit, a software problem exists that should be reported with a Software Performance Report (SPR). See the *HSC Controller Service Manual* for detailed information on SPR submission.

- **Requestor Selected Is Not a K.sdi**—The requestor specified was not a disk data channel (K.sdi/K.si). Specify a requestor that contains a disk data channel.

- **RUN DRIVE RESIDENT DIAGNOSTICS**—This message accompanies an error message, indicating some type of failure while ILDISK was communicating with a disk drive.

- **SDI Enable Variant command failed**—The HSC controller attempted to issue an SDI command to an ESE20 storage element to enable variant operations, but the SDI command failed. Verify that the ESE is available and that all SDI cable connections are secure. Check for other HSC error messages that may indicate why the SDI command failed.

- **Specified port contains a Known Drive**—The requestor and port specified contain a drive known to the disk functional software. The unit number of the drive is supplied in the report. ILDISK does not allow testing a known drive through requestor number and port number.

- **State Line Clock Did Not Start Up After Init**—The SDI verification test sent an SDI INITIALIZE command to the drive. When the drive receives this command, it should momentarily stop sending state clock to the disk data channel. The disk data channel saw the state clock stop, but the clock never restarted. The drive is the most probable FRU.

- **State Line Clock Not Running**—The SDI verification test executed a command to interrogate the real-time drive state of the drive. The returned status indicates that the drive is not sending state line clock to the disk data channel. Either the port, SDI cable, or drive is defective, or the port is not connected to a drive.

- **Testing Aborted Ping-Pong Testing Detected**—ILDISK was automatically initiated to test a disk drive declared inoperative by the disk functional code. The disk drive had previously been automatically tested at least twice and somehow was returned to service. Because the tests performed by ILDISK may be causing the inoperative drive to be returned to service,

ILDISK does not attempt to test an inoperative drive more than twice. On all succeeding invocations of ILDISK, this message prints and ILDISK exits without performing any tests on the drive.

- **Unexpected Item on Drive Service Queue**—The SDI verification test directed the disk data channel to execute one of its microdiagnostics. The microdiagnostic completed without error, and the disk data channel returned the dialog control block (DCB) with no errors indicated. However, the disk data channel sent the drive state area to its service queue, indicating an unexpected condition in the disk data channel or drive.

- **Unit Selected Is Not a Disk**—The response to the unit number prompt was not of the form D*nnnn*. Refer to Section 4.5.4 for the correct prompt format.

- **Unknown Status from DDUSUB**—A call to the diagnostic interface resulted in the return of an unknown status code. This indicates a software error and should be reported through a Software Performance Report (SPR). See the *HSC Controller Service Manual* for detailed information on SPR submission.

- **Wrong Structure on Completion Queue**—While formatting, ILDISK checks each structure returned by the K.sdi/K.si module to ensure that the structure was sent to the proper completion queue. This error indicates that one of these structures was sent to the wrong completion queue. This type of error indicates a problem with the K.sdi/K.si microsequencer or a control memory failure.

4.5.10 MSCP Status Codes—ILDISK Error Reports

Following is a list of some of the MSCP status codes that may appear in ILDISK error reports. All status codes are listed in the octal radix. Further information on MSCP status codes is provided in the *HSC Controller Service Manual*.

007—Compare Error
010—Forced Error
052—SERDES Overrun
053—SDI Command Timeout
103—Drive Inoperative
110—Header Compare or Header Sync Timeout
112—EDC Error
113—Controller Detected Transmission Error
150—Data Sync Not Found
152—Internal Consistency Error
153—Position or Unintelligible Header Error
213—Lost Read/Write Ready
253—Drive Clock Dropout
313—Lost Receiver Ready
350—Uncorrectable ECC Error
353—Drive Detected Error
410—One Symbol ECC Error
412—Data Bus Overrun
413—State or Response Line Pulse or Parity Error
450—Two Symbol ECC Error
452—Data Memory NXM or Parity Error
453—Drive Requested Error Log
510—Three Symbol ECC Error
513—Response Length or Opcode Error
550—Four Symbol ECC Error

553—Clock Did Not Restart After Init
610—Five Symbol ECC Error
613—Clock Did Not Stop After Init
650—Six Symbol ECC Error
653—Receiver Ready Collision
710—Seven Symbol ECC Error
713—Response Overflow
750—Eight Symbol ECC Error

4.6 ILTAPE—TAPE Device Integrity Tests

The following tests can be initiated through ILTAPE:

- **Tape formatter-resident integrity tests.**

- **Functional test of the tape transport.** The three types of tape transport tests are listed below. See Section 4.6.6 for a summary of each.

    – Fixed canned sequence

    – User sequence supplied at the terminal

    – Fixed streamer sequence

- **Full test of the K.sti/K.si interface.** When a full test is selected, the K.sti/K.si microdiagnostics are executed, line state is verified, an ECHO test is performed, and a default set of formatter tests is executed. See the DRIVE UNIT NUMBER prompt in Section 4.6.3 for information on initiating a full test. Detected failures result in fault isolation to the FRU level.

Hardware required to run ILTAPE includes the following:

- HSC controller with K.sti/K.si

- STI-compatible tape formatter

- TA™78, TA81, or other DIGITAL Storage Architecture (DSA) tape drive (for transfer commands only)

- Console terminal

- RX33 disk drive

In addition, the I/O control processor, program memory, and control memory must be working.

Software required to run ILTAPE includes the following:

- HSC software

- DEMON

- K.sti/K.si microcode (installed with the K.sti/K.si module)

4.6.1 Operating Instructions

The following steps outline the procedure for running ILTAPE. The test assumes that an HSC controller is configured with a terminal and an STI interface. If the HSC controller is not booted, start with step 1. If the HSC controller is already booted, proceed to step 2.

1. Boot the HSC controller.

Press the Init button on the OCP. The following message appears:

```
INIPIO-I Booting...
```

The boot process takes about 2 minutes. When booting has completed, the following message is displayed:

```
HSC Version xxxx Date Time  System n
```

2. Enter Ctrl/Y to display the HSCxx> prompt. The keyboard monitor responds with the following prompt:

```
HSCxx>
```

3. Enter RUN DXn:ILTAPE to initiate the tape device integrity test program. The following message will appear:

```
ILTAPE>D>hh:mm Execution Starting
```

4.6.2 Test Termination

ILTAPE can be terminated by entering Ctrl/C. When you terminate ILTAPE in this fashion, it runs until the current test sequence finishes. This can take several minutes. Certain errors that occur during execution will cause ILTAPE to terminate automatically.

4.6.3 User Dialog

The following paragraphs describe ILTAPE/user dialog during execution of ILTAPE. Note that the default values for the input parameters appear within the brackets of the prompt. The absence of a value within the brackets indicates that the input parameter does not have a default value.

ILTAPE executes two times for each pass when executing on cache-capable drives. Write Back Caching is disabled for the first pass and enabled for the second pass. When cache is enabled, ILTAPE issues all SDI Level Two caching commands in addition to the normal commands issued for the first pass. You are informed of the enabled/disabled status of cache with appropriate messages.

```
DRIVE UNIT NUMBER (U) []?
```

To run formatter tests or transport tests, enter T*nnn*, where *nnn* is the MSCP unit number (such as T316).

For a full interface test, enter X*m*, where *m* is any number. Typing X instead of T requires a requestor number and slot number. The following two prompts solicit requestor/slot numbers:

```
ENTER REQUESTOR NUMBER (2-9) []?
```

Enter the requestor number. The range includes numbers 2 through 9, with no default value.

```
ENTER PORT NUMBER (0-3) []?
```

Enter the port number. The port number must be 0, 1, 2, or 3 with no default value. After this prompt is answered, ILTAPE executes the K.sti/K.si interface test. At completion of this test, ILTAPE exits and issues an Execution Complete message. You must restart ILTAPE to run additional tests.

If you entered T*nnn* at the Drive Unit Number prompt, ILTAPE issues the following prompt:

```
EXECUTE FORMATTER DEVICE INTEGRITY TEST (Y/N) [Y]?
```

Enter "Y" or press the Return key to execute the formatter device integrity tests. Entering "N" will not test the formatter device.

```
MEMORY REGION NUMBER (H) [0]?
```

This prompt appears if the response to the previous prompt was a Return or "Y". A formatter test is named according to the formatter memory region where it executes. Enter the memory region (in hex) in which the formatter test is to execute. ILTAPE continues at the prompt for iterations. Refer to the appropriate tape drive service manual for more information on formatter tests.

If you specify a memory region in the range 8000 through FFFF hexadecimal, you will be further prompted for diagnostic parameters as follows:

```
ENTER FORMATTER DIAGNOSTIC PARAMETERS (Y/N) [N]? Y
PARAMETER 00: 33
PARAMETER 01: 33
.
.
.
PARAMETER 14: 77
PARAMETER 15: 77
IS SCRATCH MEDIA MOUNTED (Y/N) []?
```

Enter up to 15 parameters as shown. If you enter less than 15 parameters, terminate your last entry by pressing Return. This causes the test to skip to the IS SCRATCH MEDIA MOUNTED prompt.

If you do not elect to run the formatter device integrity test, the following prompt is displayed:

```
EXECUTE TEST OF TAPE TRANSPORT (Y/N) [N]?
```

To test the tape transport, enter "Y". If you enter "N" or press the Return key to select the default, ILTAPE exits.

The following prompts appear when you select the tape transport test:

```
IS SCRATCH MEDIA MOUNTED (Y/N) []?
```

This test writes to the tape transport, requiring a mounted scratch tape. Enter "Y" if a scratch tape is already mounted.

```
Functional Test Sequence Number (0 thru 5) [1]?
```

Select one of five transport tests. The default is 1 (the canned sequence). If you select the canned sequence, the test then skips to the ENTER CANNED SEQUENCE RUN TIME IN MINUTES prompt.

Enter 0 if a new user sequence will be input from the terminal. You are then prompted for the user sequence beginning with the following prompt:

```
INPUT STEP 00:
```

See Section 4.6.4 for a description of user sequences.

You can also enter 2, 3, or 4 to select a user sequence previously input and stored on the HSC device. Enter 5 to select the streaming sequence.

```
ENTER CANNED SEQUENCE RUN TIME IN MINUTES (D) [1]?
```

Answering this prompt determines the time limit for the canned sequence. It appears only if the canned sequence is selected. Enter the total run time limit in minutes. The default is 1 minute.

Still continuing with the canned sequence, if the device under test is not a TA90 tape drive, you are next prompted for density:

```
SELECT DENSITY (0=ALL, 1=1600, 2=6250) [0]?
```

If you select a density that is not supported by the tape drive or is not on the list of options, you will receive an error message and be re-prompted for density. The default selection, ALL, tests the drive at 1600 and 6250 bpi in separate passes.

The test now goes on to the speed selection prompt if the drive supports variable speeds. If the drive does not support variable speeds, the test skips to the DATA PATTERN NUMBER prompt.

If you have selected the canned sequence and the device under test is a TA90 tape drive *without* the optional data compaction board, ILTAPE sets the speed and density prompts automatically and skips to the DATA PATTERN NUMBER prompt.

If the device under test is a TA90 tape drive with the optional data compaction board installed, ILTAPE issues the following density prompt:

```
SELECT DENSITY (0=ALL, 1=Normal, 3=Normal Compacted) [1]?
```

If you select a density that is not supported by the tape drive, or is not on the list of options, you will receive an error message and be re-prompted for density. Selecting ALL tests the drive at normal and compacted densities in separate passes. Because the TA90 tape drive operates at fixed speeds, the test now goes on to the DATA PATTERN NUMBER prompt.

The next series of prompts concerns speed selection. The particular prompts depend upon the type of speeds supported (fixed or variable). ILTAPE determines the speed types supported and will prompt you accordingly.

_____ **Note** _____

If only a single speed is supported, ILTAPE does not prompt for speed. It runs at the single speed supported.

_____

If fixed speeds are supported, ILTAPE displays a menu of supported speeds, as follows:

```
SPEEDS AVAILABLE:
                (1) ssss ips
                (2) ssss ips
                (3) ssss ips
                (4) ssss ips
SELECT SPEED? (D) [0=AUTOMATIC]?
```

where *ssss* is the supported speed in inches per second.

To select a fixed speed, enter a number 1 through 4 that corresponds to one of the displayed speeds. The default is the lowest supported speed. ILTAPE continues at the data pattern prompt.

If variable speeds are supported, ILTAPE displays the lower and upper bounds of the supported speeds as follows:

```
VARIABLE SPEEDS AVAILABLE:

     LOWER BOUND = lll ips

     UPPER BOUND = uuu ips
```

To select a variable speed, enter a number within the bounds, inclusively, of the displayed supported variable speeds. The default is the lower bound. The prompt for a variable speed is as follows:

```
SELECT VARIABLE SPEED (D) [0 = LOWEST]?
```

The next prompt asks for the data pattern.

```
DATA PATTERN NUMBER (0,1,2,3,4) [3]?
```

Choose one of five data patterns. The data patterns are defined as follows:

0—User supplied
1—All zeros
2—All ones
3—Ripple zeros (default)
4—Ripple ones

If you enter 1, 2, 3, or 4, the test skips to the SELECT RECORD SIZE prompt. If your response is 0, the following prompt appears:

```
HOW MANY DATA ENTRIES (1-16) []?
```

Enter the number of unique words in the data pattern. Up to 16 words are permitted. Next, enter the data pattern in hexadecimal in response to the following prompt:

```
DATA ENTRY (H) []?
```

This prompt repeats until the data words specified in the previous prompt are exhausted.

```
SELECT RECORD SIZE (GREATER THAN 0) (D) [8192]?
```

---------------------------- **Note** ----------------------------

The Record Size prompt does not appear if you selected the streaming sequence (choice 5 at the Functional Test Sequence Number prompt).

Enter the desired record size in decimal bytes. The default is 8192 bytes. The maximum record size that can be specified is 12288.

```
ITERATIONS (D) [1]?
```

Enter the number of times the selected tests are to run. After the number of iterations is entered, the selected tests begin execution. Messages are displayed for any errors encountered during execution.

4.6.4 User Sequences

To test/exercise a tape transport, write a sequence of commands at the terminal. This sequence may be saved on the HSC controller load device and recalled for execution at a later time. Up to three user sequences can be saved.

Following is a list of supported user sequence commands:

WRT—Write one record
RDF—Read one record forward
RDFC—Read one record forward with compare
RDB—Read one record backward
RDBC—Read one record backward with compare
FSR—Forward space one record

FSF—Forward space one file
BSR—Backspace one record
BSF—Backspace one file
REW—Rewind
RWE—Rewind with erase
UNL—Unload (after rewind)
WTM—Write tape mark
ERG—Erase gap
C*nnn*—Counter set to *nnn* (0 = 1000)
D*nnn*—Delay *nnn* ticks (0 = 1000)
BR*nn*—Branch unconditionally to step *nn*
DB*nn*—Decrement counter and branch if nonzero to step *nn*
TM*nn*—Branch on Tape Mark to step *nn*
NT*nn*—Branch on NO Tape Mark to step *nn*
ET*nn*—Branch on EOT to step *nn*
NE*nn*—Branch on NOT EOT to step *nn*
QUIT—Terminate input of sequence steps

To initiate the user sequence dialog, enter 0 in response to the following prompt:

```
Functional Test Sequence Number (0 thru 5) [1]?
```

The paragraphs that follow describe the ILTAPE user dialog during a new user sequence.

```
INPUT STEP   nn
```

Enter one of the user sequence commands listed previously in response to this prompt. ILTAPE keeps track of the step numbers and automatically increments them. Up to 50 steps may be entered. Entering QUIT in response to the INPUT STEP prompt terminates the user sequence. At that time, the following prompt appears:

```
Store Sequence as Sequence Number (0,2,3,4) [0]?
```

The sequence entered at the terminal may be stored on the HSC controller load device in one of three files. To select one of these files, enter 2, 3, or 4. Once stored, the sequence may be recalled for execution at a later time by referring to the appropriate file (entering 2, 3, or 4 in response to the sequence number prompt).

Entering the default sequence number 0 indicates that the user sequence just entered should not be stored. In this case, the sequence cannot be run at a later time. Sequence number 1 is the canned sequence described in Section 4.6.6.4

An example of a user sequence follows:

```
INPUT STEP  00  REW    ;Rewind the tape
INPUT STEP  01  C950   ;Set counter to 950
INPUT STEP  02  WRT    ;Write one record
INPUT STEP  03  ET07   ;If EOT branch to step 7
INPUT STEP  04  RDB    ;Read backward one record
INPUT STEP  05  FSR    ;Forward space one record
INPUT STEP  06  DB02   ;Decrement counter, branch
                       ;to step 2 if nonzero
INPUT STEP  07  REW    ;Rewind the tape
```

```
INPUT STEP  08  QUIT  ;Terminate sequence input
STORE SEQUENCE AS SEQUENCE NUMBER (0,2,3,4) [0]? 3
```

This sequence writes a record, reads it backwards, and skips forward over it.
If an EOT is encountered prior to writing 950 records, the tape is rewound
and the sequence terminates. In this example, the sequence is saved on the
HSC controller load device as sequence number 3 and can be recalled at a later
execution of ILTAPE.

The following density prompts are issued if a user-defined sequence is selected.
The differences between these density prompts and the canned sequence prompts
is that the choice ALL cannot be selected. Only one pass with one density can be
run for the user sequences.

If the device under test is not a TA90 tape drive, you are prompted for density as
follows:

```
SELECT DENSITY (1=800, 2=1600, 3=6250) [3]?
```

If the device under test is a TA90 tape drive with the optional data compaction
board installed, you are prompted for density as follows:

```
SELECT DENSITY (1=Normal, 3=Normal Compacted) [1]?
```

If you select a density that is not supported by the tape drive or not on the list of
options, ILTAPE issues an error message and you are re-prompted for density.

For TA90 tape drives without the data compaction board installed, the density
prompt is skipped, since there is only one density to choose from.

4.6.5 Progress Reports

When transport testing is finished, a summary of soft errors appears on the
terminal upon completion of the test. The format of this summary is as follows:

```
Soft Error Summary:

Unit  Media  Double  Double  Single  Single  Other  Other  Other
N     Error  Trkerr  Trkrev  Trkerr  Trkrev  Err A  Err B  Err C
T020  000001 00000   00000   00000   00000   000000 00002  00000
```

Successful completion of a formatter test is indicated by the following message on
the terminal:

```
TEST nnnn DONE
```

where *nnnn* is the formatter test number.

When an error is encountered, an error message is printed on the terminal.

4.6.6 Test Summaries

The following sections summarize the tests run by ILTAPE.

4.6.6.1 Interface Test Summary

This portion of ILTAPE tests the STI of a specific tape data channel and port. It
also performs low-level testing of the formatter by interfacing to the K.sti/K.si
drive service area (port) and executing various Level 2 STI commands. The
testing is limited to dialog operations; no data transfer is done. The commands
issued are DIAGNOSE, READ MEMORY, GET DRIVE STATUS, and READ
LINE STATUS.

K.sti/K.si microdiagnostics are executed to verify the tape data channel. A default set of formatter tests (out of memory region 0) is executed to test the formatter, and an echo test is performed to test the connection between the port and the formatter.

Failures detected are isolated to the extent possible and limited to tape data channels, the STI set, or the formatter. The STI set includes a small portion of the K.sti/K.si module and the entire STI (all connectors, cables, and a small portion of the drive). The failure possibilities of the STI set are as follows:

- STI cables or connectors (most probable)

- Formatter

- K.sti/K.si module (least probable)

When the STI set is identified as the FRU, replacement should be in the order listed.

4.6.6.2 Formatter Test Summary

Formatter tests are executed out of a formatter memory region selected by the user. Refer to the tape drive service manual for a description of the formatter tests. Failures detected identify the formatter as the FRU.

4.6.6.3 User Sequence Test Summary

User sequences are used to exercise the tape transport. The particular sequence is totally user-defined. Refer to Section 4.6.4.

4.6.6.4 Canned Sequence Test Summary

The canned sequence is a fixed routine for exercising the tape transport. The canned sequence first performs a quick verify of the ability to read and write the tape at all supported densities. Using a user-selected record size, the canned sequence then writes, reads, and compares the data written over a 200-foot length of tape. Positioning over this length of tape is also performed. Finally, random record sizes are used to write, read, compare, and position over a 50-foot length of tape. Errors encountered during the canned sequence are reported at the terminal.

4.6.6.5 Streaming Sequence Test Summary

The streaming sequence is a fixed sequence that attempts to write and read the tape at speed (without hesitation). The entire tape is written, rewound, and read back. This test may be terminated at any time by entering Ctrl/Y.

4.6.7 Error Message Example

All error messages issued by ILTAPE conform to the generic error message format described in Section 4.1.2. The optional text is dependent upon the type of error. An example of an ILTAPE error message follows:

```
ILTAPE>D>09:31 T # 011 E # 011 U-T00101
ILTAPE>D>COMMAND FAILURE
ILTAPE>D>MSCP WRITE MULTIPLE COMMAND
ILTAPE>D>MSCP STATUS:   000000
ILTAPE>D>POSITION    001792
```

The test number reflects the state level where ILTAPE was executing when an error occurred. This number does not indicate a separate test that can be called. Table 4–1 defines the ILTAPE state levels.

Table 4–1 ILTAPE Test Levels

Test Number/ State Level	ILTAPE State
0	Initialize tape software interface
1	Device (port, formatter, unit) acquisition
2	STI interface test
3	Formatter tests executing in response to Diagnostic Request (DR) bit
4	Tape transport functional test
5	User-selected formatter test
6	Termination and cleanup

4.6.8 Error Messages

This section describes the error messages issued by ILTAPE.

- **AVAILABLE Set in Online Drive**—After successful completion of an ONLINE command to the formatter, the AVAILABLE bit is set.

- **Chosen Density Is Not Supported**—You have selected a density that is not supported by the drive under test.

- **Command Failure**—A command failed during execution of ILTAPE. The command in error may be one of several types, such as an MSCP or Level 2 STI command. The failing command is identified in the optional text of the error message. For example:

  ```
  ILTAPE>D>MSCP READ COMMAND
  ILTAPE>D>MSCP STATUS:  nnnnnn
  ```

- **DCB Not Returned, K Failed for Unknown Reason**—During the STI interface test, the requestor failed for an undetermined reason and the dialog control block (DCB) was not returned to the completion queue.

- **Data Compare Error**—During execution of the user or canned sequence, ILTAPE encountered a software compare mismatch on the data written and read back from the tape. The software compare is actually carried out by a subroutine in the diagnostic interface, TDUSUB. The results of the compare are passed to ILTAPE. The text of the error message identifies the data in error.

- **EDC Error**—During execution of the user or canned sequence, ILTAPE encountered an EDC error on the data written and read back from the tape. This error is actually detected by the diagnostic interface, TDUSUB, and reported to ILTAPE. The text of the error message identifies the data in error.

- **Echo Data Error**—Data echoed across the STI interface was incorrectly returned.

- **Error in DCB on Completion**—During the STI interface test, an error condition was returned in the DCB.

- **Formatter Device Integrity Test Detected Error**—A test running in the formatter has detected an error. Any error text from the formatter is displayed.

- **Formatter Device Integrity Test Detected Fatal Error**—A test running in the formatter has detected a fatal error. Any error text from the formatter is displayed.

- **Formatter State Not Preserved Across Init**—The state of the formatter prior to a formatter initialize was not preserved across the initialization sequence.

- **Init Did Not Stop State Line Clock**—During the STI interface test, after execution of a formatter INITIALIZE command, the state line clock did not drop for the time specified in the STI specification.

- **Initialization Failure**—Tape path software interface cannot be established due to insufficient resources (buffers, queues, timers, and so forth).

- **Insufficient Resources to Acquire Specified Device**—During execution, ILTAPE was unable to acquire the specified device due to a lack of necessary resources. This condition is identified to ILTAPE by the tape functional code through the diagnostic interface, TDUSUB. ILTAPE has no knowledge of the specific unavailable resource.

- **Insufficient Resources To Acquire Timer**—ILTAPE was unable to acquire a timer from the system; insufficient buffers are available in the system to allocate timer queues.

- **Invalid Multiunit Code from GUS Command**—After a unit number is input to ILTAPE and prior to acquiring the unit, ILTAPE attempts to obtain the unit's multiunit code through the GET UNIT STATUS command. This error indicates a multiunit code of zero was returned to ILTAPE from the tape functional code. Because a multiunit code of zero is invalid, this error is equivalent to a device unknown to the tape subsystem.

- **Invalid Requestor/Port Number**—Selected requestor or port number is out of range or the requestor selected is not known to the system.

- **K Microdiagnostic Did Not Complete**—During the STI interface test, the requestor microdiagnostic timed out.

- **K Microdiagnostic Reported Error**—During the STI interface test, an error condition was reported by the K microdiagnostics.

- **K.STI DOES NOT SUPPORT MICRODIAGNOSTICS**—While doing the inter-tape verification routine, the system determined that the revision level of the tape data channel module microcode was too low.

- **Load Device Error—File Not Found**—During the user-sequence dialog, ILTAPE was unable to locate the sequence file associated with the specified user-sequence number. Ensure that the load device media is properly installed. The program re-prompts for a user-sequence number. To break the loop of re-prompts, enter Ctrl/Y.

- **Load Device Read Error**—While attempting to read a user sequence from the load device, a read error was encountered. Ensure that a sequence has been stored on the load device as identified by the user sequence number. The program re-prompts for a user sequence number. To break the loop of re-prompts, enter Ctrl/Y.

- **Load Device Write Error—CHECK IF WRITE LOCKED**—An error occurred while attempting to write a user-sequence to the HSC controller load device. Check to see if the load device is write protected. The prompt calls for a user-sequence number. To break the loop of re-prompts, enter Ctrl/Y.

- **PATTERN WORD ERROR**—During the execution of a user or canned sequence, the pattern word compared to the data on tape did not match. The software compare is actually carried out by a subroutine in the diagnostic interface, TDUSUB. The results of the compare are passed to ILTAPE. The text of the error message identifies the data in error.

- **Read Memory Byte Count Error**—The requested byte count used in the read (formatter) memory command is different from the actual byte count received.

      EXPECTED COUNT: *xxxx*   ACTUAL COUNT: *yyyy*

- **Receiver Ready Not Set**—After issuing an ONLINE command to the formatter, the Receiver Ready signal was not asserted.

- **Requested Device Is Busy**—The selected device is on line to another controller or host.

- **Requested Device Unknown**—The device that was requested is not known to the tape subsystem.

- **Requestor Not A K.sti**—The selected requestor is not known to the system as a tape data channel.

- **Selected Unit Not a Tape**—The selected drive is not known to the HSC controller as a tape.

- **State Line Clock Did Not Start Up After Init**—During the STI interface test and after execution of a formatter INITIALIZE command, the state line clock did not start up within the time specified in the STI specification.

- **State Line Clock Not Running**—During the STI interface test, execution of an internal command to interrogate the real-time formatter state line of the drive indicated that the state line clock is not running.

- **Tape write protected—Test Terminating**—You have mounted a scratch tape that is write protected.

- **Timeout Acquiring Drive Service Area**—While attempting to acquire the drive service area (port) in order to run the STI interface test, a timeout occurred. If this happens, the tape functional code is corrupted. ILTAPE invokes a system crash.

- **Unable to Release Device**—Upon termination of ILTAPE or upon an error condition, the device(s) could not be returned to the system.

- **Unexpected Item on Drive Service Queue**—During the STI interface test, an unexpected entry was found on the drive service queue.

- **Unit Unknown or On Line to Another Controller**—The device identified by the selected unit number is either unknown to the system or on line to another controller. Verify that the selected unit number is correct and run ILTAPE again.

- **UNIT WENT OFFLINE OR AVAILABLE**—During the execution of a user sequence, the drive state is checked and found to be available or off line. Check the drive and make sure that it remains on line for the duration of the test.

- **Unknown Status from TDUSUB**—An unknown status was returned from the tape diagnostic interface.

4.7 ILTCOM—Tape Compatibility Test

ILTCOM tests the tape compatibility of different tape drives. The tapes tested may have been written on different systems with different STI-compatible tape drives connected to an HSC controller through the STI bus.

A compatibility tape consists of file groups (called bunches) of specific data pattern records. ILTCOM may generate, modify, read, or list a compatibility tape. Data read from the compatibility tape is compared to the expected pattern.

Each bunch contains a header record and several data records of different sizes and is terminated by a tape mark. The last bunch on a tape is followed by an additional tape mark (thus forming logical EOT).

There is a total of 199 records in each bunch: one header record followed by 198 data records. The header record contains 48 (decimal) bytes of 6-bit encoded descriptive information, as follows:

Table 4–2 ILTCOM Header Record

Field	Description	Length	Example
1	Drive type	6 bytes	TA78
2	Drive serial number	6 bytes	123456
3	Processor type	6 bytes	HSC
4	Processor serial number	6 bytes	123456
5	Date	6 bytes	093083
6	Comment [1]	18 bytes	Comment

[1]ILTCOM can read but cannot generate, a comment field.

The data records are arranged as follows:

- 66 records, 24 (decimal) bytes in length. These records sequence through 33 different data patterns. The 1st and 34th records contain pattern 1, the 2nd and 35th records contain pattern 2, and so forth, through the 33rd and 66th records that contain pattern 33.

- 66 records, 528 (decimal) bytes in length. These records sequence through the 33 data patterns as described above.

- 66 records, 12,024 (decimal) bytes in length. These records sequence through the 33 data patterns in the same manner as the preceding data records.

The data patterns used by ILTCOM are shown in Table 4–3.

Table 4–3 ILTCOM Data Patterns

Pattern Number	Pattern (Octal)	Description
1	377	Ones
2	000	Zeros
3	274, 377, 103, 000	Peak shift
4	000, 377, 377, 000	Peak shift
5	210, 104, 042, 021	Floating one

(continued on next page)

Table 4–3 (Cont.)   ILTCOM Data Patterns

Pattern Number	Pattern (Octal)	Description
6	273, 167, 356, 333	Floating zero
7	126, 251	Alternate bits
8	065, 312	Square pattern
9	000, 377	Alternate frames
10	001	Track 0 on
11	002	Track 1 on
12	004	Track 2 on
13	010	Track 3 on
14	020	Track 4 on
15	040	Track 5 on
16	100	Track 6 on
17	200	Track 7 on
18	376	Track 0 off
19	375	Track 1 off
20	373	Track 2 off
21	367	Track 3 off
22	357	Track 4 off
23	337	Track 5 off
24	277	Track 6 off
25	177	Track 7 off
26	207, 377, 370, 377	Bit peak shift
27	170, 377, 217, 377	
28	113, 377, 264, 377	
29	035, 377, 342, 377	
30	370, 377, 207, 377	
31	217, 377, 170, 377	
32	264, 377, 113, 377	
33	342, 377, 035, 377	

4.7.1 System Requirements

The hardware requirements necessary to run ILTCOM include the following:

- HSC controller with K.sti/K.si module

- STI-compatible tape formatter

- Tape drive

Because ILTCOM is not diagnostic in nature, all of the necessary hardware is assumed to be working. Errors are detected and reported but fault isolation is not a goal of ILTCOM.

ILTCOM software requirements include the following:

- HSC software

- DEMON

- K.sti/K.si microcode

- TFUNCT (on HSC software diskette)

4.7.2 Operating Instructions

The following steps outline the procedure for running ILTCOM. ILTCOM assumes that the HSC controller is configured with a terminal, an STI interface, and a TA78 tape drive (or STI-compatible equivalent). If the HSC controller is already booted, go to step 2. If the HSC controller needs to be booted, start with step 1.

1. Boot the HSC controller.

    Press the Init button on the OCP. The following message appears:

    ```
    INIPIO-I Booting...
    ```

    The boot process can take several minutes, then the following message appears:

    ```
    HSC Version xxxx Date Time System n
    ```

2. Enter Ctrl/Y to display the HSCxx> prompt. The keyboard monitor responds with the following prompt:

    ```
    HSCxx>
    ```

3. Enter RUN DXn:ILTCOM to initiate the tape compatibility device integrity test program. The following message will be displayed:

    ```
    ILTCOM>D>hh:mm Execution Starting
    ```

4.7.3 Test Termination

ILTCOM is terminated normally by selecting the exit function (EXIT) or by entering Ctrl/Y or Ctrl/C. Certain errors that occur during execution cause ILTCOM to terminate automatically.

4.7.4 Parameter Entry

ILTCOM allows the writing, reading, listing, or the modification of compatibility tapes. The following describes the user dialog during the execution of ILTCOM:

```
DRIVE UNIT NUMBER (U) []?
```

Enter the tape drive MSCP unit number (such as T21). If the device under test is a TA90 tape drive, with or without the optional data compaction board installed, ILTCOM displays the following prompt for density:

```
Density (1=Normal, 3=Normal Compacted) [1]?
```

The default density is Normal. If you select Normal Compacted density and the drive under test does not support this mode, you will receive an error message.

If the device under test is not a TA90 tape drive, ILTCOM displays the following prompt for density:

```
SELECT DENSITY FOR WRITES (1600,6250) (d) []?
```

There is no default, you must enter a density.

ILTCOM automatically sets speed for all types of drives, including the TA90 tape drive.

```
SELECT FUNCTION (WR=WRITE,REA=READ,ER=ERASE,LI=LIST,REW=REWIND,EX=EXIT) []?
```

Enter the function by using the characters that uniquely identify the desired function (for instance, REA for read).

The subsequent dialog is dependent upon the function selected.

- **Write**—The write function writes new bunches on the compatibility tape. Bunches are either written one at a time or over the entire tape. Bunches are written from the current tape position. If the write function is selected, the following prompt occurs:

  ```
  PROCEED WITH INITIAL WRITE (Y/N) [N]?
  ```

  Enter Y to proceed with the initial write. The default is no, in which case program control is continued at the function selection prompt. If the response is yes, the following prompt occurs:

  ```
  WRITE ENTIRE TAPE (Y/N) [N]?
  ```

  Enter Y if the entire tape is to be written. Writing of bunches begins at the current tape position and continues to physical EOT. Enter the default N if the entire tape is not to be written. In this case, only one bunch is written from the current tape position. This prompt only appears on the initial write selection. After the bunch has been written, control continues at the function selection prompt.

- **Read**—The read function reads and compares the data in the bunches with an expected (predefined) data pattern. As the reads occur, the bunch header information is displayed at the terminal. The format of the display is shown in the following example:

  ```
  BUNCH   01 WRITTEN BY TA78  SERIAL NUMBER 002965
  ON A HSC SERIAL NUMBER 005993 ON 09-18-84
  ```

  The number of bunches to be read is user selectable. All reads are from the beginning of tape (BOT). If the read function is selected, the following prompt is displayed:

  ```
  READ HOW MANY BUNCHES (D) [0=ALL]?
  ```

  Enter the number of bunches to be read. The default (0) causes all bunches to be read. After the requested number of bunches has been read and compared, control continues at the function selection prompt.

- **List**— The list function reads and displays the header of each bunch on the compatibility tape from BOT. The display is the same as the one described under the read function. The data contents of the bunches are *not* read and compared. After listing the tape bunch headers, control continues at the function selection prompt.

- **Erase**—The erase function erases a user-specified number of bunches from the current tape position toward BOT. ILTCOM backs up the specified number of tape marks and writes a second tape mark (logical EOT). This effectively erases the specified number of bunches from the tape. Thus, for example, if the current tape position is at bunch 5 and the user wishes to erase two bunches, three bunches are left on the tape after the ERASE command completes.

  ILTCOM does not allow the user to erase all bunches. At least one bunch must remain. For example, with five bunches on the tape, only four bunches can be erased.

  If the erase function is selected, the following prompt is displayed:

  ```
  ERASE HOW MANY BUNCHES FROM CURRENT POSITION (D) [0]?
  ```

Enter the number of bunches to be erased. The default of 0 results in
no change in tape contents or position. Control continues at the function
selection prompt.

- **Rewind**—The rewind function rewinds the tape to BOT.

- **Exit**—The exit function rewinds the tape and exits the tape compatibility
  program ILTCOM.

4.7.5 Test Summaries

ILTCOM writes, reads, and compares compatibility tapes upon user selection.
The testing that takes place looks for compatibility of tapes written on different
drives (and systems).

Incompatibilities due to data compare errors or unexpected formats are reported
as they are found. ILTCOM makes no attempt to isolate any faults found during
execution; it only reports incompatibilities and other errors as they occur.

4.7.6 Error Message Example

All error messages issued by ILTCOM conform to the generic error message
format described in Section 4.1.2. An example of an ILTCOM error message
follows:

```
ILTCOM>D>09:29 T 000 E 003 U-T00100
ILTCOM>D>COMMAND FAILURE
ILTCOM>D>OPTIONAL TEXT
```

The optional text is dependent upon the type of error. Some error messages
contain the term *object count* in the optional text. Object count refers to the tape
position (in objects) from BOT.

4.7.7 Error Messages

This section describes the error messages issued by ILTAPE.

- **Can't Find End of Bunch**—The compatibility tape being read or listed has
  a bad format.

- **Chosen density is not supported**—You have selected a density that is not
  supported by the drive under test.

- **Command Failure**—A command failed during execution of ILTCOM. The
  command in error may be one of several types (MSCP level, STI Level 2, and
  so forth). The failing command is identified in the optional text of the error
  message. For example:

```
ILTCOM>D>tt:tt T 000 E 003 U-T00030
ILTCOM>D>COMMAND FAILURE
ILTCOM>D>MSCP READ COMMAND
ILTCOM>D>MSCP STATUS: nnnnnn
```

- **Data Compare Error**—A data compare error has been detected. The actual
  and expected data are displayed in the optional text of the error message. For
  example:

```
ILTCOM>D>tt:tt T 000 E 011 U-T00030
ILTCOM>D>DATA COMPARE ERROR
ILTCOM>D>EXPECTED DATA: XXXXXX  ACTUAL DATA: YYYYYY
ILTCOM>D>NUMBER OF FIRST WORD IN ERROR:  nnnnn
ILTCOM>D>NUMBER OF WORDS IN ERROR:  mmmmm
ILTCOM>D>OBJECT COUNT = cccccc
```

- **Data EDC Error**—An EDC error was detected. Actual and expected values are displayed in the optional text of the error message.

- **Device is Unknown**—The user selected a drive not known to the system as a tape.

- **Error Releasing Drive**—After completion of execution or after an error condition, the tape drive could not successfully be returned to the system.

- **Insufficient Resources to Acquire Drive**—ILTCOM was unable to acquire the specified device due to lack of system resources. Try again later.

- **Invalid User Selection**—The selected unit is unknown to the HSC controller.

- **Specified Unit Cannot Be Brought On Line**—The selected unit is off line, on line to another controller, or not available.

- **TDUSUB Initialization Failure**—The tape path cannot be established due to insufficient resources.

- **Unknown Status from TDUSUB**—An unknown error condition returned from the software interface TDUSUB.

4.8 ILEXER—Multidrive Exerciser

ILEXER exercises the various disk drives and tape drives attached to the HSC controller. The exerciser is initiated upon demand. Drives to be tested are selected by the operator. The exerciser issues random READ, WRITE, and COMPARE commands to exercise the drives. The results of the exerciser are displayed on the terminal from which it was initiated.

The reports given by ILEXER do not provide any analysis of the errors reported, nor explicitly call out a specific FRU. This is strictly an exerciser.

ILEXER automatically enables write-back caching when executing on a cache-capable disk drive. This action is transparent to you.

ILEXER runs with other processes on the HSC controller. It is loaded from the RX33 disk drive and uses the services of the DEMON and the control software.

4.8.1 System Requirements

For the ILEXER program to run, the following hardware and software items must be available.

Hardware requirements include the following:

- Console terminal

- I/O control processor module with boot ROMs

- K.sdi, K.sti, and/or K.si data channel module

- Memory module

- RX33 disk drive

- SDI-compatible disk drive and/or STI compatible tape drive

Software requirements include the following:

- Control program (system diskette or tape)

- DEMON

- K.si, K.sdi, and/or K.sti microcode

- Disk and/or tape functional code

- Error handler

- Diagnostic Interface to disk and/or tape functional code

Tests cannot be performed on drives if their respective interfaces are not available (K.sdi, K.sti, or K.si).

4.8.2 Operating Instructions

Enter Ctrl/Y to display the HSCxx> prompt. The keyboard monitor responds with the prompt:

```
Ctrl/Y
HSCxx>
```

Enter RUN DXn:ILEXER to initiate the multidrive exerciser. The system loads the program from the specified local load media. When the program is successfully loaded, the following message is displayed:

```
ILEXER>D>hh:mm Execution Starting
```

where *hh:mm* is the current time.

ILEXER then prompts for parameters. After all prompts are answered, the execution of the test continues. Error reports and performance summaries are returned from ILEXER.

When ILEXER has run for the specified time interval, reported any errors found, and generated a final performance summary, the exerciser concludes with the following message:

```
ILEXER>D>hh:mm Execution Complete
```

4.8.3 Test Termination

ILEXER terminates normally when it completes the exercise on each selected drive, reports any errors found, and displays the final performance summary. All resources, including the drive being tested, are released. The operator may terminate ILEXER before normal completion by entering Ctrl/Y. The following output is displayed, plus a final performance summary:

```
ILEXER>D>hh:mm DIAGNOSTIC ABORTED
ILEXER>D>PLEASE WAIT -- CLEARING OUTSTANDING I/O
```

Certain parts of ILEXER cannot be interrupted, so entering Ctrl/Y may have no effect for a brief moment and may need to be repeated. Whenever ILEXER is terminated, whether normally or by operator abort, ILEXER always completes any outstanding I/O requests and prints a final performance summary.

4.8.4 Parameter Entry

The parameters in ILEXER follow the format:

```
PROMPT DESCRIPTION (DATATYPE) [DEFAULT]?
```

The PROMPT DESCRIPTION explains the type of information ILEXER needs from the operator. DATATYPE is the form ILEXER expects and can be one of the following:

Y/N—Yes/no response
D—Decimal number

U—Unit number (see form below)

H—Number (in hex)

DEFAULT is the value used if a Return is pressed for that particular value. If a default value is not allowed, it appears as [ ].

Note

Entering Ctrl/Z at any time during parameter input selects the default values for the remaining parameters.

The first prompt after starting ILEXER is as follows:

```
Drive Unit Number (U) [] ?
```

Enter the unit number of the drive to be tested. This prompt has no default. Unit numbers are either in the form D*nnnn* or T*nnnn*, where *nnnn* is a decimal number between 0 and 4094 that corresponds to the number printed on the drive's unit plug. The D or T indicates either a disk drive or tape drive, respectively. Terminate the unit number by pressing the Return key. ILEXER attempts to acquire the specified unit through the HSC controller Diagnostic Interface. If the unit is acquired successfully, ILEXER continues with the next prompt. If the acquire fails with an error, one of the following conditions was encountered:

- The specified drive is unavailable. This indicates the drive is connected to the HSC controller but is currently on line to a host CPU or an HSC controller utility. Online drives cannot be exercised. ILEXER repeats the prompt for the unit number.

- The specified drive is unknown to the disk functional software. Drives are unknown for one of the following reasons:

  - The drive and/or K.sdi/K.si port is broken and cannot communicate with the disk functional software.

  - The drive was communicating with the HSC controller when a serious error occurred and the HSC controller ceased communicating with the drive.

  In either case, ILEXER asks the operator if another drive will be selected. If so, it asks for the unit number. If not, ILEXER begins to exercise the drives selected. If no drives are selected, ILEXER terminates.

When a disk drive is specified, one set of prompts is presented. When a tape drive is selected, an entirely different set of prompts is presented.

If a nondefaultable parameter is encountered, the following message appears:

```
ILEXER>D>hh:mm Nondefaultable Parameter
```

Select up to 12 drives to be exercised. These can be either all disk drives, all tape drives, or a combination of the two.

4.8.5 Disk Drive Prompts

The following prompt is presented if the drive selected for test is a disk drive:

```
Access User Data Area (YN) [N]?
```

If this prompt is answered with an "N" or by pressing the Return key, testing is confined to the disk area reserved for diagnostics or integrity tests (DBN area). The multidrive exerciser continues by displaying the following prompt:

```
Terminate Test on Drive Following Initial Write (YN) [N]?
```

Answering "Y" to this and the next prompt directs ILEXER to perform testing in the user data area.

CAUTION

It is the operator's responsibility to see that the data contained in the user data area is either backed up or of no value.

```
Are You Sure (YN) [N]?
```

Answering "N" or pressing the Return key causes the DBN area to be exercised. Answering "Y" allows the exercise to take place in the user data area of the disk.

```
Do You Want BBR (YN) [Y]?
```

Answer "N" if you suspect the drive is bad. If you are positive the drive is good, answer "Y" or press the Return key to enable BBR.

```
Start Block Number (D) [0]?
```

This value specifies the starting block of the area ILEXER exercises when the user data area is selected. If block 0 is specified, ILEXER begins with the first LBN on the disk.

```
End Block Number (D) [0=MAX]?
```

This parameter specifies the ending block of the area ILEXER exercises when the user data area is selected. If block 0 is specified as the ending block, ILEXER exercises up to the last LBN on the disk.

```
Initial Write Test Area (YN) [N]?
```

Answering "Y" to this prompt causes ILEXER to write the entire test area before beginning random testing. If the prompt is answered with an "N" or by pressing the Return key, the prompt immediately following is omitted.

```
Terminate Test on Drive Following Initial Write  (YN) [N]?
```

This question allows an initial write on the drive and terminates the test at that point. The default answer (N) permits this initial write. After completing the initial write, the test continues to exercise the drive.

Note

The following prompts specify the test sequence for the part of the test that follows the initial write portion. Even if you request read-only mode, the drive will not be write protected until after any initial write has been completed.

```
Sequential Access (YN) [N]?
```

You have the option of requesting all disk data access be performed in a sequential manner.

```
Read Only (YN) [N]?
```

If answered with "N" or by pressing the Return key, you are prompted for both a pattern number and the possibility of write-only mode. If the answer is "Y", ILEXER does not prompt for write-only mode but only asks for a data pattern number if an initial write was requested.

```
Data Pattern Number (0-15) (D) [15]?
```

You have the option of selecting one of 16 disk data patterns. The default data pattern (15) is the factory format data pattern. Selecting data pattern 0 allows you to specify a pattern with a maximum of 16 words and presents the following two prompts:

```
Define Pattern 0 - How Many Words (16 MAX) (D) [16]?
Data in Hex (H) [0]?
```

Enter the number of hexadecimal words in your pattern and the data pattern in response to these prompts.

```
Write Only (YN) [N]?
```

This option permits only write operations on a disk. This prompt is not displayed if read-only mode is selected.

```
Data Compare (YN) [N]?
```

If this prompt is answered with an "N" or by pressing the Return key, data read from the disk is not checked; for example, disk data is not compared to the expected pattern. If you enter a "Y", the following prompt is displayed. The media must have been previously written with a data pattern in order to do a data compare.

```
Data Compare Always (YN) [N]?
```

Answering with "Y" causes ILEXER to check the data returned by every disk read operation. Answering with an "N" or pressing the Return key causes data compares on 15 percent of the disk reads.

Note

Selection of data compares significantly reduces the number of disk sectors transferred in a given time interval. This can degrade performance on other drives not being tested; do not perform data compares unless absolutely necessary.

```
Another Drive (YN) []?
```

Entering "Y" permits selection of another drive for exercising. This prompt has no default. Entering "N" causes ILEXER to display the following:

```
Minimum Disk Transfer Length in Sectors (1 TO 400) [10]?
Maximum Disk Transfer Length in Sectors (1 TO 400) [10]?
```

These prompts request the range of size in sectors of each data transfer issued to the disk drives. The default disk transfer length is 10 sectors. If data compares are selected, the maximum transfer length is 35 sectors:

```
Minimum Disk Transfer Length in Sectors (1 TO 35) [10]?
Maximum Disk Transfer Length in Sectors (1 TO 35) [10]?
```

Once the preceding parameters are entered, ILEXER continues with the global user prompts listed in Section 4.8.7.

4.8.6 Tape Drive Prompts

ILEXER displays the following prompts if the drive selected is a tape drive:

```
Do you wish to enable enhanced performance (YN) [Y]?
```

This prompt is issued if you have selected a tape drive that supports enhanced protocol. If you answer with "Y" or press the Return key, your test is run in the default enhanced protocol. Answering with "N" runs the test in normal protocol.

```
Is a Scratch Tape Mounted (YN) []?
```

Entering "N" results in a re-prompt for the drive unit number. Entering "Y" displays the next prompt.

```
Are You Sure (YN) [N]?
```

If the answer is "N", you are prompted again for the drive unit number. If you enter a "Y", the following prompt is displayed.

```
Data Pattern Number (16-22) (D) [21]?
```

Seven data patterns are available for tape. The default pattern (pattern 21) is defined in Section 4.8.8.

If the device under test is a TA90 tape drive, with or without the optional data compaction board installed, ILEXER prompts the user for density as follows:

```
Density (1=Normal, 3=Normal Compacted) [1]?
```

The default density is Normal. If you select Normal Compacted density and the drive under test does not support this mode, you will receive an error message.

ILEXER automatically sets speed for all types of drives, including the TA90 tape drive. If a device supports multiple speeds, the following three prompts are issued; otherwise, the next prompt is the "Record Length in Bytes" prompt.

```
Select Automatic Speed Management (YN) [N]?
```

Either Automatic Speed Management (if the feature is supported) or a tape drive speed is selected at this point. If the choice is Automatic Speed Management, the available speeds are not displayed.

```
ILEXER>D>{Fixed|Variable} Speeds Available:
```

This is an informational message identifying the speeds available for the tape drive. If the speeds are fixed, the value is presented. If the speed is variable within a range, the range is listed, and the next prompt asks you to select a speed. See the tape drive user documentation for available speeds.

```
Select {Fixed|Variable} Speed (D)  [1|0=Lowest]?
```

This prompt allows selection of fixed or variable speed for the tape drive selected. See the tape drive user documentation for available speeds.

```
Record Length in Bytes (2 to 12288) (D) [8192]?
```

Response to this prompt specifies the size in bytes of a tape record. Maximum size is 12 Kbytes. The default value is 8192 and the standard record-length size for 32-bit systems. Constraints on the diagnostic interface prohibit selection of the maximum allowable record length of 64 Kbytes.

```
Data Compare (YN) [N]?
```

Entering "N" results in no data compares performed during a read from tape. Entering "Y" displays the following:

```
Data Compare Always (YN) [N]?
```

Entering "Y" selects data compares to be performed on every tape read operation. Entering "N" or pressing the Return key causes data compares to be performed on 15 percent of the tape reads.

```
Another Drive (YN) []?
```

If answered with a "Y", the prompts beginning with the prompt for DRIVE UNIT NUMBER are repeated. If answered with an "N", the global prompts in Section 4.8.7 are presented. This prompt has no default, allowing you to default all other prompts and set up another drive for this pass of ILEXER.

4.8.7 Global Prompts

The following prompts are presented to you when no more drives or drive-specific parameters are to be entered into the testing sequence. These prompts are global in the sense that they pertain to all the drives.

```
Run Time in Minutes (1 TO 32767) [10]?
```

The minimum run time is 1 minute and the default is 10 minutes. After the exerciser has executed for that period of time, all testing terminates and a final performance summary is displayed.

```
Hard Error Limit (D) [20]?
```

You can specify the number of hard errors allowed for the drives being exercised. The limit can be set from 0 to 20. When a drive reaches this limit, it is removed from any further exercising on this pass of ILEXER. Hard errors include the following types:

- Tape drive BOT encountered unexpectedly
- Invalid MSCP response received from functional code
- UNKNOWN MSCP status code returned from functional code
- Write attempted on write-protected drive
- Tape formatter returned error
- Read compare error
- Read data EDC error
- Unrecoverable read or write error
- Drive reported error
- Tape mark error (ILEXER does not write tape marks)

- Tape drive truncated data read error

- Tape drive position lost

- Tape drive short transfer occurred on read operation

- Retry limit exceeded for a tape read, write, or read reverse operation

- Drive went OFFLINE or AVAILABLE unexpectedly

The next prompt calls for the report format:

```
Narrow Reprot (YN) [N]?
```

Entering "Y" presents a narrow report which displays the performance summaries in 32 columns. The default display, selected by entering "N" or pressing the Return key, is 80 columns. The format of this display is described in further detail in Section 4.8.12. This report format is intended for small hand-held terminals.

```
Enable Soft Error Reports (YN) [N]?
```

Entering "Y" enables soft error reports. By default, you do not see any soft error reports specific to the number of retires required on a tape I/O operation.

Entering "N" or pressing the Return key results in no soft error report. Soft errors are classified as those that eventually complete successfully after explicit controller-managed retry operations. They include read, write, and read reverse requested retries.

4.8.8 Data Patterns

The data patterns available for use with ILEXER are listed in the following sections. Note that pattern 0 is a user-defined data pattern. Space is available for a repeating pattern of up to 16 words.

The following are data patterns for disks:

```
Pattern 0       Pattern 1       Pattern 2       Pattern 3
User Defined    105613          031463          030221


Pattern 4       Pattern 5       Pattern 6       Pattern 7
Shifting 1s     Shifting 0s     Alter 1s,0s     B1011011011011001
000001          177776          000000          133331
000003          177774          000000
000007          177770          000000
000017          177760          177777
000037          177740          177777
000077          177700          177777
000177          177600          000000
000377          177400          000000
000777          177000          177777
001777          176000          177777
003777          174000          000000
007777          170000          177777
017777          160000          000000
037777          140000          177777
077777          100000          000000
177777          000000          177777
```

```
Pattern 8        Pattern 9     Pattern 10      Pattern 11
B0101../B1010.. B110...       26455/151322
052525          155554        026455          066666
052525                        026455
052525                        026455
125252                        151322
125252                        151322
125252                        151322
052525                        026455
052525                        026455
125252                        151322
125252                        151322
052525                        026455
125252                        151322
052525                        026455
125252                        151322
052525                        026455
125252                        151322


Pattern 12       Pattern 13    Pattern 14      Pattern 15
Ripple 1         Ripple 0      Manufacture  --  Patterns
000001           177776        155555          155555
000002           177775        133333          133333
000004           177773        155555          066666
000010           177767        155555          155555
000020           177757        133333          133333
000040           177737        155555          066666
000100           177677        155555          155555
000200           177577        133333          133333
000400           177377        155555          066666
001000           176777        155555          155555
002000           175777        133333          133333
004000           173777        155555          066666
010000           167777        155555          155555
020000           157777        133333          133333
040000           137777        155555          066666
100000           077777        155555          155555
```

The following are data patterns for tapes:

```
Pattern 16       Pattern 17    Pattern 18      Pattern 19
Alternating      All ones      Alternating     Alternating bytes
one and zero bits              bytes of all    of all ones and
                               ones            all zeros

Pattern 20       Pattern 21    Pattern 22      Pattern 23
Alternating      Alternating   Alternating     Alternating bytes
two  bytes of    four  bytes   three bytes of  of ones and zeros
ones and two     of ones and   ones and one    with high byte in
bytes  of zeros  four bytes    byte zeros      pattern number also
                                               zero. Pattern 23 is
                                               used with odd record
                                               sizes.
```

4.8.9 Setting/Clearing Flags

The ENABLE SOFT ERROR REPORT display prompt in Section 4.8.7 allows the display of soft error reports. No other error reports can be inhibited.

4.8.10 Progress Reports

ILEXER has three basic forms of progress reports, as follow:

- The **data transfer error** report is printed each time an error is encountered in one of the drives being tested.

- The **performance summary** is printed when the operator terminates the pass with Ctrl/Y. The performance summary is also printed on a periodic basis during the execution of ILEXER.

- The **communication error** report is sent to the console terminal any time ILEXER is unable to establish and maintain communications with the drive selected for exercising.

These reports are discussed in more detail in the following sections.

4.8.11 Data Transfer Error Report

The ILEXER data transfer error report is printed on the terminal each time a data transfer error is found during execution of ILEXER. The report describes the nature of the error and all data pertinent to the error found. The data transfer error report is a standard HSC error log message. It contains all data necessary to identify the error. The only exception to this is when the error encountered by ILEXER is a data compare error. In this case, ILEXER has performed a check and found an error during the compare, resulting in an ILEXER error report.

4.8.12 Performance Summary

The performance summary is printed on the terminal when a testing session is manually terminated or after the specified number of minutes for the periodic performance summary. This report provides statistical data that is tabulated by ILEXER during the execution of this test.

The performance summary presents the statistics which are maintained on each drive. This summary contains the following:

- The drive unit number
- The drive serial number
- The number of position commands performed
- The number of kilobytes read and written
- The number of hard errors
- The number of soft errors
- The number of software correctable transfers

For tape drives being exercised by ILEXER, an additional report breaks down the software correctable errors into eight different categories.

To set the frequency of the report display, enter Ctrl/G while ILEXER is executing. The following prompt is displayed:

```
Interval time for performance summary in seconds (D) [30]?
```

Answer this prompt with a time interval between 1 and 3599 seconds.

---------------------------- **Note** ----------------------------

Entering a value of 1 causes the performance summary to be immediately printed using the previous time interval.

_____

The format of the performance summary follows:

```
                  PERFORMANCE SUMMARY (DEFAULT)

Unit R   Serial   Position  Kbyte     Kbyte   Hard Soft Corr.
 No  -   Number   Operations Read     Written Error Error Error
Dddd    HHHHHHHH  dddddddddd ddddddd dddddddd ddddd ddddd ddddd
Tddd    HHHHHHHH  dddddddddd ddddddd dddddddd ddddd ddddd ddddd
```

A performance summary is displayed for each disk drive and tape drive active on the HSC controller. The following list explains the performance summary:

- **Unit Number**—The unit number of the drive. D is for disk and T is for tape. The number is reported in decimal format.

- **R**—The status of the drive. If an asterisk (*) appears in this field, the drive was removed from the test and the operator was previously informed. If the field is blank, the drive is being exercised.

- **Serial Number**—The serial number (in hex) for each drive.

- **Position**—The number of seeks.

- **Kbyte Read**—The number of Kbytes read by ILEXER on each drive.

- **Kbyte Written**—The number of Kbytes written by ILEXER.

- **Hard Error**—The number of hard errors reported by ILEXER for a particular drive.

- **Soft Error**—The number of soft tape errors reported by the exerciser if enabled by the operator.

- **Correctable Errors**—The number of correctable ECC errors encountered by ILEXER. Only ECC errors above the specific drive ECC error threshold are reported through normal functional code error reporting mechanisms. ECC errors below this threshold are not reported through an error log report but are included in this count maintained by ILEXER.

If any tape drives are exercised, the following summary is displayed within each performance summary:

```
Unit  Media Double Double Single Single Other Other Other
No    Error Trkerr Trkrev Trkerr Trkrev Err A Err B Err C

Tddd  ddddd ddddd  ddddd  ddddd  ddddd  ddddd ddddd ddddd
```

An explanation of the information in each column follows:

- **Unit No**—The unit number of the tape drive being exercised.

- **Media Error**—The number of bad spots detected on the recording media.

- **Double TRKERR**—The number of double-track errors encountered during a read or write forward.

- **Double TRKREV**—The number of double-track errors encountered during a read reverse or write reverse.

- **Single TRKERR**—The number of single-track errors detected during a read or write in the forward direction.

- **Single TRKREV**—The number of single-track errors encountered during a read reverse or write reverse.

- **Other Err A-C**—Reserved for future use.

```
                        PERFORMANCE SUMMARY (NARROW)

ILEXER>D>PER SUM
D[T]ddd
SN HHHHHHHHHHH
P ddddd
R dddddddddd
W dddddddddd
HE ddddd
SE ddddd
SC ddddd
```

This summary is repeated for each drive tested.

If tape drives are being tested, the following report is issued for each tape drive following the disk drive performance summaries:

```
ILEXER>D>ERR SUM
ILEXER>D>Tddd
ILEXER>D>ME ddddd
ILEXER>D>DF ddddd
ILEXER>D>DR ddddd
ILEXER>D>SF ddddd
ILEXER>D>SR ddddd
ILEXER>D>OA ddddd
ILEXER>D>OB ddddd
ILEXER>D>OC ddddd
```

4.8.13 Communications Error Report

Whenever an error is encountered that prevents it from communicating with one of the drives to be exercised, ILEXER issues a standard error report. This report gives details that enable you to identify the problem. For further isolation of the problem, you should run another test, such as ILDISK or ILTAPE, specifically designed to isolate the failure.

4.8.14 Test Summaries

The test numbers in ILEXER correspond to the module being executed within ILEXER itself. The following tests are included in ILEXER:

- **Test number 1, Main Program: MDE**—The MDE is the main program within ILEXER. It is responsible for calling all other portions of ILEXER. It obtains the buffers and control structures for the exerciser. It verifies that disk or tape functionalities are available before allowing ILEXER to continue.

- **Test number 2, INITT**—INITT is called to initialize drive statistic tables. It obtains the parameters and verifies the values of each one entered. This routine calls INICOD to obtain drive-specific parameters.

- **Test number 3, INICOD**—INICOD is the initialization code for ILEXER. It obtains the various parameters for the drives from the operator and fills in the drive statistic tables with initial data for each drive. It also verifies the validity of the input for the parameters. INICOD, in turn, calls ACQUIRE to acquire the disk and/or tape drive.

- **Test number 4, ACQUIRE**—ACQUIRE is responsible for acquiring the drives as specified by the operator. It brings all selected drives on line to the controller and spins up the disk drives. Errors reported in this routine cause the removal of the drive from the exercise.

- **Test number 5, INITD**—INITD initializes the disk drives for the exercise. This routine clears all disk access control blocks and invokes the initial write.

- **Test number 6, TPINIT**—TPINIT initializes the tape drives for the exercise. It rewinds all acquired tape drives and verifies that the drives are at the BOT. If an error occurs, the drive is removed from the exerciser. TPINIT is also responsible for obtaining buffers for each acquired tape drive.

- **Test number 7, Exerciser**—EXER is the main code of the exerciser. It dispatches to the disk exerciser (QDISK and CDISK) and the tape exerciser (TEXER). It continuously queues I/O commands to disk and tape and checks for I/O completion. The subroutines EXER calls are responsible for sending commands and checking for I/O completion.

- **Test number 8, QDISK**—QDISK is part of the disk exerciser that selects commands to send to the disk drives. If the initial write is still in progress, it returns to EXER. QDISK calls a routine to select the command to exercise the disk drive. The following scenario is the algorithm used to select the command:

  – If the drive is read only and data compare is not requested, a read operation is queued to the drive.

  – If read only and data compare (occasional) are requested, a read operation is queued along with a random choice of compare/no-compare.

  – If read only and data compare (always) are requested by the operator, a READ-COMPARE command is queued to the drive.

  – If write only is requested and data compare is not, then a write request is queued to the disk drive.

  – If write only and data compare (occasional) are requested, a write operation is queued along with a random choice of compare/no-compare.

  – If write only and data compare (always) are requested, a WRITE-COMPARE command is queued to the drive.

  – If only data compare (occasional) is requested, then a random selection of read/write and compare/no-compare is done.

  – If only data compare (always) is requested, a COMPARE command is paired with a random selection of read/write.

  QDISK randomly selects the number of blocks for the selected operation.

- **Test number 9, RANSEL**—RANSEL is the part of the tape exerciser that is responsible for sending commands to the tape drives. This routine is called by TEXER, the tape exerciser routine. RANSEL selects a command for a tape drive using a random number generator. Following are some constraints for the selection process:

  – No reads when no records exist before or after the current position.

  – No writes when records exist after the current position.

  – No position of record when no records exist before or after the current position.

- Reverse commands are permitted on the drive when 16 reverse commands previously have been selected. That is, 1 out of every 16 reverse commands are sent to the drive. Immediately following a reverse command, a position to the end-of-written-tape is performed. The reason for forward biasing the tape is to prevent thrashing.

The following commands are executed in exercising the tape drives:

- READ FORWARD
- WRITE FORWARD
- POSITION FORWARD
- READ REVERSE
- REWIND
- POSITION REVERSE

RANSEL randomly selects the number of records to read, write, or skip.

- **Test number 10, CDISK**—CDISK checks for the completion of disk I/O specified by QDISK. CDISK checks the return status of a completed I/O operation and if any errors occur, they are reported.

- **Test number 11, TEXER**—TEXER is the main tape exerciser which selects random writes, reads, and position commands. TEXER processes the I/O once it is completed and reports any errors encountered.

- **Test number 12, EXCEPT**—EXCEPT is the ILEXER exception routine. This is the last routine called by MDE. EXCEPT is called when a fatal error occurs, when ILEXER is stopped with Ctrl/Y, or when the program expires its allotted time. It cleans up any outstanding I/O, as necessary, returns resources, and returns control to DEMON.

4.8.15 Error Message Format

ILEXER outputs four types of error formats, as follow:

- Prompt errors
- Data compare errors
- Pattern word errors
- Communication errors

The format of these errors conform to the generic error message format described in Section 4.1.2.

4.8.15.1 Prompt Error Format

Prompt errors occur when the operator enters the wrong type of data or the data is not within the specified range for a parameter. The format is as follows:

```
ILEXER>D>error message
```

The error message is an ASCII string describing the error.

4.8.15.2 Data Compare Error Format

A data compare error occurs when an error is detected during the exercise of a particular drive. The two formats for the data compare error are data word compare error and pattern word error. A data word compare error occurs when the data read does not match the expected pattern. The error message format is as follows:

```
ILEXER>D>hh:mm T#ddd E#dddd U-dddd
ILEXER>D>Error Description
ILEXER>D>MA --  HHHHHHHHHH
ILEXER>D>EXP -- HHHH
ILEXER>D>ACT -- HHHH
ILEXER>D>MSCP STATUS CODE = HHHH
ILEXER>D>FIRST WORD IN ERROR = ddddd
ILEXER>D>NUMBER OF WORDS IN ERROR = ddddd
```

where:
hh:mm is the current system time.
T is the test number in the exerciser.
E corresponds to the error number.
U is the unit number for which the error is being reported.
MA is the media address (block number) where the error occurred.
EXP is the expected data.
ACT is the data (or code) actually received.
MSCP STATUS CODE is the code received from the operation.
FIRST WORD IN ERROR describes the number of the first word found in error.
NUMBER OF WORDS IN ERROR—Once an error is found, the routine continues to check the remainder of the data returned and counts the number of words found in error.

4.8.15.3 Pattern Word Error Format

The format for the pattern word error is slightly different from the data word compare error. A pattern word error occurs when the first data word in a block is not a valid pattern number. The error message format is as follows:

```
ILEXER>D>hh:mm T#ddd E#ddd U-dddd
ILEXER>D>Error Description
ILEXER>D>MA -- HHHHHHHHH
ILEXER>D>EXP -- HHHH
ILEXER>D>ACT -- HHHH
```

The MSCP status code, first word in error, and number of words in error are not relevant for this type of error. The other fields are as described for the data compare error.

4.8.15.4 Communications Error Format

Communications errors occur when ILEXER cannot establish/maintain communications with a selected drive. The error message appears in the following format:

```
ILEXER>D>hh:mm T#ddd E#ddd U-uddd
ILEXER>D>Error Description
ILEXER>D>Optional Data lines follow here
```

where:
hh:mm is the time stamp.
T is the test number in the exerciser.
E corresponds to the error number.
U is the unit number for which the error is being reported.
Error Description is an ASCII string describing the error encountered.

Optional Data lines—A maximum of eight optional lines per report.

4.8.16 Error Messages

This section lists the informational and error messages and explains the cause of each error. A typical error message is as follows:

```
ILEXER>D>09:32 T#006 E#204 U-T00100
ILEXER>D>Comm Error: TBUSUB call failed
```

Use the E#*xxx* code to interpret the type of ILEXER error. ILEXER generic errors have error numbers of 99 or less. ILEXER disk errors have error numbers between 100 and 199. ILEXER tape errors have error numbers between 200 and 299.

4.8.16.1 Informational Messages

Informational messages are not fatal to the exerciser and are only intended to perform the following functions:

- Alert the user to incorrect input to parameters

- Indicate missing interfaces

- Provide user information

The informational messages listed by ILEXER are as follows:

- **Disk Interface Not Available**—Indicates the disk functionality is not available to exercise disk drives. This means that the HSC controller's disk functional code is not loaded.

- **Drive online in enhanced ESE mode**—An ESE20 storage element, capable of running in enhanced mode, has been brought on line in enhanced mode for ILEXER tests, as requested by the user.

- **Drive online in normal mode**—An ESE20 storage element, capable of running in enhanced mode, has been brought on line in normal mode for ILEXER tests, as requested by the user.

- **Drive online in normal mode. HSC variants not currently enabled**— The user requested that an ESE20 storage element be brought on line in enhanced mode. However, the HSC controller has not been enabled to support the enhanced (variant) mode of operation. Refer to the *HSC Controller User Guide* for information on using the SETSHO command SET SERVER DISK/VARIANT_PROTOCOL to enable enhanced mode operations on the HSC controller.

- **Drive online in normal mode. Requested variant is not supported.**— ILEXER tried to bring an ESE20 storage element on line in enhanced mode on request from the user. However, some component of the HSC controller does not support the enhanced mode of operation. Verify that the ESE20 is attached to a K.si data channel module that is configured with disk microcode by using the SETSHO commands SHOW DISK and SHOW REQUESTOR. Refer to the *HSC Controller User Guide* for information on using these SETSHO commands.

  The ESE20 storage element cannot be run in enhanced mode on a K.sdi disk data channel module. If the ESE20 is attached to a properly configured K.si module, and this message is still being sent, there may be a software problem. Submit an SPR with the HSC console log and any other information pertinent to the HSC controller configuration.

- **Drive online in normal mode. Retry operation later.**—ILEXER attempted to bring an ESE20 storage element on line in enhanced mode on request of the user. However, the drive indicated that the enhanced mode of operation cannot be enabled. The ESE20 does not allow enhanced mode operations to be enabled while it is restoring data from its data retention system (this restoration takes approximately 10 minutes on an ESE20). If, during the restoration period, the ESE20 receives a request from the HSC controller to bring the drive on line in enhanced mode the ESE20 responds by issuing this message. Retry the operation after the restore operation is completed.

- **Number Must Be Between 0 and 15**—Reported when the user enters an erroneous value for the data pattern on a disk.

- **Pattern Number Must Be Within Specified Bounds**—Reported when the operator tries to specify a disk pattern number for a tape.

- **Please Mount a Scratch Tape**—Appears after an N response to the prompt asking if the scratch tape is mounted on the tape drive to be tested.

- **Please Wait—Clearing Outstanding I/O**—Displayed when the operator enters Ctrl/Y to stop ILEXER. All outstanding I/O commands are aborted at this time.

- **SDI Enable Variant command failed**—The HSC controller attempted to issue an SDI command to an ESE20 storage element to enable variant operations, but the SDI command failed. Verify that the ESE20 is available and that all SDI cable connections are secure. Check for other HSC error messages indicating why the SDI command failed.

- **Starting LBN is Either Larger Than Ending LBN or Larger Than Total LBN on Disk**—Re-prompts for the correct values. The operator selected a starting block number for the test that is greater than the ending block number selected, or the starting block number is greater than the largest block number for the disk.

- **Tape Interface Not Available**—Indicates the tape functionality is not available to exercise tape drives. This means that the HSC controller's tape functional code is not loaded.

- **You May Enter at Most 16 Words in a Data Pattern**—Reported if the operator specifies more than 16 words for a user-defined pattern. The operator is then re-prompted for the value.

4.8.16.2 Generic Errors

The following list indicates the error text and cause of errors displayed by ILEXER. ILEXER generic errors have numbers of 99 or less.

- **Could Not Get Buffers for Transfers**—The buffers required for a tape transfer could not be acquired.

- **Could Not Get Control Block for Timer—Stopping ILEXER**—ILEXER could not obtain a transmission queue for a timer. This should occur only on a heavily loaded system and is fatal to ILEXER.

- **Could Not Get Timer—Stopping ILEXER**—The exerciser could not obtain a timer. Two timers are required for ILEXER. This should only occur on a heavily loaded system and is fatal to ILEXER.

- **Could Not Return Drive to Available State**—The release of the drive from ILEXER was unsuccessful. This is the result of a drive being taken from the test due to reaching an error threshold or going off line during the exercise.

- **Couldn't Get Drive Status—Choose Another Drive**—ILEXER was unable to obtain the status of a drive for one of the following reasons:

  – The drive is not communicating with the HSC controller. Either the formatter or the disk is not on line.

  – The cables to the K.sdi, K.sti, or K.si modules are loose.

- **Disk Functionality Unavailable—Choose Another Drive**—The disk interface is not available. A previous message is printed at the start of ILEXER if any of the interfaces are missing. This error prints when the operator still chooses a disk drive for the exercise.

- **Drive Cannot Be Brought On Line**—ILEXER was unable to bring the selected drive on line. One of the following conditions occurred:

  – The unit went into an Offline state and cannot communicate with the HSC controller.

  – The unit specified is now being used by another process.

  – There are two drives of the same type with duplicate unit numbers on the HSC controller.

  – An unknown status was returned from the diagnostic interface when ILEXER attempted to bring the drive on line.

- **Drive Is Unavailable—Choose Another Drive**—This could result from any of the following conditions:

  – The drive port button is disabled for that port.

  – The drive is on line to another controller.

  – The drive is not able to communicate with the controller on the port selected.

- **Drive Is Unknown—Choose Another Drive**—The drive chosen for the exerciser is not known to the functional software for that particular drive type. Either the drive is not communicating with the HSC controller, or the drive has been disabled due to an error condition.

- **Invalid Time Entered...Must Be from 1 to 3599**—The user entered an erroneous value to the performance summary time interval prompt.

- **No Disk or Tape Functionality...Exerciser Terminated**—Neither disk nor tape functional software is available to run the exercise. This error condition terminates ILEXER.

- **No Tape Mounted on Unit...Mount and Continue**—The operator specified that a scratch tape was mounted on the tape drive selected when it was not mounted. Mount a tape and continue.

- **Record Length Larger than 12K or 0**—The record length requested for the transfer to tape was either greater than 12K or was 0.

- **Tape Functionality Unavailable—Choose Another Drive**—The tape interface is not available. A previous message is printed at the start of ILEXER if any of the interfaces are missing. This error prints when the operator still chooses a tape drive for the exercise.

- **Tape Rewind Commands Were Lost—Cannot Continue**—The drive was unloaded during ILEXER execution.

- **This Unit Already Acquired**—A unit number was specified for testing but the associated drive has already been acquired.

- **User Requested Write on Write-Protected Unit**—The operator should check the parameters entered and the write protection on the drive to make sure they are consistent.

4.8.16.3 Disk Errors

The following list includes the error text and cause of ILEXER disk errors. ILEXER disk errors have error numbers between 100 and 199.

- **Command Failed—Invalid Header Code**—ILEXER did not pass a valid header code to the diagnostic interface for the HSC controller.

- **Command Failed—No Buffer Available**—The diagnostic interface was unable to obtain buffers to run the exercise. The HSC controller could be overloaded. Try ILEXER when the HSC controller has less I/O activity. If the error still occurs, test the HSC controller memory.

- **Command Failed—No Control Structures Available**—The diagnostic interface could not obtain disk access control blocks to run the exercise. The HSC controller could be overloaded. Try ILEXER when the HSC controller has less I/O activity. If the error still occurs, test the HSC controller memory.

- **Couldn't Put Drive in DBN Space—Removed from Test**—An error or communication problem occurred during the delivery of an SDI command to put the drive in DBN space.

- **Data Compare Error**—Bad data was detected during a read operation.

- **Disk Unit Numbers Must Be Between 0 and 4094 decimal**—The operator specified a disk unit number outside the allowed range of values.

- **Drive No Longer Exercised**—A disk drive reached the hard error limit or the drive went off line to the HSC controller during the exercise.

- **Drive No Longer On Line**—A drive that was being exercised went into an available state. This could be caused by the operator releasing the port button on the drive. A fatal drive error could also cause the drive to go into this state. This error message identifies the function attempted by ILEXER that caused an error to occur. Error logs do not indicate the operation attempted.

- **Drive Spindle Not Up to Speed—Spin Up Drive and Restart**—The disk drive is not spun up.

- **EDC Error**—Error detection code error. Invalid data was detected during a read operation.

Note ----------------------------------

The following "hard failure" error messages identify the function attempted by ILEXER that caused an error to occur. Error logs do not indicate the operation attempted.

- **Hard Failure on Compare Operation**—A hard failure occurred during a compare of data on the disk drive.

- **Hard Failure on Disk**—A hard error occurred on the disk drive being exercised.

- **Hard Failure on Initial Write Operation**—A hard failure occurred during an initial write to the disk drive.

- **Hard Failure on Read Operation**—A hard failure occurred during a read operation on the disk drive being exercised.

- **Hard Failure on Write Operation**—A hard fault occurred during a write operation on the specified disk drive.

- **No DACB Available—Notify Customer Services, Submit SPR**—This is reported if no DACBs can be acquired. If this happens, contact Digital Services as soon as possible and submit an SPR.

- **Pattern Number Error**—The first two bytes of each sector, which contain the pattern number, did not contain a valid pattern number.

- **Some Disk I/O Failed to Complete**—An I/O transfer did not complete during an allotted time period.

- **Unknown Unit Number Not Allowed in ILEXER**—The operator attempted to enter a unit number of the form X*nnnn*, which is not accepted by ILEXER.

- **Write Requested on Write-Protected Drive**—The operator requested an initial write operation on a drive that was already write protected. The operator should write enable the drive reporting the error or have ILEXER do a read-only operation on the drive.

4.8.16.4 Tape Errors

The following list includes the error text and cause of ILEXER tape errors. ILEXER tape errors have error numbers between 200 and 299.

- **Comm Error: TDUSUB Call Failed**—ILEXER cannot communicate with the drive through interface structures because they have been removed. Either the drive went from online to available, the drive is offline, or there is a fault.

- **Controller Error...Hard Error..Rewinding to Restart**—A communications problem exists between the controller and the formatter.

- **Could Not Set Unit Char...Removing from Test**—The drive is off line and not communicating.

- **Couldn't Get Formatter Characteristics**—A communication problem with the drive is indicated. It could be caused by the unit not being on line.

- **Couldn't Get Unit Characteristics**—The drive is not communicating with ILEXER. The unit could be off line.

- **Data Pattern Word Error Defect**—The first two bytes of a record containing the data pattern did not contain a valid pattern number.

- **Data Read EDC Error**—Error detection code error; incorrect data was detected.

- **Drive Error...Hard Error**—The drive unexpectedly transitioned from the on line to the available state while being exercised.

- **Drive Went Available...Removing from Test**—During the exercise the drive unexpectedly transitioned from the on line to the available state.

- **Drive Went Offline...Removing from Test**—The drive went off line during the exercise. This is caused by the operator taking the drive off line or a hard failure forcing the drive off line.

- **Formatter Error...Hard Error**—A communications problem exists between the formatter and the controller and/or drive.

- **Hard Error Limit Exceeded...Removing Drive from Test**—The drive exceeded the threshold of hard errors determined by a global user parameter (Section 4.8.7). The drive is then removed from the exercise.

- **Read Data Error**—A read operation failed during a data transfer, and no data was transferred.

- **Retry Required on Tape Drive**—A failed read/write operation required a retry before succeeding.

- **Short Transfer Error...Rewinding to Restart**—Less data was received than transferred.

- **Some Tape I/O Failed to Complete**—The drive or formatter stopped functioning properly during a data transfer.

- **Tape Mark Error...Rewinding to Restart**—ILEXER does not write tape marks. This error indicates a drive failure.

- **Tape Position Discrepancy**—The tape position was lost, indicating a hard failure.

- **Tape Position Lost...Rewinding to Restart**—An error occurred during a data transfer or a retry of one.

- **Truncated Record Data Error...Rewinding to Restart**—More data was received than expected, indicating a drive problem.

- **Unexpected BOT Encountered...Will Try to Restart**—The drive is experiencing a positioning problem.

- **Unexpected Error Condition...Removing Drive from Test**—This is caused by TMSCP™ error conditions, which are not allowed (invalid commands, unused codes, write-protected drive write, and so forth).

- **Unrecoverable Read Error...Rewinding to Restart**—A hard error occurred during a read operation and a data transfer did not take place.

- **Unrecoverable Write Error...Rewinding to Restart**—A hard error occurred during a write operation. The write did not take place.

5
Setting System Parameters

This chapter contains the procedures necessary to complete the online portion of the rackmount HSC95 controller installation.

In performing these procedures, the HSC95 controller is first rebooted to load the HSC software. After the HSC boot process has loaded the software, an initialization process reads a System Configuration Table (SCT) from the load media. This process uses the SCT to configure the HSC subsystem. The SCT is set at the factory and remains as the default until changes are made and a reboot occurs to write over the factory settings.

The SCT contains such system parameters as system identification number and system name as alterable characteristics. However, any such alterations should be made before the HSC controller is placed online. If the validity of the SCT is doubtful, use either of the boot procedures given in this chapter to reset the SCT to the default.

---------------- **CAUTION** ----------------

Do *not* push in the Online switch on the HSC operator control panel (OCP) until all parameters are set. The HSC controller may require a reboot after setting some parameters; refer to the *HSC Controller User Guide* for information on using the SETSHO commands. After setting the parameters, use the SHOW SYSTEM command to view your settings.

5.1 Rebooting the HSC95 Controller

Use either of the following methods to reboot the HSC95 controller. Before performing either method, print a hardcopy of all the system parameters and save them for Digital Multivendor Services personnel. This hardcopy will be used for reference in case the HSC controller parameters are lost or corrupted during the process.

Both booting actions return the SCT to factory default settings. After the HSC controller boots, it displays a message indicating that the factory SCT is in use. The system identification, system name, and allocation are changed later in this chapter with the SETSHO utility.

These reboot procedures should be used with care. It is unlikely the default parameters are correct for any particular HSC controller. This action changes the system identification number and system name as set at installation time for a node address unique to the cluster.

Method 1

Perform the following steps to reboot the HSC controller:

1. Verify that the OCP Online switch is in the out position (the HSC controller is off line).

2. Hold the Fault switch in and turn the DC Power switch inside the front door of the HSC controller off and then on. Continue holding the Fault switch in until the "INIPIO-I Booting..." portion of the boot message is displayed:

```
INIPIO-I Booting...

    HSC95 Version V800 30-Jul-1992 10:25:18      System HSC009

Copyright 1982,1983,1984,1985,1986,1987,1988,1989,1990,1991,1992,
1993.  Digital Equipment Corporation. All Rights Reserved.
```

The HSC controller model, the software version number, and the system number are site specific. If this message is not displayed, verify that the Online switch is set to the out position. If it is, turn off the HSC controller by setting the circuit breaker on the power controller to 0. Verify that all modules are correctly installed and seated in the backplane, then turn the power back on.

Note

If the system has an illegal configuration of modules installed in the HSC backplane, a message listing the illegal modules is displayed on the console. Additionally, the HSC OCP displays fault code 33. Refer to Table 1–1 for a complete listing of legal modules in the HSC backplane. Figure 5–1 contains a summary of all OCP fault codes. Refer to the *HSC Controller Service Manual* for more information on the fault codes.

Method 2

The second method of rebooting is to enter SETSHO command SET SCT CLEAR. This command is equivalent to holding in the Fault switch during the initial phase of the reboot. Complete instructions for running the SETSHO utility are given in the *HSC Controller User Guide*.

Figure 5–1 Operator Control Panel Fault Codes

DESCRIPTION	HEX	OCT	BINARY	OCP INDICATORS				
				INIT	FAULT	ONLINE		
K.PLI/K.PLI2 ERROR	01	01	00001	OFF	OFF	OFF	OFF	ON
K.SDI/K.SI INCORRECT VERSION OF MICROCODE	02	02	00010	OFF	OFF	OFF	ON	OFF
K.STI/K.SI INCORRECT VERSION OF MICROCODE	03	03	00011	OFF	OFF	OFF	ON	ON
P.IOJ CACHE FAILURE[1]	08	10	01000	OFF	ON	OFF	OFF	OFF
K.CI FAILURE[1]	09	11	01001	OFF	ON	OFF	OFF	ON
DATA CHANNEL MODULE ERROR[1]	0A	12	01010	OFF	ON	OFF	ON	OFF
P.IOJ/C MODULE FAILURE	11	21	10001	ON	OFF	OFF	OFF	ON
M.STD2/M.STD4 MODULE FAILURE[4]	12	22	10010	ON	OFF	OFF	ON	OFF
BOOT DEVICE FAILURE[2]	13	**23**	10011	ON	OFF	OFF	ON	ON
PORT LINK NODE ADDRESS SWITCHES OUT OF RANGE	15	25	10101	ON	OFF	ON	OFF	ON
MISSING FILES REQUIRED[3]	16	26	10110	ON	OFF	ON	ON	OFF
NO WORKING K.CI, K.SDI, K.STI, OR K.SI IN SUBSYSTEM	18	30	11000	ON	ON	OFF	OFF	OFF
INITIALIZATION FAILURE	19	31	11001	ON	ON	OFF	OFF	ON
SOFTWARE INCONSISTENCY	1A	32	11010	ON	ON	OFF	ON	OFF
ILLEGAL CONFIGURATION[5]	1B	33	11011	ON	ON	OFF	ON	ON

1. THESE ARE TERMED SOFT OR NONFATAL ERRORS.
2. POSSIBLE MEMORY MODULE/CONTROLLER (EXCEPT ON THE HSC50 CONTROLLER).
3. THIS FAULT CODE WILL ALSO BE DISPLAYED IF THE P.IOC MODULE IS NOT AT THE MINIMUM REVISION LEVEL.
4. SWAP MEMORY MODULE FIRST. IF PROBLEM PERSISTS, TRY REPLACING THE P.IOJ/C MODULE.
5. REFER TO SECTION 1.1 AND CHECK PROPER MODULE CONFIGURATION.

CXO-3133B_R

5.2 Setting System Parameters

This section contains the procedures to set the system parameters after installation of the HSC software and reboot.

5.2.1 Setting the System Identification Number

Enter the following SETSHO command to set the system identification number:

```
SETSHO> SET ID %xnnnn
```

where:
%x informs SETSHO that the following string is a hexadecimal number
nnnn is a 12-digit hexadecimal number ranging from 1 to 7FFFFFFFFFFF.

Press the Return key. A subsequent reboot sets the system identification number.

5.2.2 Setting the HSC Controller System Name

To set the HSC controller system name, enter the following command at the HSC> prompt:

```
HSC> SET NAME SOMENAME
```

where *SOMENAME* is the HSC controller system name supplied by the system manager.

Allowable characters include A through Z, 0 through 9, a dollar sign ($), and the underscore (_). Not all host architectures allow the full range of system names. Refer to the *HSC Controller User Guide* for restrictions on character length and symbols. Make sure the system name is unique. The system name just entered will be set by a subsequent reboot.

5.2.3 Setting the Storage Allocation Class

To set the storage allocation class, enter the following command at the HSC> prompt:

```
HSC> SET ALLOCATE DISK N
```

You can also use the following command:

```
HSC> SET ALLOCATE TAPE N
```

These commands are used in conjunction with VAXcluster software functionality to set the disk or tape allocation class. *N* is a decimal number (0 through 255); the initial default value is 0. A subsequent reboot sets the storage allocation class.

5.2.4 Verifying System Parameters Are Set

Do *not* push in the Online switch on the HSC controller OCP until all parameters are set.

Some SETSHO commands require an HSC controller reboot to exit properly; refer to the *HSC Controller User Guide* for information on using the SETSHO utility. After rebooting, enter Ctrl/Y or Ctrl/C to return to the HSC> prompt and enter the SHOW SYSTEM command to view your settings:

```
Ctrl/C
HSC> SHOW SYSTEM  Return
 3-Nov-1992 13:08:33.84 Boot:  2-Nov-1992 16:47:17.84   Up: 20:21
Version: V800           System ID: %X00000000FA05       Name: HSC005
Front Panel:  Enabled                                   HSC Type: HSC95
Console Dump:  Enabled
Automatic DITs:  Enabled
Periodic DITs:  Enabled, Interval = 1
Disk Allocation Class:    0              Tape Allocation Class:    0
Disk Drive Controller Timeout: 2 seconds
Disk Drive Caching:  Enabled
Maximum Tape Drives:  24
Maximum Formatters:  24
SETSHO-I Program Exit
```

Press the HSC controller OCP Online switch only after the desired parameters set with the SET commands have been verified. When the HSC controller finishes the boot procedure, it is on line to the host and all system parameters are valid.

Another SETSHO utility command that is useful during HSC controller installation is the SHOW ALL command (enter SHOW ALL). This command displays the same information that the SHOW SYSTEM command does, plus more system-specific information, such as which data channel modules are in which slots, which CI circuits are open, and so on. Individual SHOW commands, such as SHOW TAPE and SHOW DISK, also may be used. Refer to the *HSC Controller User Guide* for more information on the SETSHO utility and for detailed instructions on operating an HSC controller.

5.3 Configuring the HSC SCSI Data Channel

Refer to the *HSC Controller User's Guide* and run the KSUTIL utility to configure the SCSI data channel module using this procedure.

5.3.1 Configuring Single-Path HSC SCSI Data Channels

If the HSC controller is single-pathed, configure the K.scsi module for the following parameters:

- Single-pathing
- MSCP unit numbers
- SCSI ID=7

5.3.2 Configuring Dual-Path HSC SCSI Data Channels

Dual-path HSC controller configurations containing one or more K.scsi modules require that you shut down one of the HSC controllers in the pair while you set up the K.scsi module parameters on the other. This is to prevent a duplicate SCSI ID error due to the default SCSI ID that comes up when a K.scsi module is powered on. Use the following procedure to configure the K.scsi modules when installing a dual-path HSC controller configuration:

---------------------------- **CAUTION** ----------------------------

Because this procedure requires you to shut down both HSC controllers in the dual-path pair, do not use this procedure when removing and replacing a defective K.scsi module. Refer to Appendix B for the correct remove and replace procedure.

----

1. Shut down one HSC controller of the pair by setting the front panel DC power switch to the off (0) position.

2. Use the KSUTIL utility to configure the following parameters in the K.scsi module on the powered-up HSC controller:

   - Dual-pathing
   - MSCP unit numbers
   - SCSI ID=0

3. Shut down this HSC controller by setting the DC power switch to the off (0) position.

4. Set the DC power switch on the first HSC controller to the on (1) position.

5. After this HSC controller completes its boot, run KSUTIL and configure the following parameters on the K.scsi module in this HSC controller:

   - Dual-pathing
   - MSCP unit numbers
   - SCSI ID=7

   When you have finished setting these parameters, boot this HSC controller.

6. Set the DC power switch on the other HSC controller to the on (1) condition.

7. With both HSC controllers booted, check that the K.scsi module configurations are as previously set.

6

Installing HSR95 Add-On Components

This chapter contains instructions for adding HSC95 controllers or StorageWorks building block (SBB) shelves to an existing HSR95 cabinet. Digital Multivendor Services or trained installers must perform these procedures.

_____ WARNING _____

Hazardous voltages exist in the HSR95 cabinet and in the components of the cabinet. When performing any operation involving the power sources, turn the power controls of all storage elements and power controllers to the OFF position. Then disconnect the power cables from the source outlets. Perform the operation, then reconnect the power cables to the sources.

_____

_____ WARNING _____

The HSR95 cabinet may have two power controller power cords. To reduce the risk of electric shock, perform the following steps before servicing:

• Disconnect the two power controller power cords from their sources.

• At each SBB shelf, disconnect the individual power supply cord.

• At each power controller, disconnect the external power supply cord.

_____

6.1 Add-On Component Configuration Rules

Up to two HSC95 controllers and eight SBB shelves can be installed in an HSR95 cabinet. All components must be added in the manner described in this section in order to adhere to safety and human factors considerations.

_____ WARNING _____

Failure to comply with recommended loading rules may result in an unstable HSR95 cabinet. Cabinet instability may cause serious damage to the cabinet and installed storage elements, or personal injury.

_____

Appendix A contains configuration information for the SBB shelves with an HSC95 controller. Refer to the SBB shelf user documentation for further configuration procedures.

Use the following configuration rules when adding storage enclosures to the HSR95 cabinet:

- Add any HSC controllers first, by the position order shown in Figures 6–1 and 6–2. Add an additional 881 power controller as required by the system configuration.

- Configure the SBB shelves devices as either through-bus or split bus.

- Add terminators as required by Appendix A.

- Install the SBB shelves by the position order shown in Figures 6–1 and 6–2.

Figure 6–1 Cabinet Loading Positions (Front View)

BA350 SHELF
(6TH POSITION)

BA350 SHELF
(5TH POSITION)

HSC95
CONTROLLER
(1ST POSITION)

HSC95
CONTROLLER
(2ND POSITION)

BA350 SHELF
(3RD POSITION)

BA350 SHELF
(1ST POSITION)

881 POWER
CONTROLLER
(2ND POSITION)
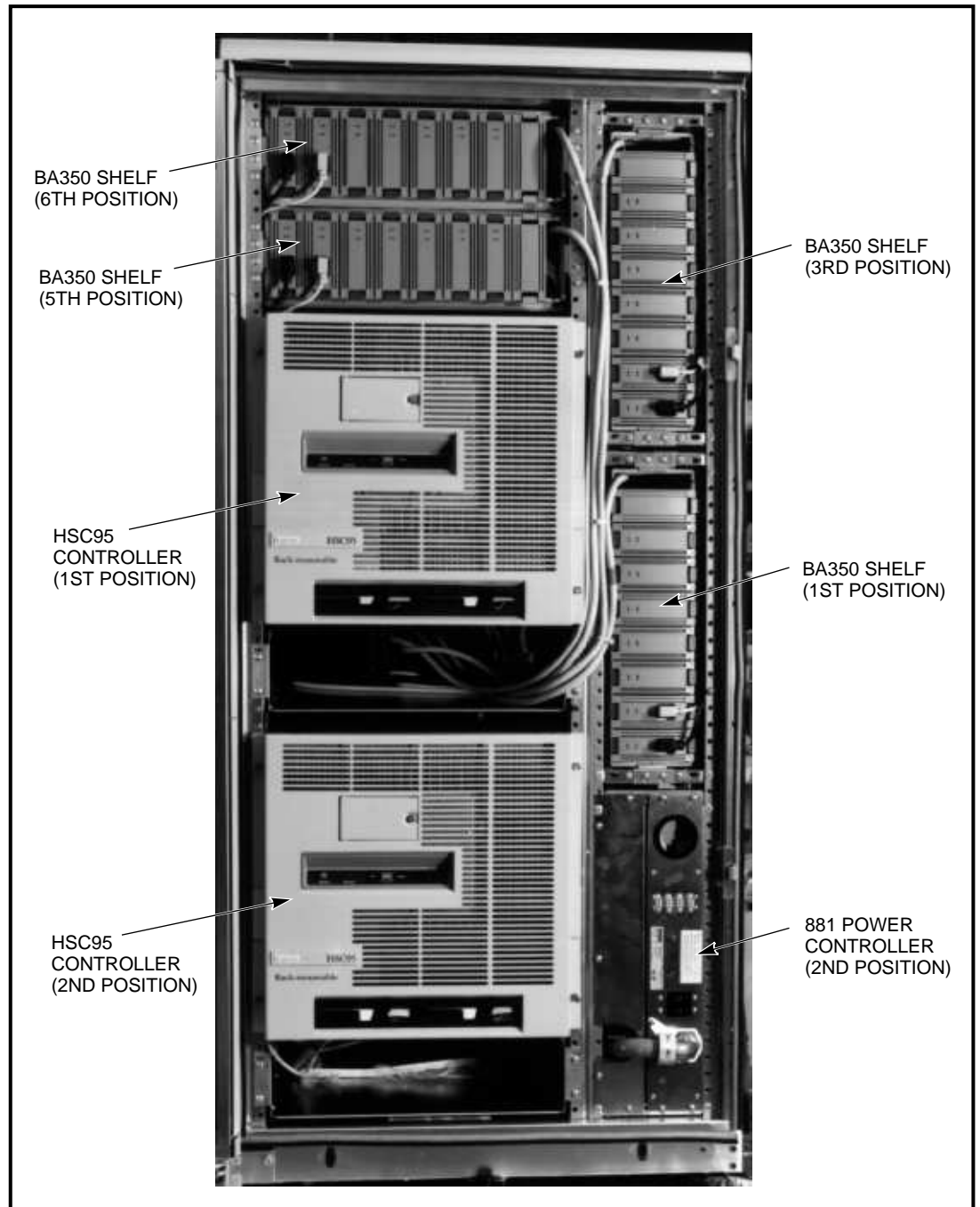
CXO-3673B-PH

Figure 6–2 Cabinet Loading Positions (Rear View)

BA350 SHELF
(8TH POSITION)

BA350 SHELF
(4TH POSITION)

BA350 SHELF
(7TH POSITION)

HSC95
CONTROLLER
(1ST POSITION)

BA350 SHELF
(2ND POSITION)

881 POWER
CONTROLLER
(1ST POSITION)

HSC95
CONTROLLER
(2ND POSITION)
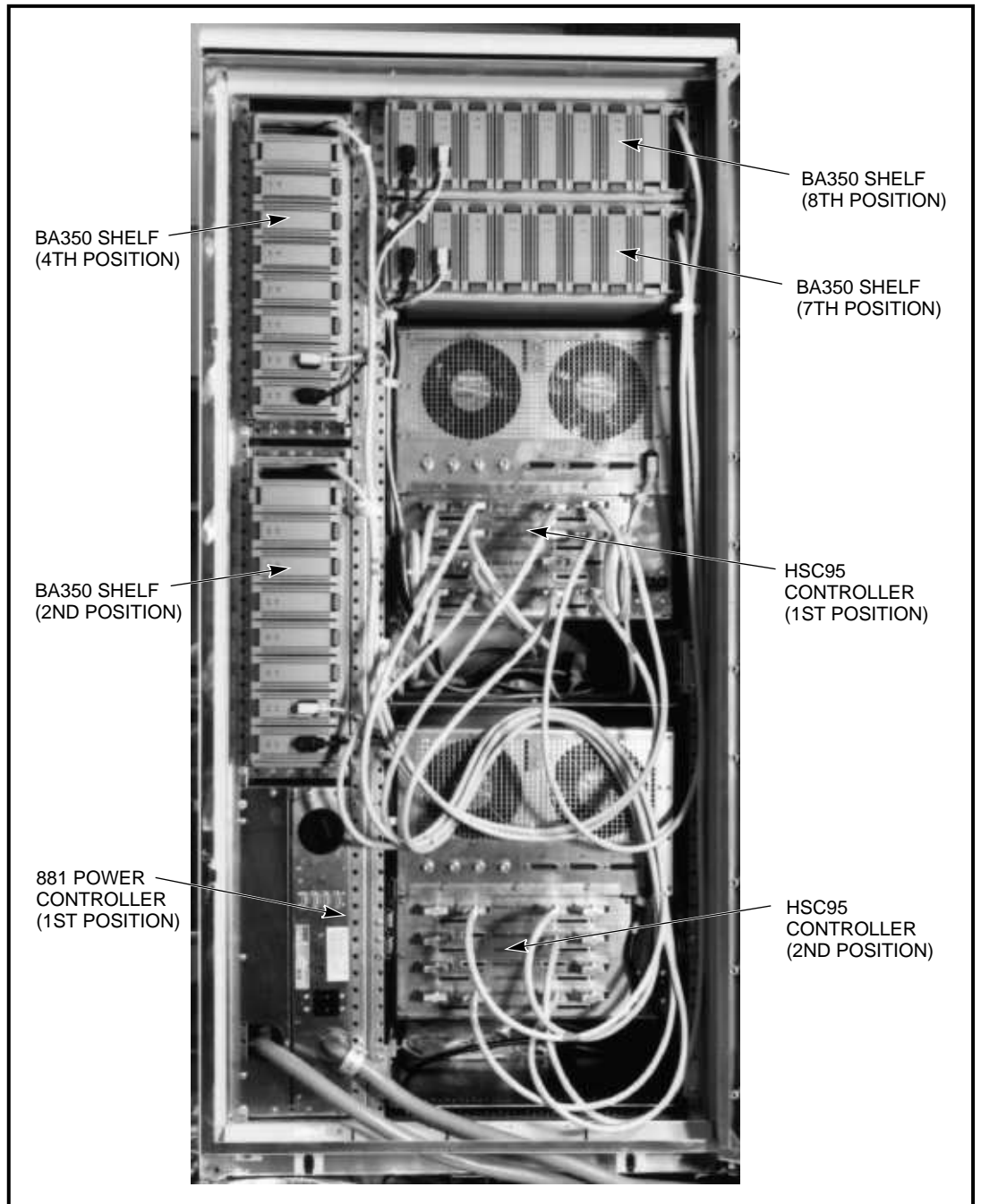
CXO-3674B-PH

6.2 Locating Components in the HSR95 Cabinet

See Table 6–1 when locating holes in the cabinet vertical rail for adding
components to the HSR95 cabinet. The holes given in this table are referenced by
counting *down* from the top hole in the rail. All vertical rails, front and back, use
the same reference holes.

Table 6–1 Locating Holes for Installing Components

Hole	Description	Purpose
2	.500 inch THRL	Upper screw for position 6 and 8 SBB shelf rail (front and rear)
3	.500 inch THRL	Upper screw for position 6 and 8 SBB shelf retainer (front and rear)
4	.500 inch THRL	Lower screw for position 6 and 8 SBB shelf retainer (front and rear)
5	.500 inch THRL	Lower screw for position 6 and 8 SBB shelf rail (front and rear)
6	10-32 x .625 SEMS w/ U-nut	Cable clamp for position 6 SBB shelf (front), supplied with cabinet
8	.500 inch THRL	Upper screw for position 5 and 7 SBB shelf rail (front and rear)
9	.500 inch THRL	Upper screw for position 5 and 7 SBB shelf retainer (front and rear)
10	.500 inch THRL	Lower screw for position 5 and 7 SBB shelf retainer (front and rear)
11	.500 inch THRL	Lower screw for position 5 and 7 SBB shelf rail (front and rear)
12	10-32 x .625 inch SEMS w/ U-nut	Cable clamp for position 5 SBB shelf (front), supplied with cabinet
14	N/A	Pin for position 1 HSC95 controller upper HSC mounting bracket (front)
16	10-32 cap head	Shoulder screw and KEP nut for position 1 HSC95 controller upper HSC mounting bracket (front)
23	10-32 cap head	Shoulder screw and KEP nut for position 1 HSC95 controller slide assembly (front)
24	10-32 x .343 inch SEMS	Upper screw into nut bar of position 1 HSC95 controller slide assembly (front)
25	10-32 x .343 inch SEMS	Lower screw into nut bar of position 1 HSC95 controller slide assembly (front)
25	10-32 x .343 inch SEMS	Upper screw into nut bar of position 1 HSC95 controller slide assembly (rear)
26	10-32 x .343 inch SEMS	Lower screw into nut bar of position 1 HSC95 controller slide assembly (rear)
27	10-32 cap head	Shoulder screw and KEP nut for position 1 HSC95 controller slide assembly (rear)
28	N/A	Pin for position 1 HSC95 controller lower HSC mounting bracket (front)
30	10-32 cap head	Shoulder screw and KEP nut for position 1 HSC95 controller lower HSC mounting bracket (front)
33	.500 inch THRL	Upper screw for position 1 HSC95 controller cable management tray (front and rear)
35	.500 inch THRL	Lower screw for position 1 HSC95 controller cable management tray (front and rear)
38	N/A	Pin for position 2 HSC95 controller upper mounting bracket (front)
40	10-32 cap head	Shoulder screw and KEP nut for position 2 HSC95 controller upper mounting bracket (front)
47	10-32 cap head	Shoulder screw and KEP nut for position 2 HSC95 controller slide assembly (front)
48	10-32 X .343 inch SEMS	Upper screw into nut bar of position 2 HSC95 controller slide assembly (front)
49	10-32 x .343 inch SEMS	Lower screw into nut bar of position 2 HSC95 controller slide assembly (front)

(continued on next page)

Table 6–1 (Cont.)   Locating Holes for Installing Components

Hole	Description	Purpose
49	10-32 x .343 inch SEMS	Upper screw into nut bar of position 2 HSC95 controller slide assembly (rear)
50	10-32 x .343 inch SEMS	Lower screw into nut bar of position 2 HSC95 controller slide assembly (rear)
51	10-32 cap head	Shoulder screw and KEP nut for position 2 HSC95 controller slide assembly (rear)
52	N/A	Pin for position 2 HSC95 controller lower mounting bracket (front)
54	10-32 cap head	Shoulder screw and KEP nut for position 2 HSC95 controller lower mounting bracket (front)
57	.500 inch THRL	Upper screw for position 2 HSC95 controller cable management tray (front and rear)
59	.500 inch THRL	Lower screw for position 2 HSC95 controller cable management tray (front and rear)

6.3 Installing Add-On HSC95 Controllers

When delivered, the HSC95 controller is packed in a cardboard container attached to a shipping pallet. Table 6–2 lists the container contents.

Table 6–2   HSC95 Controller Add-on Package Contents

Quantity	Item	Part Number
1	Chassis slide, 300 lb, right hand/left hand	12–34821–01
1	Panel, HSC trim	74–46438–01
1	Bracket, tray mounting, right hand	74–46436–01
1	Bracket, tray mounting, left hand	74–46436–02
1	Tray, HSC cable management	74–46437–01
1	Mount, cable tie	90–08264–00
11	Tie, cable bundle 1 3/4 inch diameter	90–07032–00
8	U-nut 10-32 x 0.615 inch	90–07786–00
2	Key, 1/4 turn fastener	90–11194–01
1	Bag, poly reclose	99–06557–12
1	Cord, power, 3-conductor, gray	17–00442–51
4	Bracket, HSC mounting	74–46434–01
1	Clamp, cable, screw mount 5/8 inch	90–07087–00
1	Screw, SEMS 6-32 x .375 inch XRCS	90–09984–00
8	Screw, SHLD 10-32 cap, .501 SOCK	12–24007–01
8	Screw, THRL 10-32 TRS .500 XRCS	90–00063–39
20	Screw, SEMS 10-32 x .343 XRCS	12–21368–03
8	Nut, KEPS 10-32, .375 AF	90–06565–00
4	Nut bar, HSC rackmount, metric	74–46435–01

Use the following procedure to unpack the shipping container:

1. Check the cardboard container and pallet for signs of shipping damage. Report any damage to the Digital Multivendor Services or to your local Digital sales office and to the local carrier.

2. Keep all packing material and receipts when a damage claim is filed. Save all shipping brackets and hardware for future use in moving equipment to a new site.

3. Unpack contents.

Installing an additional HSC95 controller requires that you install the slide assemblies, associated cabinet hardware, and the cable management tray. Depending on the configuration, you may also have to install a power controller using the documentation supplied in the power controller kit. You must then route the cables into the cable management tray and secure them with tie wraps before making the connections to the HSC controller back panel. A system checkout is required before releasing the HSR95 cabinet to service.

6.3.1 Installing the Slide Assemblies

The HSC95 controller is mounted on two slide assemblies to allow easy access for maintenance. The slide assembly is shown in Figure 6–3. Use the following procedure to install the slides.

1. Locate the left and right hand slide assemblies in the parts kit.

2. On each slide, install the nut bars by inserting one 10-32 x .343 inch SEMS screw in hole 3 of each nut bar. Hole 3 is counted down from the top of the nut bar, which is identified by an "M" stamped into the metal. Slide each bar into the slots provided on the front and rear mounting flanges of the slide and install another screw in hole 6 through the bracket and into the nut bar. Tighten the screws.

3. Verify that the two pan head screws and KEP nuts that hold the rear bracket of the slide assembly are in the lower holes of the bracket. If the screws are not properly located, move the screws to the positions shown. Both screws must be loose before installing the slide assembly in the cabinet. These will be adjusted and tightened later in the the procedure.

4. Refer to Table 6–1 and locate the hole numbers for the HSC95 controller's position. These hole numbers are referenced from the top of the cabinet, counting down. It may be helpful to mark every 10th hole in the vertical rail as an aid to locating components.

_____ **Note** _____

Performing the next steps is easier if a second person supports the slide at the rear of the cabinet.

_____

5. At the front of the cabinet, position the front of the slide assembly behind the front rail and insert a shoulder screw through the vertical rail and the top hole in the nut bar into a KEP nut. Do not tighten. Repeat this operation for the rear vertical rail using the bottom hole of the nut bar.

6. Install two 10-32 x .343 inch SEMS screws through the appropriate holes of the front and rear vertical rails and into the nut bar. Tighten all screws.

7. Tighten the two pan head screws that hold the slide rear bracket to the slide.

8. Repeat this procedure for the opposite slide.

Figure 6–3 HSC95 Controller Slide Assembly

CXO-3771A-MC
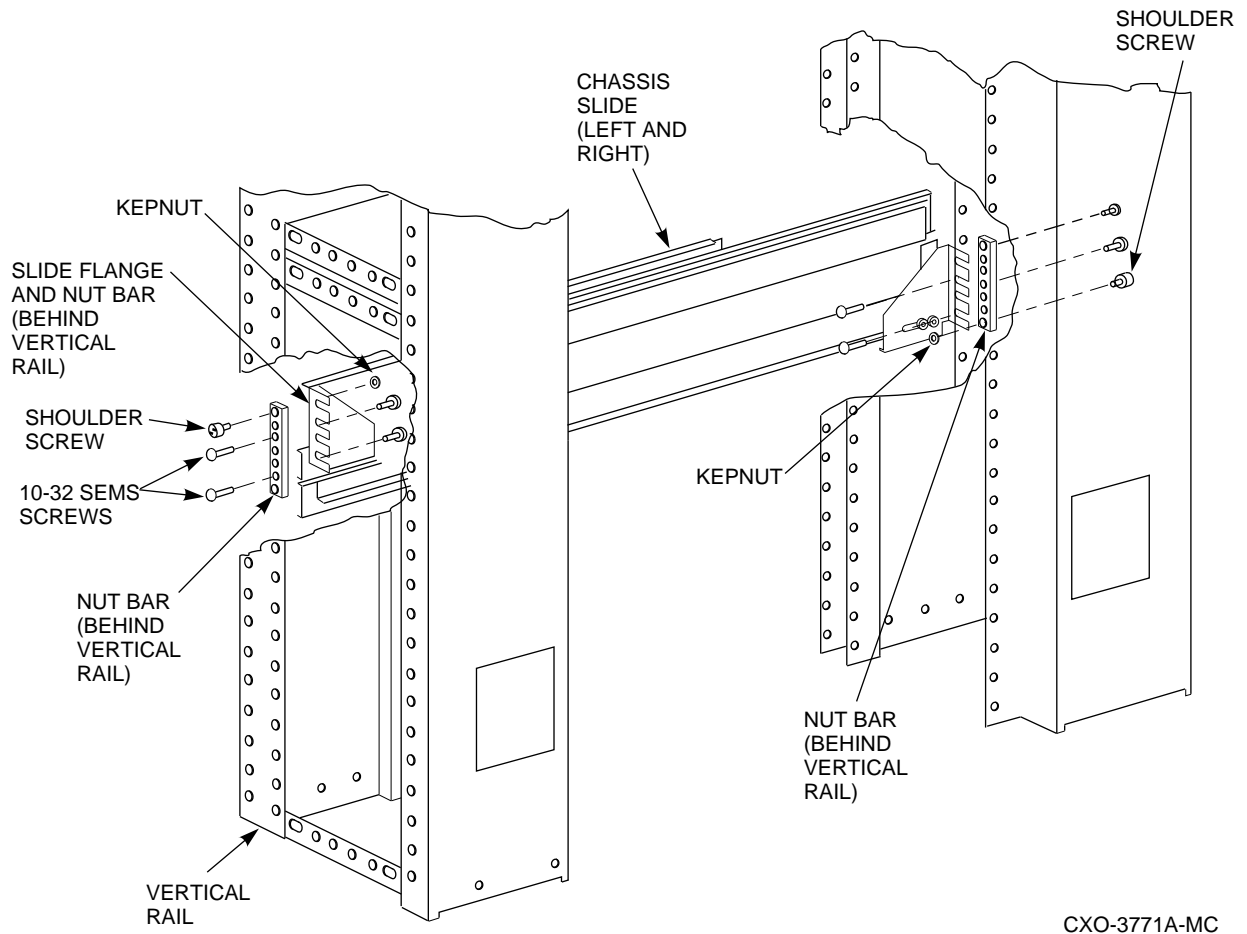
6.3.2 Installing the Cable Management Tray

Use the following procedure to install the cable management tray:

1. Install the U-nuts on the front and rear cabinet vertical rails at the positions shown in Table 6–1.

2. Loosely fasten the tray to the front rails with four .500 inch THRL screws. Support the tray to avoid damage to the screw threads.

3. The tray mounting brackets are left (stamped 7446436–01) and right (stamped 7446436–02) handed. Install these to the rear of the cable management tray with 10-32 x .343 inch SEMS screws. Do not tighten these screws.

4. Place the tray into position at the holes indicated in Table 6–1 and install all 10-32 x .500 inch THRL screws. After all screws are started in their holes, tighten the front and rear vertical rail screws first, followed by the ones on the tray mounting brackets.

6.3.3 Installing the HSC Mounting Brackets

See Figure 6–4 and Table 6–1 when installing the four HSC mounting brackets at the positions listed on the front rails of the cabinet. Each bracket is located with a pin in the upper hole. A shoulder screw through the mounting bracket, the inside vertical rail of the cabinet, and into a KEP nut behind the rail attaches the mounting bracket. The chassis is secured to the cabinet vertical rails by tightening the captive screws on the HSC95 controller front panel into the matching holes in the HSC mounting bracket.

Figure 6–4 HSC Mounting Bracket Installation
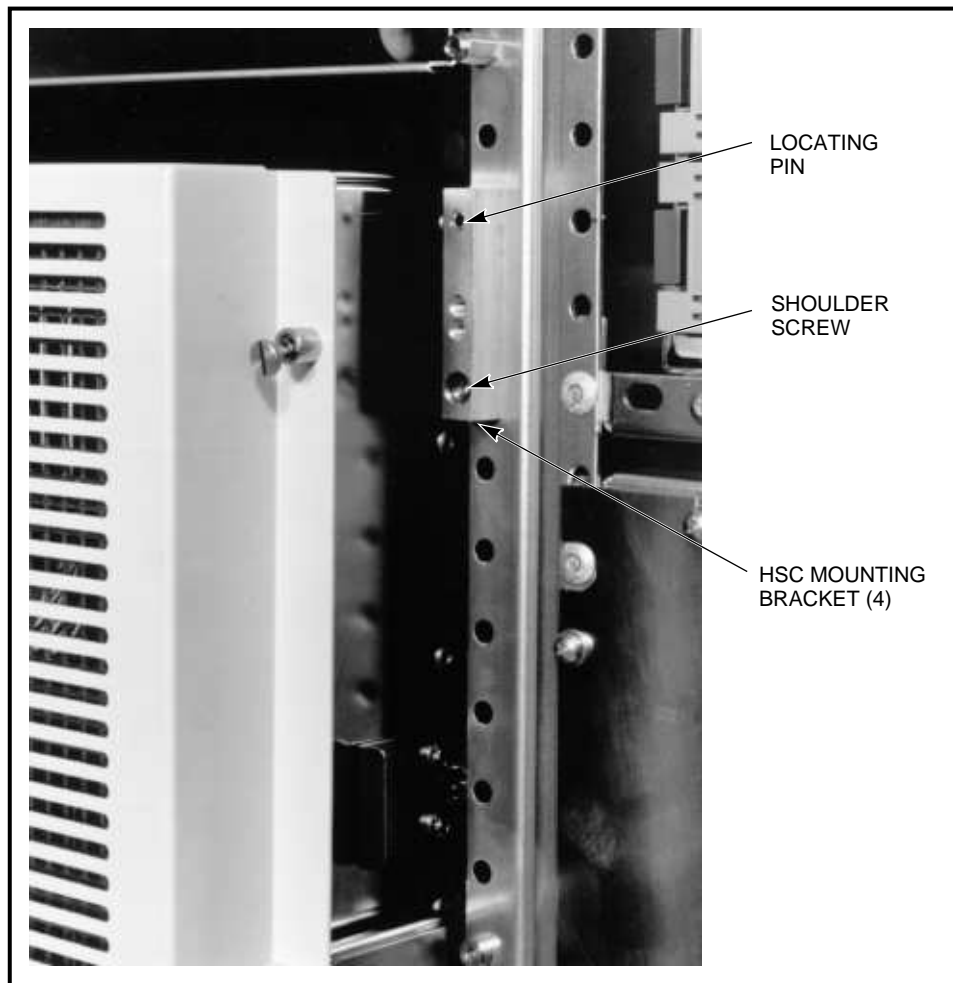
CXO-3825A-PH

6.3.4 Installing the HSC95 Controller

Use the following procedure to install the HSC95 controller:

_____ WARNING _____

The rackmount HSC95 controller chassis weighs approximately 59
kilograms (130 pounds). To avoid personal injury, verify that the cabinet
stablilizer foot is fully extended and use sufficient personnel or proper
lifting equipment before installing the chassis or extending the chassis on
slides for maintenance.

_____

1. Extend the cabinet stabilizer foot.

2. Fully extend both chassis slides from cabinet.

3. Remove the three 8-32 screws supplied in each bag of slide parts. These
   screws are the only parts from the bag that are used to install the HSC95
   controller.

4. Lift the chassis onto the extended slides and carefully position the slide index
   plate on the HSC95 controller over the three mounting holes in the slide.
   Make certain that the tabs at each end of the indexing mechanism on the
   HSC95 controller chassis are outside of the slides. The proper position for the
   HSC95 controller on the slides is shown in Figure 6–5.

5. Install the three 8-32 screws through the slide index plate and into the slides.

6. Release the slide locking levers on each slide and carefully slide the chassis
   into the cabinet. Ensure that the chassis is level, that it can clear the
   equipment above and below it, and that the slides operate smoothly.

6.4 Installing An Add-On SBB Shelf

This section describes the procedure used to install a StorageWorks building block
(SBB) shelf in an HSR95 cabinet.

Use Table 6–3 to inventory the kit for completeness.

Table 6–3 SBB Shelf Package Contents

Part No.	Description	Qty
74–46442–01	Rail, shelf mounting	2
74–46441–01	Bracket, locking front	2
74–46441–03	Bracket, locking front (TOTO)	2
74–46439–01	Bracket, locking rear	2
74–46440–01	Bracket, stop	2
90–00063–39	Screw, THRL 10-32 TRS 0.500 XRCS	14
90–07786–00	U-nut, 10-32	4

Figure 6–5 Placing the Chassis on the Slides
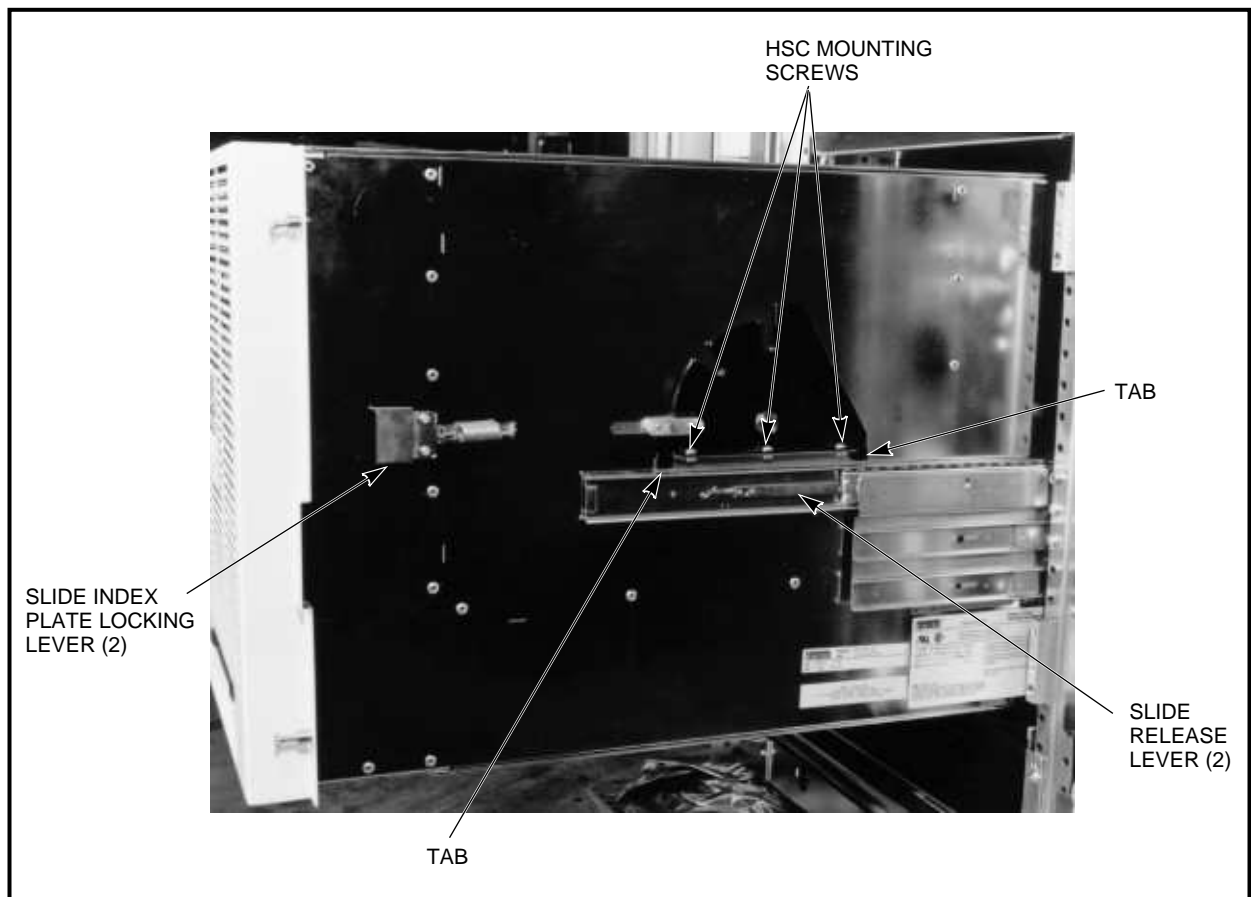
CXO-3823A-PH

6.4.1 Installing the SBB Shelf Mounting Brackets (Except Positions 1 and 3)

Complete the following procedure to install the shelf mounting brackets in the horizontal or vertical position. Use the following figures as reference when installing the SBB shelf mounting brackets:

- Figure 6–6 for a vertical shelf in positions 2 and 4.

- Figure 6–7 for a horizontal shelf in positions 5 and 6.

- Figure 6–8 for a horizontal shelf in positions 7 and 8.

1. For installing the shelf into all positions other than 1 and 3, insert the tab of a stop bracket into the proper slot on the shelf mounting bracket, as listed in Table 6–4. Secure the stop bracket with a screw into the shelf mounting bracket. Repeat this step to install a stop bracket on the opposite side shelf rail.

Figure 6–6 SBB Shelf Mounting Brackets, Positions 2 and 4

STOP
POSITIONS
#1 - 5

STOP
BRACKET

CABINET
INTERIOR

REAR
SHELF
LOCKING
BRACKET

SHELF MOUNTING
BRACKET (LOWER
POSITION)

SCREW, THRL 10-32
TRS .500 XRCS
(7 PLACES)

REAR VERTICAL
CABINET RAILS

CXO-3776A-MC
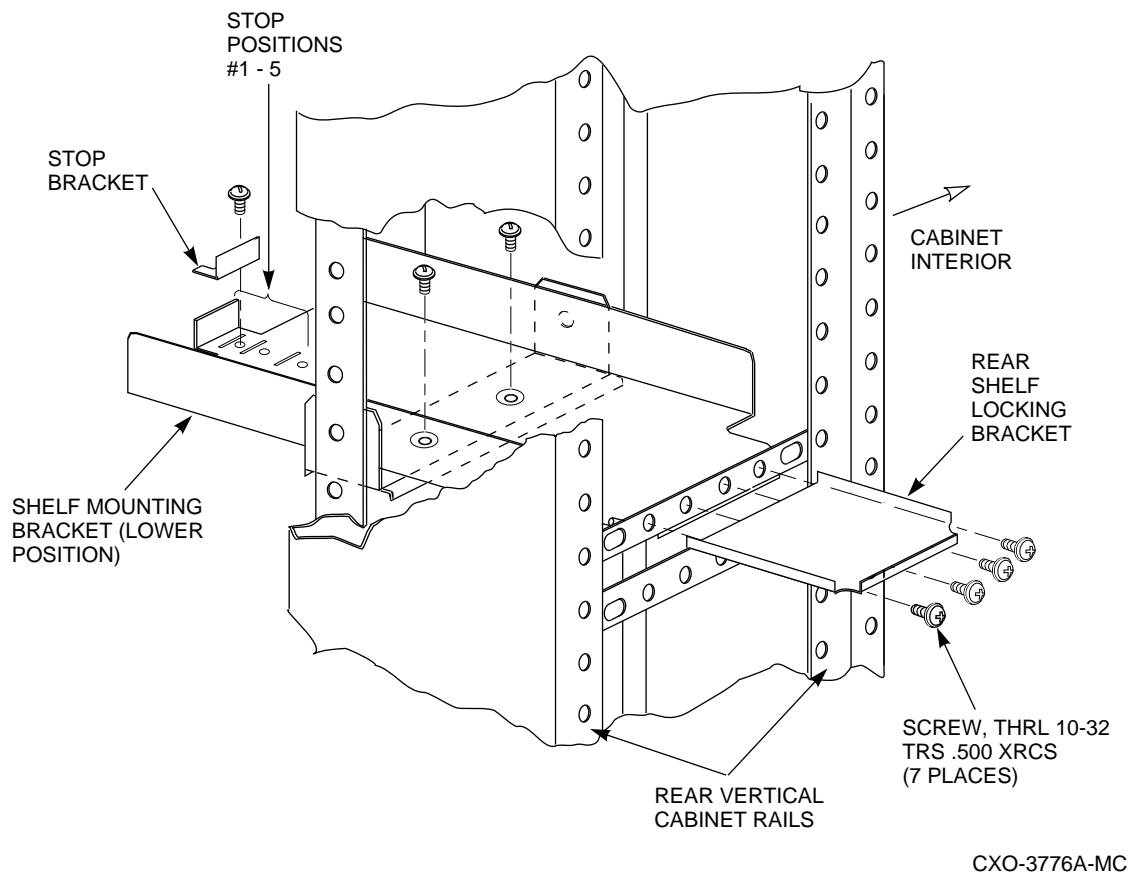
Figure 6–7 SBB Shelf Mounting Brackets, Positions 5 and 6

STOP
POSITION
#4

STOP
POSITION
#3

U-NUT, 10-32
(2 PLACES)

STOP
POSITION
#2

FRONT
VERTICAL
CABINET
RAIL

STOP
POSITION
#1

STOP
POSITION
#5

FRONT SHELF
LOCKING
BRACKET

STOP
BRACKET

SCREW, THRL 10-32
TRS .500 XRCS
(7 PLACES)

SHELF MOUNTING
BRACKET (LEFT
FRONT POSITION)
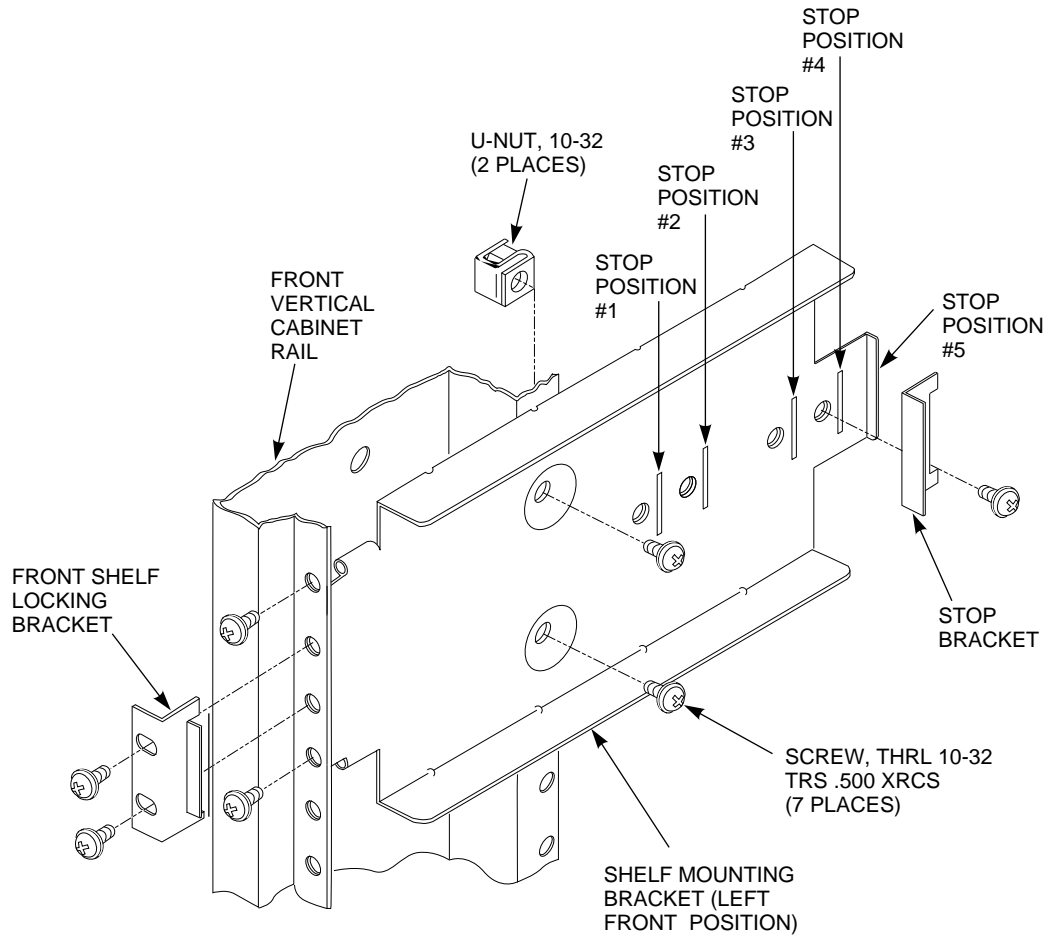
CXO-3768A-MC

Figure 6–8 SBB Shelf Mounting Brackets, Positions 7 and 8
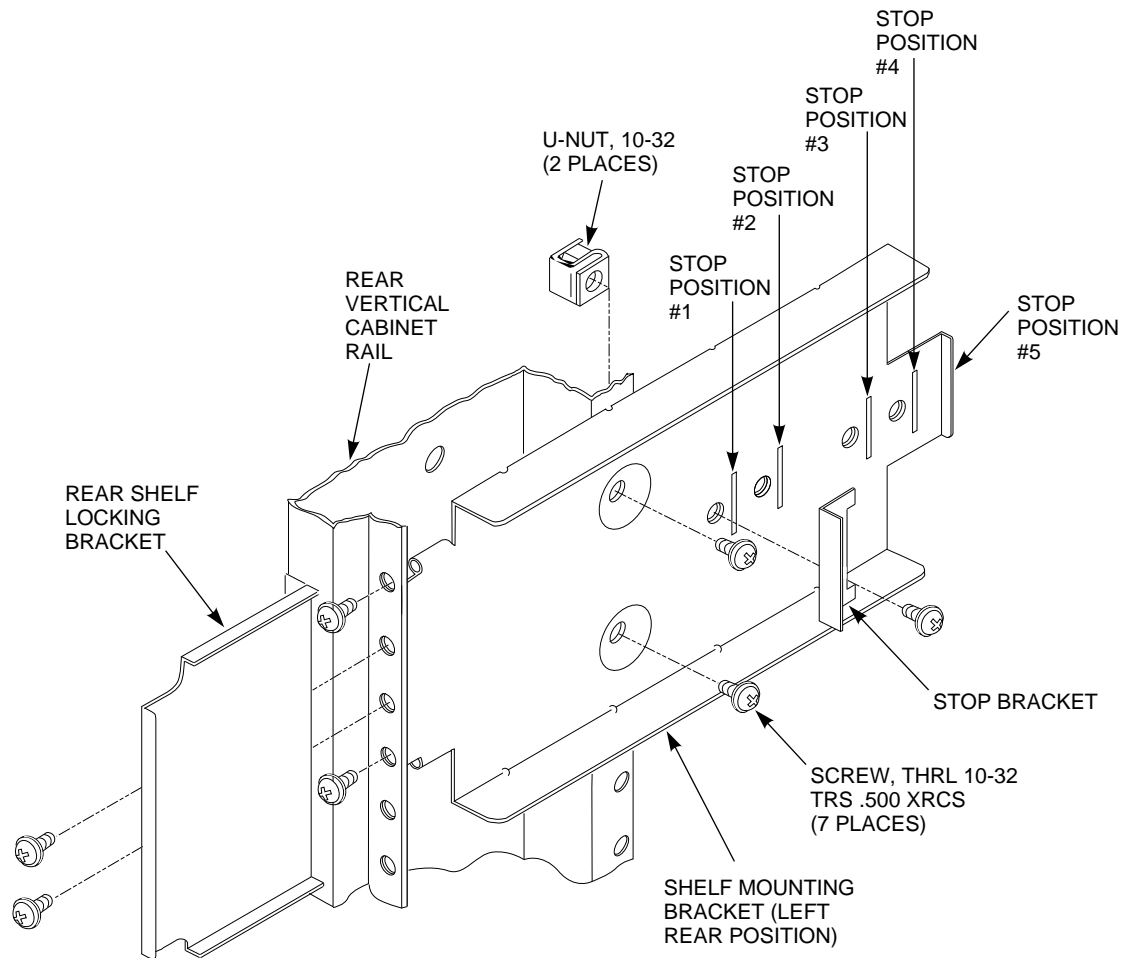
CXO-3767A-MC

Table 6–4   SBB Shelf Tab Stop Mounting Positions

Shelf Position	Stop Position	Locking Bracket Part No.	Shelf Location
1, 3	3	74–46441–03	Front vertical
5, 6	4	74–46441–01	Front horizontal
2, 4, 7, 8	1	74–46439–01	Rear vertical and horizontal

2. For a horizontally mounted shelf in positions 5, 6, 7, and 8, install a U-nut in the inside vertical rails of the cabinet. Vertically mounted shelves do not need this U-nut.

3. For a horizontally mounted shelf in positions 5, 6, 7, and 8, position a shelf mounting bracket assembly with the shelf mounting bracket flange *behind* the vertical upright. Install two 10-32 x .500 inch THRL screws in the two outer screw holes. Do not tighten.

   For a vertically mounted shelf, position the shelf mounting bracket assembly behind the horizontal rail. Install the two .500 inch 10-32 THRL screws through the horizontal rail and into the two outer screw holes on the shelf mounting bracket assembly. Do not tighten. The two inner screw holes are used later in the installation procedure.

4. Install two 10-32 x .500 THRL screws in the indented holes in the middle of the shelf mounting bracket. For horizontally mounted shelves, these screws go into the holes with the U-nuts previously installed on the cabinet vertical rails. For vertically mounted shelves, these screws go into the horizontal support.

5. Tighten all screws.

6. Install the opposite shelf mounting bracket assembly in the same manner.

6.4.2 Installing the SBB Shelf (Except Positions 1 and 3)

After configuring the shelf according to the rules given in Section 6.1, use the following procedure to install an SBB shelf:

1. Unload the shelf of any storage elements and power supplies.

2. Install the SBB shelf into the shelf mounting bracket assemblies. The shelf should fit in the brackets snugly, but you should not need to use force to get it into position.

3. Refer to Figures 6–6, 6–7, or 6–8 and install the front or rear locking brackets.

6.5 Installing SBB Shelf Power Cables (Except Positions 1 and 3)

Each SBB shelf has a unique routing for its power cable. If there are redundant power supplies in the shelf, the two cables will be routed in the same manner. See Table 6–5 to route these cables. Refer to Figures 6–1 and 6–2 for the power cable routing. The power cable routing clamps have been installed at the factory and are listed in Table 6–5.

Table 6–5 Routing SBB Shelf Power Cables

Shelf Position	Through Cable Clamp In Hole	Of Cabinet Vertical Rail
1	35	Right side, facing from front
2	39,43	Right side of inside rail, facing from rear
3	15	Right side, facing from front
4	39,43	Right side of inside rail, facing from rear
5	12	Left side, facing from front
6	6	Left side, facing from front
7	13,17	Right side of inside rail, facing from rear
8	13,17	Right side of inside rail, facing from rear

Use the following procedure to route the SBB shelf cables:

1. Route the power cables as listed in Table 6–5. As you route each cable, check to be sure that you will be able to slide out the HSC95 controllers, the SBB shelves, and the installed SCSI devices for maintenance without damaging the cable. However, you must remove the power cords to remove the SBB shelves in positions 1 and 3. Note that the power cables are routed down the vertical rails and *inside* the cabinet

2. Gather the power cables from shelf positions 5 and 6 in an adhesive tie placed just above the square cutout on the inside vertical rail at the bottom of the cabinet. You should remove the cable management tray on the HSC95 controller in position 2 to properly gather these cables.

3. The power cables from positions 7 and 8 are secured with a cable tie to the inside vertical rail of the cabinet at hole 19.

4. The power cables from positions 2, 4, 7, and 8 at the rear of the cabinet are gathered and secured with a cable tie in a hole in the inside vertical rail about 6 inches up from the bottom of the rail.

5. Gather all power cables *under* the tray and check that the cords will clear the HSC95 controllers when the controllers are pulled out to the maintenance positions.

6. Separate the power cords and route over to the power controller positions in the lower cabinet. If there is a redundant power controller configuration installed in the cabinet, there will be two cords from each power supply. The black cords go to the "A" power controller, and the white cords go to the "B" power controller.

6.5.1 Installing An SBB Shelf in Positions 1 and 3

Before starting this procedure, configure the shelf according to the rules given in Section 6.1. Use the following procedure to install the shelf mounting brackets in positions 1 and 3:

1. Facing the front of the HSR95 cabinet, remove the right side panel as follows:

   a. Pop the top panel off and remove the two bolts that hold the side panel to the cabinet.

   b. Lift the panel up and off the cabinet.

2. See Figure 6–9 and position the shelf mounting bracket assembly behind the horizontal rail. Install two 10-32 x .500 inch THRL screws through the horizontal rail and into the two outer screw holes on the shelf mounting bracket assembly. Do not tighten. The two inner screw holes are used later in the installation procedure.

3. Install two 10-32 x .500 THRL screws in the indented holes in the middle of the shelf mounting bracket and into the horizontal support.

4. Tighten all screws.

5. Slide the shelf into position between the mounting brackets. Push the shelf as far back in the brackets as it will easily go. The shelf should fit in the brackets snugly, but you should not need to use force to get it into position.

6. Route the shelf power cord as listed in Table 6–5 for position 1 or 3. These power cables are routed down the vertical rails and *inside* the cabinet

7. Pull shelf slightly forward, being careful to not damage the power cord. Install the stop brackets through the cabinet right side into the shelf mounting bracket position listed in Table 6–4.

8. Push the shelf back until it is rests against the stop brackets. Install the locking bracket (the part number is listed in Table 6–4).

9. Replace the cabinet side panel.

Figure 6–9 SBB Shelf Mounting Brackets, Positions 1 and 3
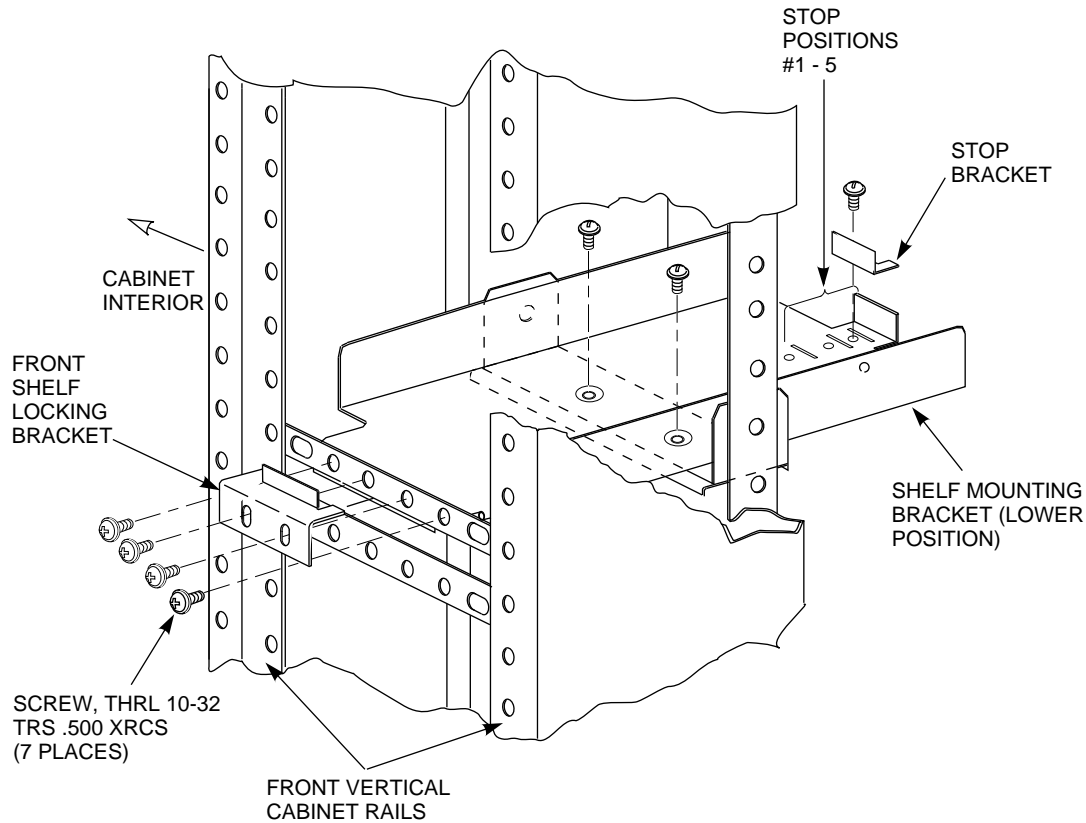
CXO-3775A-MC

6.5.2 Installing the SBBs

Use the following procedure to install the SBBs:

1. As shown in Figure 6–10, install the primary ac power supply SBB in the slot at the left end of the shelf, slot 7.

2. Install the redundant power SBB or the battery backup (BBU) SBB in slot adjacent to the primary power supply (slot 6).

3. If you are installing 5.25 inch storage SBBs in a mixed single-ended/differential configuration, set the SCSI address of each SBB as follows:

Shelf	SCSI Address
First shelf	1, 2
Second shelf	3, 4
Third shelf	5, 6

4. Install the storage SBBs starting with the first empty slot at the right end of the shelf (slot 0 or slot 1).

Figure 6–10 SBB Shelf

<div align="right">CXO-3617A-PH</div>

5. Ensure that all SBBs are firmly seated and can only be removed when the the SBB mounting tabs are pressed.

6.6 Installing the HSC95 Controller Power Cables

Use the following procedure to route the power cables from the HSR95 controller to its power controller:

1. Plug the power cord into the rear of the HSC95 controller and secure it with a cable clamp and 6-32 SEMS screws. Refer to Figure 6–2 for a rear view of the HSR95 cabinet showing the way the cord is secured.

2. Route the cord into the HSC95 controller's cable management tray.

3. Install an adhesive tie wrap mount on the left side (facing from the rear) of the tray.

4. Secure the cords to the adhesive tie wrap mount with a tie wrap. Leave about 50 inches of power cable between the tie wrap and the cable clamp.

5. Route the plug end of the power cable over the top of the tray and down to the power controller.

6.7 Connecting the Power Cables

Use the following procedure to connect the power cables. If a new controller is installed, it is done as part of this procedure.

1. Remove the existing power controller by removing the four 10-32 x .500 inch THRL screws at each corner of the power controller panel. Slide the controller out of the cabinet and set in a safe position near the cabinet. If a second power controller is installed and has new SBB shelf power cords to connect, repeat this step for that controller.

2. If installing a new power controller in the B position, remove the existing filler panels at the front and rear of the cabinet. Route the B power controller cable through the space to the side of the B power controller. Install a filler panel over this space and route the B power controller's cord through the notch in the panel. Repeat this step with the space on the side of the A power controller.

3. At each power controller, connect the cables as follows. Install four shelf power cords to phase 1 (the phase with 4 plugs), three shelf power cords to phase 2, and the remaining shelf power cord, along with the HSC95 controller power cord, to phase 3. For redundant power controller configurations, the black cords go to the "A" power controller, installed in the rear of the cabinet as shown in Figure 6–2, and the white cords go to the "B" power controller, installed in the front of the cabinet as shown in Figure 6–1.

4. Lift each power controller into its cabinet position and install the four mounting screws.

5. If adding a new power controller, attach a B label to the front filler panel next to the serial number label on the power controller and on the rear filler panel next to the A power controller. Attach the remaining B label to the cord for the B power controller next to the plug.

6. Attach the warning label that advises the user to disconnect both power controllers from the source to the insides of the front and rear doors at eye level.

6.8 Installing HSR95 Cabinet SCSI Cables

Use the procedures in this section to label and install the SCSI cables for the components in the HSR95 cabinet. If one or both HSC95 controllers has a 50-percent SCSI I/O bulkhead, install the SDI/STI cables as described in Sections 6.9 and 6.10.

This section contains two procedures; one for installing the cables in a shelf using single-ended SCSI cables and 3.5 inch disk drives, and another for a shelf with a mixture of single-ended and differential cables with 5.25 inch disk drives.

6.8.1 Single-Ended SCSI Cables with 3.5 Inch Disk Drives

Use this procedure when installing the cables in an HSR95 cabinet with single-ended SCSI cables and 3.5 inch disk drives. Refer to Figures 6–1 and 6–2 when connecting the cables in this procedure.

The HSR95 cabinet cables are labeled according to the *SF Family Label Booklet*. The cable colors and markings used for each position of HSR95 cabinet components are listed in Table 6–6.

Table 6–6   SCSI Cable Label Colors and Routing for Single-Ended Cables and 3.5 Inch Disk Drives

Label Color	From SBB [1]	Connects To HSR95[2] (For 100% SCSI)	Connects To HSR95[2] (For 50% SCSI)
Red	Position 1, JA1	Position 1, requestor 2	Position 1, requestor 2
Red/white	Position 2, JA1	Position 1, requestor 6	Not used
Yellow	Position 3, JA1	Position 1, requestor 5	Position 1, requestor 5
Yellow/white	Position 4, JA1	Position 1, requestor 9	Not used
Blue	Position 5, JA1	Position 1, requestor 3	Position 1, requestor 3
Green	Position 6, JA1	Position 1, requestor 4	Position 1, requestor 4
Blue/white	Position 7, JA1	Position 1, requestor 7	Not used
Green/white	Position 8, JA1	Position 1, requestor 8	Not used

[1]Facing the shelf, for vertically mounted shelves JA1 is the left connector and JB1 is the right connector. For horizontally mounted shelves, JA1 is the top connector and JB1 is the bottom connector.

[2]Facing the I/O panel, each cable goes to the single-ended connector nearest the *outside* edge of the panel.

1. Place each label 4 inches behind the cable connector and make the connections shown in Table 6–6. Note that the front SBB shelves use the solid colors, and the rear SBB shelves use colors with a white stripe.

2. If there is only one HSC95 controller in the cabinet, terminate the other single-ended port with a terminator plug. If there is an HSC95 controller in position 2 of the cabinet, connect a cable with the appropriate color from the second port of the single-ended pair on the HSC95 controller in position 1 to the corresponding port on the HSC95 controller in position 2.

3. Install a terminator plug on the unused port of the HSC95 controller in position 2.

4. Gather the cables into two bundles of four cables each and route to the cable management tray.

5. Where the cables are unsupported with the installed cable clamps, tie to vertical upright holes as required. The rear cables are routed through the cable clamps on standoffs. Do not stress the cables while tying.

6. Secure the cables to the cable management tray with tie wraps. Be sure that the HSC95 controllers can be pulled out to the maintenance position 3 without binding the cables. However, you will probably have to cut the tie wraps for future maintenance operations.

6.8.2 Mixed Cables with 5.25 Inch Disk Drives

Use this procedure when installing the cables in an HSR95 cabinet with both single-ended and differential cables and 5.25 inch disk drives. The single-ended SCSI cables are used between SBB shelves, and the differential cables are used between the HSC controller and a DWZZA in an SBB.

The HSR95 cabinet cables are labeled according to the *SF Family Label Booklet*. The cable colors and markings used for each position of HSR95 cabinet components are listed in Table 6–7.

Table 6–7 SCSI Cable Label Colors and Routing for Mixed Cables and 5.25 Inch Disk Drives

Label Color	From	To	Cable Type
Front SBB Shelves:			
Red	Position 1 HSC, requestor 2	Position 3 shelf, DWZZA[1]	Differential
Red	Position 3 shelf, JB1	Position 6 shelf, JA1	Single-ended (BN21H–01)
Red	Position 6 shelf, JB1	Position 5 shelf, JA1	Single-ended (BN21H–0E)
Rear SBB Shelves:			
Blue	Position 1 HSC, requestor 3	Position 7 shelf, DWZZA	Differential[1]
Blue	Position 7 shelf, JB1	Position 8 shelf, JA1	Single-ended (BN21H–0E)
Blue	Position 8 shelf, JB1	Position 4 shelf, JA1	Single-ended (BN21H–01)

[1]The DWZZA is configured as follows: A single-ended bus terminator is installed in the DWZZA. If there is one HSC controller in the cabinet, install differential terminators in the DWZZA. If there are two HSC95 controllers in the cabinet, remove the differential terminators and connect the HSC95 controllers through a tri-link (part # H885–AA)

1. Place each label 4 inches behind the cable connector and make the connections shown in Table 6–7.

2. See Table 6–8 and add terminator boards (part no. BA35X–MB) and jumpers (part no. BA35X–MC) to the SBB shelves as listed. If only two SBB shelves are installed, the shelf terminator is in the last shelf of the single-ended bus.

Table 6–8 SBB Shelf Jumper/Terminator Positions

Shelf Number	Slot 1	Slot 5
Front SBB Shelves:		
3	None	Jumper
6	None	Jumper
5	Terminator	Jumper
Rear SBB Shelves:		
7	None	Jumper
8	None	Jumper
4	Terminator	Jumper

3. Where the cables are unsupported with the installed cable clamps, tie to vertical upright holes as required. The rear cables are routed through the cable clamps on standoffs. Do not stress the cables while tying.

4. Secure the cables to the cable management tray with tie wraps. Be sure that the HSC95 controllers can be pulled out to the maintenance position 3 without binding the cables. However, you will probably have to cut the tie wraps for future maintenance operations.

6.9 Routing the SDI/STI Cables

If a 50-percent SCSI HSC95 controller is installed in the cabinet, see Figure 6–11 and route the SDI/STI cables as follows:

1. Label the cables on both ends.

2. Loosely bundle four cables together using three tie wraps. Starting 60 cm (2 ft) from the HSC95 end of the cables, install the tie wraps at 60 cm (2 ft) intervals.

3. Repeat step 2 with the second bundle.

4. Lay two sets of bundled cables in the cable tray. Starting with the first bundle, place the third bundle point at the right rear corner of the cable tray with the rest of the bundled portion running toward the front of the cable tray.

5. Adjust the cables as shown in Figure 6–11.

Figure 6–11 Routing the SDI/STI Cables
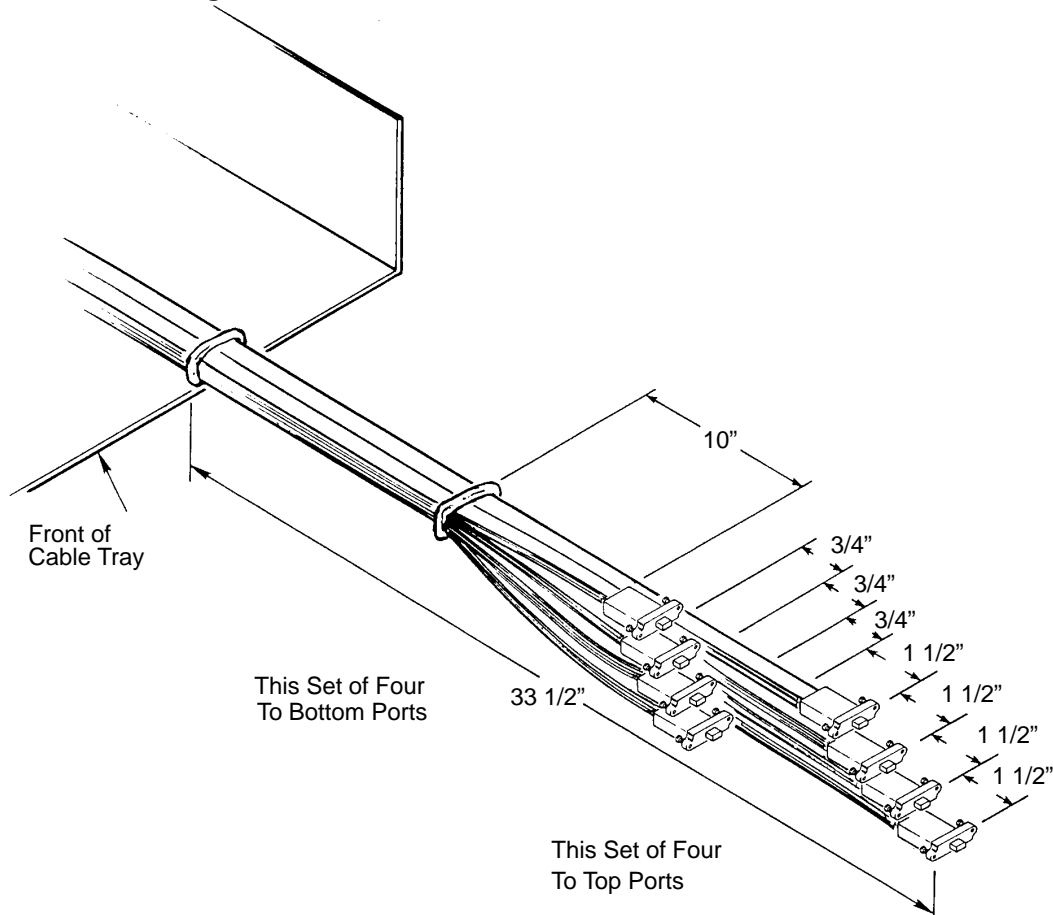
NOTE: The appearance of SDI/STI or SCSI cables may vary in some applications.

CS–10064

6. Tie the bundles together at the following points:

   - 85.0 centimeters (33.5 inches) from the end of the longest cable
   - 25.4 centimeters (10 inches) from the back of the connector housing of the shortest cable

   Be sure to pull the tie wraps tight to maintain cable length adjustment.

7. Align the 85.4 centimeters (33.5 inches) tie wrap with the front of cable tray, then tie the cable bundles to the rear of the tray in two places. See Figure 6–12 for cable tie wrap points.

Figure 6–12   HSC95 Controller Cable Tie Wrap Points
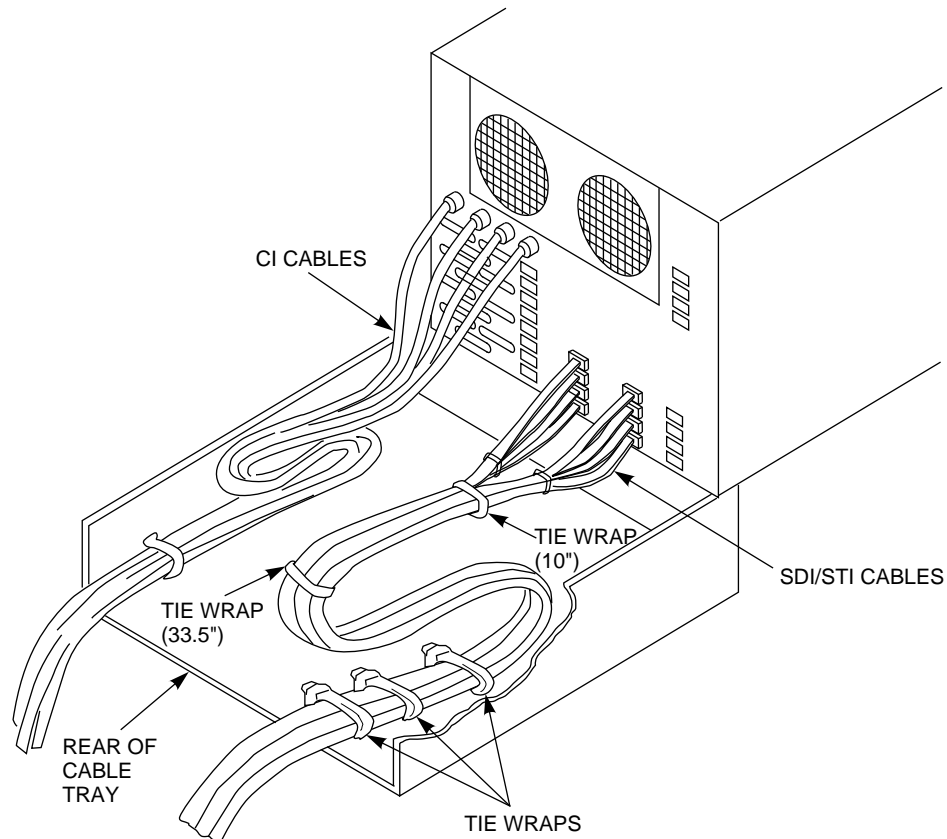
NOTE: NUMBER AND LOCATION OF CONNECTIONS VARY.
       THE APPEARANCE OF SDI/STI CABLES MAY VARY IN SOME APPLICATIONS.

CXO-3822A-MC

8. Loop the cable bundle back to rear of the tray.

9. Repeat steps 1 through 8 for additional cables proceeding to the left side of the tray.

6.10 Connecting the SDI/STI Cables

The HSC95 controller I/O bulkhead is divided into data channel cabling sections. There are five data channel cabling sections labeled E, F, L, M, and N. Each of these data channel sections contains four cable connector ports. Each port slot (labeled 0, 1, 2, or 3) has the same performance characteristics. Connecting SDI/STI cables to any one of the four ports in the same data channel sections allows all of the disks/tapes connected to be controlled by the same requestor module (see the module utilization label located on the underside of top cover).

Figure 6–13 shows the 50-percent SCSI I/O bulkhead. The data section designators and the SDI/STI cable port numbering schemes are also shown in Figure 6–13.

Figure 6–13 HSR95 Rear View of I/O Bulkhead
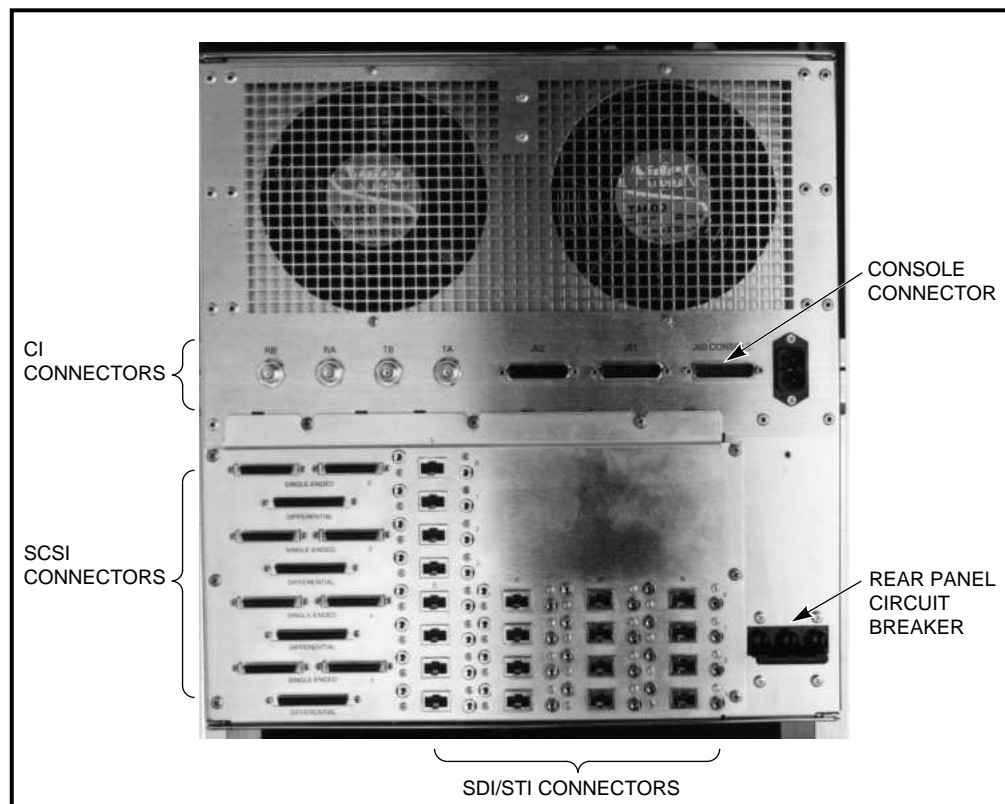
CXO-3821A-PH

The external SDI and STI cables are identical, and the number of cabling sections used depends on the number of data channel modules installed.

The cabling sections are utilized as follows:

- A single cabling section driven by disk/tape data channel module (L0119) supports either disk drives or tape drives, but not both.

- A single cabling section driven by disk data channel module (L0108–YA) supports only disk drives.

- A single cabling section driven by tape data channel module (L0108–YB) supports only tape drives.

Use the following procedure to connect SDI/STI cables to the 50-percent SCSI I/O bulkhead. Do not secure the SDI/STI cables to the I/O bulkhead panel with tie wraps until all ports of each requestor has been tested with the ILDISK or ILTAPE device integrity tests and a known good disk or tape drive.

1. Start cabling at the bottom of the I/O bulkhead. This will allow connection to the top row of cables without interference (refer to the module utilization label on the underside of top cover to determine active bulkhead cabling sections).

2. Group the SDI/STI cables as shown in Figure 6–12.

3. Install the device end of the SDI/STI cables into each device I/O bulkhead as described in the appropriate disk drive or tape drive formatter user guide.

4. Adjust the length of the cable loop in the cable tray and tighten the tie wraps.

6.11 Routing the CI Cables

_____ CAUTION _____

The CI cables have a 6.5 centimeters (2.5 inches) minimum bend radius requirement. To avoid damage, do not bend the cables tighter than this radius.

_____

When routing the CI cables, manually mark the cables labeled receive (R) and transmit (T) with an #A or #B, as appropriate, on each cable tag. The #A or #B marking must correspond to the path that the cable uses. Also, mark the node address (see the system manager for address) on each CI cable tag.

The CI cable connectors markings correspond to the receive and transmit paths. Both CI bus paths must be connected to each HSC95 controller in the cabinet.

The A path contains Transmit A (TA) and Receive A (RA). The B path contains Transmit B (TB) and Receive B (RB). TA on the HSC95 controller connects to TA on the star coupler; TB on the HSC95 controller connects to TB on the star coupler.

Mark both ends of each CI cable before installation to aid in tracking cable destinations for future maintenance and troubleshooting.

Use the following procedure to route the cables:

1. Label the cables on both ends.

2. Bundle all four cables together using six tie wraps. Starting 30 centimeters (1 foot) from the HSC95 controller end of the cables, install the tie wraps at 30 centimeters (1 foot) intervals.

3. Lay the bundled cables in the cable tray. Place the sixth bundle point at the right rear corner of the cable tray with the rest of the bundled portion that runs along the right edge of the cable tray.

   Do not tighten the tie wraps until the cables are installed in the HSC95 controller. This will allow the length of the cable bundle from the back of the cable tray to the HSC95 controller to be adjusted.

4. Loosely tie the cable bundle on the side of the tray using the holes in the tray.

5. Loop the cable bundle back to the right rear corner of the tray.

6.12 Connecting the CI Cables

Connect the CI cables (refer to Figure 6–12) as follows:

1. Locate the four CI cable connectors on the rear panel of the HSC95 controller chassis.

2. Screw each CI cable into the appropriate CI cable connector on the rear panel of the HSC95 controller.

3. Adjust the length of the cable loop and tighten the tie wraps attaching the cable bundle to the cable tray to align with the length of the SDI/STI cables. Ensure that the CI cable bundle runs along the side of the tray and does not interfere with motion of the SDI/STI cables.

4. Screw the other end of each CI cable into the star coupler bulkhead panel as described in the installation chapter of the *Star Coupler User's Guide* or into the host computer bulkhead panel as described in the host computer documentation.

6.13 Connecting the Console Cable

Connect the console cable as follows:

_____ CAUTION _____

To avoid damaging or breaking the console cable, ensure that the cable is long enough to allow the chassis to be pivoted for maintenance.

_____

1. Lay out the console cable in the same manner as the other cables in the tray were laid out. Extend the cable 55.9 centimeters (22 inches) beyond the front edge of the cable tray.

2. Connect the console cable to one of the EIA terminal connectors on the rear panel of the HSC95 controller.

3. Tie the cable to an existing cable bundle using tie wraps.

6.14 Checking Switch Positions

The K.pli2 and K.si modules have switchpacks that are set during manufacturing. These switches must be in the OFF position for normal operation of the HSC controller. Use the following procedure to verify that the switches on the K.pli2 module and the K.si modules are properly set for normal operation.

1. With the HSC conroller in Maintenance 2 position, locate and remove the K.pli2 module.

2. Reinstall the K.pli2 module in the card cage.

3. Locate and remove the first K.si module in the card cage.

4. Reinstall the K.si module and repeat the verification step for all other K.si modules in the card cage.

6.15 Setting the LINK Module Switches

The port link module has three switches that must be set for each installation. Two of these switches set the unique node address for the HSC controller; the third switch sets the slot count timing according to the VAXcluster™ configuration.

6.15.1 Guidelines for Setting the Node Address Switches

Unique node addresses are set using the two node address switches on the HSC port LINK module. Use the following guidelines when setting the node address switches on the LINK module:

1. If the HSC controller or a new CPU is added to a cluster, set the address switches to the next available node address for the cluster. The HSC controller should be assigned to lower node addresses.

2. If the HSC controller is presently part of a cluster to which no new nodes have been added, but a LINK module has been replaced, ensure the node address on the new LINK module is set to the same address as the previous module.

6.15.2 Guidelines for Setting the Slot Count Timing Switch

Incorrect switch and/or jumper settings on the CI interface modules in both the HSC controllers and the CI host nodes can cause various cluster disturbances, including:

- Disks in Mount Verification

- Many virtual circuit (VC) closures, resulting in shadow copy initiation on shadowed disks

- Various OpenVMS™ bugchecks, most commonly \CLUEXIT

Figure 6–14 Location of the K.pli2 Module Switchpack

PILA MODULE

NOTE:
ALL SWITCHES
MUST BE OFF FOR
NORMAL OPERATION.

RED STATUS
LED

GREEN STATUS
LED
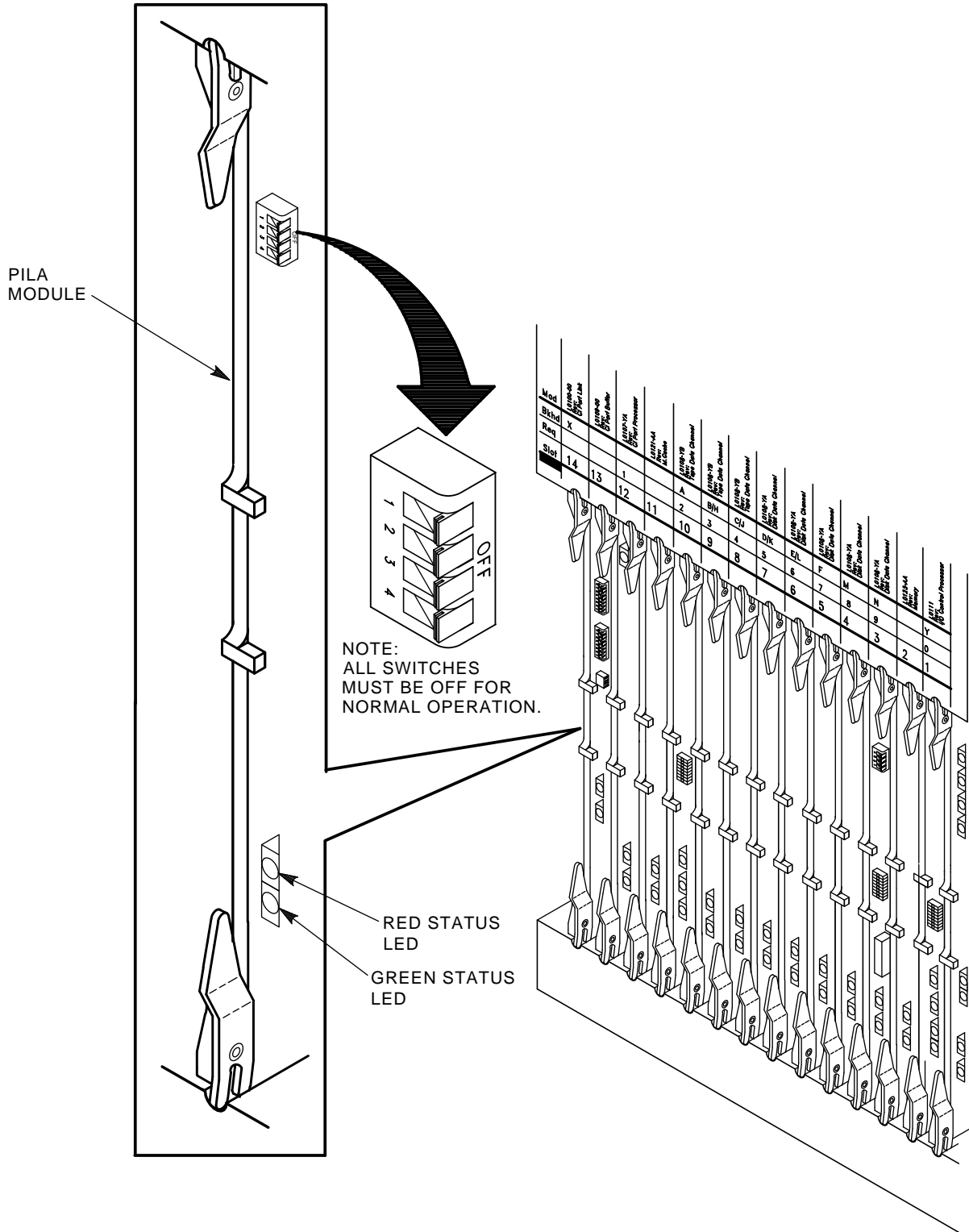
CXO-3960A-TI

Figure 6–15 Location of the K.si Module Switchpack

K.SI DATA CHANNEL
MODULE

NOTE:
ALL SWITCHES
MUST BE OFF FOR
NORMAL OPERATION.

AMBER LEDs,D1-D8
(D1 IS ON TOP)

J1

RED STATUS LED

GREEN STATUS LED

CXO-2495B

The cause of these disturbances are CI collisions caused by mismatched CI communication mechanisms. There are two mechanisms involved:

- Slot count (also called "quiet time")
- Cluster size

Settings for these mechanisms are selected by switch positions on the LINK modules in HSC controllers and older VAX host systems, and by backplane jumpers for CIBCA and CIXCD CI port adapters on newer VAX hosts.

Slot count has two possible settings: 7 or 10. At the time of HSC controller installation, it is necessary that all LINK and CI adapter modules in the cluster be set to a consistent value to avoid the cluster disturbances mentioned above.

Digital recommends that the slot count for all CPU and HSC controller nodes within a cluster be set to a value of 10 (not 7).

If your cluster does contain a CIXCD adapter, all LINK and CI adapter modules should already be set to 10 because the CIXCD adapter does not support a slot count of 7.

To assist you with setting the slot count in your cluster, Table 6–9 lists LINK and adapter module switch and jumper settings.

In addition, the cluster size parameter must be consistent throughout the cluster at a value of either 16 or 32. If **all** nodes in your cluster are numbered in the range of 0 to 15, you may select a cluster size of either 16 or 32. If your cluster has **any** node numbered in the range of 16 to 31, you must select a cluster size of 32. Table 6–9 also contains a list of LINK and adapter module switch and jumper settings to select the appropriate cluster size.

Table 6–9   L0118 LINK Module and CI Adapter Module Switch/Jumper Settings

Adapter Type	Host System	LINK Module	Function	Switch/Jumper Setting
	HSC95[1]	L0118–YA	Slot=7 Slot=10 Clu_size=16 Clu_size=32	S3–4=Open S3–4=Closed S3–1=Open S3–1=Closed
CIBCA–Ax, CIBCA–Bx[2, 3]	VAX™ 82x0, VAX 83x0 VAX 85x0, VAX 8700 VAX 88x0, VAX 6000™	T1025 T1046	Slot=7 Slot=10 Clu_size=16 Clu_size=32	Jumper E11–41=Out Jumper E11–41=In Jumper D30–60=Out Jumper D30–60=In
CIXCD–xx[3]	VAX 6000, VAX 9000™	T2080	Slot=7 Slot=10 Clu_size=16 Clu_size=32	Not Supported Jumper E15–45=In Jumper D15–45=Out Jumper D15–45=In

[1]On L0118 modules, all on-module jumpers must be left in their default positions and S3–2 and 3 must remain open.

[2]For CIBCA options, all referenced jumpers are located on the backplane slot for the PORT (T1015/T1045) module, *not* the slot allocated to the LINK (T1025/T1046) module. For CIBCA options, all reference jumpers are on the backplane slot for the PORT (T1015 or T1045 module).

[3]For CIBCA and CIXCD options, install *only* those backplane jumpers listed and those required to specify the node address.

6.15.3 LINK Module Switch Setting Procedure

The procedure that follows contains the steps for setting the node address and slot count timing switches.

Set the LINK module switches as follows:

1. If this is a new HSC controller installation, remove and replace all modules (while wearing your properly grounded ESD wrist strap) to ensure they are properly seated. The modules may have loosened during shipping.

CAUTION

Remember to plug the HSC controller into a wall receptacle to properly ground the unit before using the ESD wrist strap.

---

2. Locate the LINK module in the HSC controller card cage. Refer to Figure 6–16 for the location of the node address switches on the LINK module.

3. Set the node address switches to a unique node address.

Note

Remember to set the S1 and S2 node address switches to the same value.

---

4. Locate the slot count timing switch (S3) on the L0118–YA port LINK module.

5. Set the cluster size on S3–1. Switch S3–1 can be set to open (1) or Closed (0) if all nodes in the cluster have a node number of 15 or less. Set S3–1 to Closed (0) if **any** node in the cluster has a node number of 16 or greater. Refer to Table 6–9 for a listing of LINK module switch and jumper settings for various VAXcluster configurations.

6. Set the slot count switch to the proper value for the cluster by using the settings for S3–2, S3–3, and S3–4 (either 7 or 10) given in Table 6–9. Refer to Figure 6–16 for the location of the slot count switch pack.

   Table 6–10 lists the settings of the switches as Open or Closed on the LINK module for slot counts of 7 and 10. The table also lists two additional reserved settings for S3. These settings should be used only as directed by Digital Multivendor Services.

Table 6–10 L0118–YA LINK Module S3 Switch Slot Count Timing Settings

Slot Count	S3–2	S3–3	S3–4	Comment
7	Open	Open	Open	
10	Open	Open	Closed	Default
Reserved #1	Open	Closed	Open	Slot count=11
Reserved #2	Open	Closed	Closed	Slot count=14

Figure 6–16 Location of the Switches on L0118–YA LINK Module
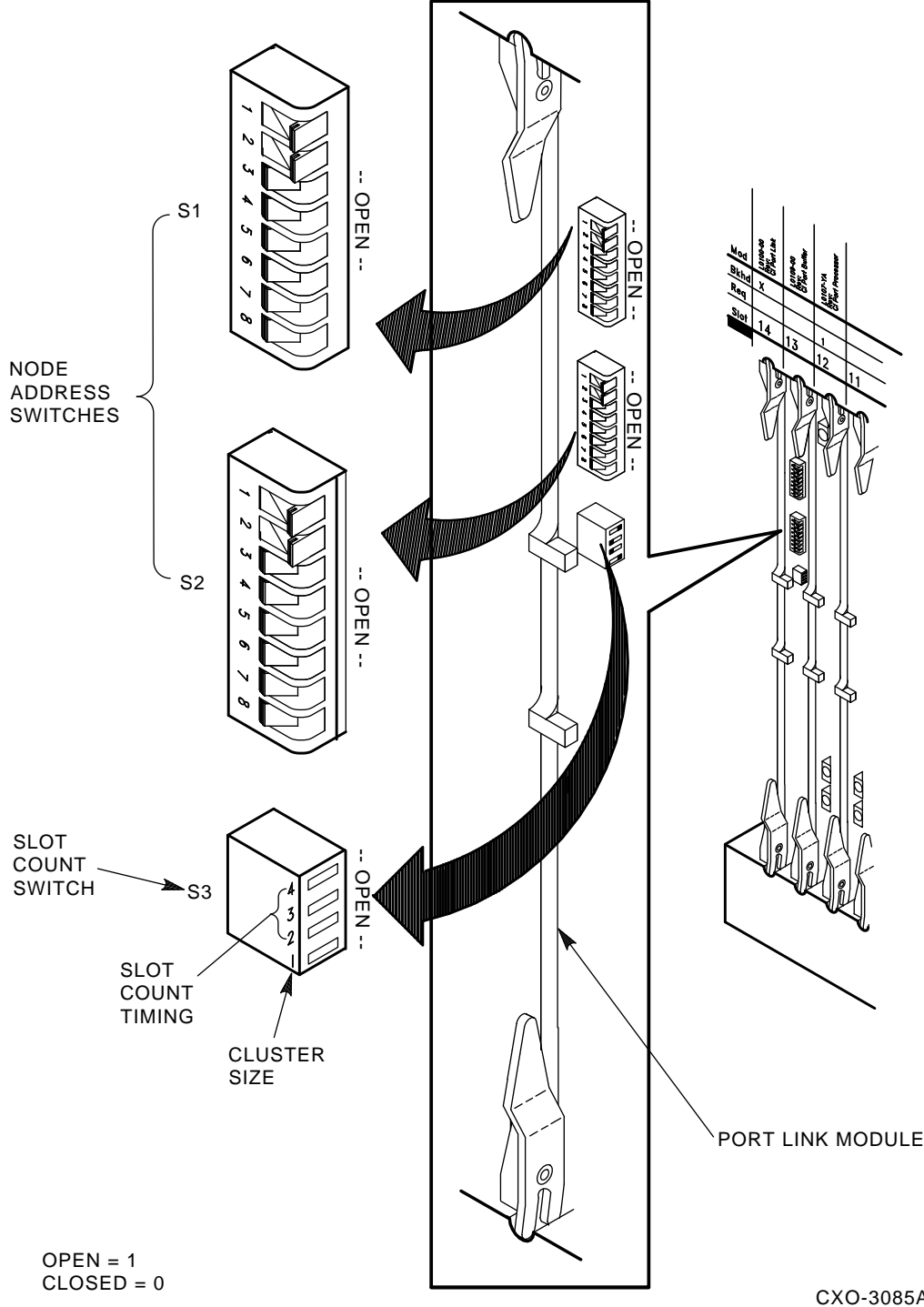
CXO-3085A

_____ **Note** _____

When setting the S3 switches, Open= 1 and Closed= 0. Remember that
S3–1 is used to set the cluster size and is not related to the slot count
timing settings.

7. Insert the LINK module into the backplane slot after the node address (S1 and S2) and slot count (S3) switches have been set.

8. Install other requestors in the HSC controller backplane.

6.16 Installing the HSC95 Controller Trim Panel

Install the trim panel over each HSC95 controller position as follows:

1. Using a punch or blunt tool at least the diameter of the plastic studs on the inside of the door, gently tap out each stud for the grillwork over each HSC95 controller position.

2. Remove the grillwork as it comes free of the door.

3. Align the trim panel's studs on the holes in the door and use a soft hammer to tap the panel into place on the door. If you do not have a soft hammer, use a piece of wood or similar material to avoid damaging the door.

6.17 HSC95 Controller Configuration and Check Out

Perform the procedures given in Chapter 3, then refer to the *HSC Controller User Guide* and run the KSUTIL utility to configure the devices in the cabinet.

After configuring the devices in the cabinet, perform the procedures in Chapters 4 and 5 of this manual to finish the installation procedure.

Close the cabinet doors and turn the hex-Allen fasteners one half turn clockwise to lock. The system is ready to be turned over to the system manager.

7

Installing the Rackmount HSC95 Controller

This chapter describes how to unpack and install a rackmount HSC95 controller in either a 19-inch RETMA cabinet with inch spacing on the vertical rail holes or in a cabinet with metric vertical hole spacing. Refer to Chapter 6 for information on how to install a rackmount HSC95 controller in an HSR95 cabinet.

7.1 Site Preparation and Planning

Site preparation and planning are necessary before installing a rackmount HSC95 controller. Refer to Table 1–3 for a listing of rackmountable HSC95 controller specifications.

7.1.1 Environmental Considerations

The rackmount HSC95 controller is designed to operate in a business or light industrial environment that complies with FCC Class A computing device standards. The cleanliness of the site is important for the operation of any computer system, and the rackmount HSC95 controller requires these same standards.

7.1.2 Electrostatic Discharge

Electrostatic discharge (ESD) is a common problem for any electronic device and may cause lost data, system down time, or other problems. The most common source of static electricity is the movement of people in contact with carpets and clothing materials. Low humidity allows a large amount of electrostatic charge to build up. Use the following strategies to minimize ESD problems:

* Maintain more than 40 percent relative humidity in the computer room.

* Place the system away from heavy traffic paths.

* Do not use carpeting, if possible. If carpeting is necessary, choose antistatic carpeting. If carpeting is already in place, place antistatic mats around the system to help decrease ESD.

* Always use ESD wrist straps when handling modules.

7.1.3 Floor Space Requirements

The floor space needed for the rackmount HSC95 controller in a typical cabinet is shown in Figure 7–1. With the rack extended, allow an additional 61 centimeters (24 inches) clearance beyond the front and on the sides of the (extended) rack. No service clearance is required on either side of the cabinet. Allow 61 cm (24 in) for clearance to the rear. Rear access is primarily for ease of installation and is not needed for routine servicing.

Figure 7–1 Floor Space Requirements
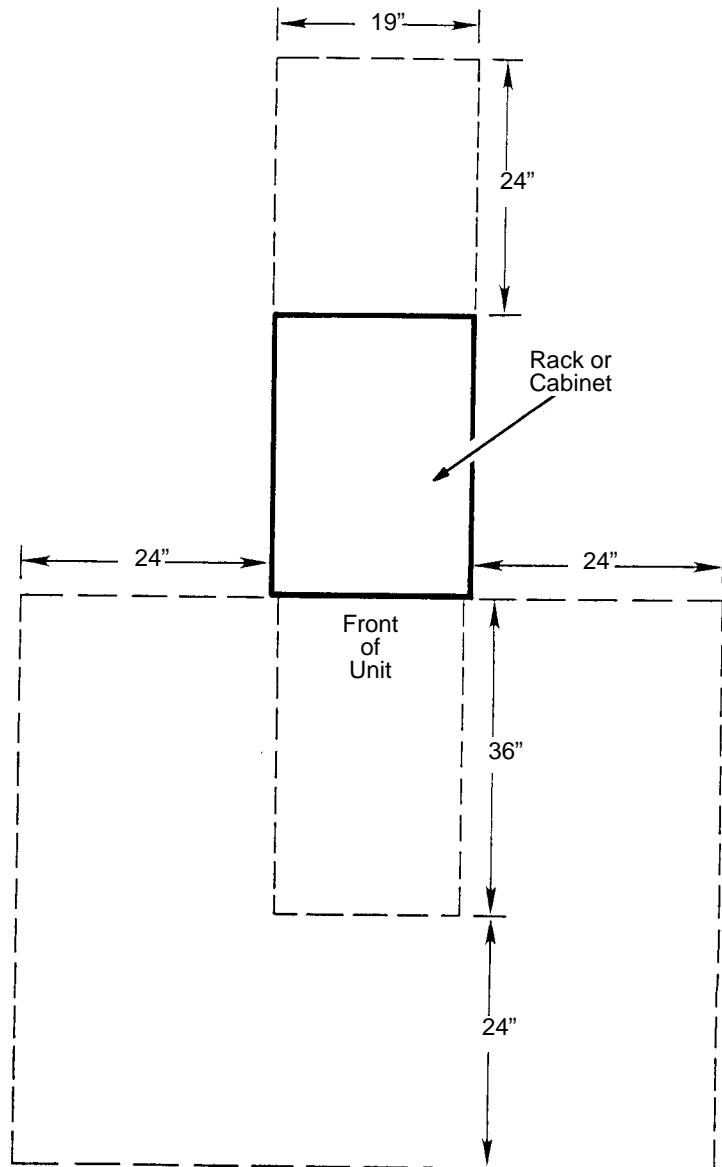
CS–8234

7.1.4 Power and Safety Requirements

_____ **WARNING** _____

The rackmount HSC95 controller chassis weighs approximately 59 kg
(130 lb). To help prevent injury, use sufficient personnel and proper
equipment when lifting or moving these units.

_____

Before attempting to install the equipment into a cabinet, ensure that the cabinet is stable by setting the stabilizing features provided. The stabilizing features for the rack or enclosure are dependent upon the type of cabinet used and usually includes a stabilizer foot that must be pulled out before the HSC95 controller is extended from the cabinet.

The rackmount HSC95 controller adds no unusual fire or safety hazards to an existing computer system. The wiring used by Digital Equipment Corporation conforms to UL, CSA, and IEC standards. The rackmount HSC95 controller conforms to Digital product safety standards.

The ac circuit breaker on the rear of the chassis removes ac power from the logic modules, fans, and power supplies.

A standard IEC 950 power cord is shipped with all systems that are used with a type 881 power controller. Power cords for all other installations must be ordered separately.

7.2 Unpacking the Rackmount HSC95 Controller

When delivered, the rackmount HSC95 controller is packed in a cardboard container attached to a shipping pallet. Table 7–1 lists the container contents. These parts can be used to install the controller in either a 19-inch RETMA cabinet with inch spacing for the holes on the vertical rails or in a cabinet with metric vertical hole spacing.

Table 7–1 Rackmount HSC95 Controller Package Contents

Quantity	Item	Part Number
1	Chassis slide, 300 lb, right hand/left hand	12–34821–01
1	Panel, HSC trim	74–46438–01
1	Bracket, tray mounting, right hand	74–46436–01
1	Bracket, tray mounting, left hand	74–46436–02
1	Tray, HSC cable management	74–46437–01
1	Mount, cable tie	90–08264–00
11	Tie, cable bundle 1 3/4 inch diameter	90–07032–00
8	U-Nut 10-32 x 0.615 inch	90–07786–00
2	Key, 1/4 turn fastener	90–11194–01
1	Bag, poly reclose	99–06557–12
1	Cord, power, 3-conductor, gray	17–00442–51
4	Bracket, HSC mounting	74–46434–01
1	Clamp, cable, screw mount 5/8 inch	90–07087–00
1	Screw, SEMS 6-32 x .375 inch XRCS	90–09984–00
8	Screw, SHLD 10-32 cap, .501 inch SOCK	12–24007–01
8	Screw, THRL 10-32 TRS .500 inch XRCS	90–00063–39
20	Screw, SEMS 10-32 x .343 inch XRCS	12–21368–03
8	Nut, KEPS 10-32, .375 inch AF	90–06565–00
4	Nut bar, HSC rackmount, metric	74–46435–01

Use the following procedure to unpack the shipping container:

1. Check the cardboard container and pallet for signs of shipping damage. Report any damage to the Digital Multivendor Services or your local Digital sales office and to the local carrier.

2. Keep all packing material and receipts when a damage claim is filed. Save all shipping brackets and hardware for future use in moving equipment to a new site.

3. Unpack the contents.

7.3 Installing the RETMA Rack Components

This section contains the procedure for installing the rack-mount HSC95 controller in a 19-inch RETMA cabinet with inch spacing on the vertical holes.

7.3.1 Preparing the RETMA Rack

Before installing the components, use the following procedure to locate the cabinet position you will mount the HSC95 controller into and to install the clip nuts into the proper holes on the vertical rails.

1. Adjust the spacing between the forward edge of the front rails and the back edge of the rear rails to 63.5 centimeters (25 inches).

2. Determine the area of the rack that the HSC controller and cable tray are to be installed into. This space must be at least 57.8 centimeters (22.75 inches) of vertical rail, or 39 contiguous holes in the cabinet vertical rail.

3. Establish a datum line at the base of the area between two holes with 1.3 centimeters (.5 inches) spacing.

4. Starting at the datum line, count up the number of holes indicated in Table 7–2 and install the clip nuts.

Table 7–2 Installing the Clip Nuts

Component	Number Of Holes Up From Datum Line	
	Front Rails	Rear Rails
Cable Management Tray	3rd and 7th hole	3rd and 7th hole
Front Bezel	16th and 39th hole	N/A

7.3.2 Installing the Chassis Slides In the RETMA Rack

The chassis is shipped with a pair of EIA chassis slides (see Figure 7–2).

Figure 7–2 EIA Chassis Slides
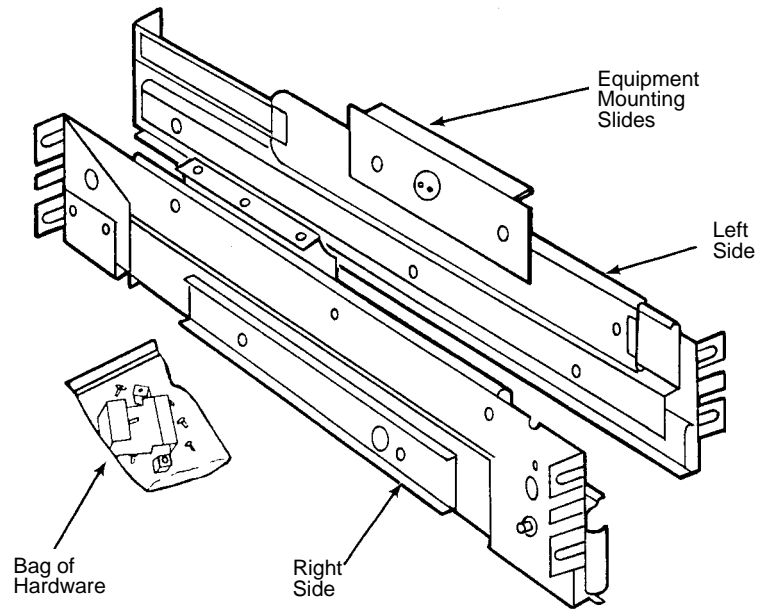
CS–8498

The chassis slides are labeled right and left. To install the slides, use the hardware in the bag supplied with the slides and perform the following steps (see Figure 7–3):

1. Check each slide for damage and for smooth operation.

2. Locate the 20th through the 23rd hole up from the datum line (refer to Section 7.3.1).

3. Install the left slide between the front and rear vertical mounting rails from the front of the cabinet. The slide must be installed to the rear of the front rail for proper bezel fit.

Note

Performing the next steps will be easier if a second person supports the slide at the rear of the cabinet.

---

4. Using the hardware from the bag of parts supplied with the slide, position the bar nut, align the four holes, and install two 10-32 screws.

5. Repeat steps 3 through 4 at the other end of the slide at the rear of the cabinet.

6. Repeat steps 1 through 5 for the other slide.

Figure 7–3   Installing the EIA Chassis Slides and Cable Tray
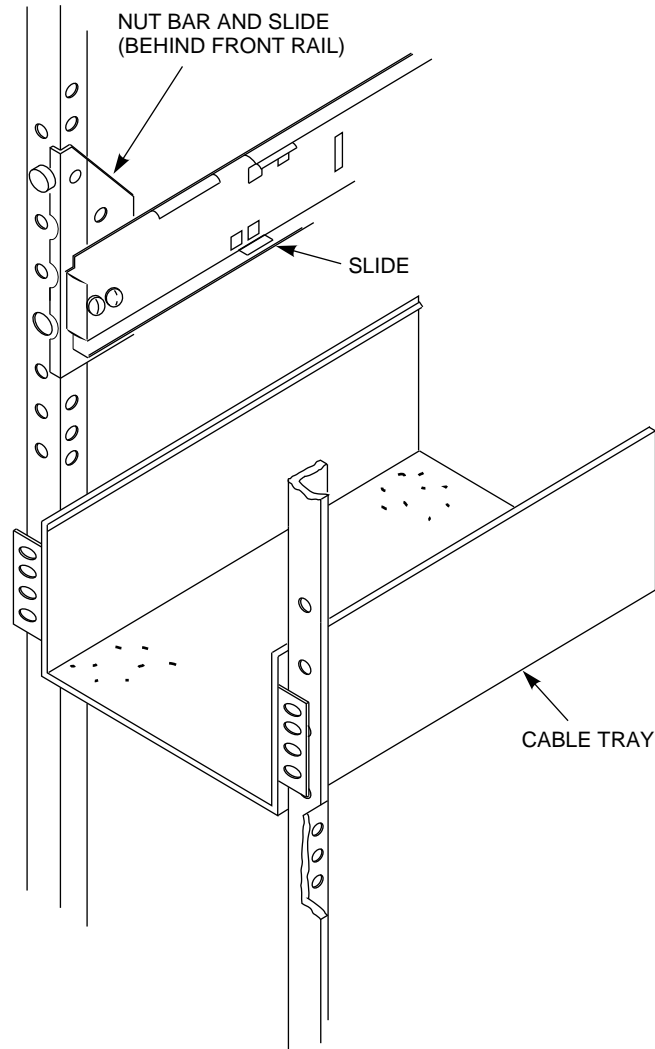
CXO-3824A-MC

7.3.3 Installing the Cable Management Tray

Use the following procedure to install the cable management tray in a RETMA cabinet:

1. Install the U-nuts on the rear vertical rail of the cabinet at the positions listed in Table 7–2.

2. The tray mounting brackets are left (stamped 7446436–01) and right (stamped 7446436–02) handed. Install these to the rear of the cable management tray with 10-32 x .343 inch SEMS screws. Do not tighten the screws.

3. Place the tray into position at the holes indicated in Table 7–2 and install all 10-32 x .500 inch THRL screws (refer to Figure 7–3). After all screws are started in their holes, tighten the front and rear vertical rail screws first, followed by the ones on the tray mounting brackets. Support the tray while installing the screws to avoid damage to the screw threads.

7.4 Installing the Metric Rack Components

This section contains the procedure for installing the rack-mount HSC95 controller in a 19-inch cabinet with metric spacing on the vertical holes.

7.4.1 Preparing the Metric Rack

Before installing the components, use the following procedure to locate the cabinet position you will mount the HSC95 controller into.

1. Adjust the spacing between the forward edge of the front rails and the back edge of the rear rails to 65 centimeters (25.50 inches).

2. Determine the area of the rack that the HSC controller and cable tray are to be installed into. This space must be at least 60 centimeters (23.62 inches) of vertical rail, or 24 contiguous holes in the cabinet vertical rail.

See Table 7–3 when locating holes in the cabinet vertical rail for adding components to the cabinet. The holes given in this table are referenced by counting *down* from the top of the HSC95 controller. All vertical rails, front and back, use the same reference holes.

Table 7–3 Locating Holes for Installing Rack Mount HSC95 Controller Components (Metric Rack)

Hole	Description	Purpose
1	N/A	Pin for HSC95 controller upper HSC mounting bracket (front)
3	10-32 cap head	Shoulder screw and KEP nut for HSC95 controller upper HSC mounting bracket (front)
10	10-32 cap head	Shoulder screw and KEP nut for HSC95 controller slide assembly (front)
11	10-32 x .343 inch SEMS	Upper screw into nut bar of HSC95 controller slide assembly (front)
12	10-32 x .343 inch SEMS	Lower screw into nut bar of HSC95 controller slide assembly (front)
12	10-32 x .343 inch SEMS	Upper screw into nut bar of HSC95 controller slide assembly (rear)
13	10-32 x .343 inch SEMS	Lower screw into nut bar of HSC95 controller slide assembly (rear)
14	10-32 cap head	Shoulder screw and KEP nut for HSC95 controller slide assembly (rear)
15	N/A	Pin for HSC95 controller lower HSC mounting bracket (front)
17	10-32 cap head	Shoulder screw and KEP nut for HSC95 controller lower HSC mounting bracket (front)
20	.500 inch THRL	Upper screw for HSC95 controller cable management tray (front and rear)
22	.500 inch THRL	Lower screw for HSC95 controller cable management tray (front and rear)

7.4.2 Installing the Slide Assemblies

The HSC95 controller is mounted on two slide assemblies to allow easy access for maintenance. Figure 7–4 shows the slide assembly and associated components. Use the following procedure to install the slides:

Figure 7–4 Metric Rack HSC Controller Slide Assembly
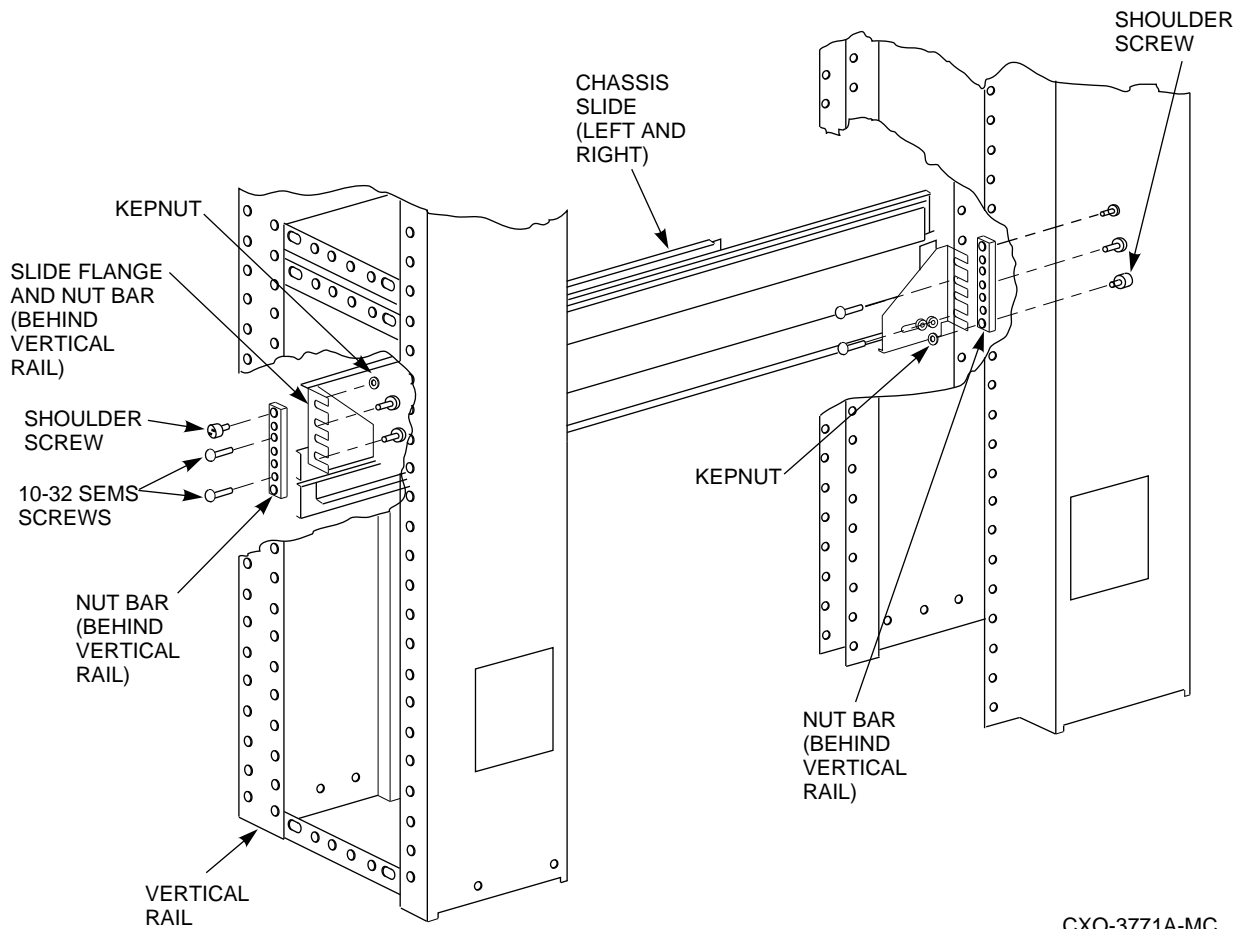
CXO-3771A-MC

1. Locate the left- and right-hand slide assemblies in the parts kit.

2. On each slide, install the nut bars by inserting one 10-32 x .343 inch SEMS screw in hole 3 of each nut bar. Hole 3 is counted down from the top of the nut bar, which is identified by an "M" stamped into the metal. Slide each bar into the slots provided on the front and rear mounting flanges of the slide and install another screw in hole 6 through the bracket and into the nut bar. Tighten the screws.

3. Verify that the two pan head screws and KEP nuts that hold the rear bracket of the slide assembly are in the lower holes of the bracket. If the screws are not properly located, move the screws to the positions shown. Both screws must be loose before installing the slide assembly in the cabinet. These will be adjusted and tightened later in the procedure.

4. Refer to Table 7–3 and locate the hole numbers for the HSC95 controller's position. These hole numbers are referenced from the top of the rackmount HSC95 controller, counting down. It may be helpful to mark every 10th hole in the vertical rail as an aid to locating components.

_____ **Note** _____

Performing the next steps is easier if a second person supports the slide at the rear of the cabinet.

_____

5. At the front of the cabinet, position the front of the slide assembly behind the front rail and insert a shoulder screw through the vertical rail and the top hole in the nut bar into a KEP nut. Do not tighten. Repeat this operation for the rear vertical rail using the bottom hole of the nut bar.

6. Install two 10-32 x .343 inch SEMS screws through the appropriate holes of the front and rear vertical rails and into the nut bar. Tighten all screws.

7. Tighten the two pan head screws that hold the slide rear bracket to the slide.

8. Repeat this procedure for the opposite slide.

7.4.3 Installing the Cable Management Tray

Use the following procedure to install the cable management tray:

1. Install the U-nuts on the front and rear cabinet vertical rails at the positions shown in Table 7–3.

2. Loosely fasten the tray to the front rails with four 10-32 x .500 inch THRL screws. Support the tray to avoid damage to the screw threads.

3. The tray mounting brackets are left (stamped 7446436–01) and right (stamped 7446436–02) handed. Install these to the rear of the cable management tray with 10-32 x .343 inch SEMS screws. Do not tighten the screws.

4. Place the tray into position at the holes indicated in Table 7–3 and install all 10-32 x .500 inch THRL screws. After all screws are started in their holes, tighten the front and rear vertical rail screws first, followed by the ones on the tray mounting brackets. Support the tray while installing screws to avoid damage to the screw threads.

7.4.4 Installing the HSC Mounting Brackets

See Figure 7–5 and refer to Table 7–3 to install the four HSC mounting brackets at the positions listed on the front rails of the cabinet. Each bracket is located with a pin in the upper hole. A shoulder screw through the bracket, the inside vertical rail of the cabinet, and into a KEP nut behind the rail attaches the mounting bracket. The chassis is secured to the cabinet vertical rails by tightening the captive screws on the HSC95 controller front panel into the matching holes in the HSC mounting bracket.

Figure 7–5 HSC Mounting Bracket

LOCATING
PIN

SHOULDER
SCREW

HSC MOUNTING
BRACKET (4)
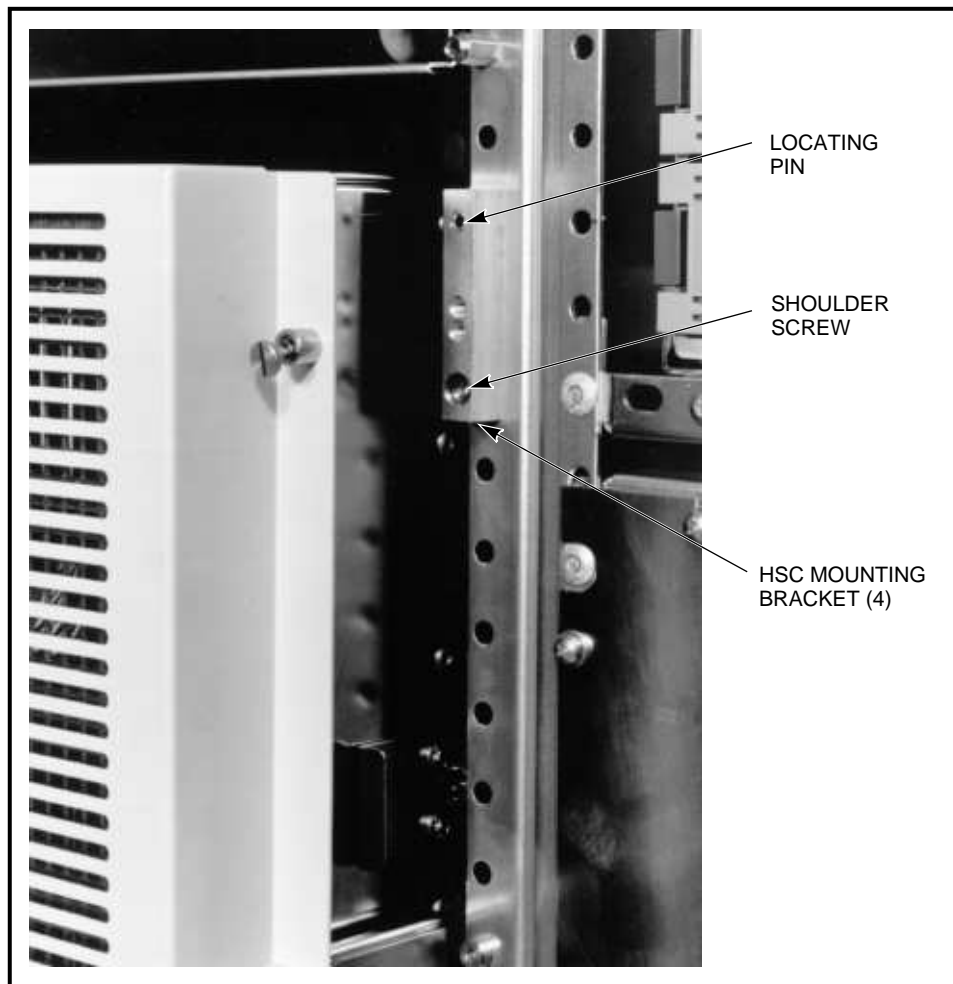
CXO-3825A-PH

7.5 Installing the Rackmount HSC95 Controller

Use the following procedure to install the HSC95 controller in both the RETMA
and metric cabinets:

1. Extend the cabinet stabilizer foot.

2. Fully extend both chassis slides from the cabinet.

3. Remove the three 8-32 screws that are supplied in each bag of slide assembly
   parts. These screws are the only parts from the bag that are used to install
   the HSC95 controller in a metric cabinet.

_____ **WARNING** _____

The rackmount HSC95 controller chassis weighs approximately 59
kilograms (130 pounds). To avoid personal injury, verify that the cabinet
stablilizer foot is fully extended and use sufficient personnel or proper

lifting equipment before installing the chassis or extending the chassis on slides for maintenance.

4. Lift the chassis onto the extended slides and carefully position the slide index plate on the HSC95 controller over the three mounting holes in the slide. Make certain that the tabs on each end of the indexing mechanism on the HSC95 controller are outside of the slides. The proper position for the HSC95 controller on the slides is shown in Figure 7–6.

Figure 7–6 Placement of the Chassis on the Slides
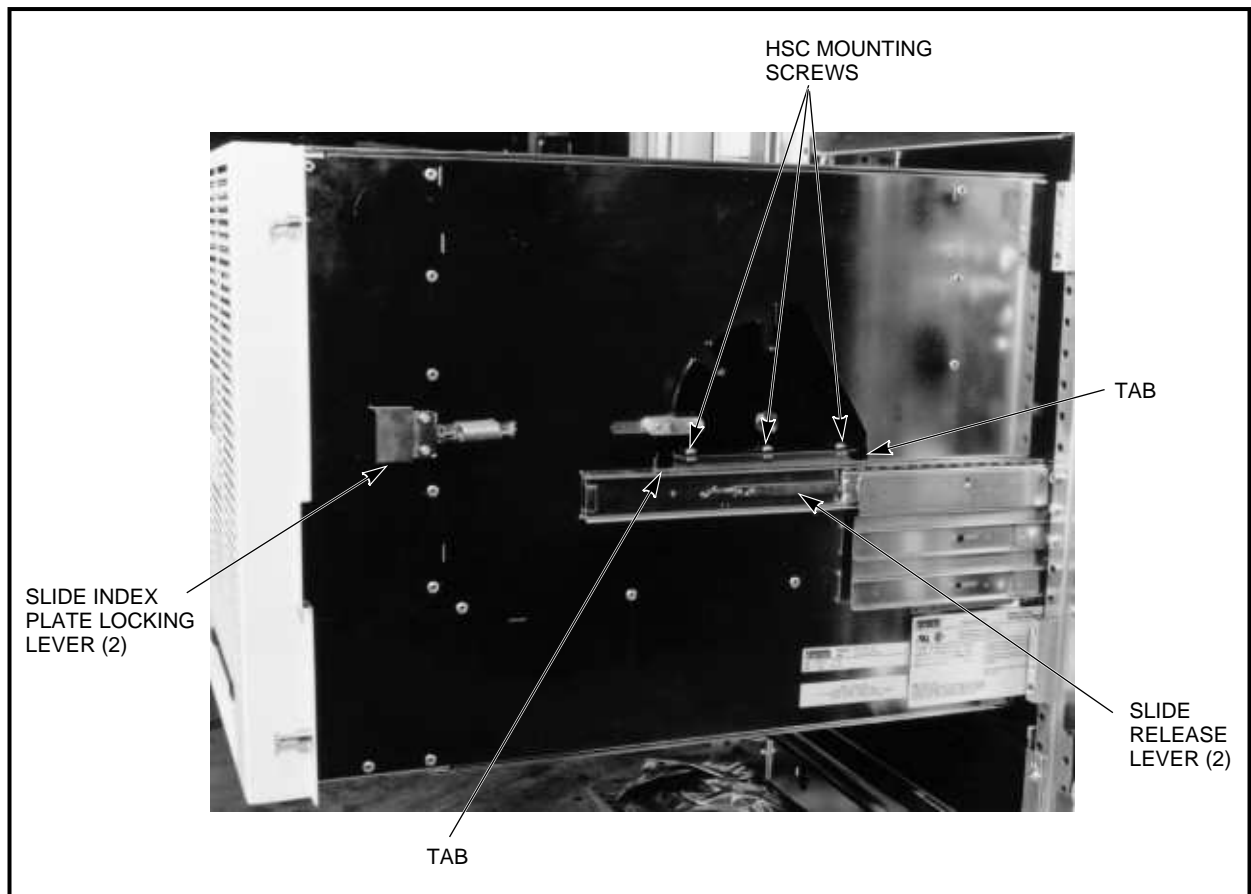
CXO-3823A-PH

5. Install the three 8-32 screws through the slide index plate and into the slides.

6. Release the slide locking levers on each slide and carefully slide the chassis into the cabinet. Ensure that the chassis is level, that it can clear the equipment above and below it, and that the slides operate smoothly.

7. Secure the chassis to the cabinet vertical rails by tightening the captive screws on the HSC95 controller front panel into the matching holes in the HSC mounting bracket.

7.6 Installing the HSC95 Controller Power Cables

Use the following procedure with both the RETMA and metric cabinets to route the power cables from the HSC95 controller to the cabinet power controller:

1. Plug the power cord into the rear of the HSC95 controller and secure it with a cable clamp and 6-32 screws as shown in Figure 7–7.

2. Route the cord into the controller's cable management tray and secure it to an adhesive cable tie wrap attached to the left side (facing from the rear) of the tray. Leave about 50 inches of power cable between the tie wrap and the cable clamp.

3. Route the plug end of the power cable over the top of the tray and down to the power controller.

Figure 7–7   Installation of the Power Cord
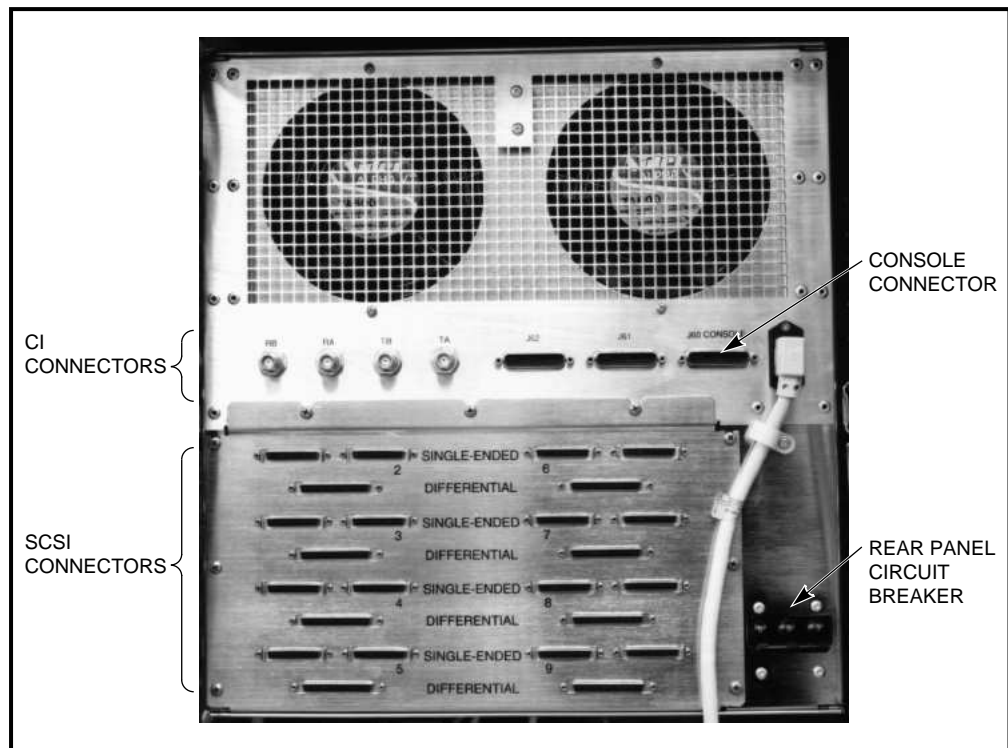
CXO-3826A-PH

7.7 Connecting the Power Cables to the Power Controller

Use the following procedure to connect the power cables. A new power controller is installed after the cables are connected using the instructions supplied with the power controller kit.

1. If a power controller is already installed in the cabinet, you may have to remove it to make the power cable connections to its panel. To remove the power controller, remove the four screws at the top and bottom of the power controller's panel. Slide the controller out of its position.

2. With the power controller resting on the floor just outside of its position, connect the HSC95 controller power cord to an unused phase on the power controller panel.

3. Lift the power controller into its cabinet position and install the four 10-32 x .500 inch THRL mounting screws.

4. If applicable, install the power controller filler panel over this space with the power controller cord running through the notch in the panel.

7.8 Installing the Rackmount HSC95 Controller SCSI Cables

Use the procedures in this section to label and install the SCSI cables for the components in the cabinet. If the HSC95 controller has a 50-percent SCSI I/O bulkhead, you will have to install the SDI/STI cables as described in Sections 7.9 and 7.10.

Labeling and Connecting the SCSI Cables

The cabinet cables are labeled according to the *SF Family Label Booklet*. As an example installation, refer to Section 6.8 when installing components into an 800 millimeter cabinet with two rackmount HSC95 controllers and up to eight StorageWorks building block (SBB) shelves.

Figure 7–8 shows a typical installation of SCSI cables to a 50-percent SCSI configuration rackmount HSC95 controller.

CAUTION

Do not place the rackmount HSC95 controller into maintenance position 3 unless directed to do so by Digital Multivendor Services. This position can disconnect some of the cables attached to the HSC I/O backplane and interrupt service on the controller, or on the other controller in a dual-pathed pair.

Gather the cables into two bundles of four cables each and secure them to the cable management tray with tie wraps. Be sure that each HSC95 controller can be pulled out to the maintenance 3 position without binding the cables. However, you may have to cut the tie wraps for future maintenance operations.

Figure 7–8   HSC95 Controller Rear Bulkhead Cables
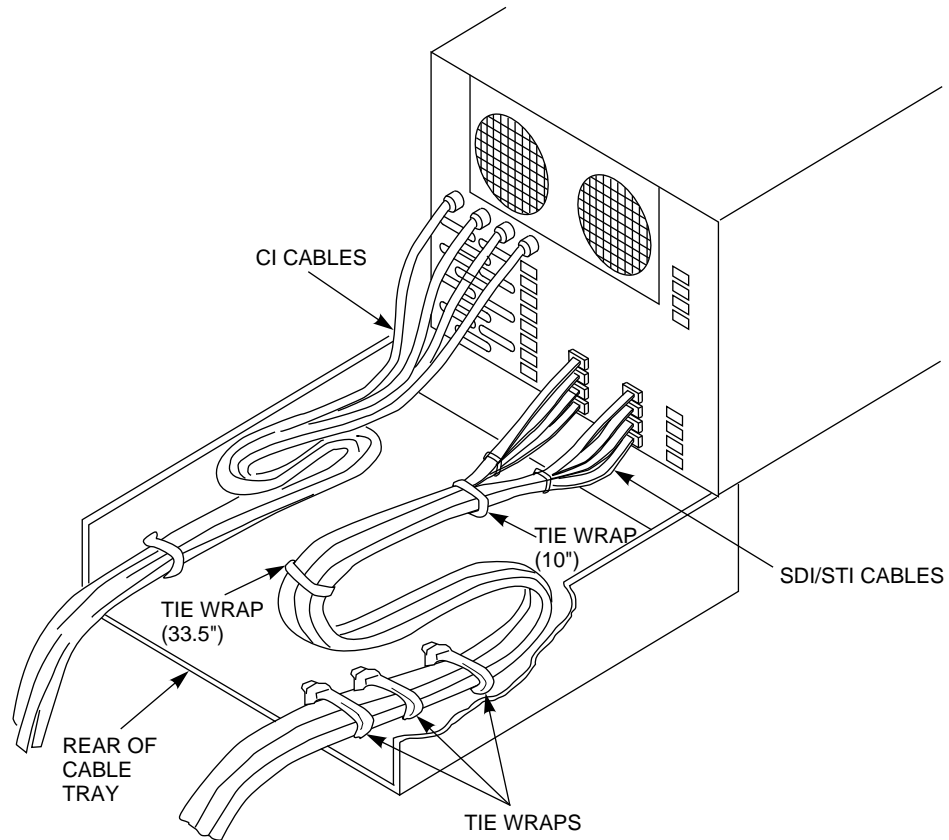
CI CABLES

TIE WRAP
(10")

SDI/STI CABLES

TIE WRAP
(33.5")

REAR OF
CABLE
TRAY

TIE WRAPS

NOTE: NUMBER AND LOCATION OF CONNECTIONS VARY.
THE APPEARANCE OF SDI/STI CABLES MAY VARY IN SOME APPLICATIONS.

CXO-3822A-MC

7.9 Routing the SDI/STI Cables

If a 50-percent SCSI HSC95 controller is installed in the cabinet, see Figure 7–9 and route the SDI/STI cables as follows:

1. Label the cables on both ends.

2. Loosely bundle four cables together using three tie wraps. Starting 60 centimeters (2 feet) from the HSC95 end of the cables, install the tie wraps at 60 centimeter (2 foot) intervals.

3. Repeat step 2 with the second bundle.

4. Lay two sets of bundled cables in the cable tray. Starting with the first bundle, place the third bundle point at the right rear corner of the cable tray with the rest of the bundled portion running toward the front of the cable tray.

5. Adjust the cables as shown in Figure 7–9.

Figure 7–9 Routing the SDI/STI Cables
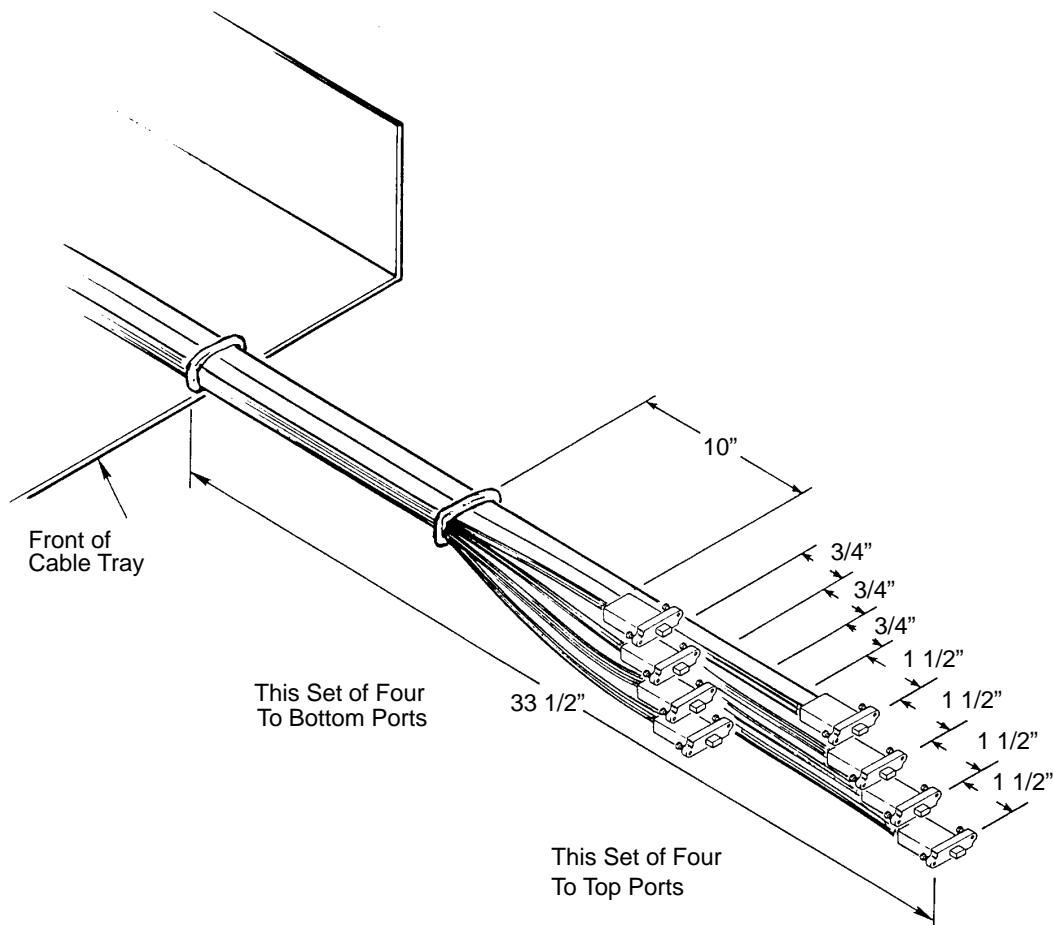
Front of
Cable Tray

10"

3/4"
3/4"
3/4"
1 1/2"
1 1/2"
1 1/2"
1 1/2"

This Set of Four
To Bottom Ports

33 1/2"

This Set of Four
To Top Ports

NOTE: The appearance of SDI/STI or SCSI cables may vary in some applications.

CS–10064

6. Tie the bundles together at the following points:

- 85.0 centimeters (33.5 inches) from the end of the longest cable
- 25.4 centimeters (10 inches) from the back of the connector housing of the shortest cable

Be sure to pull the tie wraps tight to maintain cable length adjustment.

7. Align the 85.4 centimeter (33.5 inches) tie wrap with the front of cable tray, then tie the cable bundles to the rear of the tray in two places. Refer to Figure 7–8 for cable tie wrap points.

8. Loop the cable bundle back to the rear of the tray. Connectors to be installed on the HSC95 controller are now at the rear of the rack.

9. Repeat steps 1 through 8 for additional cables, proceeding to the left side of the tray.

7.10 Connecting the SDI/STI Cables

The HSC95 controller 50-percent SCSI I/O bulkhead is divided into data channel cabling sections. There are five data channel cabling sections labeled E, F, L, M, and N. Each of these data channel sections contains four cable connector ports. Each port slot (labeled 0, 1, 2, or 3) has the same performance characteristics. Connecting SDI/STI cables to any one of the four ports in the same data channel sections allows all of the disks/tapes connected to be controlled by the same requestor module. The module utilization label, located on the underside of top cover, shows the configuration of modules in the rack mount HSC95 controller.

Figure 7–10 shows the 50-percent SCSI I/O bulkhead.

The external SDI and STI cables are identical, and the number of cabling sections used depends on the quantity of optional data channel modules installed.

Figure 7–10 50-Percent SCSI I/O Bulkhead
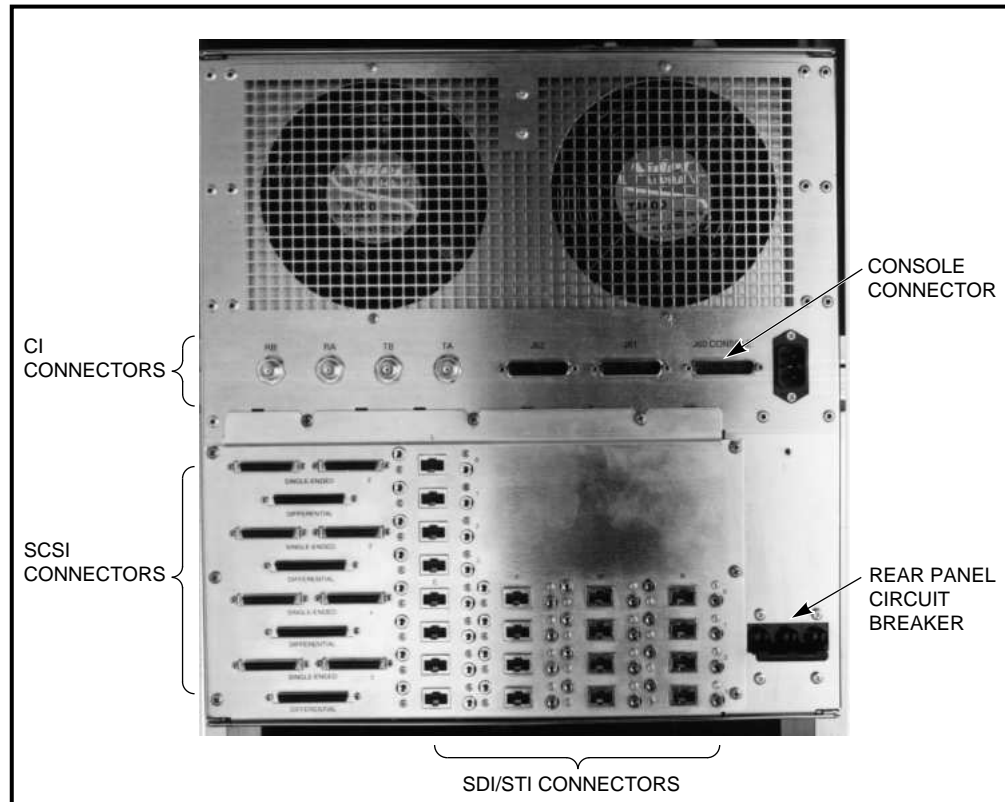
CXO-3821A-PH

The cabling sections are utilized as follows:

- A single cabling section driven by disk/tape data channel module (L0119) supports either disk drives or tape drives, but not both.

- A single cabling section driven by disk data channel module (L0108–YA) supports only disk drives.

- A single cabling section driven by tape data channel module (L0108–YB) supports only tape drives.

Use the following procedure to connect the SDI/STI cables to the 50-percent SCSI I/O bulkhead. Do not secure the SDI/STI cables to the I/O bulkhead panel with tie wraps until all ports of each requestor have been tested with the ILDISK or ILTAPE device integrity tests and a known good disk or tape drive. Instructions for running these tests are given in Chapter 4.

1. Start cabling at the bottom of the I/O bulkhead. This will allow connection to the top row of cables without interference. Refer to the module utilization label on the underside of the top cover to determine active bulkhead cabling sections.

2. Group the SDI/STI cables as shown in Figure 7–8.

3. Install the device end of the SDI/STI cables into each device I/O bulkhead as described in the appropriate disk drive or tape drive formatter user guide.

4. Adjust the length of the cable loop and tighten the tie wraps attaching the cable bundle to the cable tray.

7.11 Routing the CI Cables

_____ CAUTION _____

The CI cables have a 6.5 centimeter (2.5 inch) minimum bend radius requirement. To avoid damage, do not bend the cables tighter than this radius.

_____

When routing the CI cables, manually mark the cables labeled receive (R) and transmit (T) with an #A or #B, as appropriate, on each cable tag. The #A or #B marking must correspond to the path that the cable uses. Also, mark the node address (see the system manager for address) on each CI cable tag.

The CI cable connector markings correspond to the receive and transmit paths. Both CI bus paths must be connected to each HSC95 controller in the cabinet.

The A path contains Transmit A (TA) and Receive A (RA). The B path contains Transmit B (TB) and Receive B (RB). TA on the HSC95 controller connects to TA on the star coupler; TB on the HSC95 controller connects to TB on the star coupler.

Mark both ends of each CI cable before installation to aid in tracking cable destinations for future maintenance and troubleshooting.

Use the following procedure to route the cables:

1. Label the cables on both ends.

2. Bundle all four cables together using six tie wraps. Starting 30 centimeters (1 foot) from the HSC95 controller end of the cables, install the tie wraps at 30 centimeter (1 foot) intervals.

3. Lay the bundled cables in the cable tray. Place the sixth bundle point at the right rear corner of the cable tray with the rest of the bundled portion that runs along the right edge of the cable tray.

   Do not tighten the tie wraps until the cables are installed in the HSC95 controller. This will allow the length of the cable bundle from the back of the cable tray to the HSC95 controller to be adjusted.

4. Loosely tie the cable bundle to the side of the tray using the holes in the tray.

5. Loop cable bundle back to right rear corner of the tray. Connectors to be installed on the HSC95 controller are now at the rear of the rack.

7.12 Connecting the CI Cables

Connect the CI cables as follows (refer to Figure 7–8):

1. Locate the four CI cable connectors on the rear panel of the rackmount HSC95 controller chassis.

2. Screw each CI cable into the appropriate CI cable connector on the rear panel of the HSC95 controller.

3. Adjust the length of the cable loop and cinch the tie wraps attaching the cable bundle to the cable tray to align with the length of the other cables in the tray. Ensure that the CI cable bundle runs along the side of the tray, and does not interfere with motion of the other cables.

4. Screw the other end of each CI cable into the star coupler's bulkhead panel as described in the installation chapter of the *Star Coupler User's Guide* or into the host computer bulkhead panel as described in the host computer documentation.

7.13 Connecting the Console Cable

Connect the console cable as follows:

CAUTION

To avoid damaging or breaking cables, ensure that the cable is long enough to allow the chassis to be pivoted for maintenance.

---

1. Lay out the console cable in the same manner as with the other cables in the tray. Extend the cable 55.9 centimeters (22 inches) beyond the front edge of the cable tray.

2. Connect the console cable to one of the EIA terminal connectors on the rear panel of the HSC95 controller.

3. Tie the cable to an existing cable bundle using the tie wraps.

7.14 Checking Switch Positions

The K.pli2 and K.si modules have switchpacks that are set during manufacturing. These switches must be in the OFF position for normal operation of the HSC controller. Use the following procedure to verify that the switches on the K.pli2 module and the K.si modules are properly set for normal operation.

1. With the HSC conroller in Maintenance 2 position, locate and remove the K.pli2 module.

2. Refer to Figure 7–11 and verify that the swiches on the switch pack are all set to the OFF position.

3. Reinstall the K.pli2 module in the card cage.

4. Locate and remove the first K.si module in the card cage.

5. Refer to Figure 7–12 and verify that the switches on the switch pack are all set to the OFF position.

6. Reinstall the K.si module and repeat the verification step for all other K.si modules in the card cage.

7.15 Setting the LINK Module Switches

The port link module has three switches that must be set for each installation. Two of these switches set the unique node address for the HSC controller; the third switch sets the slot count timing according to the VAXcluster™ configuration.

7.15.1 Guidelines for Setting the Node Address Switches

Unique node addresses are set using the two node address switches on the HSC port LINK module. Use the following guidelines when setting the node address switches on the LINK module:

1. If the HSC controller or a new CPU is added to a cluster, set the address switches to the next available node address for the cluster. The HSC controller should be assigned to lower node addresses.

2. If the HSC controller is presently part of a cluster to which no new nodes have been added, but a LINK module has been replaced, ensure the node address on the new LINK module is set to the same address as the previous module.

7.15.2 Guidelines for Setting the Slot Count Timing Switch

Incorrect switch and/or jumper settings on the CI interface modules in both the HSC controllers and the CI host nodes can cause various cluster disturbances, including:

• Disks in Mount Verification

• Many virtual circuit (VC) closures, resulting in shadow copy initiation on shadowed disks

• Various OpenVMS™ bugchecks, most commonly \CLUEXIT

Figure 7–11 Location of the K.pli2 Module Switchpack

PILA
MODULE

NOTE:
ALL SWITCHES
MUST BE OFF FOR
NORMAL OPERATION.

RED STATUS
LED

GREEN STATUS
LED
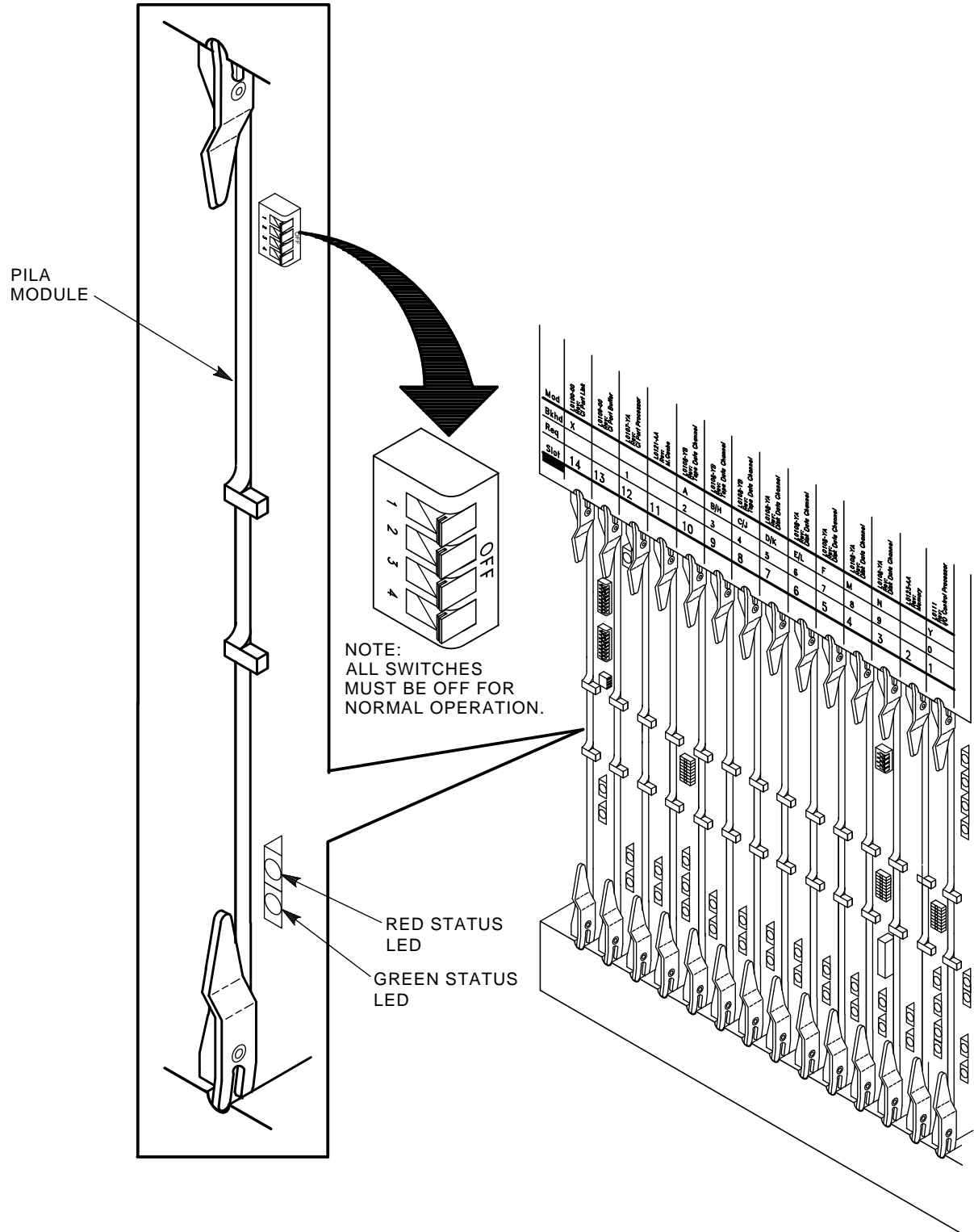
CXO-3960A-TI

Figure 7–12 Location of the K.si Module Switchpack

K.SI DATA CHANNEL
MODULE

NOTE:
ALL SWITCHES
MUST BE OFF FOR
NORMAL OPERATION.

AMBER LEDs,D1-D8
(D1 IS ON TOP)

J1

RED STATUS LED

GREEN STATUS LED

CXO-2495B

The cause of these disturbances are CI collisions caused by mismatched CI communication mechanisms. There are two mechanisms involved:

- Slot count (also called "quiet time")
- Cluster size

Settings for these mechanisms are selected by switch positions on the LINK modules in HSC controllers and older VAX host systems, and by backplane jumpers for CIBCA and CIXCD CI port adapters on newer VAX hosts.

Slot count has two possible settings: 7 or 10. At the time of HSC controller installation, it is necessary that all LINK and CI adapter modules in the cluster be set to a consistent value to avoid the cluster disturbances mentioned above.

Digital recommends that the slot count for all CPU and HSC controller nodes within a cluster be set to a value of 10 (not 7).

If your cluster does contain a CIXCD adapter, all LINK and CI adapter modules should already be set to 10 because the CIXCD adapter does not support a slot count of 7.

To assist you with setting the slot count in your cluster, Table 7–4 lists LINK and adapter module switch and jumper settings.

In addition, the cluster size parameter must be consistent throughout the cluster at a value of either 16 or 32. If **all** nodes in your cluster are numbered in the range of 0 to 15, you may select a cluster size of either 16 or 32. If your cluster has **any** node numbered in the range of 16 to 31, you must select a cluster size of 32. adapter module switch and jumper settings to select the appropriate cluster size.

Table 7–4   L0118 LINK Module and CI Adapter Module Switch/Jumper Settings

Adapter Type	Host System	LINK Module	Function	Switch/Jumper Setting
	HSC95[1]	L0118–YA	Slot=7 Slot=10 Clu_size=16 Clu_size=32	S3–4=Open S3–4=Closed S3–1=Open S3–1=Closed
CIBCA–Ax, CIBCA–Bx[2], [3]	VAX™ 82x0, VAX 83x0 VAX 85x0, VAX 8700 VAX 88x0, VAX 6000™	T1025 T1046	Slot=7 Slot=10 Clu_size=16 Clu_size=32	Jumper E11–41=Out Jumper E11–41=In Jumper D30–60=Out Jumper D30–60=In
CIXCD–xx[3]	VAX 6000, VAX 9000™	T2080	Slot=7 Slot=10 Clu_size=16 Clu_size=32	Not Supported Jumper E15–45=In Jumper D15–45=Out Jumper D15–45=In

[1]On L0118 modules, all on-module jumpers must be left in their default positions and S3–2 and 3 must remain open.

[2]For CIBCA options, all referenced jumpers are located on the backplane slot for the PORT (T1015/T1045) module, *not* the slot allocated to the LINK (T1025/T1046) module. For CIBCA options, all reference jumpers are on the backplane slot for the PORT (T1015 or T1045 module).

[3]For CIBCA and CIXCD options, install *only* those backplane jumpers listed and those required to specify the node address.

7.15.3 LINK Module Switch Setting Procedure

The procedure that follows contains the steps for setting the node address and slot count timing switches.

Set the LINK module switches as follows:

1. If this is a new HSC controller installation, remove and replace all modules (while wearing your properly grounded ESD wrist strap) to ensure they are properly seated. The modules may have loosened during shipping.

   ---------------------------- **CAUTION** ----------------------------

   Remember to plug the HSC controller into a wall receptacle to properly ground the unit before using the ESD wrist strap.

   ----

2. Locate the LINK module in the HSC controller card cage. Refer to Figure 7–13 for the location of the node address switches on the LINK module.

3. Set the node address switches to a unique node address.

   ----------------------------- **Note** -----------------------------

   Remember to set the S1 and S2 node address switches to the same value.

   ----

4. Locate the slot count timing switch (S3) on the L0118–YA port LINK module.

5. Set the cluster size on S3–1. Switch S3–1 can be set to open (1) or Closed (0) if all nodes in the cluster have a node number of 15 or less. Set S3–1 to Closed (0) if **any** node in the cluster has a node number of 16 or greater. Refer to Table 7–4 for a listing of LINK module switch and jumper settings for various VAXcluster configurations.

6. Set the slot count switch to the proper value for the cluster by using the settings for S3–2, S3–3, and S3–4 (either 7 or 10) given in Table 7–4. Refer to Figure 7–13 for the location of the slot count switch pack.

   Table 7–5 lists the settings of the switches as Open or Closed on the LINK module for slot counts of 7 and 10. The table also lists two additional reserved settings for S3. These settings should be used only as directed by Digital Multivendor Services.

Table 7–5 L0118–YA LINK Module S3 Switch Slot Count Timing Settings

Slot Count	S3–2	S3–3	S3–4	Comment
7	Open	Open	Open	
10	Open	Open	Closed	Default
Reserved #1	Open	Closed	Open	Slot count=11
Reserved #2	Open	Closed	Closed	Slot count=14

Figure 7–13 Location of the Switches on L0118–YA LINK Module
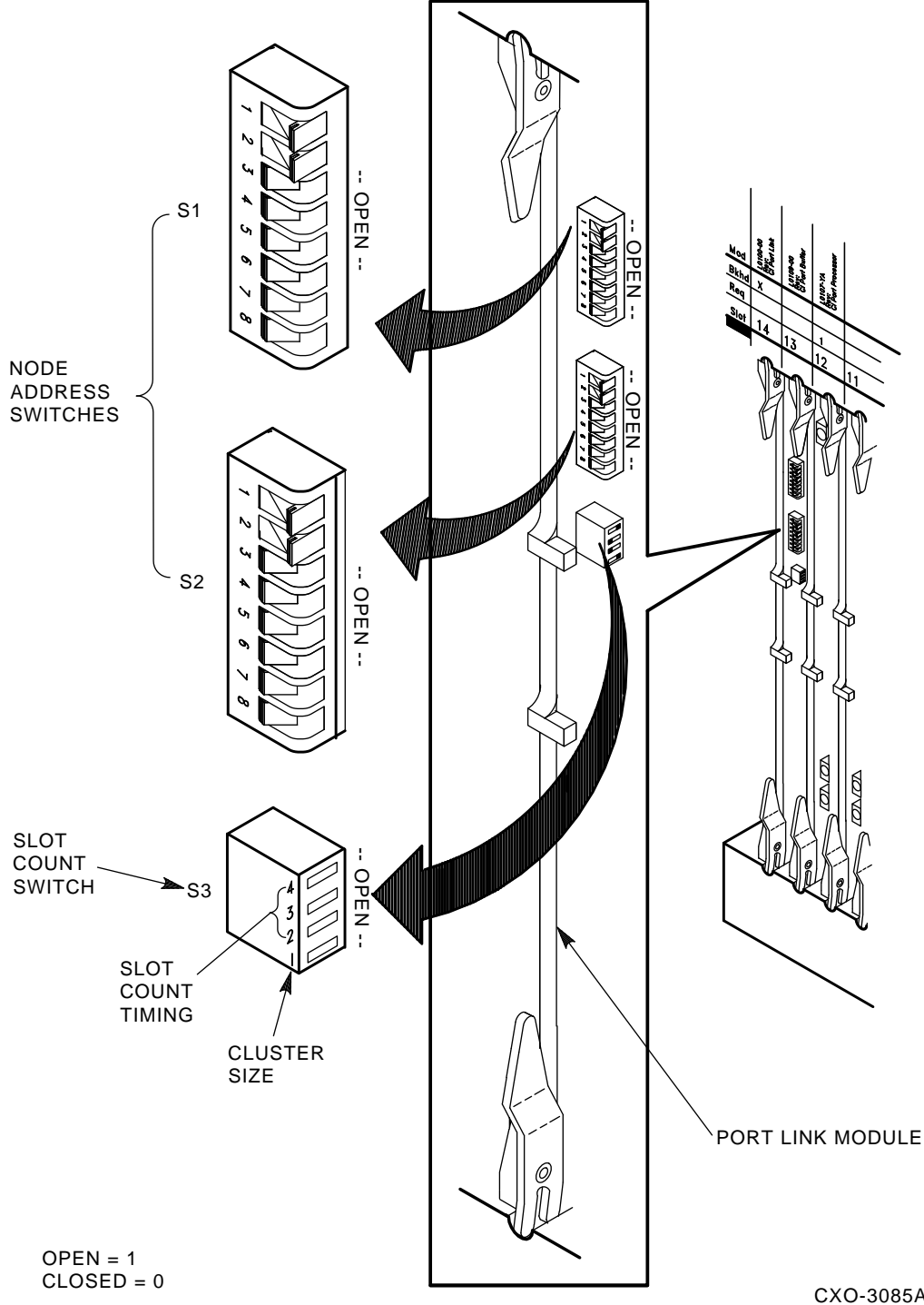
OPEN = 1
CLOSED = 0

CXO-3085A

Note

When setting the S3 switches, Open= 1 and Closed= 0. Remember that
S3–1 is used to set the cluster size and is not related to the slot count
timing settings.

7. Insert the LINK module into the backplane slot after the node address (S1 and S2) and slot count (S3) switches have been set.

8. Install other requestors in the HSC controller backplane.

7.16 Installing the HSC95 Controller Trim Panel

This procedure is for installing the trim panel in an 800 millimeter cabinet. Refer to the cabinet documentation for installation in other cabinet types. Install the trim panel over each HSC95 controller position as follows:

1. Using a punch or blunt tool at least the diameter of the plastic studs on the inside of the door, gently tap out each stud for the grillwork over each HSC95 controller position.

2. Remove the grillwork as it comes free of the door.

3. Align the trim panel's studs on the holes in the door and use a soft hammer to tap the panel into place on the door. If you do not have a soft hammer, use a piece of wood or similar material to avoid damaging the door.

7.17 HSC95 Controller Configuration and Check Out

Perform the procedures given in Chapter 3, then refer to the *HSC Controller User Guide* and run the KSUTIL utility to configure the SCSI devices.

After configuring the SCSI devices, perform the procedures in Chapters 4 and 5 of this manual to finish the installation procedure.

Close the cabinet doors and turn the hex-Allen fasteners one half turn clockwise to lock. The system is ready to be turned over to the system manager.

8

Changing Rackmount HSC95 Requestor Configurations

This chapter contains the procedure used to upgrade the rackmount HSC95 controller to support the following configurations of SCSI devices:

- Changing an SDI/STI configured rackmount HSC95 controller to either a 50-percent or 100-percent SCSI device configuration.

- Changing a 50-percent SCSI configured rackmount HSC95 controller to support 100-percent SCSI devices.

Transition connector boards (TCBs) are supplied with SCSI module upgrade kits HSC9X–SX and HSC9X–SZ. These kits consist of a SCSI module, TCB, and in the case of the –SZ kit, a StorageWorks building block (SBB) shelf. If you are upgrading an existing 50-percent SCSI configured HSC95 controller to a 100-percent configuration or adding new SCSI requestors to an existing HSC95 controller, you should order kit HSC9X–SC or HSC9X–SD. These kits do not contain a TCB because the TCBs are already installed in these configurations at the factory.

8.1 SCSI Upgrade Procedure

Use the following procedure to upgrade the I/O backplane configuration to support SCSI devices:

> ———————————— WARNING ————————————
>
> Because hazardous voltages exist inside the HSC controller, service must only be performed by qualified people. Bodily injury or equipment damage can result from improper servicing procedures.
>
> ——————————————————————————————————

1. Take all equipment associated with the rackmount HSC95 controller off line. If the controller is part of a cluster, perform the procedures to fail over all requestors to the alternate HSC95 controller.

2. Press the Online button on the HSC controller operator control panel (OCP) once to take the HSC95 controller off line. Shut down the controller by setting the DC Power switch on the OCP to the 0 (off) position.

3. Remove ac power to the HSC95 controller by setting the ac circuit breaker on the rear panel of the controller to the 0 (off) position.

4. Disconnect the HSC controller power cord to the cabinet power controller. If the other equipment in the cabinet is off line due to this conversion, shut down the power controller and remove the cabinet power cord from the source voltage.

_____ WARNING _____

The rackmount HSC95 controller chassis weighs approximately 59
kilograms (130 pounds). To avoid personal injury, verify that the cabinet
stablilizer foot is fully extended and use sufficient personnel or proper
lifting equipment before installing the chassis or extending the chassis on
slides for maintenance.

_____

5. Extend the cabinet stabilizer foot.

6. Open and, if applicable, remove the front and back doors of the cabinet.

7. Disconnect all cables from the I/O bulkhead and rear panel of the HSC95
   controller.

8. Loosen the four captive retaining screws on the front panel of the HSC95
   controller.

9. Pull the chassis forward on its slides to the fully extended position.

10. Place the HSC95 controller in maintenance position 2, as described in
    Section 1.2.2.

_____ CAUTION _____

Do not attempt to handle HSC controller modules unless you have taken
proper precautions against electrostatic discharge (ESD). When handling
modules, wear the ESD grounding wrist strap provided inside the front
door of the HSC controller cabinet. Do not put modules on anything other
than a properly grounded antistatic work surface.

_____

11. Observe ESD precautions. Locate and remove the non-SCSI requestors in the
    HSC95 backplane.

12. Refer to Table 1–1 and install the new K.scsi (L0131–AA) data channel
    modules into the HSC controller backplane requestor positions to support the
    50- or 100-percent SCSI configuration.

13. Replace the top cover of the HSC95 controller.

_____ CAUTION _____

Do not place the rackmount HSC95 controller into maintenance position
3 unless directed to do so by Digital Multivendor Services. This position
can disconnect some of the cables attached to the HSC I/O backplane
and interrupt service on the controller, or on the other controller in a
dual-pathed pair.

_____

14. With the HSC95 controller in maintenance position 2, remove the screws from
    the bottom cover of the HSC controller and remove the bottom cover.

15. Loosen or remove the screws holding the I/O bulkhead to the chassis and
    slide the bulkhead out of the chassis. Carefully disconnect the bulkhead from
    the TCBs and backplane of the HSC controller.

16. If installing TCBs, locate the "jumper" label on the top center of each new TCB. Verify that the jumper is clipped; if it is not clipped, do so before installing it into the backplane. This jumper is used when the TCB is installed in other than a rackmount HSC controller.

17. Install the new TCBs in the backplane to fill the requestors as required by the I/O backplane configuration listed in Table 1–1. In installing the TCBs, the 50-pin connector on the board is the upper connector when the board is plugged into the backplane.

18. Install the new I/O bulkhead on the chassis and replace the screws.

19. Plug each cable into the backplane in turn, matching the requestor numbers marked on the bulkhead with the numbers listed on the backplane protective cover. Make sure that each cable and its TCB are fully seated.

20. Tuck the cables from the I/O bulkhead to the backplane into the backplane space.

21. Replace the bottom cover to the HSC95 controller.

22. Roll the chassis back into the cabinet and tighten the four captive retainer screws.

23. If you are upgrading an HSR95 cabinet, refer to Connecting the SCSI Cables and install the SCSI cables to the I/O backplane of the HSC95 controller. If you are upgrading a rack mount HSC95 controller in a generic RETMA cabinet, refer to Section 7.8 and install the SCSI cables to the I/O backplane of the HSC95 controller.

24. Reinstall the other cables to the I/O backplane as required by the configuration.

25. Restore power to the cabinet and HSC controller.

26. Perform the procedures in Chapter 3, then refer to the *HSC Controller User Guide* and use the KSUTIL utility to configure the SCSI devices in the cabinet. After configuring the devices, perform the procedures given in Chapters 4 and 5.

27. Once the verification is complete, close the cabinet doors and turn the Allen fasteners one-half turn clockwise to lock. The system is ready to be turned over to the system manager.

A

StorageWorks Building Block Shelf Configuration Guidelines

Use the guidelines in this section for configuring the K.scsi module in an HSC controller. Table A–1 lists the internal bus lengths to be used when calculating the total bus length.

Table A–1   Bus Length Calculations

| Item | Length | |
	Meters	Feet
The SBB shelf contributes	0.8	2.62
The HSCxx internal cable contributes	0.8	2.62
The Rack Mount HSC internal cable contributes	1.0	3.28
These additions to total SCSI bus length must be considered when calculating the bus length.		

A.1 SBB Shelf with Single SCSI–2 Bus

When the SBB shelf has only one bus for a maximum of seven SBBs, the configuration rules are:

- The terminator board (BA35X–MB) must be installed in the backplane connector adjacent to slot 1.

- The jumper board (BA35X–MC) must be installed in the backplane connector adjacent to slot 5.

- The SCSI–2 single-ended bus is a slow bus (5 megabytes per second transfer rate). The total bus length must not exceed six meters (19.7 feet).

- For differential SCSI bus operations, the HSC controller must be in the end bus position. It cannot be placed in the mid-bus position.

- The maximum cable length for differential bus operations is 20 meters (65.6 feet).

- SCSI signal converters, such as the DWZZA–VA, must be installed in slot 0.

- When a SCSI–2 single-ended cable is connected to JA–1, you must disable single-ended terminator on the DWZZA–VA SCSI signal converter in slot 0.

- Using a tri-link connector block (H885–AA) with a DWZZA–VA SCSI signal adapter, requires disabling the DWZZA–VA differential terminators.

A.2 SBB Shelf with Dual SCSI–2 Buses

When the SBB shelf has two SCSI–2 buses (one for three SBBs and one for four SBBs), the configuration rules are as follow:

- The terminator board (BA35X–MB) must be installed in the backplane connector adjacent to slot 5.

- The jumper board (BA35X–MC) is not required for dual-bus operation. However, it is recommended that it be installed in the backplane connector adjacent to slot 1, to ensure it easily located. When the jumper is installed in this location it has no effect on SCSI bus operations.

- The SCSI–2 single-ended bus is a slow bus (5 megabytes per second transfer rate). The total bus length must not exceed six meters (19.7 feet).

- For differential SCSI bus operations, the HSC controller must be in the end bus position. It cannot be placed in the mid-bus position.

- The maximum cable length for differential bus operations is 20 meters (65.6 feet).

- SCSI signal converters, such as the DWZZA–VA, can be installed in slot 0 (which is connected to JA–1) or slot 1 (which is connected to JB–1).

- When a SCSI–2 single-ended cable is connected to JA–1, you must disable the single-ended terminator on the DWZZA–VA SCSI signal converter in slot 0.

- When a SCSI–2 single-ended cable is connected to JB–1, you must disable the single-ended terminator on the DWZZA–VA SCSI signal converter in slot 1.

- The SHELF_OK signal is connected to slot 0. Therefore, only the HSC controller connected to JA–1 can monitor this signal.

- Using a tri-link connector block (H885–AA) with a DWZZA–VA SCSI signal adapter, requires disabling the DWZZA–VA differential terminators.

A.3 Multiple SBB Shelves

Multiple SBB shelves can be used with an HSC controller. When multiple SBB shelves are used, they can be configured as either a single or dual bus shelf—a hybrid configuration—using the following the configuration rules:

- The single bus or dual bus connection rules apply to each single or dual bus shelf.

- The first shelf in a single-ended hybrid configuration must be a single bus shelf with the HSC controller connected to JA–1. The jumper board BA35X–MC is installed in the backplane connector adjacent to slot 5. JB–1 is the bus output connector.

Note

Single-ended SCSI-2 buses can only be terminated at the end of the bus. Therefore, do not install a terminator board in the first shelf.

- The second shelf in a single-ended hybrid configuration can be configured as either a single bus shelf or as a dual bus shelf.

- When there are more than four devices to be added to the bus, configure the shelf as a single shelf with the terminator board behind slot 1, and the jumper board behind slot 5. The input connector is JA–1.

- When there are *three or fewer SBBs*, connect JB–1 of the first shelf to JA–1 of the second shelf. Install the terminator board behind slot 5. No jumper board is required, but it can be installed behind slot 1 for safekeeping.

- When there are *four* SBBs, connect JB–1 of the first shelf to JB–1 of the second shelf. Install the terminator board behind in slot 5. No jumper board is required, but it can be installed behind slot 1 for safekeeping.

A.4 Examples of HSC Controller/SBB Configurations

This section contains some examples of typical configurations using the HSC controller and StorageWorks building blocks. The configurations are as follows:

- **Single-ended dual-path:** This configuration is used with the rackmount HSC95 controller only and incorporates a Y-cable between the TCB and the I/O bulkhead (Figure A–1).

- **Dual-path HSC controllers with internal SBBs:** This configuration is for HSC controllers that have either the HSC SCSI Array Starter Kit (HSC9X–SS) or the HSC Extended Top Cover Kit (HSC9X–SF) installed (Figure A–3).

- **Six 5¼-inch SCSI devices on one HSC controller:** This configuration uses a DWZZA in Slot 0 of the first SBB shelf (Figure A–4).

- **Six 5¼-inch SCSI devices in dual-path configuration with tri-link:** This configuration uses a DWZZA and Tri-Link in slot 0 of the first SBB shelf (Figure A–5).

- **Six 5¼-inch SCSI devices in dual-path configuration with two DWZZAs:** This configuration uses two DWZZAs and no tri-link. (Figure A–6).

Figure A–1   Single-Ended Dual-Path (Rackmount HSC95 Controller Only)
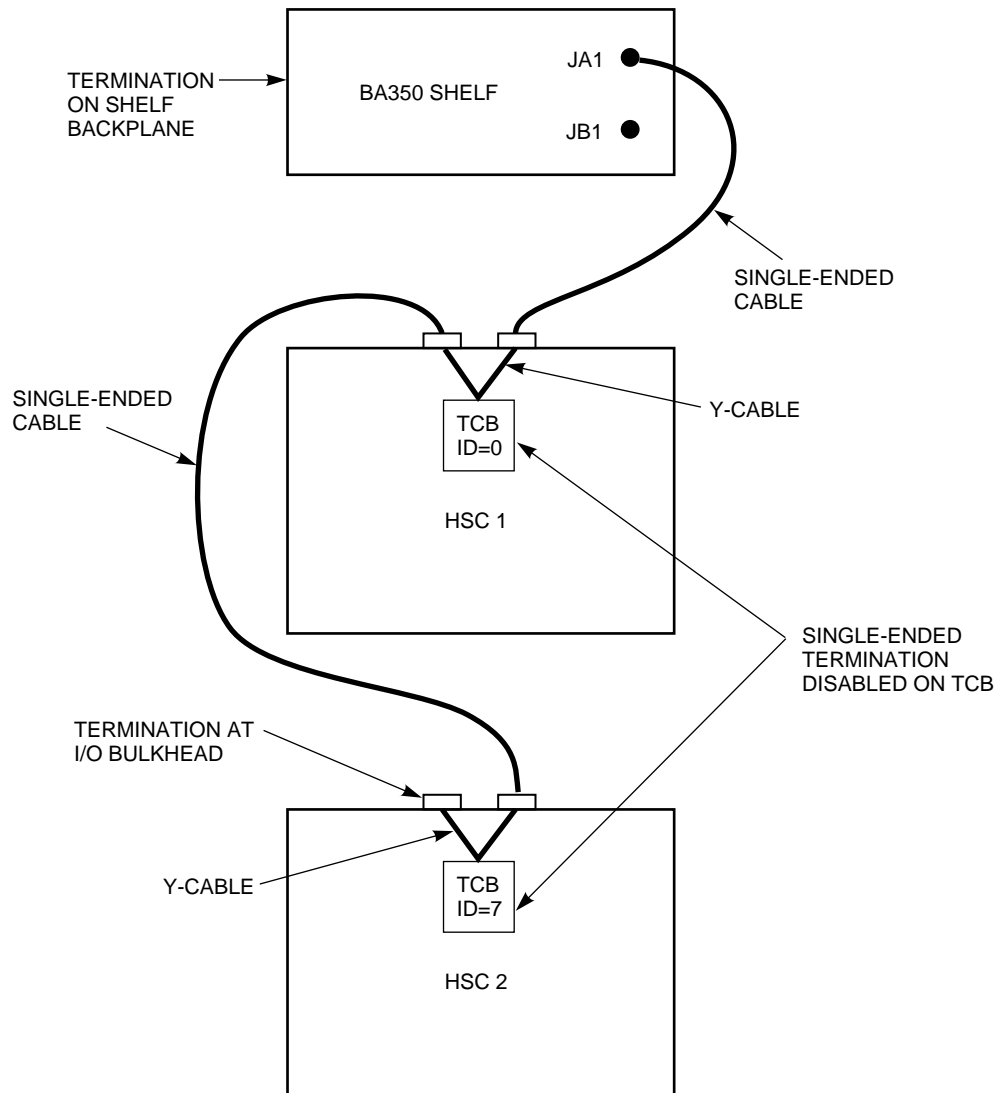
CXO-3943A-MC

Figure A–2 Dual-Path HSC Controllers with Single Internal SBB
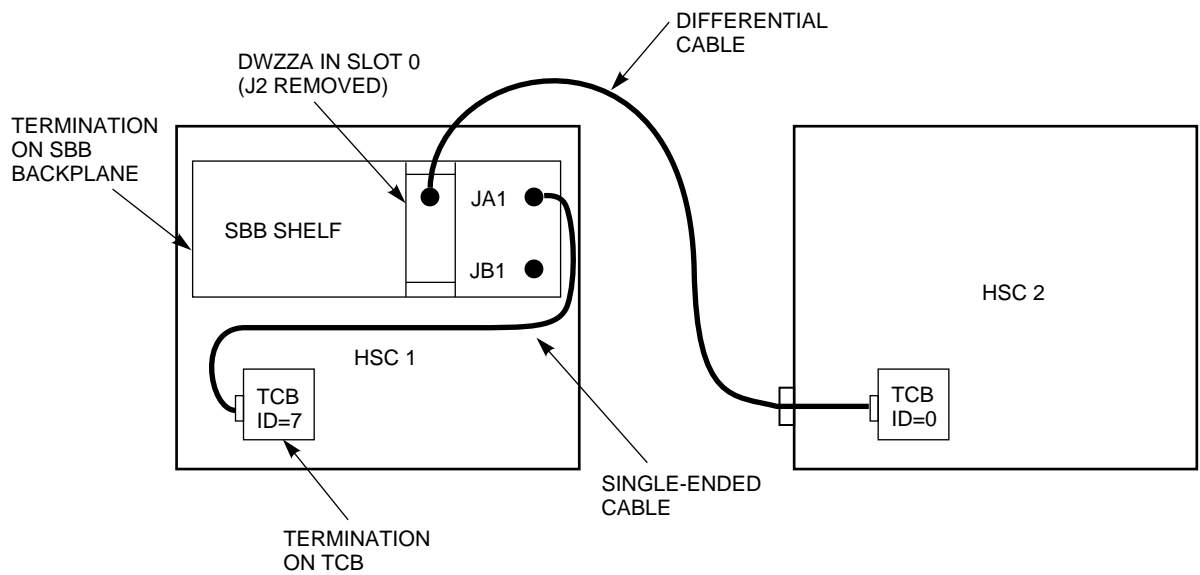
CXO-3990A-MC

Figure A–3 Dual-Path HSC Controllers with Internal SBBs
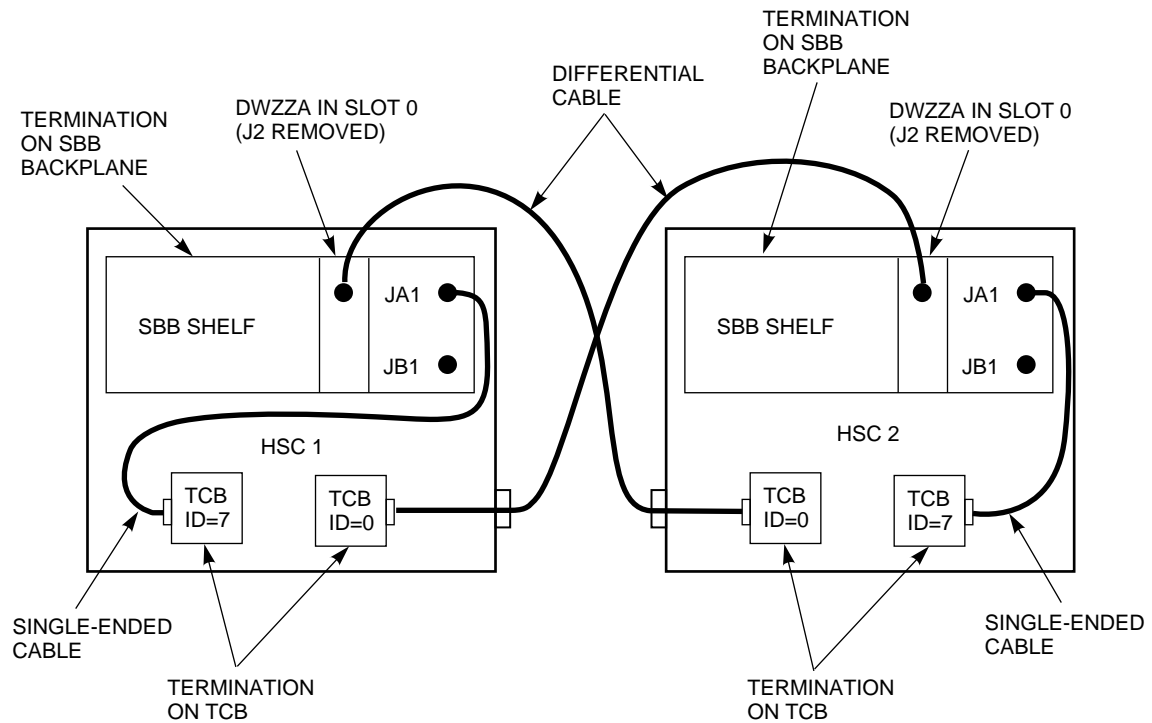
CXO-3944A-MC

Figure A–4 Six 5¼-Inch SCSI Devices On One HSC Controller

DWZZA IN SLOT 0
(J2 , AND DIFFERENTIAL
TERMINATION INSTALLED)

DIFFERENTIAL
CABLE

SBB SHELF

JA1

JB1

HSC

TCB
ID=7

BACKPLANE
TERMINATION
REMOVED

SBB SHELF

JA1

JB1

SINGLE-ENDED
CABLE

SBB SHELF

JA1

JB1

BACKPLANE
TERMINATION
INSTALLED
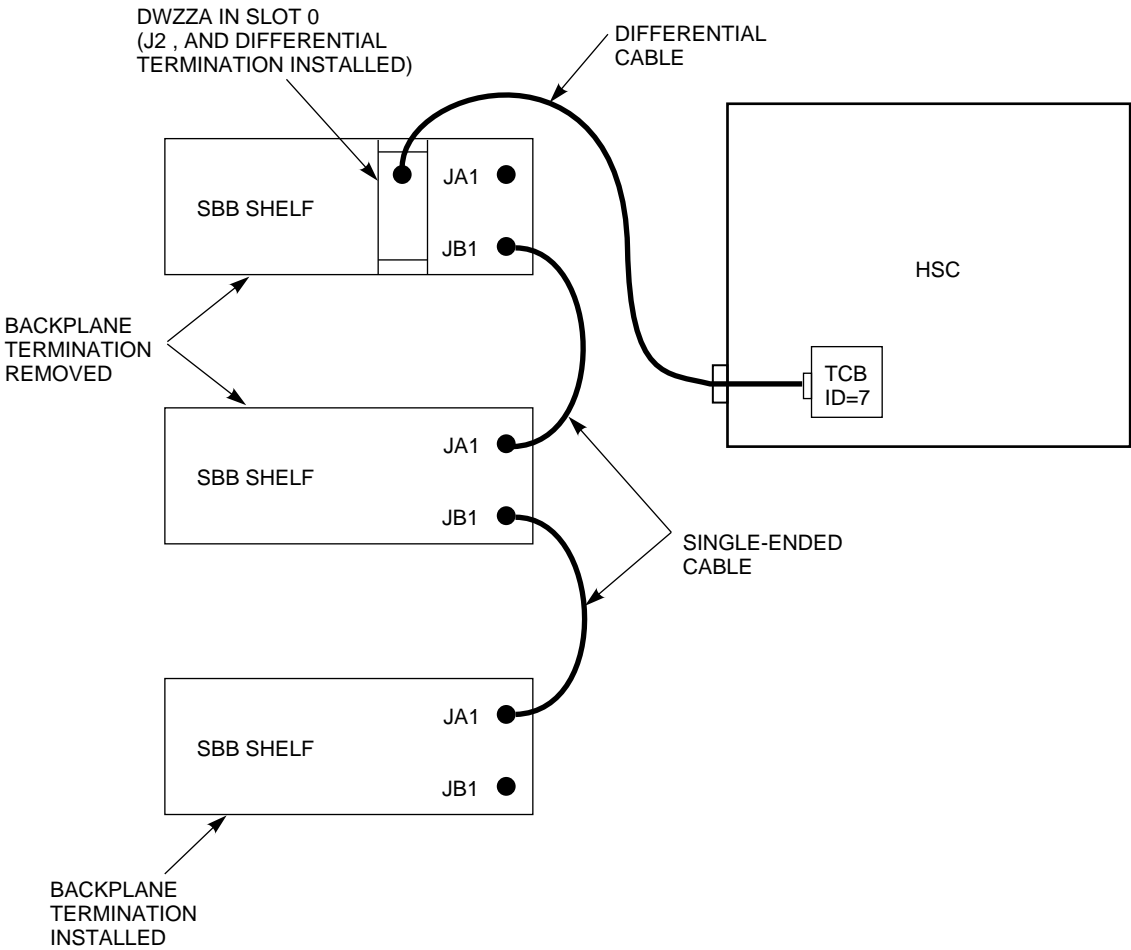
CXO-3951A-MC

Figure A–5   Six 5¼-Inch SCSI Devices in Dual-Path Configuration with Tri-Link

CXO-3945A-MC
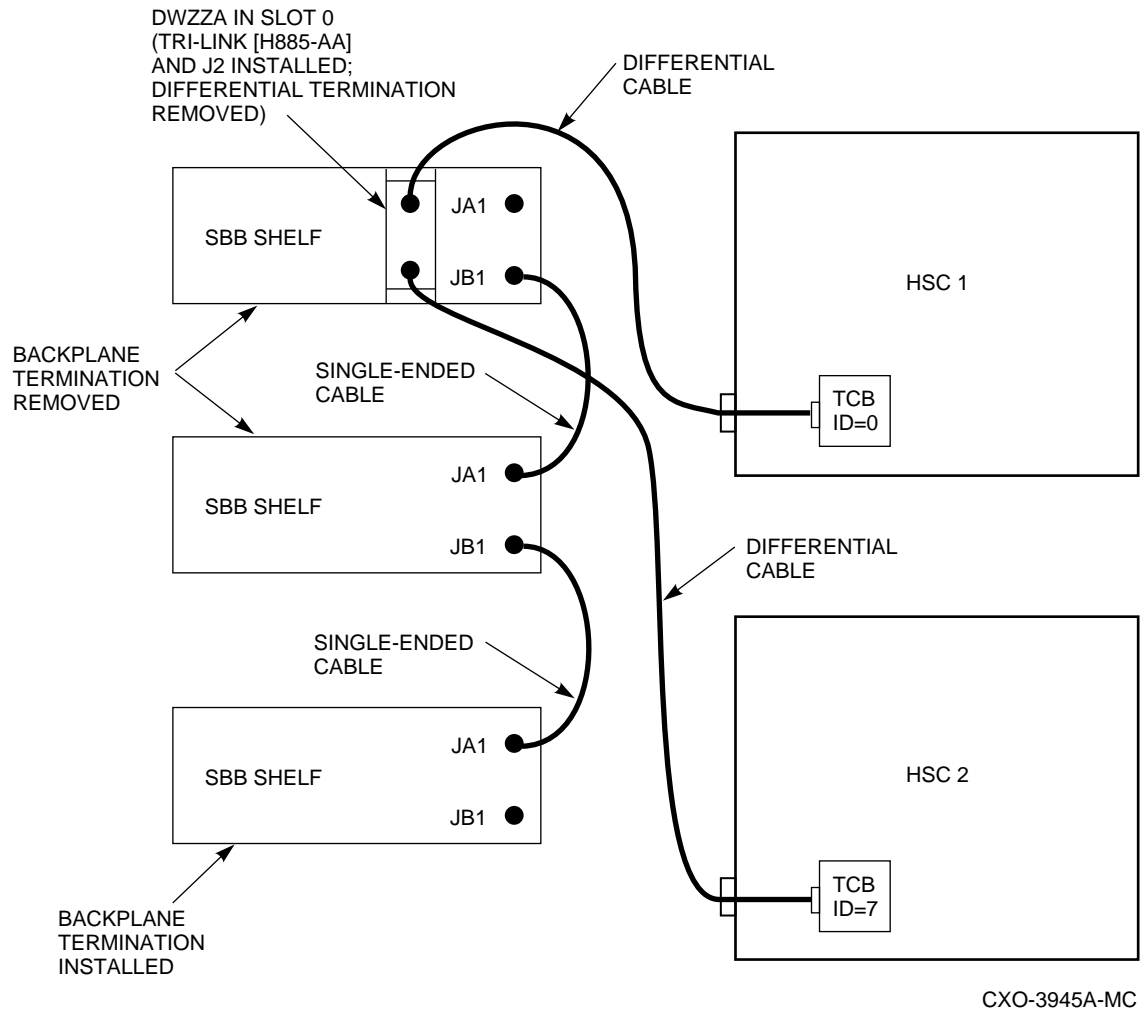
Figure A–6 Six 5¼-Inch SCSI Devices in Dual-Path Configuration with Two DWZZAs

DWZZA IN SLOT 0
(J2 AND DIFFERENTIAL
TERMINATION INSTALLED)

DIFFERENTIAL
CABLE

SBB SHELF

JA1

JB1

HSC 1

TCB
ID=0

BACKPLANE
TERMINATION
REMOVED

SBB SHELF

JA1

JB1

SINGLE-ENDED
CABLE

HSC 2

SBB SHELF

JA1

JB1

TCB
ID=7

BACKPLANE
TERMINATION
INSTALLED

DWZZA IN SLOT 0
(J2 REMOVED,
DIFFERENTIAL
TERMINATION
INSTALLED)

DIFFERENTIAL
CABLE

CXO-3946A-MC

B
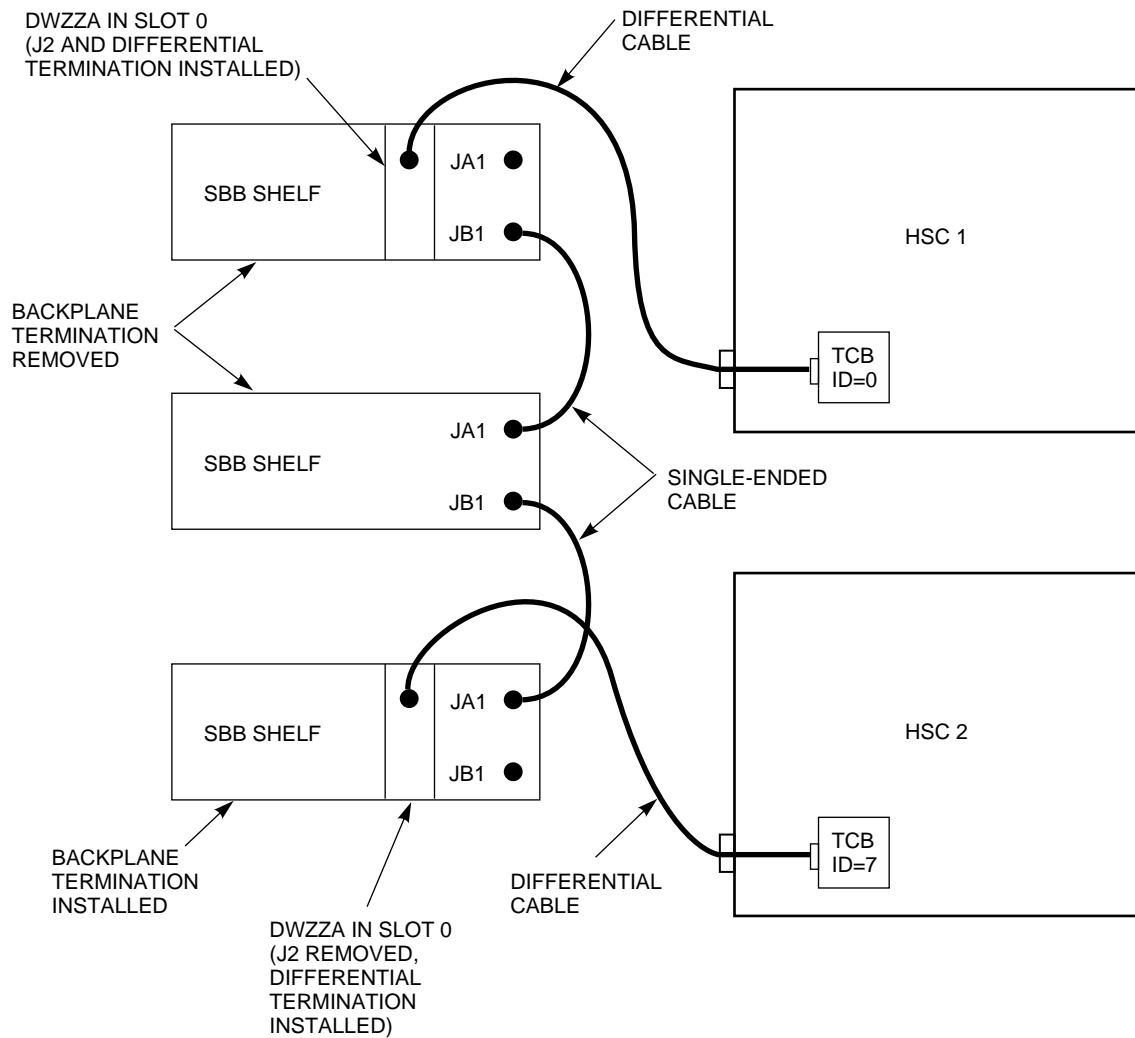
Removing and Replacing a K.scsi Module

This appendix describes how to remove and replace the K.scsi data channel module and test it for proper operation.

Use the following procedure to remove and replace the K.scsi data channel module:

CAUTION

Do not attempt to handle HSC controller modules unless you have taken proper precautions against electrostatic discharge (ESD). When handling modules, wear the ESD grounding wrist strap provided inside the front door of the HSC controller cabinet. Do not put modules on anything other than a properly grounded antistatic work surface.

---

1. Notify users that the HSC controller is being taken off line and the drives attached to it will not be available.

2. Dismount or fail over any drives connected to the HSC controller.

3. Power down the HSC controller by setting the front panel DC Power switch to the 0 (off) position.

4. Place the rackmount HSC95 controller in maintenance position 2 as described in Section 1.2.2.

5. Place the ESD grounding strap from inside the front door on your wrist and adjust it for proper fit.

6. Check the module utilization label above the card cage for the location of the problem K.scsi module. Remove the K.scsi module.

7. Carefully unwrap the replacement K.scsi module and place it on an antistatic work surface.

8. See Tables B–1 and B–2 and verify that jumpers are installed correctly on the module board and the terminators are removed.

Table B–1 K.scsi Module Jumpers

HSC SCSI Data Channel Module Jumpers

| Jumper | Jumper Pins | | State | Function and Comments |
	From	To		
JP1	1	2	In	32 MHz clock
JP2	1	2	In	48 MHz clock
JP3	N/A	N/A	Out	Not used—No jumper installed
JP4	N/A	N/A	Out	Not used—No jumper installed
JP5	N/A	N/A	Out	Not used—No jumper installed
JP6	1	2	In	Reset control
	2	3	Out	
JP7	N/A	N/A	Out	Not used—No jumper installed
JP8	1	2	In	MFP clock H
JP9	1	2	In	MFP clock L
JP11	1	2	Out	No internal termination power source required.
	2	3	In	TERM PWR
JP12	1	2	In	Supply SCSI bus TERM PWR

Table B–2 K.scsi Module Terminators

Device	Action	Function
U163	Remove	Differential SCSI bus terminator
U164	Remove	Differential SCSI bus terminator
U165	Remove	Differential SCSI bus terminator
U166	Remove	Single-ended SCSI bus terminator
U167	Remove	Single-ended SCSI bus terminator

9. Align the module with the requestor slot guide slides of the card cage and slide it in until it is fully seated. Press down on the card latches to secure the module.

_____ **CAUTION** _____

Do not place the rackmount HSC95 controller into maintenance position 3 unless directed to do so by Digital Multivendor Services. This position may disconnect some of the cables attached to the HSC I/O backplane and interrupt service on the controller, or on the other controller of a dual-pathed pair.

_____

10. With the HSC controller in maintenance position 2, remove the screws on the bottom cover of the HSC controller. Do *not* place the rackmount HSC95 controller in maintenance position 3 for this operation.

11. At the backplane of the HSC controller, unplug the single-ended Y-cable at the TCB for the K.scsi requestor being configured.

12. Apply power to the HSC cabinet by setting the front panel DC Power switch to the 1 (on) position.

13. See Table B–3 to interpret the status LEDs on the K.scsi module.

Table B–3 K.scsi Module LED Status Codes

Color	LED Number	Test or Failure Status[1]	Downloading Firmware	Operating Mode
Yellow	1[2]	Primary error bit 0	Off	Off (On = transferring data)
Yellow	2	Primary error bit 1	Off	Off
Yellow	3	Primary error bit 2	Off	Off
Yellow	4	Secondary error bit 4	Off	Flashing = normal
Yellow	7	Secondary error bit 3	Off	On = KSUTIL running
Yellow	8	Secondary error bit 2	Off	Off
Yellow	9	Secondary error bit 1	Off	Off
Yellow	10[3]	Secondary error bit 0	Off	Flashing = dual-path
Green	5	Off	On	On
Red	6	On	Off	Off

[1]State of yellow LEDs changes to indicate test status or failure code. See Table B–4.

[2]Least Significant Digit (LSD), upper LED.

[3]Most Significant Digit (MSD), lower LED.

Failure of any part of the power on self-test generates the following display:

- The top four yellow LEDs (LEDs 1 through 4) display the code of the **first** test failed.

- The green LED (LED 5) is off.

- The red LED (LED 6) is on.

- LEDs 7 through 10, the lower LED block, are not part of the error code display.

Table B–4 lists the power on self-tests in the sequence of execution. The diagnostic code and the most probable cause of a failure are also listed.

Table B–4   Diagnostic Codes

Self Test Sequential Listing	Primary LED Value (Hex)	Secondary LED Value (Hex)	Status Code[1]	Cause of Failure[2]
68000 register test	2	3 through 7	013	SCSI data channel module
68901 MFP test	2	8 through F	013	SCSI data channel module
68681 DUART test	3	1 through 8	013	SCSI data channel module
MAC BC test	3	9 through C	301	SCSI data channel module
D-memory interface[3]	4	0 through F	302	SCSI data channel module or M.std memory module
C-memory interface[3]	6	0 through 5	103	SCSI data channel module
RAM	C, D	9 through B	106	SCSI data channel module
Flash ROM	D	1 through 4	106	SCSI data channel module
Single ended ESP test	E	1 through 9	307	SCSI data channel module, cabling, TCB, or termination
Differential SCSI test	F	1 through 9	307	SCSI data channel module

[1]Diagnostic status.

[2]Most *probable* cause of failure.

[3]Test not fully run unless requested.

14. If the HSC controller is single-pathed, or is SCSI ID=7 of a dual-pathed pair, configure the K.scsi module for the following parameters:

   - Single or dual pathing
   - MSCP unit numbers
   - SCSI ID = 7

   If the HSC controller is SCSI ID=0 of a dual-path pair, use the KSUTIL utility to configure the K.scsi module for the following parameters:

   - Dual pathing
   - MSCP unit numbers
   - SCSI ID=0

15. Power down the HSC controller by setting the DC Power switch to the 0 (off) position.

16. Replace the Y-cable disconnected in Step 11.

17. Power up the HSC controller by setting the DC Power switch to the 1 (on) position.

18. With both HSC controllers booted, check that the K.scsi module configurations are as previously set.

19. Run the Test Bus offline diagnostics to ensure that the HSC SCSI data channel module is functioning properly and interfaces properly with the other requestors.

20. Reinstall the top and bottom covers on the HSC controller and roll the unit back into the cabinet.

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